Practical Wireless, March 3rd, 1934

FREE INSIDE! BLUEPRINT OF THE LEADER THREE

Practical Wireless

3D

AND PRACTICAL TELEVISION

EDITED BY F.J.CAMM

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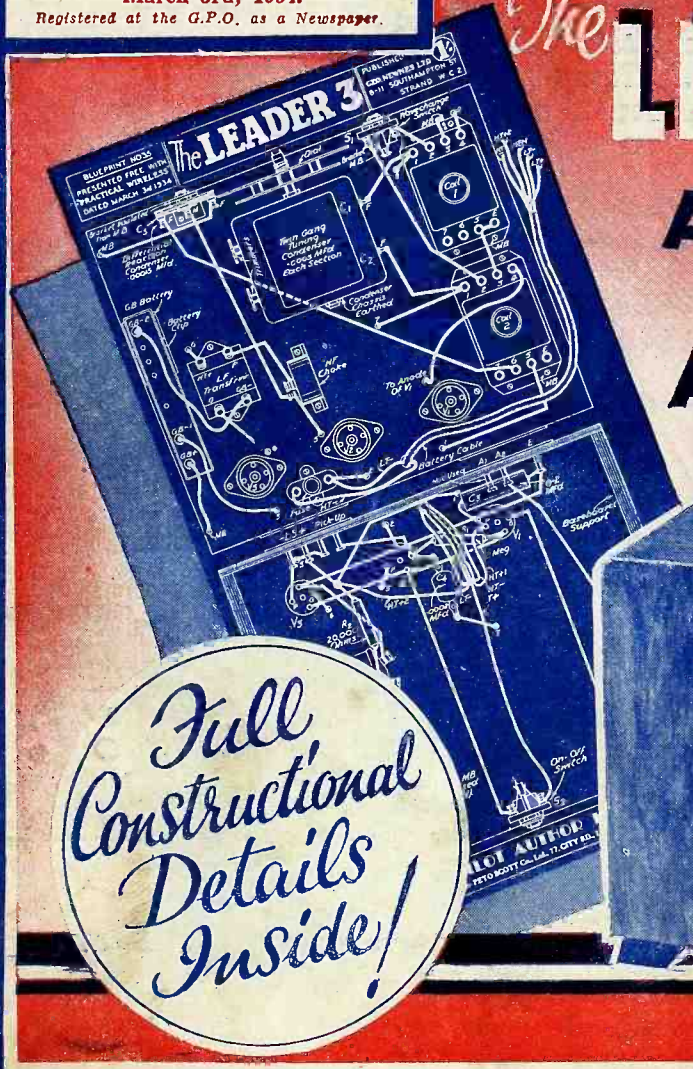
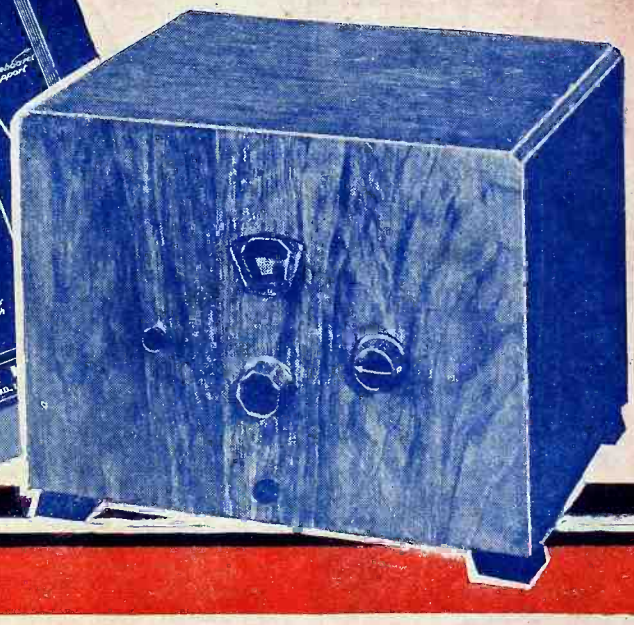
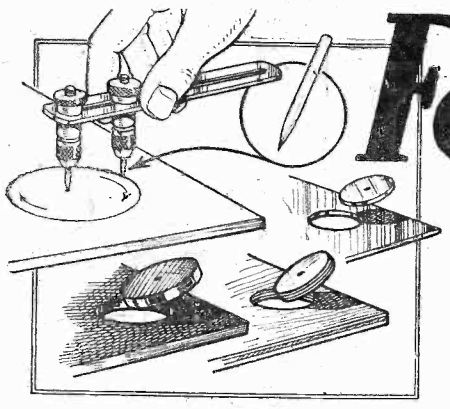


The LEADER 3

A NEW Set and A NEW Policy!



Full Constructional Details Inside!



For a LIMITED

Our Greatest Gift Offer

in response to many

SINCE the closing of our recent great Gift Offer of a complete Pocket Kit of Home-Constructor's Tools, expressly designed by the Editor of this paper, we have been inundated by requests from new readers who missed the offer but have seen the Kit and want to know where it may be bought.

We have had to reply in every case that the "Practical Wireless" Tool Kit was specially made for the Purpose of our Presentation Offer and therefore is unobtainable in the shops. However, in view of the obvious widespread disappointment thus occasioned, we have since arranged for a further supply of Kits identical in every respect

READ THESE SIMPLE CONDITIONS

All you have to do to obtain your Pocket Tool Kit is :—
(a) Complete the Forms on right in ink.
(b) Post Reservation Form and stamped address label.

On receipt of Reservation Form and the address label, we will send you a special Subscription Voucher on which to qualify for your Pocket Tool Kit. Your Kit will be reserved for you, and will be despatched immediately we receive the completed Subscription Voucher.

Affix to the Subscription Voucher which we post to you 4 Gift Stamps cut from the bottom right-hand corner of the back page of PRACTICAL WIRELESS for 4 consecutive weeks commencing this week. (Tool Kit Gift Stamp No. 1).

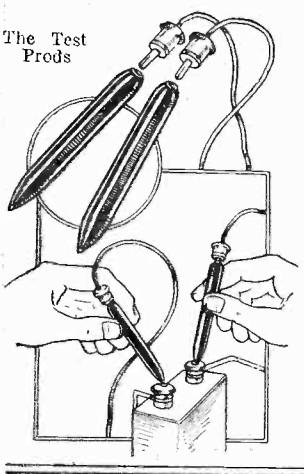
When your Subscription Voucher is complete, send it, together with a Postal Order for 3s. 6d., to include registration, postage, packing, insurance, etc., to PRACTICAL WIRELESS Presentation Department, and your Pocket Tool Kit will be despatched to you immediately.

No reader may qualify for more than one Pocket Tool Kit.

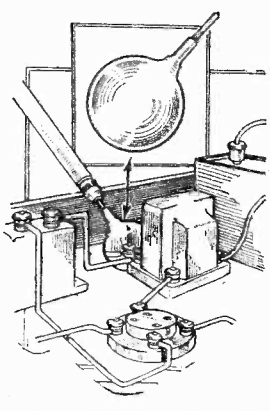
This offer applies to persons residing in Great Britain and Ireland. Readers in the Irish Free State must pay any duty imposed.

The Case, which is made of stout stamped metal, measures 6½"×4". Recesses are provided for all tools and when loaded, the Kit slips easily into the pocket.

The Test Prods



The Viewing Mirror



Period only!

to Readers repeated urgent requests

with those previously issued, and these we now have pleasure in offering to our readers on even more advantageous terms than before. This time only 4 Gift Stamps (see Conditions) being required, applicants will therefore obtain their Kits *in four weeks only*.

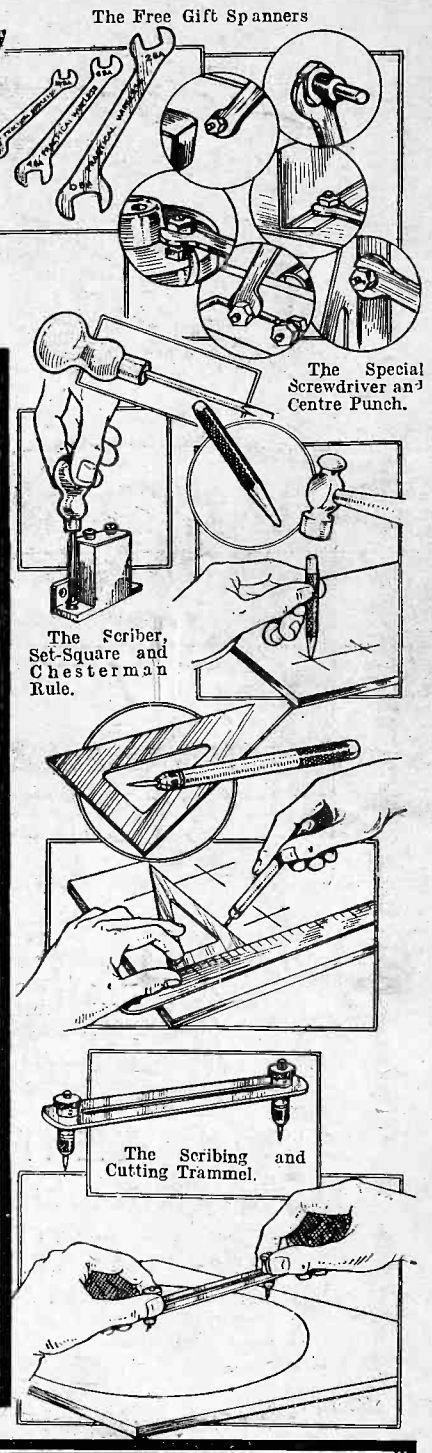
Sufficient Kits have been obtained to meet the estimated demand, but it must be definitely understood that when these are exhausted no more will be available at any price or under any conditions. Prompt acceptance of this Offer is therefore essential.

As to the Kit itself, this, as stated, has been specially designed by Mr. F. J. Camm, the Editor of this paper. It comprises in handy pocket form a complete battery of tools for the Wireless Constructor's use. Every tool is a sound engineering job. All of them, together with a few of their many uses, are illustrated in this announcement.

It is unnecessary to stress the extreme value of this Kit to the practical man. The tools alone, if purchasable in the ordinary way, would cost not less than 12/6, and being so ingeniously packed into the limits of their 6¼ins. by 4ins. Pocket Case, form an outfit which has only to be seen to be appreciated.

LIST OF TOOLS IN THE "PRACTICAL WIRELESS" KIT

1. One 4in. Spring Steel Chesterman Rule No. 300D-2.
2. One special Steel Scriber with adjustable Chuck for scribing point renewal.
3. One pair of special Ebonite Test Prods with Wander Plug Socket Ends and Brass Test Points.
4. One special 4in. Trammel with one fixed and one Sliding Head enabling circles to be scribed from 0 up to 3⅝ in. in radius. This tool may also be used for cutting holes in ebonite and baseboards too large to be drilled in the ordinary way.
5. One 60 degree 16-gauge Steel Set Square with Finger Fret, for easy use.
6. One special Viewing Mirror for inspecting obscure parts of the set. This Viewing Mirror fits into the Scriber Chuck.
7. One Steel Screwdriver with Brass Ferruled Handle, extremely useful for locking screws, securing components to baseboard, etc.
8. Three Steel Spanners 0-B.A., 2-B.A., 4-B.A., 6-B.A., 8-B.A., 10-B.A., fitting all or any standard size nuts and bolts used in Radio Construction.



If for any reason you failed to avail yourself of our previous Offer, do not let this opportunity pass you by. Fill in and post the Reservation Form now and thus *make certain* of securing your Kit.

NOTE: Post the Forms *at once*. Do not separate Address Label from Reservation Form. Write name and address clearly in BLOCK letters. Post in *unsealed* envelope, ½d. stamp only.

ADDRESS LABEL

If undelivered please return to Geo. Newnes, Ltd., 22, Tavistock St., Covent Garden, W.C.2

½d. Stamp must be affixed here.

Name .....

Street .....

Town & County .....

.....

POST THIS RESERVATION FORM IMMEDIATELY TO
PRACTICAL WIRELESS
Presentation Department, T.K.
22, Tavistock Street, Covent Garden, London, W.C.2.

In accordance with the conditions of your special offer, please send me a SUBSCRIPTION VOUCHER on which to qualify for my Pocket Tool Kit. I have asked my Newsagent to deliver PRACTICAL WIRELESS regularly every week until further notice.

Reader's Name .....

Full Address .....

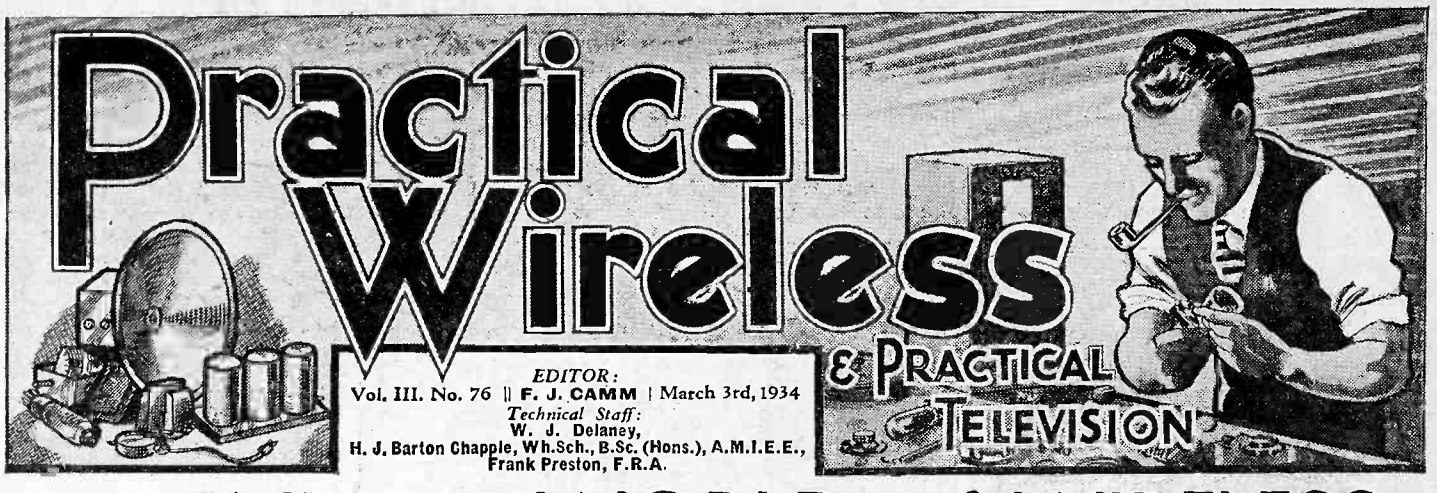
.....

Newsagent .....

Address .....

Reader's Signature ..... *Leave blank.*

Fill in this form and the label on left in Block Letters.
Stamp the label as directed and post both of them in an *unsealed* envelope (½d. stamp only required).



ROUND *the* WORLD *of* WIRELESS

Low-power Relay Stations

IN order to provide a better broadcasting service, especially in Wales, the B.B.C. are considering the question of opening low-powered relay transmitters in various parts of the kingdom, of which one or more may be erected in Wales. In addition, for facilitating the taking of programmes from the Northern districts of the principality, it is proposed to establish a studio at Bangor. Wales was not included in the Regional scheme, as was Scotland, when this system was drawn up in 1927.

Six Millions—and Over

WITH the issue of roughly 1,100,000 wireless licences in January, the Post Office state that the number has now reached 6,124,000 as against 5,366,000 at the end of January, 1933. Although it is impossible to secure actual figures, it is now estimated that some thirty million people in the United Kingdom are listeners to the B.B.C. programmes.

Radio from the Rates

AT Eschbach, in Germany, in order to comply with the wish expressed by the Ministry of Propaganda that every household should own a wireless set, the Municipality has voted a gift to its employees of maximum 15 marks (at par 15s.) towards the purchase of a suitable receiver. The money is to be supplied by the communal rates!

Is This a Record?

WHEN, on January 20th, the Vienna station relayed an act of the first performance of Lehar's new operetta, *Giudetta*, from the Opera House, the broadcast was taken by 133 transmitters in Europe and the United States.

United States Broadcast Licences?

A SUGGESTION has been put forward in America to introduce a listener's licence; it is anticipated that a minimum sum of twenty million dollars could be obtained in this manner. In addition, further income could be secured by taxing transmitters at an annual rate of 500 to 1,000 dollars, according to their power.

What is a Goosly?

AT first sight most readers might think it was a member of the feathered tribe—but the goosly is a Magyar musical instrument! In many ways it is a larger edition of the zither, and stands on four legs. To play it, you pluck the strings with the right hand, using a plectrum, whilst the left hand plays the keyboard. Walford Hyden, in his Katinka programme, to be broadcast on March 5th, will have one of these weird instruments in his orchestra. The entertainment comprises Russian peasant, soldier, and gipsy songs.

Another Attempt on the Stratosphere

ALTHOUGH so far the Russians hold the height record, another attempt is to be made shortly to elucidate still further the mysteries of the stratosphere. On this occasion the experiment will be carried out by Professor Moltchanov, of the Science Academy at Leningrad. The balloon will not carry any passengers, but will be of a true "robot" pattern; the working of the various recording instruments will be started by radio from a land station. By this method it is hoped to attain an even greater height than hitherto reached without courting the risk of disaster with loss of life.

This Radio Racket

THE National and Regional programmes on March 5th and 6th will prove of interest to thousands of listeners, inasmuch as the radio revue transmitted will consist of truthful disclosures of what goes on behind the scenes of a broadcasting studio. The cast includes many well-known names, amongst which are found Doris Gilmore, Lawrence Baskcomb, Harry Hemsley, Philip Wade, John Rorke, and Fred Hartley.

The *Egypt's* Gold

ANOTHER new microphone play will be produced in the National programme on March 5th. It tells of the recovery by divers of a million pounds of bullion from the liner *Egypt*, which sank off Ushant on May 20th, 1922. Salvage operations were begun seven years later, but it was only in 1930 that the wreck was discovered. The B.B.C. sound effects department are promising a very realistic background to the drama enacted before the microphone.

Italian Broadcasting Network

TO permit a National broadcast through all transmitters when occasion arises, the Italian stations have now been amalgamated into two networks. The Northern group, which already included Genoa, Milan, Florence, Trieste, has been extended to Bolzano *via* Turin; the Southern circuit now comprises Rome, Naples, and Bari, to which by special cable Palermo has been attached. Broadcasts from this studio will now be relayed from time to time to the Capital and other stations situated in the same network.

The Return of Johann Strauss

AUSTRIA, since the installation of its first broadcasting station, has steadily worked to increase the popularity of its late composers, and in particular has regularly transmitted in its programmes works by the Waltz King. During 1934 the Vienna studio proposes to broadcast every melody written by this prolific musician, including fifteen operettas, some of which have not been played for many years. The power of the new Bisamberg transmitter will permit them being heard over the greater part of Europe.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

On Exmoor with a Camera

"HUNTING on Exmoor — With a Camera" is the title of a West Regional talk to be given by Mr. Alfred Vowles on March 7th. In this talk Mr. Vowles will tell of his experiences in photographing deer on the moors and of his work in photographing birds.

Orchestral Concert from Folkestone

FOLKESTONE Municipal Orchestra's concert on March 5th will be relayed to London Regional listeners. The orchestra, which will be under the direction of Eldridge Newman, will be heard in Eric Coates's suite, *London Every Day*, and in a pot-pourri, *Tales from Strauss*. Soffie Schönning, soprano, will sing *Love Everlasting*, by Friml, and Adele's Waltz Song from *Die Fledermaus*, by Strauss.

Music-hall Broadcast by Stars of Yester-year

VETERANS of variety will be presented by Mr. John Southern in a "Music-hall" programme entitled *There is Gladness in Remembrance*, on March 3rd. These are no imitations, but the genuine articles; "stars" of yester-year singing their original "hits" in the way in which they sang them twenty or more years ago. Among the veterans whom Mr. Southern will bring to St. George's Hall for the broadcast are Tom Costello, Leo Dryden, Joe O'Gorman, and Charles Coburn. In addition, Sable Fern, Marie Kendall, Vesta Victoria, and Daisy Dormer will revive popular numbers with which their names are indelibly associated. With Mr. Southern as chairman, in the old style of presentation, the programme should provide an hour of real entertainment. Mr. Southern's most recent venture is the revival of Old-Time Music-hall at the Garrick Theatre, London, where he has made an outstanding success.

Massed Bands Concert

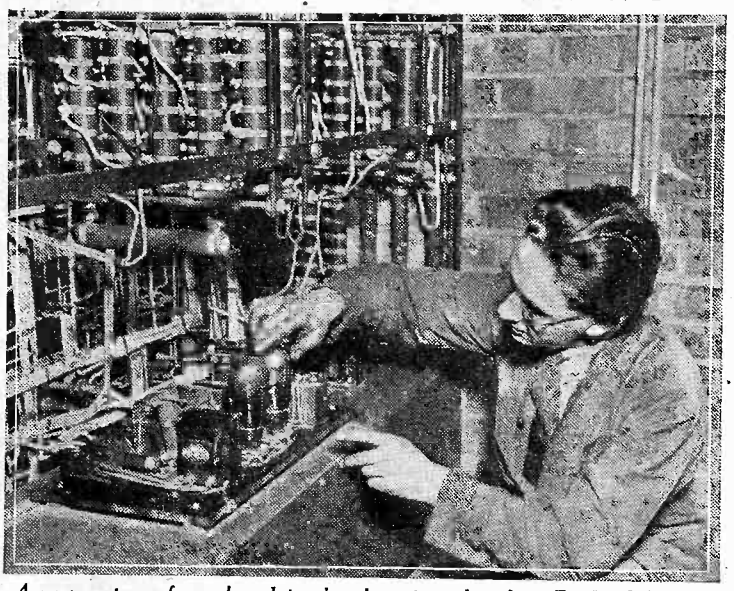
ON March 3rd, a massed band concert will be relayed to Midland Regional listeners from the De Montfort Hall, Leicester, where the city's eleventh annual brass band festival concludes. James Oliver will conduct. The programme includes Henry Hall's arrangement *Sweethearts of Yesterday*, the fantasia *Other Days*, by Gordon MacKenzie, and an arrangement of Three Hymn Tunes, by Handel Parker.

"Boyhood at Sea" Broadcast

WHILE apprentice in a sailing ship fifty years ago, Major Valentine Baker was washed overboard but landed back on deck by the following wave, saw a man fall from the foreyard arm to the deck and escape serious injury, and watched a shipmate who had gone overboard keep himself afloat by clinging to the leg of an albatross until a boat arrived. Major Baker is to give an account of his experiences in a Midland Regional talk, "Boyhood at Sea," on March 5th. After leaving the sea, he served in Warren's expedition to Mafeking in 1885, learned scouting from Selous, the famous hunter, and became one of the pioneers in Rhodesia in 1890.

INTERESTING and TOPICAL PARAGRAPHS

CONTROLLING LIFTS BY WIRELESS VALVES



A new system of gearless drive has been introduced to England for the first time in a London building, where sixteen new lifts have just been installed. The interesting feature of this system is that two thermionic valves, such as are used in ordinary wireless sets, smoothly control the stopping and slowing of the lifts. The illustration shows an engineer replacing one of the thermionic valves.

Post Office Activities against Wireless "Pirates"

AMERICAN broadcasters have given the unlicensed listener in Great Britain a new name. In our home circle he is sometimes described as a "pirate"; but the Americans now call him a "bootlegger," and show some interest in the various campaigns undertaken by the British Post Office in order to trace and expose him. On both sides of the Atlantic, therefore, the news that the British Post Office is to undertake a new campaign next month may be received with interest. One direction finding van will pay a month's visit to the Cardiff, Newport, and Swansea areas, starting on March 5th, and listeners (or bootleggers) who are operating unlicensed wireless receiving apparatus in those districts should lose no time in obtaining the necessary licence from the nearest post office, thus removing the slur which our American friends have cast upon the name of the offenders.

"Tea Mixture"

THE first of a new series of Saturday afternoon concerts, *Tea Mixture*, will be broadcast from the Midland Regional on March 3rd. Artists new to the microphone, as in the recent *First Time Here* programmes, will take part, as well as old and tried favourites. A dance band will also appear and the first programme of the series will be compèred by a well-known Yorkshire comedian. Producer Charles Brewer is in charge of the series.

SOLVE THIS!

PROBLEM No. 76.

Jarvis had read that the impedance of an iron-cored choke varied with the frequency. He also understood that the equivalent impedance of a pure resistance did not vary with frequency. He therefore decided that he would obtain improved results if he used a resistance in place of a choke in the output filter of his receiver and he accordingly looked up the valve-maker's instruction sheet and found that the optimum load for his output valve was 8,000 ohms. He fitted a resistance of this value in place of the choke, but results were worse. Why? Three books will be awarded for the first three correct solutions opened. Address your attempts to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 76 and must be posted to reach here not later than the first post March 5th.

Solution to Problem No. 75.

Although all the wiring in Dobson's set was correct, the leads to the coils were bared at the end and in the case of one of the coils the coil-screen, when in position, made contact with one of the leads to the wave-change switch. Thus, when switched to the long wave position the switch was inoperative owing to the fact that the lead in question was earthed through the coil screen. The switch operated effectively when the screen was removed.

Only one reader successfully solved Problem No. 74, and a book has accordingly been forwarded to—

D. J. Moses, 34, Prichard Street, Tonyrefail, Glam.

Alban Berg's "Wozzeck"

AN outstanding event of the B.B.C.'s season of Symphony Concerts at Queen's Hall is undoubtedly the first performance in England of the opera, *Wozzeck*, by Alban Berg, to be conducted by Adrian Boult on March 14th. Since its first performance in 1925 by the Berlin State Opera, *Wozzeck* has been repeated no less than twenty times in the German capital, a considerable number of times in provincial towns, such as Cologne, Oldenburg, and Mannheim, in Vienna and in America under Stokowski. It is the first opera by one of the younger contemporary school of composers to have received an international success.

Grousing over the Lucerne Plan

SOME readers have complained that certain European stations cannot always be found on the wavelengths officially allocated to them. This is true in specific cases where the transmitters have arbitrarily chosen their own channels, and discrepancies in the lists of wavelengths published, for this reason, will continue to exist until the whole matter has been cleared up. In regard to the long waves, a conference will shortly take place at Brussels, and it is to be hoped that on this occasion a better all-round agreement may be reached. So far, whatever interference exists on some European broadcasts, it is pleasing to note that most of the home stations are still unaffected; generally speaking, apart from minor incidental collisions, our channels have remained clear.

HOW TO CONSTRUCT A SIMPLE CAPACITY BRIDGE

By W. L. PATTULO

A simple device for testing condenser capacities

THE small instrument about to be described can be made and calibrated with apparatus from every amateur's junk-box. It will give sufficient accuracy for all normal purposes and is quite easy to use. The meter will measure the capacity of any condenser, except the electrolytic variety, from 10 mfd. down to .0001 mfd. This range is covered in three steps.

It is not intended to discuss the theoretical circuit, which is given in Fig. 1, but for those who are interested it is sufficient to say that it consists of a simple resistance bridge, which is adjusted until the hum from the A.C. mains, or other source of oscillations, heard in the telephones, is balanced out. The unknown capacity can then be calculated from the formula :—

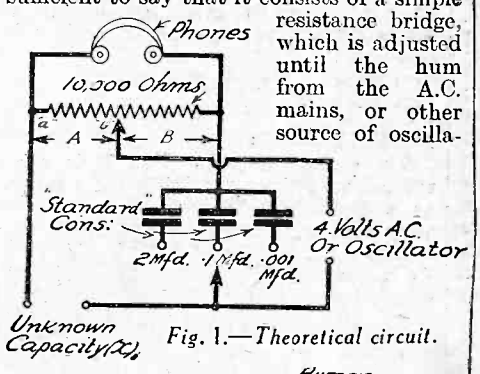


Fig. 1.—Theoretical circuit.

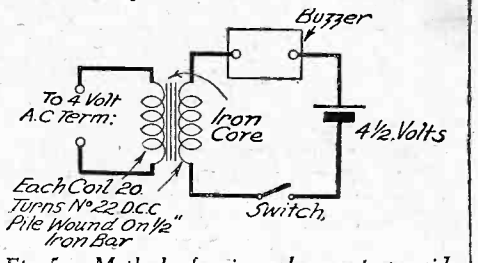


Fig. 5.—Method of using a buzzer to provide oscillations.

$$X = \frac{B \times C}{A}$$

where X = the unknown capacity in microfarads

B = the total resistance of the bridge in ohms, minus A

C = the standard capacity used, in microfarads

A = the resistance between the points "a" and "b" in ohms. See Fig. 1.

Parts Required

One 10,000 ohm potentiometer (Watmel).
One 2 mfd. condenser (T.C.C.).
One .1 mfd. condenser (T.C.C.).
One .001 mfd. condenser (T.C.C.).
Three Clix sockets with two coloured erinoid washers to slip underneath the heads.

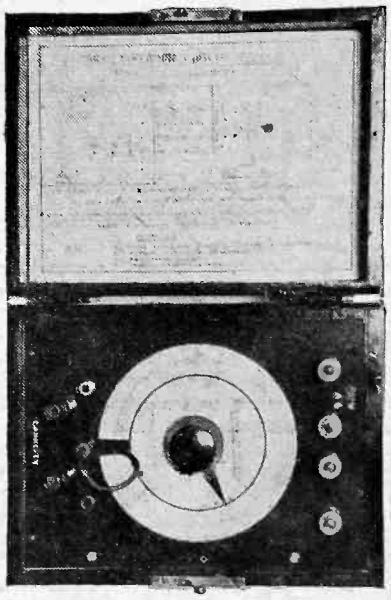


Fig. 4.—Photograph of finished instrument.

One Clix plug.
Ebonite panel about 8in. by 6in. by 3/16in.
Wood for case.
Wire.
Six terminals.

Auxiliary parts required, but which are not built into the apparatus, are a pair of headphones and a bell transformer. If the latter is not available, then the four-volt winding of the mains transformer in a wireless set can be used. The object of using the transformer is to isolate the apparatus from the mains and thus prevent the possibility of shocks. It is important to note that the frequency of the mains is used to provide the necessary oscillations, and therefore D.C. mains are unsuitable.

Lay-out and Construction

The lay-out adopted is not very important, but that shown in Figs. 2 and 3 was adopted by the writer. Note the use of a narrow baseboard at right-angles to the panel, for mounting the condensers and so saving space. When wiring up, be careful to avoid parallel or bunched-up wires, which may introduce unwanted capacity and make the calibration of the low-capacity range inaccurate.

Calibration

The next step is to calibrate the instrument. There are two ways of doing this. The first method is not quite so accurate as the second, but has the advantage of only requiring a pair of compasses to carry it out. The second method requires the use of an ohm-meter such as has been described several times in PRACTICAL WIRELESS. Those who have such an instrument are advised to use it.

Method No. 1

Prepare a circular paper or thin card scale, diameter about 3in., and draw on it two concentric circles with a radii of about

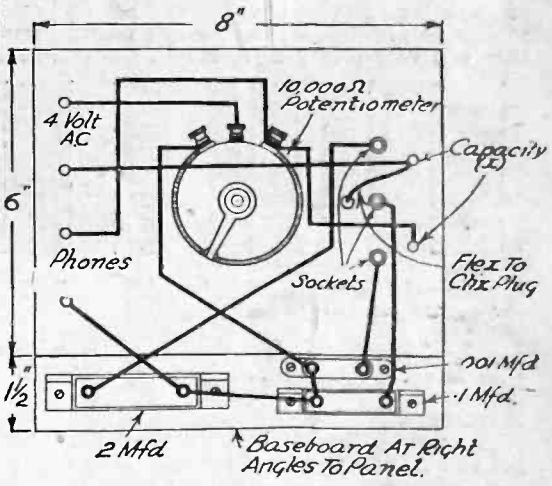


Fig. 2.—Sketch plan of lay-out and wiring diagram.

1¼in. and 1in. respectively. Fit the scale under the knob of the potentiometer and mark on it the two extreme points of movement of this knob.

Divide up the portion of the scale over which the pointer of the knob travels into ten equal parts, and subdivide each of these into ten additional parts. Now each degree of the scale equals 100 ohms, therefore using the table given on page 1080, mark off the various resistances given. Print against each mark the capacities shown in columns 2, 3, and 4, using the inner circle of the scale for column 2 and the centre circle for column 3, etc. Figure 3 shows how the finished scale appears.

Note that the lowest resistance starts from the end of the potentiometer, which is connected to one of the terminals labelled "Capacity" (see Fig. 1), and that therefore the highest capacity readings on the scale will commence from this end. If coloured erinoid washers have been fitted under the Clix sockets on the panel, then the three sections of the scale should be labelled accordingly. The scale is now complete and may be glued down. A piece of

(Continued on page 1080)

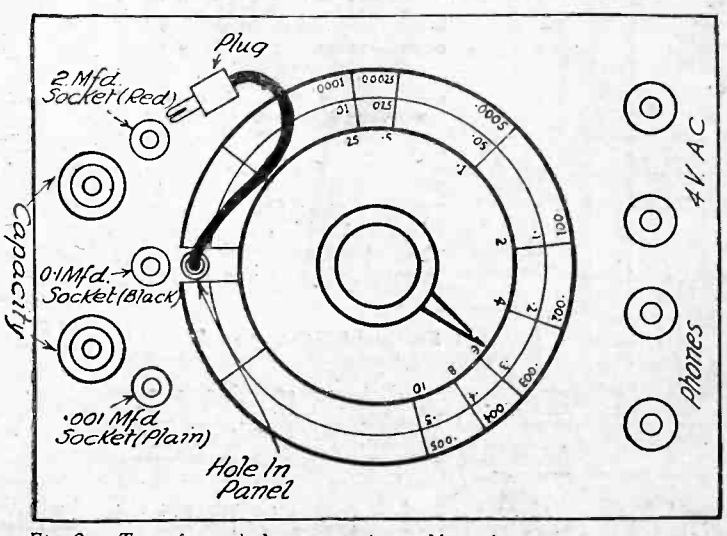


Fig. 3.—Top of panel showing scales. Note the extra long pointer on the knob.

WILL THE PENTAGRID REVOLUTIONIZE THE SUPERHET?

The Pentagrid Valve is a Newcomer with Many Interesting Possibilities: Its Advantages are Interestingly Described in This Article by PERCY RAY

THE pentagrid is beginning to engage the attention of every serious constructor, and when news of this valve first became available it was taken for granted that it would revolutionize the superheterodyne, and yet it seems to have achieved little popularity up to the present. It is, therefore, not surprising that the constructor is losing confidence in the pentagrid and wondering if it is already dead. The writer is of the opinion that the pentagrid is far from dead, and feels that it will be a welcome addition when it is properly launched on the British market in a form designed to meet the requirements and conditions of this country. Before describing the unique working of this valve it is essential that the limitations of existing frequency-changers should readily be understood, and for this reason they will very briefly be reviewed.

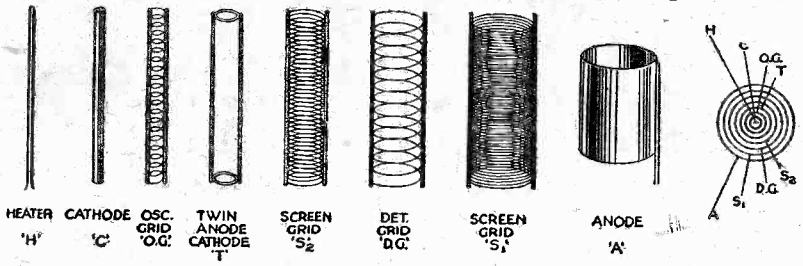


Fig. 2.—Showing the eight elements of the pentagrid valve. There are five grids in all. Note particularly the open structures of the grid marked "T."

Frequency Changing

The main difference between the superhet and all other types of receivers is that most of the amplification takes place on some predetermined wavelength other than that of the received signal; the incoming signal is made to beat with a locally-generated "carrier-wave" of such frequency that the resulting beat-note has a frequency corresponding to that of the I.F. amplifier. This wavelength mixing takes place in a stage generally called the frequency-changer, which may employ one or two valves, or, in certain exaggerated American superhets, three valves. Obviously, this stage is vital to the overall performance of the superhet, and it is probably true to say that 90 per cent. of the superhet receivers that have proved disappointing to their owners would be quite satisfactory if it were not for trouble in the frequency-changer.

The original form of frequency-changer consisted of a triode detector coupled to a triode oscillator. This arrangement possessed among its various disadvantages very low stage gain and a terrible tendency towards "dragging," which is the pulling out of tune of one tuned circuit by the other. It should be understood that the frequency-changer can actually amplify; in fact, the output from this stage can be so much greater than the input that a single I.F. stage may suffice, while with a poor changer two such stages would be necessary. All the various methods of frequency-changing will not be discussed in detail, as many of the minor variations have no real advantage over each other, selection being a matter of convenience only.

The many forms of frequency-changers to-day make use of almost every form of valve either in pairs or singly in an autodyne changer, which is that form of circuit where a single valve performs the duty of detector and oscillator. In all these circuits couplings have to be provided whereby the signal and oscillator output are fed to the detector, and this leads to difficulties, while the use of a single valve is inclined to encourage the oscillator to "drag" the aerial circuit off tune. Both circuits are apt to radiate into the aerial, a state of affairs to be deplored, and it is well-nigh impossible to arrange a coupling where mixing is anything like uniform over the whole wave-band and which does not give rise to that annoying falling-off in sensitivity at one end of the dial.

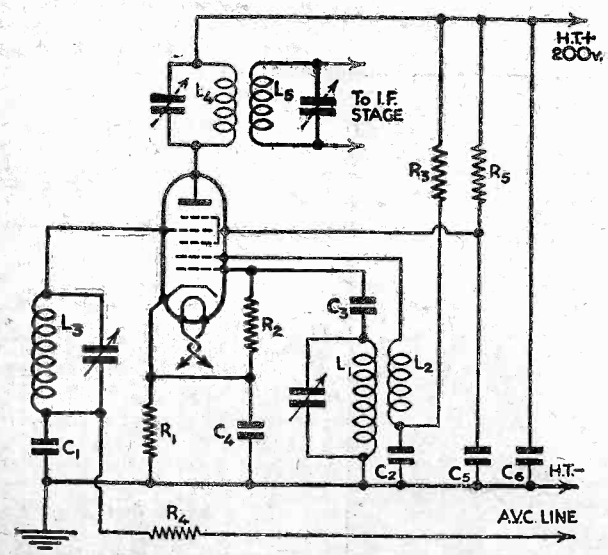


Fig. 3.—The circuit of the pentagrid frequency changer. R_5 is not mentioned in the text as it is merely to drop the 200v. to a lower value for the screen grids.

Uniform Efficiency on All Wavelengths

Whatever coupling is used, whether inductive, capacative, or both, it is bound to be more efficient at a certain frequency or frequencies, and the only truly uniform coupling is that provided by the pentagrid where electronic mixing is employed. This will readily be understood when the strange functioning of this altogether unorthodox valve has been described.

So far the grids S_1 and S_2 have been ignored for the simple reason that they do not materially interfere with the working of the valve; they are situated on the inside and outside of the signal grid and screen it from the other electrodes. This is a vital feature, as it prevents radiation into the aerial and stops interaction between the aerial tuning and

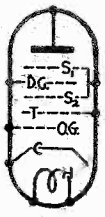


Fig. 1.—The schematic diagram of the pentagrid valve; the accompanying article explains the purpose of all these grids.

oscillator tuning circuits, and prevents one from dragging the other off its proper tuning point. The grids S_1 and S_2 may be considered as being similar to the screening grids in a screen-grid valve, and are joined together inside the valve, as shown in Fig. 1, and a single lead is brought out.

Pentagrid Circuits

The circuit diagram (Fig. 3) is one of several variations for using the pentagrid as a frequency-changer. The others are very similar, one makes use of a tapped coil in place of L_1 and L_2. In this circuit L_1 is the tuned oscillator-grid coil and is connected to grid "OG"; it is coupled to the oscillator anode "T" by means of the anode coil L_2.

L_4 and L_5 are the two windings on the I.F. input transformer, while L_3 is the aerial coil; it will be observed that the low potential end of this coil is taken away to the automatic volume control feed, the detector portion of the pentagrid having variable-mu characteristics permitting the smooth gain control associated with this type of valve. If A.V.C. is not used, the resistance R_1 can be variable to give manual control of volume.

R_1 is the bias resistance to apply the small fixed bias in the usual way, while R_2 gives a bias on the oscillator grid by reason of the voltage-drop across this resistor due to the passage of grid current through it. R_3 and R_4, in conjunction with C_1 and C_2, are for decoupling purposes; C_3 is a blocking condenser to prevent the partial shorting of the resistance R_2, and C_4, C_5 and C_6 are just ordinary by-pass condensers.

The pentagrid has many advantages, including the important one of electronic frequency-mixing, but there may be one point in favour of the two-valve method—greater amplification.

It has been suggested in one of our contemporaries that the pentagrid functions by virtue of a space charge, i.e., a cloud of electrons that, it is alleged, gather round the area of grid "T" (see Fig. 1) and form a "cathode" for the other half of the valve. It was suggested that mixing was achieved by virtue of the fact that the efficiency of the other part of the valve depended on the space charge the density of which was controlled by the oscillator grid "OG."

Since the electron cloud is in between two areas that are not crowded it could only be caused by the electron stream slowing up; the same effect is produced on a road,

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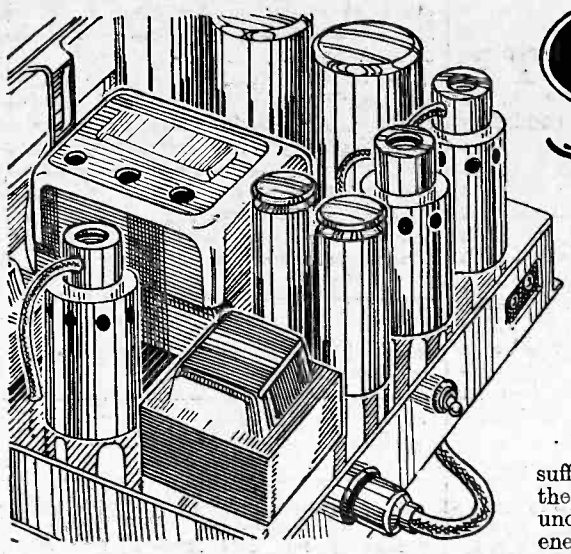

Screening Properly Explained

Too Often is the Subject of Screening Misunderstood by the Amateur Constructor. The Details Given in This Article Clarify the Situation

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.

ONE of the greatest problems in receiver design is that of avoiding unwanted interaction between various parts of the circuit. Such interaction is similar in its effects to back-coupling, but, as we shall see, is due to other causes. Interaction is said to occur when energy, in one form or another, is transferred from one circuit or piece of apparatus to a second circuit, so that variations in the first are impressed as a spurious signal upon the second.

The trouble is that these spurious signals are amplified in succeeding stages of the set. At "the best" they spoil loud-speaker reproduction, but, if originally received from one of the later stages and fed back into an earlier stage, the re-amplification may be sufficient to upset the stability of the circuit and cause oscillation and howling.

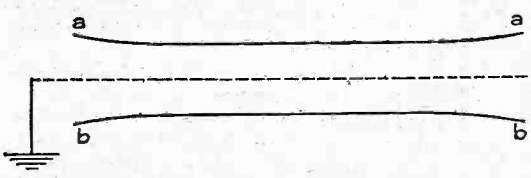

Fig. 1.—Showing simple electrostatic screening.

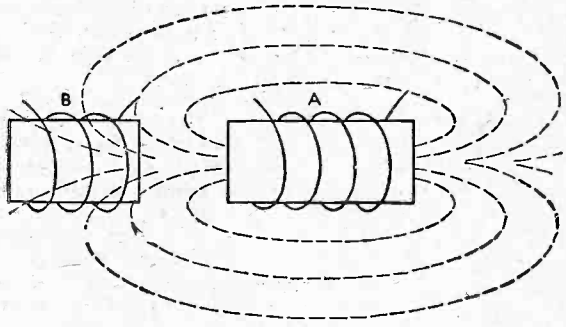

Fig. 2.—Magnetic field leakage between A and B.

Two Main Methods

There are two ways in which interaction may take place, namely, by magnetic and electrostatic coupling.

Magnetic coupling arises when the magnetic field of one circuit or component carrying an audio-frequency or radio-frequency current embraces part of another circuit. The whole arrangement acts as a transformer, alternating voltages being generated inductively in the coupled circuit.

Electrostatic coupling exists if conductors forming parts of two separate circuits are sufficiently close to each other to form the plates of a small condenser, for under these circumstances alternating energy will be transferred from one circuit to the other.

Not only may spurious signals be introduced in this way, but often the feeble but precious energy of the true signal may be dissipated, resulting in a loss of volume and power.

Two important points in connection with the design and layout of a circuit, which have a profound effect in avoiding interaction are, first, to see that wiring and components which might affect each other are well spaced apart, and second, that they are so disposed that their magnetic fields are not likely to interlink.

Indeed, in the earlier years of broadcasting these were the only precautions taken to avoid retro-action, and they were usually fairly efficacious because apparatus in general was comparatively insensitive, and the amounts of energy handled relatively small. Besides this, the losses due to interaction were usually masked by the still greater losses in the somewhat crude apparatus used.

Reducing Electrostatic Coupling

As the efficiency of individual components and receivers as a whole improved, however, and especially when A.C. mains operation was introduced and sensitive valves came into use, the effects of interaction became more noticeable. The complete solution to the problem was provided by combining sound layout and spacing with more or less complete screening of the various circuits.

Before describing the several methods of screening components and circuits, it is necessary to see exactly what effect screening has on the different kinds of interaction. First of all, then, consider how metal screening can reduce electrostatic coupling.

Fig. 1 shows two wires, aa and bb, which, it can be assumed, form parts of two different circuits. Suppose aa is carrying a radio-frequency signal (say the anode current of a high-frequency valve) and bb is part of the grid circuit of the same valve. If these two wires run side by side and are fairly close together, they will form a small condenser, and this will give rise to an unwanted feed-back or reaction. If, now, a metallic screen is placed between them and connected to earth, the wire bb will be isolated from the electrostatic field of aa, and energy cannot pass between the two circuits.

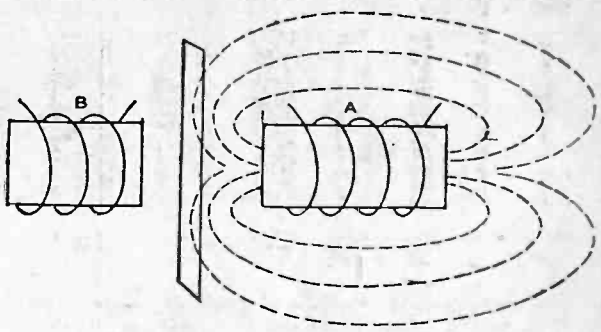

Fig. 3.—Employing an iron screen to "protect" B.

Note, however, that the wire aa and the screen now form a condenser, so that energy will be lost by the circuit aa by passing away to earth. Furthermore, there will be additional losses due to eddy currents being set up in the metal of the screen. These losses will be greater at high frequencies than at low frequencies, and it is therefore essential to combine the design of the screening with adequate spacing in order to minimize losses and eddy-current damping.

Magnetic Shielding

Magnetic interaction can, of course, be cured only by a screen of iron or steel—tin plate, which is tinned iron sheet, is also efficacious. But it is quite useless to try to prevent magnetic leakage from, say,

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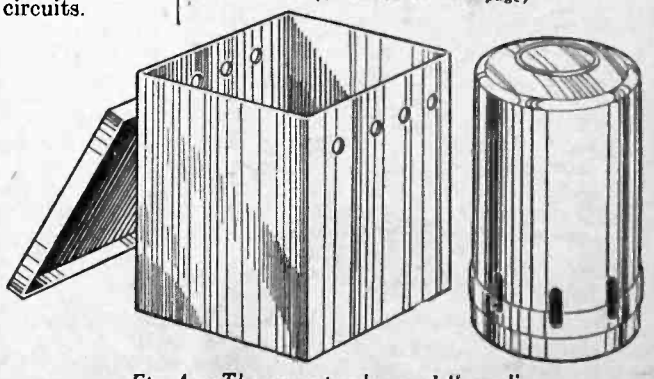


Fig. 4.—The screening box and "can."

(Continued from previous page)

the power pack of an A.C. mains set by surrounding it with an aluminium screen. Even an iron screen is of little value unless it is of substantial thickness, and ¼in. iron plate is the minimum thickness which can be really recommended.

Referring to Fig. 2 it will be seen that the magnetic field of A, say a low-frequency transformer or choke, cuts the circuit of B, which may be another transformer or choke. A voltage corresponding in frequency with that of the current in A will therefore be induced in B. When, however, an iron screen is interposed between A and B as in Fig. 3, the magnetic flux due to A is concentrated in the screen and does not reach B.

Screening Devices

It is now necessary to deal in detail with the principal screening devices which are available. The simplest form consists of built-up partitions of aluminium or tin plate arranged between the circuits it is desired to isolate from each other. This was the first type of screening to be employed and proved reasonably efficient with the older types of components.

Usually a metal sheet covering the baseboard, with transverse shields between the H.F. stages and a metal panel, gave a fair measure of shielding. It must be admitted, however, that a certain amount of interaction was still possible with such an arrangement, and it is an interesting conjecture as to what proportion of the "liveliness" of some of the 3-valve and 4-valve sets of the 1928-1929 era was due to the sensitivity of the circuits and what to the spurious reaction resulting from incomplete screening.

The next step came with complete screening boxes for various stages or individual components. Rectangular copper boxes were at one time popular, and then came the individual screening "can" as we know it to-day, see Fig. 4. The difficulty has always been to strike the best balance between bulk and efficiency. To avoid losses, the cans should be large, but considerations of space place restrictions on dimensions.

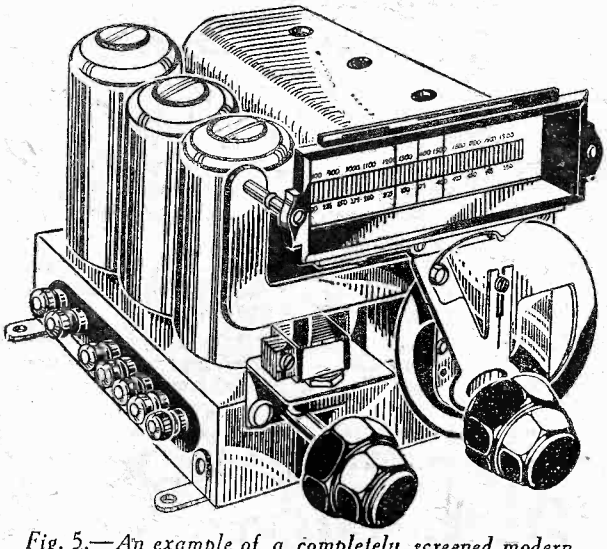


Fig. 5.—An example of a completely screened modern tuning pack.

High-water Mark

It may, however, safely be said that modern screened components of good make represent the best possible compromise, taking up only a reasonable amount of room, yet avoiding serious loss.

The high-water mark of canned components is reached in the modern tuning unit or pack, comprising all the coils and tuning condensers required for a highly-sensitive set, mounted upon a metal chassis, and with each coil and condenser element efficiently screened. A typical example is illustrated in Fig. 5.

Allied to the canned coil is the question of metallized valves. All H.F. and detector valves can now be obtained with bulbs which have been sprayed with a metal coating, this, in turn, being connected to one of the filament pins in the case of directly-heated valves, or to the cathode pin for indirectly-heated mains valves. This metal coating serves the same purpose as an effective screening can.

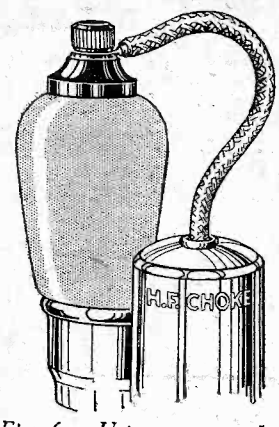


Fig. 6.—Using a screened wire for connection to the anode cap of an S.G. valve.

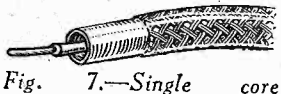


Fig. 7.—Single core cable in systoflex metal braiding.

In order that all screens and cans shall be at the same (earth) potential, it is usual to mount them upon a metal base. This may be achieved by placing a sheet of metal plate or foil on the top surface of the baseboard, or a chassis of metal sheet may be used instead of a baseboard.

Other Cases

An excellent and convenient alternative that has come greatly into favour during recent months is the wooden base or chassis heavily impregnated with metal, such as the "Metaplex" baseboard. These metallized bases are quite easily worked with ordinary wood working tools, and good electrical contact is produced by ordinary wood screws.

Mention must now be made of methods for shielding individual wires. It frequently happens that a single wire should be screened—for example, the connection to the anode cap of a screened grid valve (see Fig. 6), or the connection from the aerial terminal to the first H.F. grid, or some other wire carrying signal current. Various forms of metal-covered sleeving are available, but in making a choice it is wise to remember the following points: The actual wire must be insulated, and the screening metal earthed, while to avoid losses the metal cover must be of large diameter compared with the wire. Probably the best combination is a *thin* connecting wire enclosed in fairly wide bore systoflex and covered over-all in one of the many forms of metal sleeving (Fig. 7).

Handy makeshifts for the metal sleeving can be devised by means of a wrapping of metal foil, or even by winding bare wire closely over the systoflex. Finally, mention must be made of the practice of using metal-braided flex for the heater circuits of A.C. mains sets. Obviously, with the usual tinned copper braiding no magnetic shielding results. Probably the only effect of the braiding is to keep the two twisted cores as close together as possible, and thus to restrict the magnetic leakage. At any rate, I have used both metal-braided and ordinary twin twisted flex for different sets and have never found any noticeable difference in performance between the two.

(Continued from page 1077)

celluloid fitted over it improves the appearance.

1. Resistance in ohms of "ab"	2. Standard Condenser. 2 mfd.	3. .1 mfd.	4. .001 mfd.
1666	10 mfd.	.5 mfd.	.005 mfd.
2000	8 ,,	.4 ,,	.004 ,,
2500	6 ,,	.3 ,,	.003 ,,
3333	4 ,,	.2 ,,	.002 ,,
5000	2 ,,	.1 ,,	.001 ,,
6666	1 ,,	.05 ,,	.0005 ,,
8000	.5 ,,	.025 ,,	.00025 ,,
8888	.25 ,,	.01 ,,	.0001 ,,

Prepare a circular scale as in method No. 1. Connect an ohm-meter across the potentiometer at points "a" and "b" of the circuit and adjust the potentiometer until the first reading given in column 1 of the table above is obtained on the ohm-meter. Mark the scale at this point and repeat the process for the remaining readings. Complete the scale by printing on the capacities, etc., as in Method No. 1.

The table above is worked out for each of the twenty-four different capacities from the formula referred to at the beginning of this article, by solving the equation for "A." The apparatus can therefore be calibrated for any other capacities by substituting the desired capacity for "X." The resulting value for "A" will give the resistance at which it is necessary to set the potentiometer in order to balance out the oscillator note for the capacity under test.

It is important that the value assigned to "C" be reasonably near that of the condenser to be measured, otherwise the resistance "A" or "ab" will be too near one end of the scale to obtain a true silent point.

Connect a pair of high-resistance headphones and the low-voltage winding of a bell transformer, or other source of oscillations, to their appropriate terminals. Join the condenser under test to the terminals labelled "Capacity" with short lengths of wire (not twisted flex), and insert the Clix plug into one of the sockets. Switch on the oscillator and adjust the potentiometer knob carefully until the note heard in the phones is balanced out. It should be possible to find a point which is quite silent, but where a slight movement of the knob either side will make the oscillator note audible again.

If no silent point can be obtained, transfer the Clix plug into each of the other sockets in turn and repeat the process.

It is desirable, though not essential, to use a high note oscillator in preference to the A.C. mains when using the low-capacity range. This is principally because the low-frequency hum from the mains does not readily pass the small-capacity condensers used in the circuit.

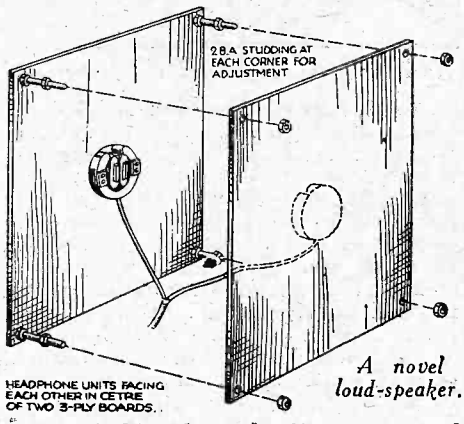
A simple oscillator, incorporating a buzzer, which the writer has used with success, is given in Fig. 5.

READERS' WRINKLES

THE HALF-GUINEA PAGE

A Cheap and Novel Speaker

THE components required for the novel speaker illustrated are: 4 lengths of 2BA threaded rod and 8 2BA nuts; 2



A novel loud-speaker.

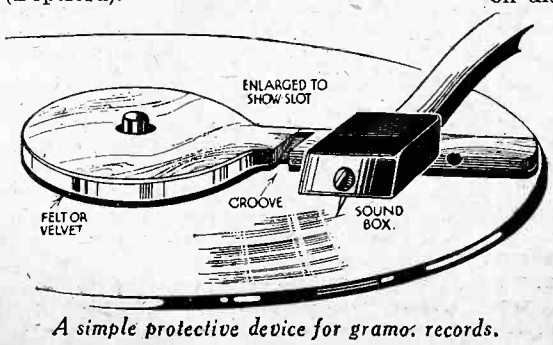
pieces of thin plywood, 18in. square, and a pair of 'phones.

The 'phone magnets are removed in their entirety from their cases and mounted in the centres of the plywood squares, so that when placed together the magnets attract each other. If they do not, reverse the magnets (quite a distinct pull can be felt). A hole is then drilled in each corner of the squares. Replace the leads to the earpieces, screw two 2BA nuts on to each rod and assemble the parts as shown. Thread on the outside the remaining 2BA nuts, and, by means of the threaded rod, adjust till the magnets are practically touching. Lock with the outside nuts and, except for a coat of varnish on the squares, the speaker is complete.—P. TEMPLE (Hull).

Protective Device for Gramo. Records

IT often happens that the gramo. needle, after finishing on the recording surface, skids out of the groove made for it, with subsequent damage to the record. The simple device shown in the sketch, which easily overcomes that trouble, can be made from thin plywood, ebonite, or bakelite. One side could be covered by felt or velvet which would act as a brush.

In operation the needle is placed against the "board," and on completion slips into the groove and is then raised off the record surface by the chamfered slot and retained by the small vertical portion.—D. JONES (Deptford).



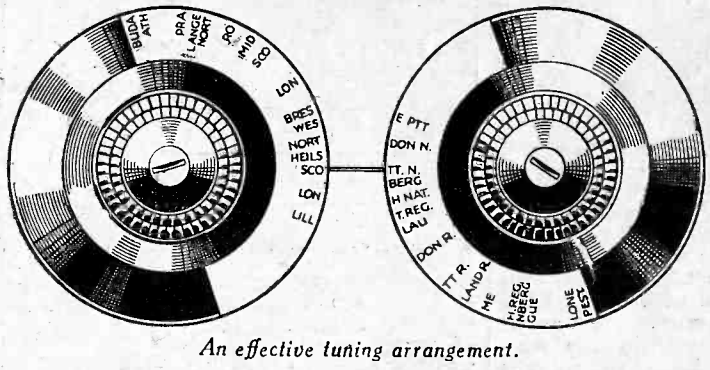
A simple protective device for gramo: records.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

An Easy Tuning Device

THE following method of calibrating and marking of dial readings for a two-knob tuner will prove very simple and effective. First, cover the degree markings on the condensers with a piece of cartridge paper cut out to shape. Having switched

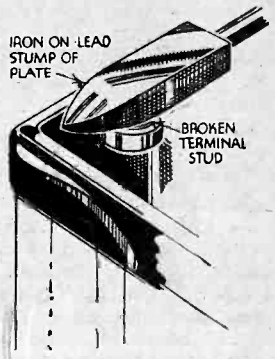


An effective tuning arrangement.

on set, turn knobs until a station is heard. These can easily be identified now, by call signs, tuning notes, language, etc. If a doubt exists, reference can be made to the daily advertised programme, and verified by the item being broadcast. Having satisfied himself as to the station he is receiving, the operator should proceed to mark dial settings in the following manner. The left-hand condenser dial should be marked with first part of station name, and right dial with the second half of name in continuation. When this has been done at each position where a station has been received, tuning-in afterwards becomes the simplest of motions. Merely rotate both knobs until the name of station shows on dial.—VICTOR DEAN (London, S.E.15).

Removing Broken Terminals from H.T. or L.T. Accumulators

IT sometimes happens that accumulators with good plates in them cannot be used because a terminal has broken in (generally the positive). A quick and easy method of removing the broken part is to pour a little killed spirit, or spirit of salt, around the broken stump and then press on it with a hot soldering iron for a few seconds, keeping the iron flat and completely covering the stump. The iron expands the lead stump of the plate and the killed spirit runs inside and sends all corrosion and sulphation, which previously held the terminal stump fast, to the top. With a sharp-nosed pair of pliers it is then an easy matter to remove the stump. Care must, naturally, be exercised with celluloid accumulators.—H. KAY (Royton).

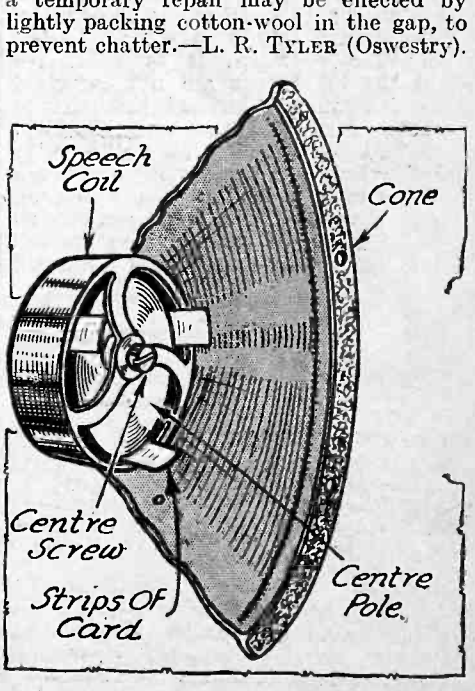


Method of removing broken terminals from accumulators.

Centring M.C. Speaker Speech Coils

HERE is a simple method of centring the speech coil of a moving-coil loud-speaker.

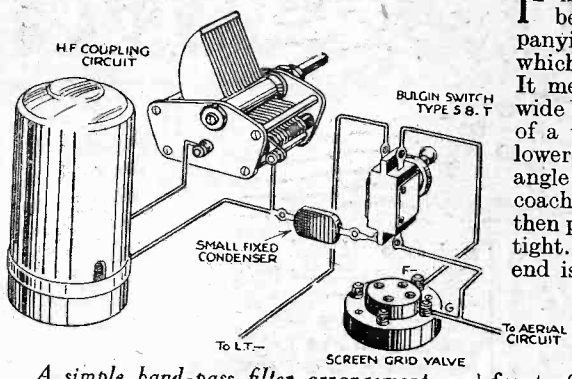
First loosen off screw holding the spider to centre pole, then insert three pieces of cigarette card or paper (according to the size of the gap) about ¼in. wide, at equal distances round the centre pole, and on the inside of speech coil. Tighten up the screw and remove cards, when the speaker will be found to be correctly centred. If the spider is damaged a temporary repair may be effected by lightly packing cotton-wool in the gap, to prevent chatter.—L. R. TYLER (Oswestry).



Centring a speech coil in an M.C. speaker.

READERS' WRINKLES

(Continued from page 1081)



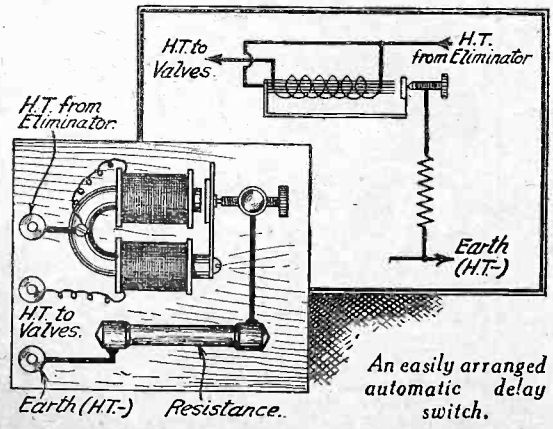
A simple band-pass filter arrangement.

A Simple Band-pass Filter

HAVING on hand a two-way Bulgin snap switch, I devised the switching arrangements shown in the accompanying sketch, whereby the S.G. valve of my set is cut out and at the same time a small capacity condenser is brought into circuit across the fixed terminals of the tuning condensers. An efficient band-pass filter is thus formed which will bring in the locals and many of the more powerful foreigners at excellent quality, at the same time saving the current that the S.G. valve would have consumed.—J. H. WYLDE (Marsden).

Automatic Delay Switch

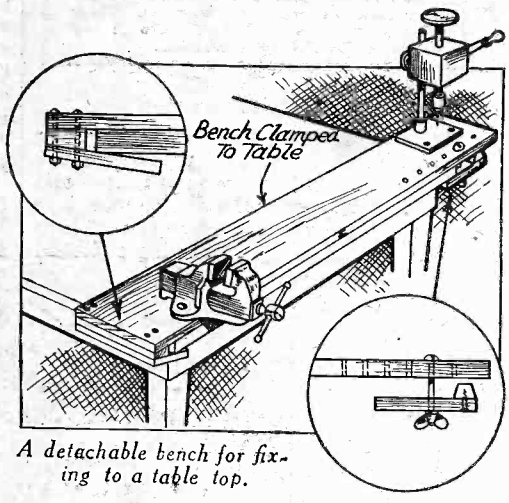
SOME A.C. set builders will perhaps welcome a simple alternative to the thermal-delay switches which are on the market. The device illustrated, which is fairly easy to construct, has the advantage of earthing the H.T., through a big resistance, until the valves are in a condition to receive the full load. It consists of a resistance the actual value of which is determined by the consumption of the set, and a small relay. The coils and magnet of the relay may be taken from an old bell, the coils being rewound with about 1,500 turns each of 38 s.w.g. wire. The accompanying diagram will explain the constructional details. An important point is that the tension on the armature should be adjustable to determine the actual point of operation; this can easily be done by arranging a small spring as shown in broken lines. The operation is as follows:—When the relay coils are not energized the resistance is connected through the contact to earth, thus preventing the H.T. from "building up." When the valve cathodes heat up, current flows through the relay coils, which are then energized. This breaks the contact, cutting the resistance out of circuit and applying the full load to the valves.—J. CHURCH (Arlesey).



An easily arranged automatic delay switch.

A Universal Bench

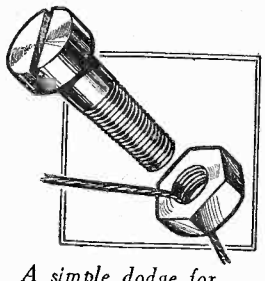
IT is often difficult to find room for a bench in the house, and the accompanying sketch shows a detachable one which can easily be fitted to any table. It merely consists of a board about 9in. wide and 4ft. or 5ft. long, fixed to the top of a table as in sketch. One end has a lower piece about 8in. long fixed at an angle to the top and held by two or four coach or countersunk bolts. The bench is then pulled on to the table until this end is tight. Then the lower part of the other end is pushed up on the bolt, which may be placed in the most convenient of the holes provided, and the wing nut tightened. Since all the wear and tear comes on the front of a bench, this "makeshift" will be quite wide enough. A piece of newspaper should be placed on the table before the bench. It will protect the table and serve to collect dirt.—JAMES H. ROWE (Dublin).



A detachable bench for fixing to a table top.

A Nut-locking Hint

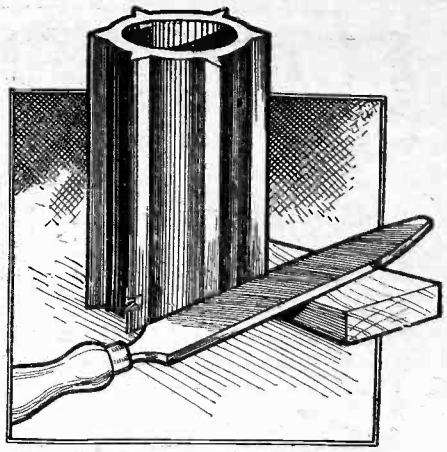
MOST amateur constructors find soldering a rather difficult job, but here is a simple method of securing nuts without resorting to the soldering iron. First, dip a piece of thin twine in shellac, and then pass the twine through the nut (as in sketch) and screw the nut on with the twine between. This method will effectively lock the nut if the shellac is wet when the nut is screwed on. The ends of the twine can then be cut off.—P. H. LOVELL (Honor Oak).



A simple dodge for locking nuts.

Slotting Ribbed Coil Formers

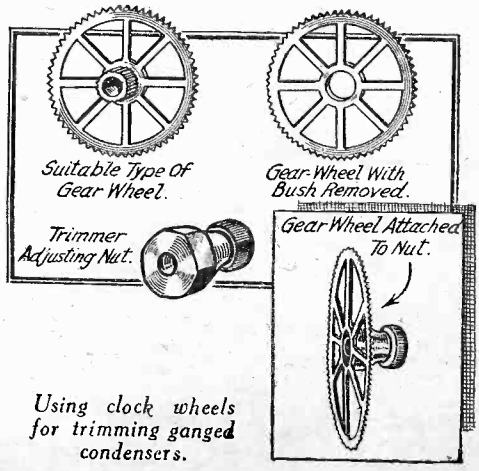
FOR those who are desirous of matching home-made coils on a six-ribbed ebonite former, the following dodge will ensure that the windings are identically spaced on each coil. It is usual to wind the long-wave section in slots in the bottom part of the coil, and the medium wave winding as a plain solenoid. A reaction winding will also be required on some coils, and possibly a small aerial coupling winding for the medium waves. A few scraps of oak are all that are required. It is advisable to leave a space of about half an inch at the bottom of the former to accommodate terminals or soldering tags. A flat piece of oak therefore, ½in. thick, is screwed to the bench, and the former held firmly against this and resting on the bench. A slot is then cut in each rib with the edge of a flat file. The file resting on the piece of wood whilst it is cutting. The file should be about ½in. thick, which will give a suitable winding space for as many as a hundred turns of, say, 34 enamelled wire, if each slot is cut to half the depth of the rib. For the second series of slots, a piece of ½in. oak is now screwed on top of the first one so that the front faces are flush, and the cutting process repeated, keeping the file riding flat on the wood. If more slots are required, additional pieces of ½in. wood are screwed on the top of the preceding ones.—L. PITCHFORD (Normanton).



A method of slotting ribbed coil formers.

Trimming Ganged Condensers

I RECENTLY acquired a ganged condenser assembly on which the trimmers were adjusted by means of hexagonal-headed nuts the size of ordinary terminal nuts. With the condenser mounted it was most inconvenient to adjust the trimmers with ordinary spanners in such a manner as to effect proper adjustment, so I detached the ganged unit and removed the adjusting nuts. From a broken alarmclock I secured two brass gear-wheels of equal size and removed the bushes, thus leaving a hole in the centre of each. These I sweated on to the ends of the adjusting nuts, the holes being concentric. On replacing the nuts-cum-gear-wheels, trimming became simplicity itself, the wheels being moved round either way by means of a long wooden rod with one end flattened.—T. D. RAMSAY (Sterkspruit, South Africa.)



Using clock wheels for trimming ganged condensers.

BRITAIN'S GREATEST RADIO VALUE

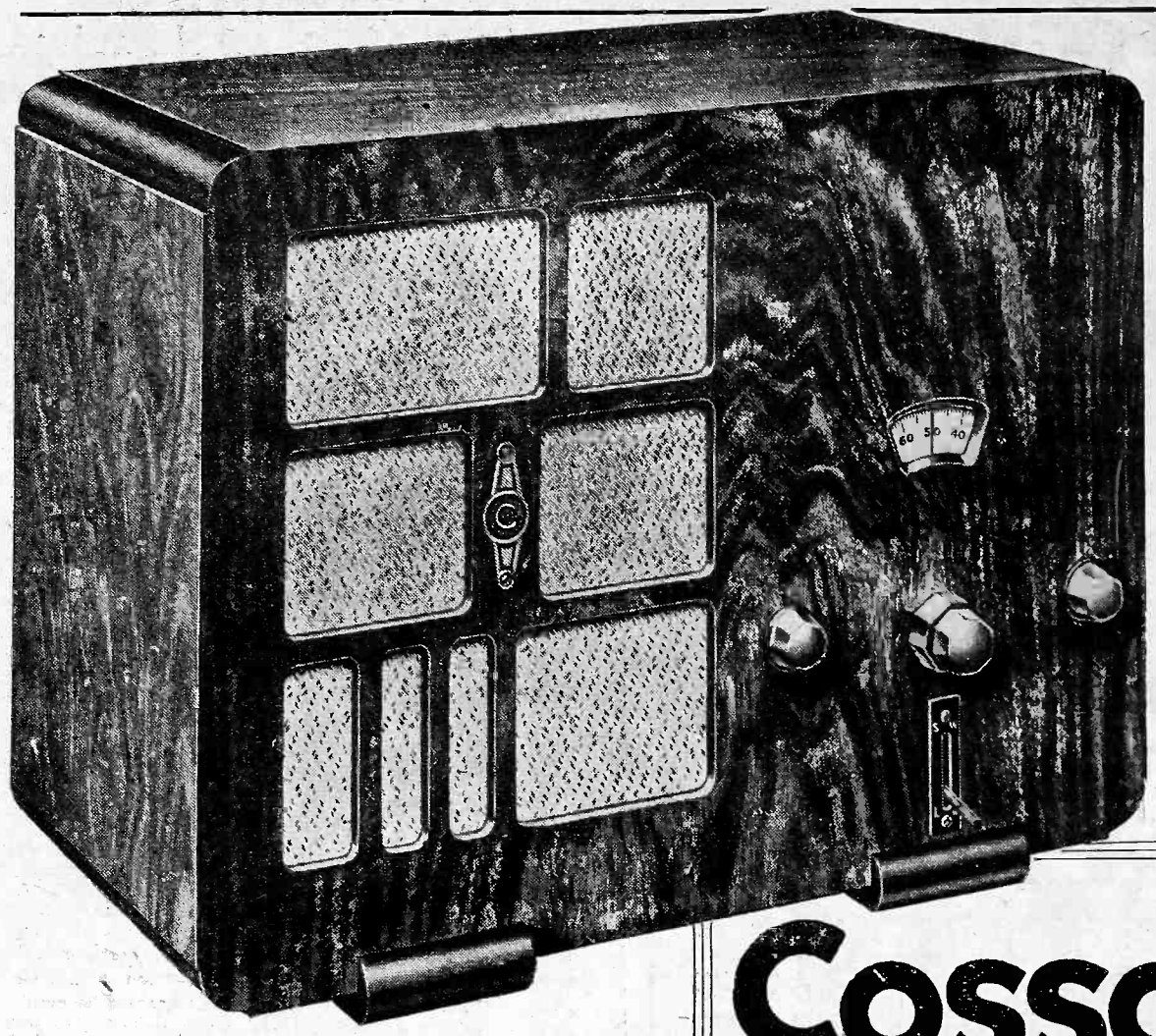


Illustration shows Models 342, 344 and 347. Model 341 has similar cabinet but with Loud Speaker adjustment in centre of fret.

COSSOR MELODY MAKER

BATTERY MODEL
KIT **341**
PENTODE OUTPUT
Balanced Armature Speaker

Complete Kit of Parts including Cossor Variable-Mu S.G., Detector, & Pentode Valves, and all necessary parts. Cabinet 18½" x 13½" x 10", space for batteries and accumulator. Balanced Armature Speaker; provision for Gramophone Pick-up Plug and Jack, Wave-lengths 200/530 and 900/2,000 metres. **Price £6.7.6**

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BATTERY MODEL
KIT **342**
MOVING COIL SPEAKER

Complete Kit of Parts similar to Model 341, except that it is supplied with a permanent Magnet Moving Coil Loud Speaker **Price £7.2.6**

Hire Purchase Terms 17/6 deposit and 9 monthly payments of 15/6.

BATTERY MODEL
KIT **344**
CLASS "B" OUTPUT

Complete Kit of Parts as model 341, but with four Cossor Valves, Class "B" Output Stage and Permanent Magnet Moving Coil Speaker. **Price £8.2.6**

Hire Purchase Terms 20/- deposit and 10 monthly payments of 16/-.

Prices do not include Batteries or Accumulator.

ALL-ELECTRIC
MODEL KIT 347

Complete Kit of Parts, similar to Model 341, but with four Cossor A.C. Mains Valves (incl. Rectifier) Power Unit and Mains Energised Moving Coil Loud Speaker. For A.C. Mains only 200/250 volts (adjustable) 40/100 cycles **Price £8.19.0**

Hire Purchase Terms 20/- deposit and 9 monthly payments of 20/-.

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You can own this fine Receiver — the Cossor Melody Maker—for much less than its real worth. It will cost you no more than the bare price of its parts. When you have assembled it you will possess a Set capable of outstanding performance. It will bring you a wide choice of programmes—free from interference—with a rich, true-to-life tone. Bought in the ordinary way a Receiver of equal efficiency would cost pounds more. Send at once for Construction Chart that tells you all about it — use the coupon.

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Get one of the new Cossor Station Charts which gives the revised wave-lengths, etc., of over 80 foreign stations and has space for entering your own dial readings, price 2d. from your Dealer or write to A. C. Cossor Ltd., Melody Dept., Highbury Grove, London, N.5, enclosing 2d. stamp.

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PRAC. 3/3/34.

DYNATRON OSCILLATORS AND THEIR USES

An Interesting Explanation of the Dynatron Principle with Some Practical Information in Regard to the Construction and Use of Dynatron Oscillator.

By K. E. BRIAN JAY

IF the electrons emitted by the hot filament of a valve strike the plate sufficiently hard they will knock electrons out of the metal of the plate, and so set up a secondary electron stream in the opposite direction to themselves. By raising the grid of the valve to a higher D.C. potential than the plate, as in Fig. 1, the speed of the filament or primary electrons is accelerated, so that they knock more electrons from the plate and increase the stream of these secondary electrons, which are attracted to the grid. The result of this is shown in the plate volts-plate current curve of Fig. 2. As the plate voltage is increased, the plate current (measured by the milliameter M) increases until it reaches the point A, at which secondary electrons begin to be liberated. Beyond A an increasing number of secondary electrons are set free which return to the grid and so reduce the total plate current until the point B is reached at which the plate voltage approaches that of the grid and the potential difference is no longer sufficient to draw the electrons to the grid. We see then that over the part of the curve between A and B the valve has the unusual property of passing less current the more the voltage is increased, a condition called negative resistance. This effect was first described in 1918 by A. W. Hull, who gave to it the name dynatron; he found that improved dynatron effect could be obtained by putting a fourth electrode (shown dotted in Fig. 1) into his valve, which he then called a pliodynatron, although dynatron is the commonly used term now. Little practical use of the effect was made until the introduction of screen-grid valves made it easy to obtain valves having dynatron characteristics. The curves of Fig. 2 are actually those of a 2-volt screen-grid valve drawn for a fixed screen-grid voltage, and control-grid voltages of 0 and −1.5 volts.

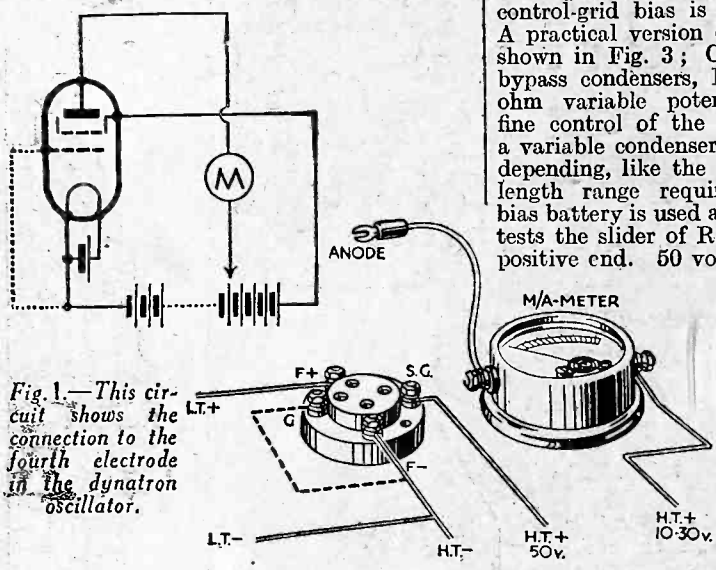


Fig. 1.—This circuit shows the connection to the fourth electrode in the dynatron oscillator.

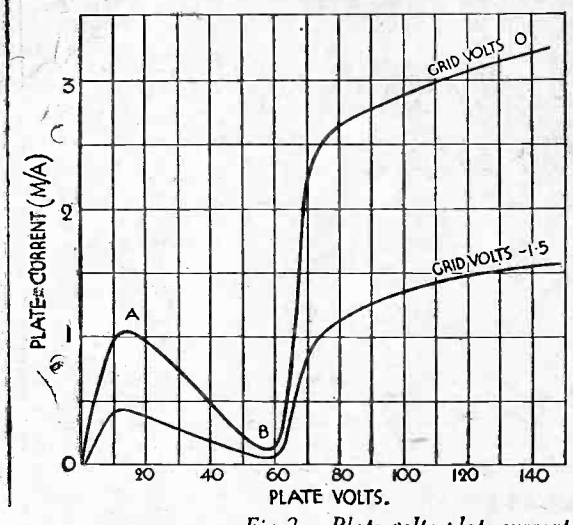


Fig. 2.—Plate volts-plate current curves for an S.G. valve.

Operating the Dynatron

The utility of the device lies in the fact that a tuned circuit will oscillate when it is connected across a negative resistance if its resonant impedance is greater than the negative resistance. The dynatron provides a simple negative resistance that has the advantage that it is easily varied by altering the bias on the control grid; the negative resistance is equal to the reciprocal of the slope of the curve AB, so that decreasing the slope increases the negative resistance, and from Fig. 2 it is clear that the slope of the curve is decreased when the control-grid bias is made more negative. A practical version of the arrangement is shown in Fig. 3; C_1 and C_2 are 1 mfd. bypass condensers, R_1 a 5,000 to 10,000-ohm variable potentiometer to provide fine control of the control-grid bias, C_3, a variable condenser of .0005 mfd. or less, depending, like the coil L_1, on the wavelength range required. A six-volt grid bias battery is used and for the preliminary tests the slider of R_1 should be set at the positive end. 50 volts H.T. on the screen grid will suit almost any valve, but the voltage on the plate is rather more critical although it will probably be between 10 and 30 volts. To find out whether the dynatron is working, a coil covering the 200 to 500-metre broadcast band should be placed at L_1 and the broadcast receiver tuned to the local station; C_3 is then rotated until a heterodyne whistle is heard in the loud-speaker; if there is no whistle the plate voltage is altered until it appears. Most mains or battery screen-grid valves work satisfactorily, high conductance valves being the best, but pentodes are quite useless because the third grid has been introduced for the express purpose of removing the dynatron kink.

For Comparing Coil and Condenser Efficiencies

When the valve is oscillating, increasing the negative grid bias by moving the slider of R_1 to the negative end increases the negative resistance, which approaches the impedance of the tuned circuit L_1C_3 until, when they are just equal, the oscillations cease; decreasing the negative bias should cause the oscillations to restart immediately; if they do not, backlash is present and may be removed by adjustment of the plate voltage. When properly adjusted the oscillator provides an excellent means of testing the relative "goodness" of coils and small condensers. To compare two coils one is connected in place of L_1 and tuned by C_3 to give a beat note with a station tuned in on the receiver; the grid bias is then increased by adjusting R_1 until the valve just stops oscillating, when the bias voltage is read on the voltmeter shown dotted at V in Fig. 3. The second coil is then put in place of the first and the

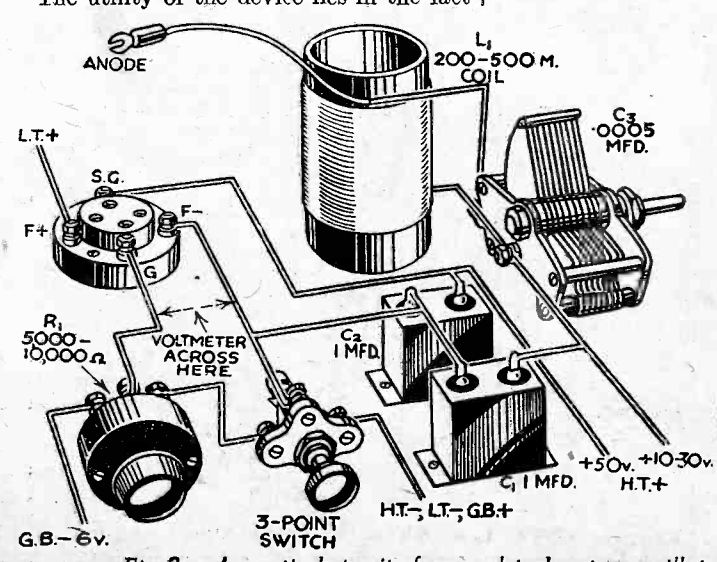
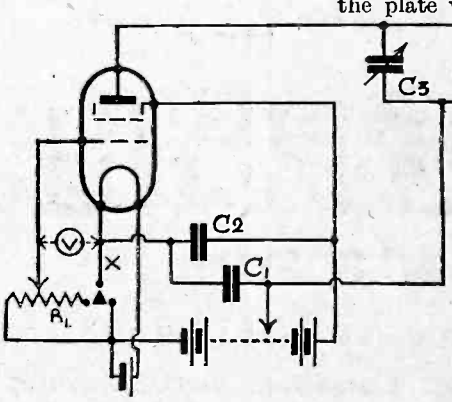
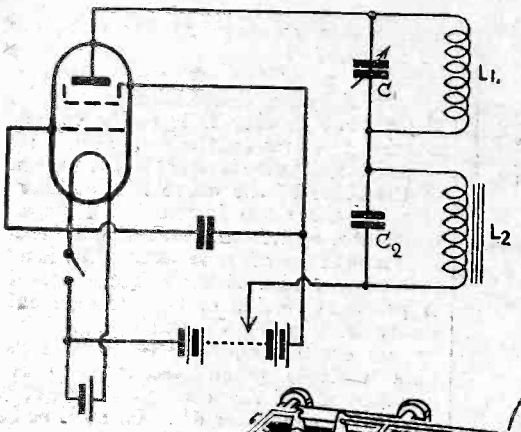


Fig. 3.—A practical circuit of a complete dynatron oscillator which is described in the text.





test repeated; if the valve stops oscillating with a smaller bias the coil is inferior because it gives a lower-impedance circuit, whereas if it continues to oscillate when a higher bias is used, you have a better coil.

Measuring Wavelength Range

The wavelength range of an unknown coil can also be measured; the coil is connected in circuit and an oscillating receiver operating on the approximate wavelength is tuned until a beat note is obtained with the dynatron when C_3 is at minimum capacity; the calibration of the receiver gives the wavelength to which it is tuned and the upper limit of the unknown coil can be obtained in the same way. Ganged-coil sets can also be checked by tuning each coil in turn to a certain wavelength and noting any discrepancy in the capacity of C_3. Small fixed condensers can be connected in parallel with C_3, using a good coil for L_1, and after re-tuning C_3 to give the initial wavelength, the grid bias is increased to the non-oscillating point; the bias with and without the fixed condenser then gives a measure of its efficiency compared with the air condenser. As in the case of coils the matching of a ganged condenser unit also can be checked.

Audible-frequency Oscillations

The dynatron will oscillate at audible frequencies if a high inductance coil, such as an L.F. choke or transformer primary, is used at L_2 and tuned by a fixed condenser of between .001 and .01 mfd. capacity, depending on the pitch of the note required. If a low-frequency circuit L_2C_2 of this kind is connected in series with a H.F. circuit L_1C_1, as shown in Fig. 4, the dynatron will oscillate at both high and low frequencies and radiate a modulated wave that can be picked up on a non-oscillating receiver and used, for example, instead of a broadcast transmission to trim a ganged condenser unit. The dynatron is particularly useful for this type of work and for the measurements and comparisons outlined above.

A Dynatron Wavemeter

In addition, it makes a good wavemeter because, as long as the total space current drawn by the valve (measured by a milliammeter inserted at X in Fig. 3) is kept constant, the wavelength of the circuit is very little affected by changes in the plate and screen-grid potentials, provided they vary in the same ratio as they would if due to the running-down of the H.T. battery. Furthermore, the circuit gives strong harmonics with a good valve so that although it cannot be made to perform very satisfactorily below about 50 metres, a wavemeter for use with short-wave receivers can be made by covering the band from, say, 55 to 120 metres (C_3 .0002 mfd., L_1, about 30 turns on a two-inch former),

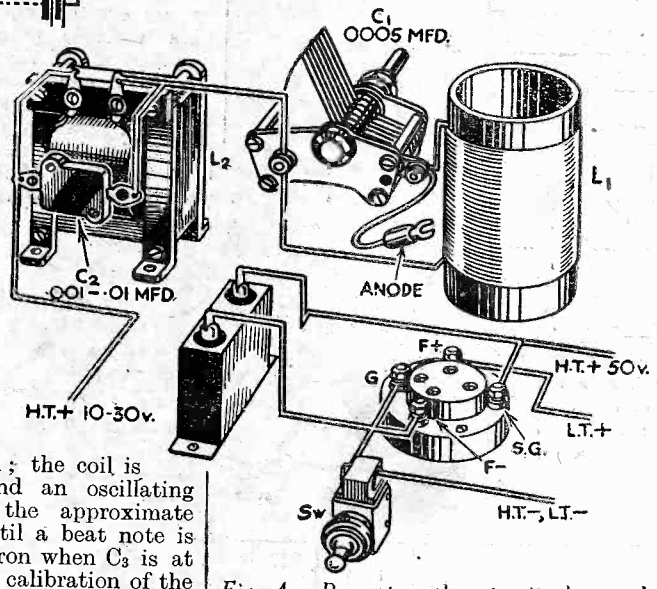


Fig. 4.—By using the circuit shown above, where an iron-core choke is connected in series with a tuned H.F. circuit, the oscillator will oscillate at both high and low frequencies.

and using the second harmonic to cover from 22.5 to 60 metres, and the fourth from 11.25 to 30 metres. A wavemeter of this kind must be very rigidly constructed, especially as regards the coil and condenser, and must have a metal panel to remove hand-capacity effects. A milliammeter must be kept permanently in circuit at X, and the total space current always adjusted to the value at which the meter was calibrated; it will generally be from 2.5 to 5 m/a and should, of course, be kept as low as possible in order to prolong the life of the valve and battery.

TOPICAL TECHNICALITIES

Wattage Dissipation

WHEN current is passed through any circuit or component having resistance, a voltage drop occurs across that circuit. In other words, a certain amount of voltage is "lost," or wasted. It is one of the laws of science that nothing can be "created" or "destroyed," but, as the voltage-drop across the resistance multiplied by the current flowing represents "power," it would appear that in the case under consideration, some power must inevitably be lost or destroyed. This is not actually the case, however, since the electrical power is simply converted into energy of another kind—heat. This explains why all resistances show a certain rise in temperature after they have been passing current for any length of time. As a matter of fact, the temperature commences to rise as soon as a voltage is applied between the ends of the component, or circuit including it.

It will be evident that the energy which is in the form of heat is "wasted" or "dissipated," and it is this which gives rise to the expression "wattage dissipation," due to the fact that the power (in watts, found by multiplying the voltage across the resistance by the current) is changed into heat, and is then "dissipated."

Knowledge of these facts is essential when choosing resistances and other components for use in wireless circuits, because if these are not capable of dissipating sufficient energy they will heat up unduly, and damage will result.

FILTERS AND FUSES

ALTHOUGH at first sight there appears to be no connection between filters and fuses, it can be seen on closer consideration that fuses should be fitted to mains filters. The type of filter referred to is shown in Fig. 1, and is for reducing hum and interference. This filter should be placed as close as possible to the point at which the mains enter the house if the trouble is to be reduced to a minimum. From Fig. 1 it can be seen that the condensers C_1 and C_2 are connected directly across the mains, the centre point being earthed. This is a very effective method of reducing the interference due to the mains, and it is essential that fuses of low current-carrying capacity should be connected in the circuit as shown.

House Mains Fuses

At this point the practical wireless man will be thinking of the main fuses in the house. If the main fuses are relied upon, any trouble which does occur to either of the condensers will cause the house fuses to blow. If extra fuses of low current-carrying capacity are in circuit these will blow first, thus eliminating the possibility of the house being in darkness should any breakdown occur.

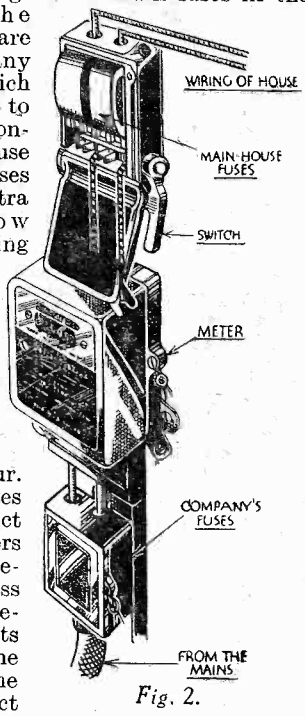


Fig. 2.

These fuses will have no effect on the filters which are required to by-pass the high frequency currents and to steady the voltage in the case of direct current mains. Any light fuse rated at .5 amp or so may be fitted. We shall thus have a fully-protected filter.

The wireless engineer always tries to avoid fuses where possible, and although this is quite all right on some circuits it is advisable to be on the safe side when using the mains. The "heavy" electrical engineer does not leave things to chance, as can be seen from considering the usual house switch and fuses; this is shown in Fig. 2, which should be of interest to readers. First of all comes the company's main fuses, the meter, the main switch, then the main fuses to the house wiring. It can be seen from this that things are not just left to chance.

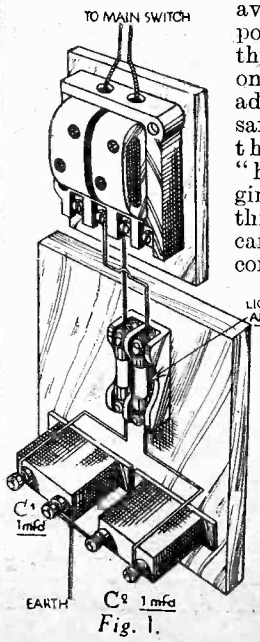


Fig. 1.

Ship's Wireless Operator ENTERTAINS THE PASSENGERS! with the LISSEN SKYSCRAPER 4

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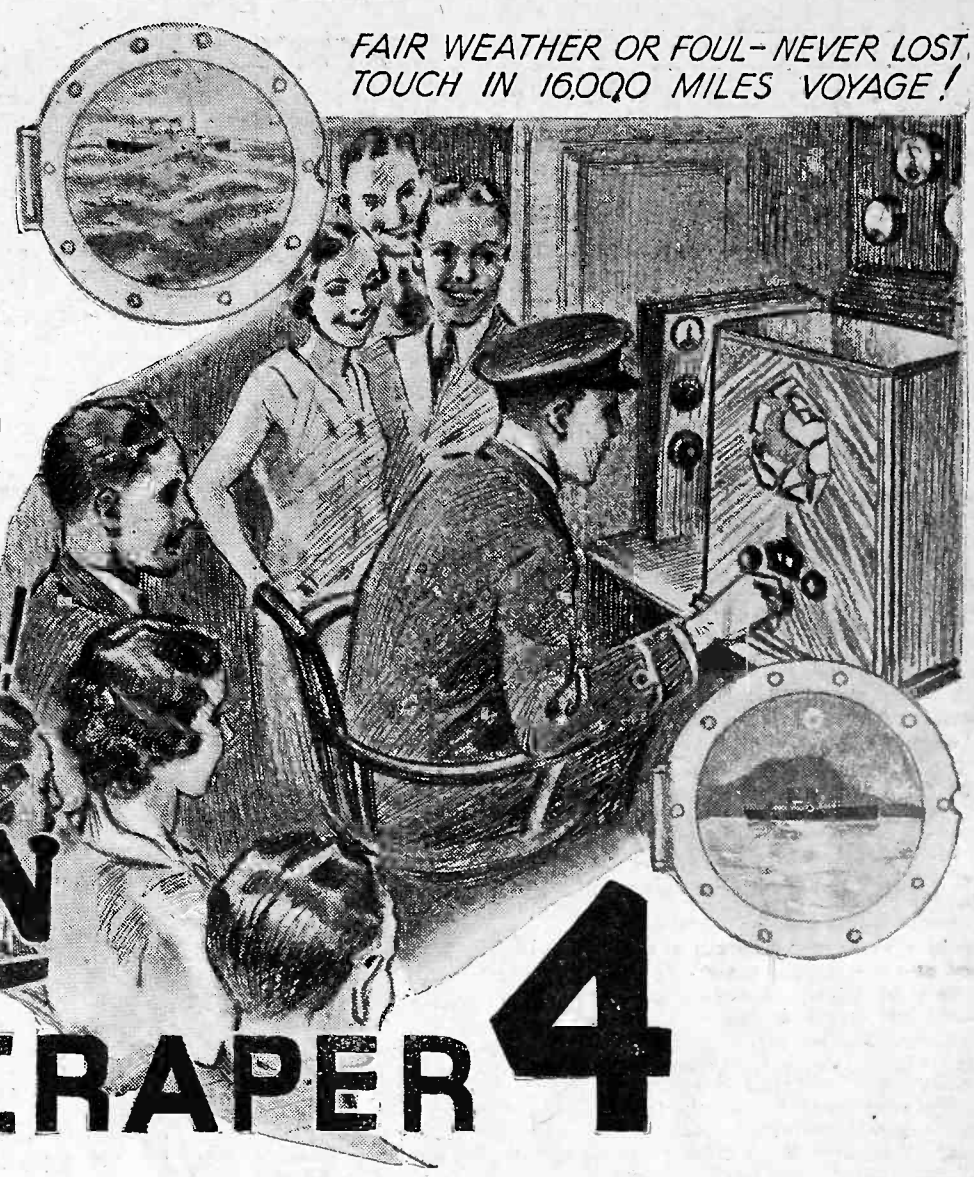

YOU can build an identical receiver with a screwdriver and a pair of pliers . . . YOU can enjoy the same world-wide range . . . the same full power moving coil reproduction!

Mr. Ford, a ship's wireless operator, took a Lissen Skyscraper 4 with him on a voyage from England to Burma and back. The distance was 16,000 miles and Mr. Ford reports the remarkable fact that "The Skyscraper kept me continually in touch . . . in fair weather and foul . . . in the Bay of Bengal demonstrated the Skyscraper to interested passengers who were most pleasantly surprised to learn that such results were possible *on the loud-speaker* at that distance — about 7,000 miles."

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USE LISSEN BATTERIES, LISSEN VALVES, LISSEN ACCUMULATORS FOR YOUR SET

DISTORTION IN AMPLIFIERS

Notes On Its Cause And How It Can Be Overcome.

By E. G. ROWE, B.Sc. (Hons.), A.C.G.I.

THE general aim in the design of all amplifiers is high amplification with the minimum of distortion. The ideal amplifier is one whose output waveform is exactly similar to the input waveform; then there is no distortion. To put this in another way—distortionless amplification is obtained if the amplified current in the output circuit is an enlarged reproduction of the input current for the whole range of frequencies which it is desired to transmit. However, distortion creeps in at every part of the circuit, from the detector to the loud-speaker, and the amount that it is overcome is as much an economic proposition as a technical one. Any dissimilarity between the input and output currents is known as waveform distortion. As is well known, the electrical oscillations in an amplifier have a complex waveform. This waveform, no matter how complicated it is, may be broken up, or analysed, into a number of smooth curves called sine waves. These represent pure tones, such as one would get from an organ pipe or a tuning fork. To understand waveform distortion it is necessary to remember this.

Waveform Distortion

We will consider waveform distortion under three heads. The first is *phase shift* which is introduced by the characteristics of the circuit. It is of great importance in long telephone lines, but causes very little trouble in audio frequency amplifiers because fortunately the ear is a very accommodating organ and is very insensitive to phase shift, taking note of the intensity and frequency of the components of the complex wave rather than of the wave itself.

The way in which phase shift alters the shape of the received signal is illustrated in Fig. 1. We have taken two frequencies A and B and combined them to form the complex waveform C. Then B is moved along the time axis, that is, its phase is altered, and the combined wave then becomes as shown at D.

The second form is known as *frequency distortion*. This is caused through voltage variations applied to the grid at various frequencies not being equally amplified. Thus, 1 volt at 50 cycles/sec. may only be amplified one-tenth as much as 1 volt at 3,000 cycles/sec. This is due chiefly to the variation of the circuit impedances with frequency. For example, a 60 henry choke has an impedance of 1,880 ohms at 50 cycles/sec., while at 5,000 cycles/sec. its impedance has become 190,000 ohms and it thus offers 100 times the impedance to a 5,000 cycle note than it would to a 50 cycle note. Similarly, a 0.0005 mfd. condenser has an impedance of 0.16 ohms at 50 cycles and 0.0016 ohms at 5,000 cycles. This is the reason that resistance-coupled amplifiers are considered to be much freer from distortion because a properly designed resistance has a constant value regardless of the frequency—this applies to audio frequency amplifiers. However, transformers and condensers can be so chosen that for the operating range of frequencies the total impedance is not unduly affected by the frequency.

Amplitude Distortion

The third type of distortion is known as *amplitude distortion* in which the amplitude of the output variations is not linearly related to the amplitude of the input variations. By "linear relation" we mean that if the instantaneous input and output currents were plotted against each other the graph would be a straight line, showing that the output varied as the input. This is shown in Fig. 2. It can be shown mathematically that this non-linear relationship introduces harmonics, or high multiples, of all the frequencies present in the input voltage, together with new components having frequencies equal to the sum and difference of each pair of frequencies in the input. Thus, if there are frequencies f_1, f_2, f_3 in the input, the harmonics of these would have frequencies of $2f_1$, $2f_2$, $2f_3$; $3f_1$, $3f_2$, $3f_3$ and so on, while the sum and difference frequencies would be f_1+f_2, f_1-f_2, f_2+f_2, f_2-f_3, and so on. Sum and difference tones cause the more annoyance in an audio frequency amplifier because they are generally discordant. The unpleasant fuzziness often met with in amplifier, particularly in orchestral passages, is generally due to the sum and difference frequencies. Amplitude distortion may be caused by the curvature of the valve characteristics or by the bad characteristic of the output device. To overcome the trouble in straight amplifiers the operation must take place on the straight part of the valve characteristic, and also the amplitude of the plate and grid potentials should be kept comparatively small so that the amplification and the anode resistance may remain approximately constant over the whole cycle of operations. Class B amplifiers work over a larger part of the characteristic, but distortion is overcome by using either two valves or a double valve in one glass envelope, one valve operating on each side of the time axis.

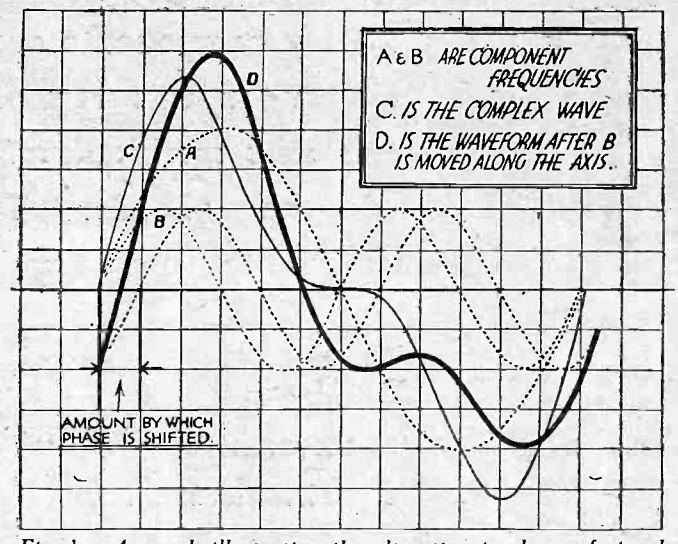


Fig. 1.—A graph illustrating the alteration in shape of signal waveforms.

With low-frequency amplifiers both frequency and amplitude distortion are serious, but the latter is the worse; with high-frequency amplifiers it is frequency distortion that causes the most trouble.

The distortion in high-frequency amplifiers, while generally the same as in low-frequency ones, has several distinctive features. Frequency distortion, as before stated, is the more serious because any modulation of the high-frequency signal is after rectified. However, it must be recognised that as radio frequency amplifiers are generally tuned it is only frequencies in the neighbourhood of the resonant frequency that pass through the amplifier—thus a common form of high-frequency distortion occurs when the difference in frequency between two high-frequency carrier waves approaches the resonant frequency. Then again, a deeply modulated carrier wave, which acts on the amplifier at the same time as a second carrier, to which the amplifier is tuned, is being received, is liable to set up what is known as crosstalk.

In conclusion, we may sum up distortion as consisting of two principal kinds:—

(1) That set up when currents of different frequencies are not amplified by equal amounts. This is overcome by good design.

(2) That due to the amplification not being independent of the input voltage. To ensure freedom from this fault the working characteristic must be linear over the operating range of voltage, which demands the correct choice of valves and a high external output impedance.

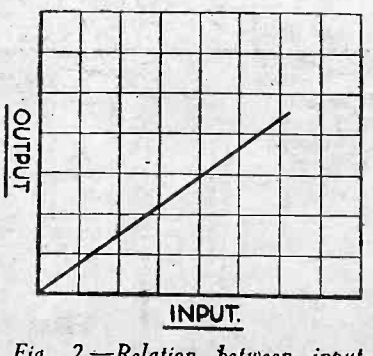
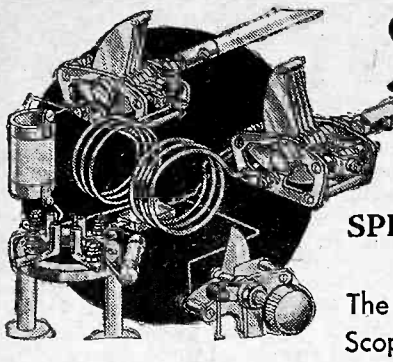


Fig. 2.—Relation between input and output.

Poznan's New Transmitter

BETTER signals from Poznan (Poland) are now being picked up on 345.2 m., as since the beginning of February the new 17-kilowatt transmitter has been gradually taking over the broadcasts. According to a Polish paper, Poznan will be endowed later with more powerful plant; in fact, it is possible that when the system has been reorganised a 50-kilowatt transmitter may be installed in the neighbourhood of that city.



Short Wave Section

SPECIAL AERIAL SYSTEMS FOR SHORT-WAVE RECEPTION.

The Short-Wave Enthusiast Will Find Ample Scope for Practical Experiments in the Various Types of Aerials Described in This Article

By ALF. W. MANN

THERE are various types of short-wave aerials, the majority of which are of simple construction, and which may be used in conjunction with any type of short-wave receiver. As a rule, the magnitude of aerial experiments undertaken by the average amateur is governed by the amount of space in which to erect alternative aerials and the particular site of his house.

It is, of course, well known that almost any aerial, either long or short, will do for short-wave reception. It does not follow, however, that the results obtained will do justice to the capabilities of even the most ordinary receiver; therefore, if at all possible, the construction and erection of a special aerial suitable for short-wave reception should be considered.

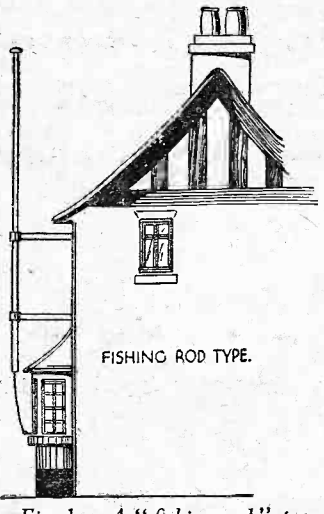


Fig. 1.—A "fishing rod" type of vertical aerial.

In placing the suggestions outlined in this article before readers, the writer has taken into account the circumstances under which the majority of short-wave enthusiasts carry out their DX and experimental work, and has confined his suggestions to those where unlimited space is not the ruling factor. Fig. 5 is, of course, given as an interesting example only, as very few enthusiasts will be fortunate enough to have the amount of open space at their command which is necessary to erect the type of aerial shown.

In many instances, aerials consisting of a length of insulated wire laid behind a picture rail are in use. Whilst no doubt moderately satisfactory for broadcast reception, such an aerial leaves much to be desired so far as short-wave reception is concerned.

Aerials Under the Roof

If the experimenter lives in a private house, and wishes to use the short-wave receiver at will leaving the broadcast receiver coupled to its own aerial, the possibilities of an inside aerial zigzagged between the rafters under the roof should certainly be considered. The writer uses an aerial of this type strung from corner to corner with the down-lead from the far end. The total length is 65ft. of insulated aerial wire, and the results obtained are quite satisfactory.

The flat dweller in the cities and large towns has a difficult problem to solve, especially if his flat happens to be about half-way between the top and bottom of the block, for it is certain that those above him will have availed themselves of the roof facilities, whilst those below will take advantage of the back space available at ground level.

A commercial idea known as the "Fishing Rod Aerial," shown in Fig. 1, provides a solution to this problem, as it is mounted in a vertical position by means of two wall brackets. Whilst specially applicable to the circumstances outlined above, the idea is commendable to anyone who requires an additional aerial, or, for instance, an aerial for broadcast reception which may be erected with the minimum of trouble.

Vertical Aerials

As vertical aerials are under consideration, details, as given in Fig. 2, may be of interest. As the sketch is self-explanatory, further comment is unnecessary. It should be noted, however, that providing it is possible to use supporting brackets which will allow the aerial to hang at least 2ft. from the wall, there is no reason why this type of aerial should not be used when there is sufficient height available.

In Fig. 3 we have a variation of the above idea, and, whilst eminently suitable under certain circumstances, the possibilities of swinging signals, due to the swaying of the broadcast aerial in the wind, should not be overlooked, as under these circumstances tuning in and holding signals even on a stable and trouble-free receiver is apt to be difficult.

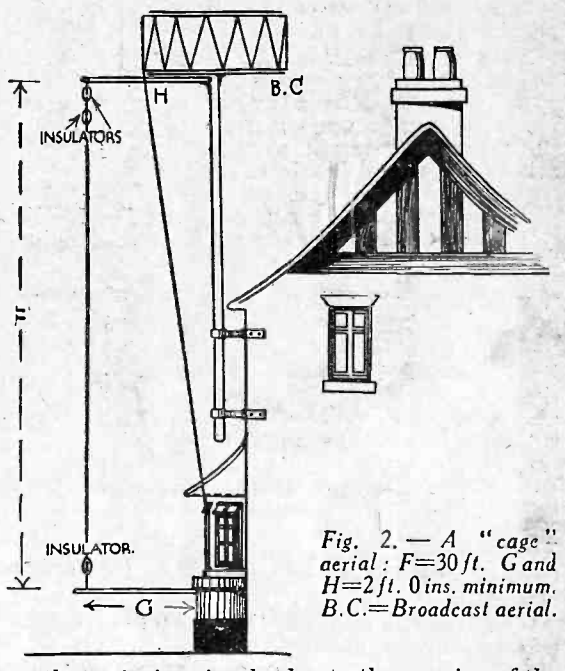


Fig. 2.—A "cage" aerial: F=30ft. G and H=2ft. 0ins. minimum. B.C.=Broadcast aerial.

A Divided Aerial

The details concerning the arrangement shown in Fig. 4 were forwarded to the

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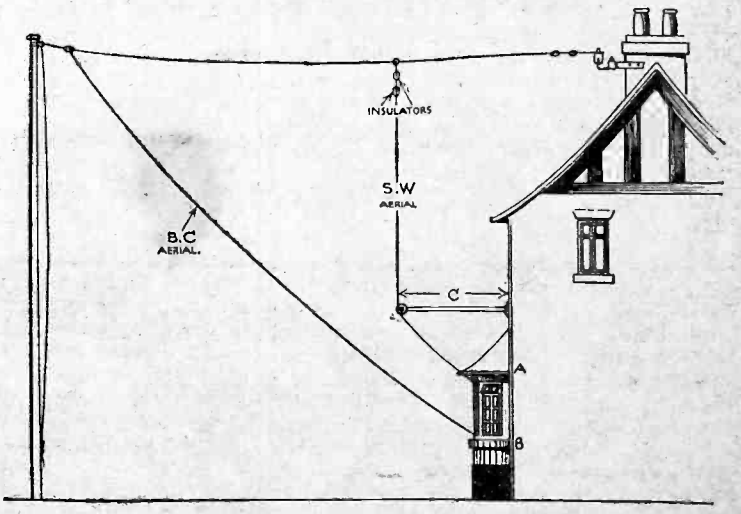


Fig. 3.—A dual aerial, A=S.W. aerial: lead-in at top right-hand side of window. B=B.C. aerial: lead-in at bottom left-hand side of window. C=2 ft. minimum.

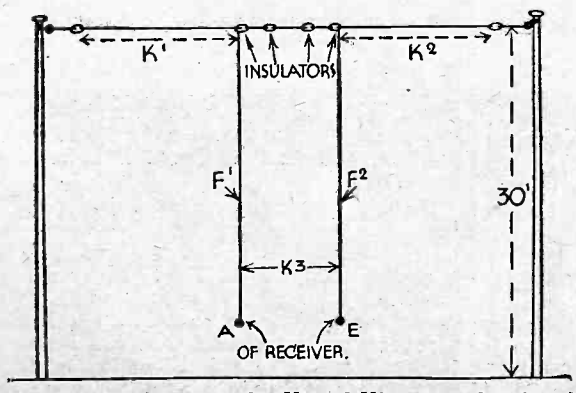


Fig. 4.—A divided aerial: K1 and K2 are equal in length to half the wavelength. K3 = 4½ inches.

AERIAL SYSTEMS FOR S.W. RECEPTION

(*Continued from previous page*)

writer by a New Zealand enthusiast who is highly satisfied with the results obtainable. The fundamental principle is that each flat top is half a wave length, *i.e.*, if the listener wishes to receive say, for example, on a wavelength of 25 metres, the individual flat tops must be 12½ metres long. Unfortunately, details as to whether the feeders F^1—F^2 are tuned in order to bring each half in resonance is not stated. The writer has not sufficient space available to try out the idea, but it may have an appeal to listeners abroad who hear one or more of the British Empire Transmitters regularly.

As previously stated, the transposed aerial arrangement shown at Fig. 5 is included as a matter of interest. The advantage of this type is, that whilst it is not a complete eliminator of outside interference, such as that caused by electric signs, lifts, car-ignition, and other systems, it is effective in cutting down the interference to such an extent that the ratio of signal strength to noise is in favour of the former.

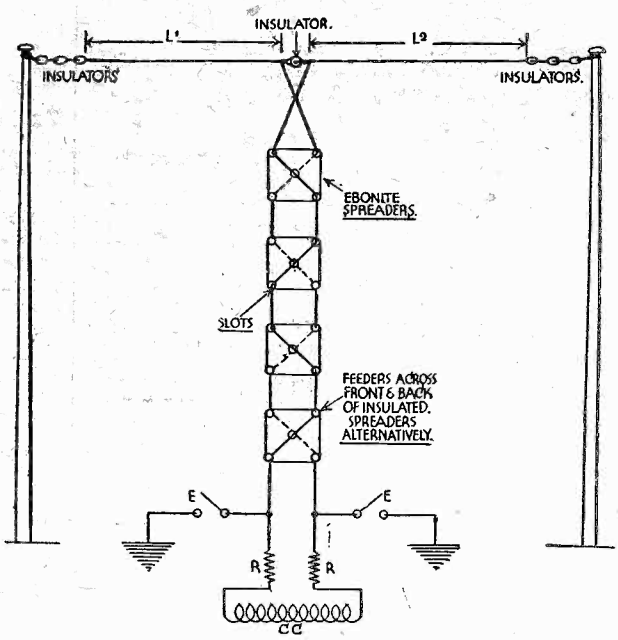


Fig. 5.—Transposed or horizontal doublet aerial. E= earthing switches. CC=coupling coil. RR=600 ohm resistances. L^1, L^2=40 ft. aerials.

There is no doubt that about 80 per cent. of such interference is picked up directly by the lead-in and earthing systems, as the interference is near the ground. Taking these facts into consideration, it is quite clear that the flat top of the aerial system will pick up less interference, as it is farthest from the source.

It should be understood, however, that whilst both signal and interference are picked up by this type of aerial, the voltages set up in each feeder is due to the transposition, 180 degrees out of phase with the other. These voltages, when applied across the tuning coil, partially cancel out the interference.

This type of aerial system is favoured by many listeners in the Antipodes. A considerable amount of open space is required, however, but providing sufficient height is available, some interesting results may be obtained by erecting the transposed feeders without the flat top arrangement. The usual earthing system is not used.

MAKING SURE OF PERFECT RECEPTION

How the B.B.C. Looks After Listeners.

By HAROLD A. ALBERT.

A CRITICISM often levelled at the B.B.C. is that although perfect transmission is assured, the reception side of radio is generally left to take care of itself. In solid fact, this accusation is unjust. Under the control of the Chief Engineer, a department at Broadcasting House specializes in looking after the technical troubles of listeners. Known as Technical Correspondence, its job is to answer the complaints of amateurs, wireless traders, old ladies and enthusiastic schoolboys alike.

Complaints about oscillation and interference, sorrowful questions of the "what's wrong with my set?" type, and replies to criticisms of the quality of broadcast transmissions—all come within its scope, while the records of the department form an almost unique guide to the gradual march towards perfect radio reception.

Oscillation Complaints

At one time, for instance, complaints of oscillation preponderated. Programme time was seriously jeopardized by S O S messages from local stations, asking residents of various streets to look to their sets lest they be causing interference. A huge map at broadcasting headquarters, studded with pins, enabled the engineers to see how the tide of oscillation complaints ebbed and flowed in different districts. And grounds for suspicion arose that some listeners grumbled of oscillation solely in order to hear the name of their street read into the microphone!

The advent of the screen-grid valve with its higher magnification, and the greater signal strength of modern transmitters, ended all that. Oscillation complaints are now almost nil. Listeners have learned how to control the reaction of their sets. The powers of Broadcasting House, by their tactful suggestions through the mike, and the admirable pamphlets prepared through the Technical Correspondence Section, have almost entirely eliminated an etherial curse.

The B.B.C.'s Questionnaire

The few complaints there are nowadays are dealt with by sending in reply a questionnaire. Does this seem red tape? In reality, the question paper is so cleverly constructed and arranged that after reading it the listener himself is generally able to locate the offender and put matters right. If, by any chance, he does fail, the Post Office Engineers—working hand-in-hand with Broadcasting House—are set on the trail, and their much-discussed blue van with its direction-finding apparatus patrols the streets and tracks down the oscillator.

Other forms of interference are handled in similar fashion. Are you troubled by wireless telegraphy or morse? The men in charge of the Technical Correspondence will send you gratis full information and advice on improving the selectivity of your set. Should this prove useless, a visiting Post Office engineer will do his best to put the matter right. Is an amateur station working next door, and spoiling your entertainment? The G.P.O. will fix it.

Electrical Interference

Electrical interference, that other bugbear, is also rectified whenever possible. If a listener is getting noises in his set from electric signs, X-ray apparatus in a neighbouring hospital, or a dynamo in an adjacent cinema, he has merely to tell the B.B.C., and assure the engineers of the genuineness of his complaint by taking the trouble to fill in their questionnaire, and the G.P.O. send out experts with apparatus which will probably cure the trouble.

Perhaps something can be done to your set, or to the cause of interference itself.

Difficult Cases

Only in those cases in which trams or electric railways are concerned do the engineers find themselves "up against it." Interference from electric trains is on the wane now that overhead wires are giving way to the third rail system, but trams and trolley 'buses still give trouble. In frosty or rainy weather, or perhaps after a sandstorm has taken place on the front, they create such havoc with the wireless reception that sometimes little can be done to ease matters. There is nothing for it but to wait until the trouble has blown over—although improving the selectivity of one's set or altering the position of the aerial will occasionally do the trick.

Heterodyne Interference

Heterodyne troubles—that is, interference between stations due to the shortage of wavelengths—are another matter. They can only be dealt with internationally. The B.B.C. representatives at international meetings are kept fully aware of listeners' difficulties in this regard. The B.B.C., it will be seen, really are as keen on perfect reception of their transmissions as they are on the perfection of the transmissions themselves.

Complaints of interference by no means account for all the technical correspondence. There are also hundreds of letters from listeners who want to get the best out of their sets, or who are suffering from mysterious breakdowns for which they are unable to account. Every letter is answered and the B.B.C. prove themselves again, as always, willing to help so far as the reception of their own service is concerned. Or a technically-minded man may write to say that the reverberation period of a certain transmission on such-and-such a night was so-and-so, whereas it is usually something-or-other, and that he found it better or worse.

Such letters supply a great deal of information concerning listeners' opinions on the quality of the transmissions which otherwise would be lacking. Many a listener has been advised from headquarters as to the best place to stand his loudspeaker for good results, and the articles chosen for the Technical Section of the B.B.C. year books are based largely on the type of inquiry made by listeners!

REVIEWS OF LATEST RECEIVERS

Tests of Standard Receivers On Our Aerial.

"HIS MASTER'S VOICE" "SUPERHET FOURFORTY" (A.C.)

THIS latest production of The Gramophone Company is somewhat of an experiment in one direction, although there is nothing of doubtful efficiency in its make-up and performance. The experiment is in regard to the price—12 guineas—which undoubtedly sounds far too low for a high-grade instrument having four valves and bearing the hall-mark of perfection bestowed by the name "H.M.V." As a matter of fact, the makers have a very good and sound reason for offering such amazing value. It is their intention that an instrument capable of giving the best possible reproduction should be within the reach of every household.

It need scarcely be pointed out that this latest set, which has only just become available to the public, upholds the high standards which have always been set by "H.M.V." products. It is, as the name suggests, a four-valve (plus rectifier) superheterodyne receiver, and can be obtained for operation from all 50-cycle A.C. mains supplies.

The Cabinet and Controls

This set is beautiful to look upon besides being pleasing to the ear. It is housed in a remarkably attractive modern—but not fantastic—walnut cabinet which has been specially designed and made in the "H.M.V." factories to eliminate all resonance and "boom." The front is attractively veneered and has a square speaker opening which is in very good taste. There are four controls symmetrically arranged about a rectangular tuning-scale opening. The scale is illuminated when the set is switched on and is marked off in wavelengths from 200 to 550 metres and from 900 to 2,000 metres; it is traversed by a vertical pointer. At first the makers had in mind the fitting of a station-calibrated tuning scale, but this was wisely deferred for the moment, due to the fact that there will probably be a number of minor wavelength changes before the Lucerne Plan gets quite "into its stride." In order that users may have no difficulty in finding the setting for any desired station, however, a carefully prepared stout card is supplied to fit into a slide beneath the cabinet; the card is in the form of a chart showing the wavelengths of all the popular European stations, whilst two scales also printed on the card show the positions of long- and medium-wave stations on the tuning scale. The makers advise us that they propose to issue a station-calibrated scale to fit over the existing one when, and if, the wavelengths of European stations become definitely and finally settled. This scale will be supplied at very low cost and will be in such a form that it can be fitted almost instantaneously.

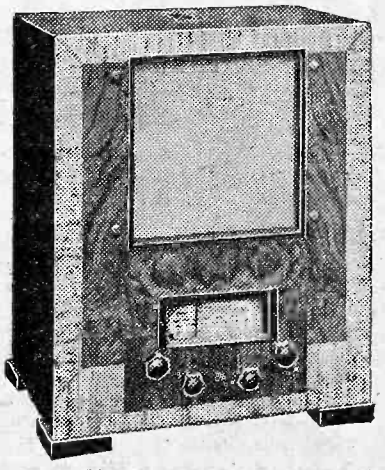
Of the four controls mentioned, one is, of course, for tuning, a second (that on the extreme right) can be rotated into four positions to give "Medium Waves," "Long Waves," "Gramophone Pick-up" and "Off." The knob on the left is for volume control, and the one next to it is for the purpose of varying the tone of reproduction to suit all "taste" and every type of transmission. All the controls are very accessible and work in a particularly smooth and effective manner, the volume and tone controls being "graded" in such a way as to produce a uniform change over the whole of their movement.

A Modern Circuit

The circuit of the "Superhet Fourforty" is on very efficient and up-to-date lines, and comprises a non-radiating screen-grid frequency-changing valve having cathode coupling, a 125 k/c variable-mu intermediate-frequency amplifier, a power-grid second detector, and power pentode output valve fed by a special L.F. transformer and giving an undistorted output of 1½ watts. The rectifier for H.T. supply is a full-wave with an output of 325 volts at 120 milliamps, which is obviously a very generous one for a four-valve set.

To ensure high-quality reproduction a new type of "H.M.V." energized moving-coil loud-speaker is employed, and this is mounted on an open baffle so that there is no wooden fret to act as an obstruction to the sound waves.

Other special features of the receiver under review are: the fitting of an effective whistle suppressor; the circuit is so designed that there is no sudden "blast" when tuning past a powerful station; the set can, if desired, be operated in any room without the necessity for an aerial and earth; reproduction is not marred by the appearance of images. These are just a few of the points which are very apparent and which are worthy of particular attention.



The new "His Master's Voice" "Superhet Fourforty" costs only 12 guineas for the A.C. model. It has a cabinet of finely figured walnut, and the tuning arrangements are extremely simple.

Tested Without Aerial

Our first test of the "Superhet Fourforty" was under rather unfavourable conditions, since the set was used without either aerial or earth some twelve miles from Brookmans Park. Despite such a handicap we found no difficulty whatever in bringing in no less than twenty stations at honest "programme" strength. The question of selectivity simply did not exist, and no transmission occupied more than a fraction of a division on the tuning scale. Reproduction was what we expected from an "H.M.V." instrument—as near to perfection as possible under present conditions (and that is really saying a lot). The tone control was found particularly useful in obtaining the maximum pleasure from listening to foreign stations whose transmissions are not always of such high quality as those of our own B.B.C. A commendable feature of the tone control was that it did not affect volume to a very marked degree, as is usually the case, and it functioned remarkably well in every way. The volume control was equally useful and effective; it had to be made good use of when receiving a number of stations in order to prevent overloading, so the reader may judge what a high degree of amplification is afforded.

"Crampless" Controls

A point which should be stressed in regard to the volume control is that it did not appear to have the very slightest effect upon the quality, with a result that volume could be turned down to almost inaudibility without music sounding "thin" and lacking in "body." A feature of all the control knobs which is well worthy of mention is that they are "crampless," having been designed in conjunction with anatomical experts—this is surely a sign of the times and a point of importance. It should be mentioned in respect to the tuning scale that it was found to be really accurate.

After the rather unfair preliminary test we tried the set on a moderately good outside aerial and connected an earth lead. Results were truly astounding, and there was apparently no limit to the number of stations which could not only be received, but actually enjoyed for their entertainment value. In every case the quality was all that could be desired, and we could find no item upon which to criticise adversely.

Every reader who intends to buy an up-to-date set of marvellous quality and at an almost unheard-of price should not fail to consider the merits of the "H.M.V." "Superhet Fourforty." The set can be obtained for D.C. operation at 13 guineas, or as a complete and attractive radio-gramophone in console cabinet at 20 guineas (A.C.) or 21 guineas (D.C.).

GRID DECOUPLING—

A Number of Lesser-known Points in Respect of L.F. Amplifiers are Dealt With in This Article

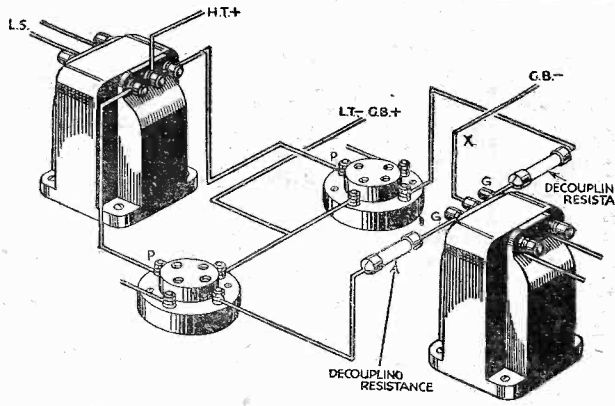


Fig. 1.—Showing how grid decoupling resistances are connected in the case of a battery-operated push-pull amplifier.

THE general subject of grid bias, automatic and otherwise, has been dealt with in these pages on more than one previous occasion, so it is not proposed to repeat any information which has been given before, but rather to touch upon points of a rather more specialized kind. The following notes have been prompted very largely by readers' queries and by incidents which have arisen in carrying out experimental work, and in designing various forms of L.F. amplifiers. My remarks may appear somewhat disjointed, because I shall attempt to cover as much ground as possible in reasonably few words. Moreover, I shall try to deal with all those points which have been known to puzzle readers whilst designing amplifiers and receivers for their own use.

Grid bias and grid decoupling are not always associated one with the other, but in most cases they are so closely bound up that they should be considered jointly; this is especially true in the case of mains receivers where two or more L.F. amplifying stages are employed. In order to make this point quite clear, it might be as well to commence by considering a battery-operated amplifier having a push-pull output stage something like that shown in Fig. 1. In this case a centre-tapped input transformer is employed and the negative G.B. connection is made to the centre tap of the secondary winding. It is known that the two valves in push-pull should be as nearly identical as possible in order to ensure correct "balance"; if they are not alike there will be a loss in amplification and a danger of parasitic oscillation. In practice it is almost impossible to obtain two valves with exactly similar characteristics, except by ordering two matched ones from the makers and paying a slight extra charge. Even when this is done the valves deteriorate at different rates, so that, in time, the circuit becomes "unbalanced." But the effects of this can nearly always be overcome satisfactorily by inserting a decoupling resistance in each grid lead, as shown in Fig. 1. The value of the resistances can generally lie anywhere between 50,000 and 100,000 ohms and is not critical.

Output Valves in Parallel

A precisely similar thing applies when two valves are connected in parallel to handle a greater output, and in this case grid decoupling is generally even more important. Provided that the valves are of similar types, however, excellent results can nearly always be obtained by including a fixed resistance in the grid circuit of each; this is shown in Fig. 2. It might be argued that there is no point in connecting two output valves in parallel these days because a greater output can be obtained by using Class B. This is not quite true, though, because it is often wished to make use of two valves which are on hand without having to buy special transformers and a new Class B valve. Besides, parallel working is very satisfactory indeed when the output stage is preceded by a high-amplification L.F. valve and an efficient detector. Particularly is this true when the set is operated from an eliminator which is unsuitable for Class B purposes.

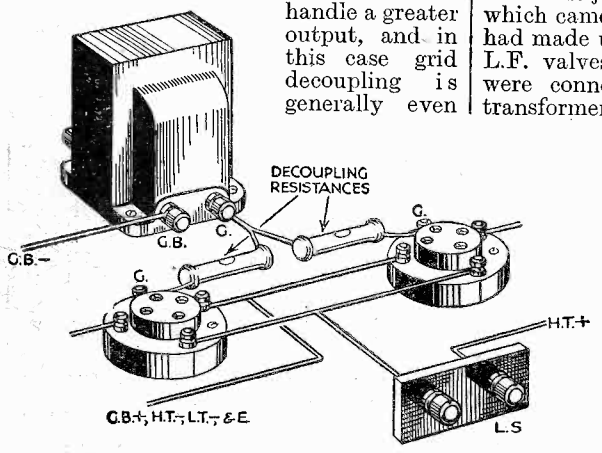


Fig. 2.—Grid decoupling resistances are very desirable when two valves are wired in parallel.

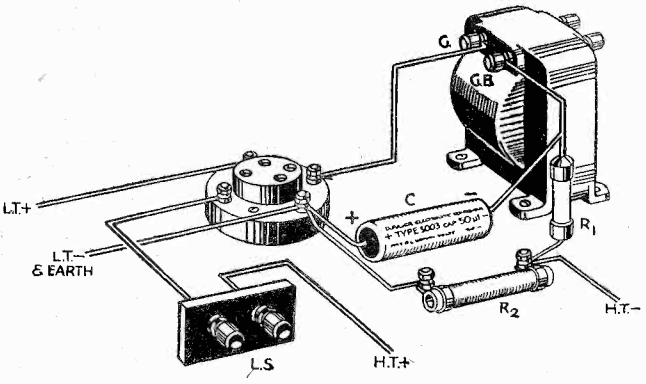


Fig. 3.—G.B. and decoupling resistances in a battery-operated output stage. R.1 is for decoupling and works in conjunction with the electrolytic condenser C.

Q.P.-P. and Class B

An arrangement similar to that shown in Fig. 1 is useful in the case of Q.P.-P. (which, incidentally, looks like becoming very popular again in view of the new valves which have just been produced), but it is equally satisfactory, and rather less expensive, to employ a single decoupling resistance only, this being included in the G.B. negative lead at the point marked X. The resistance in this case should generally have a value between 100,000 ohms and 150,000 ohms.

At this juncture I might refer to a query which came my way recently. An amateur had made up a Class B amplifier using two L.F. valves of low impedance, and these were connected after a correct Class B transformer. The arrangement should have functioned reasonably well, but it was found that it distorted terribly — why? Well, this particular constructor was well aware of the advisability of decoupling grid circuits, and he had inserted resistances in the grid leads of the two valves. In other words, he had done what has been advised above, and yet he was wrong. The explanation is that valves connected in Class B pass a comparatively high and widely-fluctuating grid current when functioning correctly, but if there is a high resistance in their grid circuits grid-current fluctuations are strongly opposed. This applies with equal force when a proper Class B valve is employed and is an exception to the general rule given above, and which should be followed in every case excepting that of Class B.

Automatic G.B. in Battery Sets

When automatic grid bias is used in a battery set, grid circuit decoupling is often extremely important, for if it is omitted

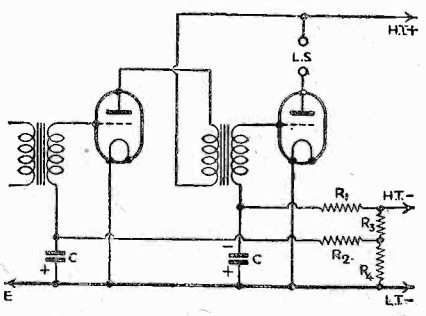


Fig. 4.—This shows grid-bias decoupling arrangements when two battery-operated L.F. valves are automatically biased.

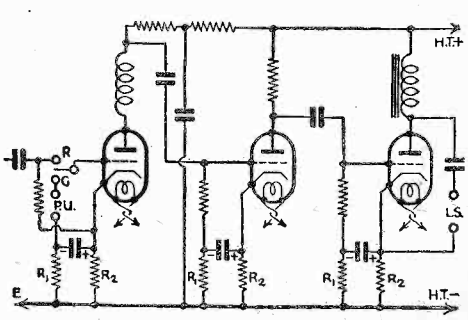


Fig. 6.—Skeleton circuit of the detector and two L.F. stages of a mains receiver where every grid is effectively decoupled.

—AND GRID BIAS

By FRANK PRESTON

all kinds of troubles are likely to be experienced. The method of fitting a decoupling resistance in a set having a single L.F. amplifier is given in Fig. 3, where the resistance in question is marked R.1, and the bias resistance, R.2. It will be seen that the decoupling resistance is inserted between the H.T. negative terminal and the G.B. terminal on the L.F. transformer, and also that a decoupling condenser is connected between the latter terminal and the earth line. The resistance (R.1) may have a value of about 50,000 ohms, whilst the condenser should preferably be of the electrolytic type having a capacity of about 50 mfd. and a working voltage of 20 or so. Notice the polarity of the condenser, and that the positive terminal goes to earth.

When automatic bias is provided for two L.F. valves the arrangement will be something like that shown in Fig. 4. In this case both grid circuits are decoupled, but it would be sufficient to decouple one only in most instances unless automatic bias were also taken for an H.F. valve. At the same time it is slightly "safer"—from the point of view of perfect stability and good quality—to decouple both valves.

Biasing Indirectly-heated Valves

The method of applying automatic grid bias to indirectly-heated mains valves (either A.C. or D.C.) is slightly different from that shown in Figs. 3 and 4, because the bias resistance is included in the cathode lead as shown in Fig. 5. In this case the grid-bias voltage is that developed across R.2, and R.1 serves for decoupling in conjunction with the electrolytic condenser marked C. If decoupling were omitted, R.1 and C would not be used and the G.B. terminal on the L.F. transformer would be connected direct to the earth line. It should be mentioned that grid-bias decoupling is particularly useful in a mains set, not only on the score of L.F. stability, but also because it tends to remove any residual hum, especially if a really large-capacity electrolytic is employed. In practice it is nearly always worth while to use a condenser having a capacity of 100 mfd. or so when such a condenser can be obtained with a sufficiently high working voltage. It should be noticed that the condenser is "returned" direct to the cathode of the valve instead of to earth as one might think would be correct. The point in this is that there should be the least possible resistance to alternating currents between the actual cathode and the G.B. end of the transformer.

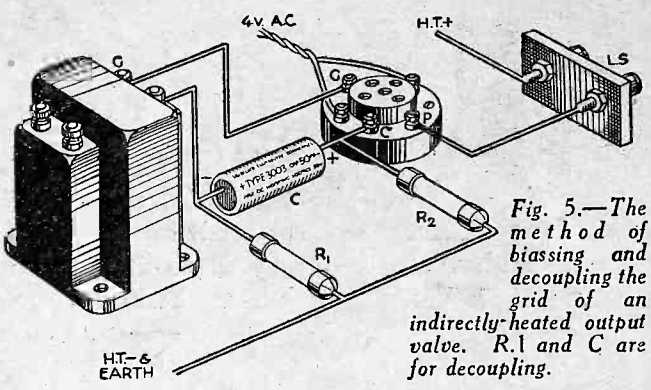


Fig. 5.—The method of biassing and decoupling the grid of an indirectly-heated output valve. R.1 and C are for decoupling.

Decoupling in the Pick-up Circuit

As a further example of G.B. decoupling a circuit is given in Fig. 6 which shows a detector valve (with radio-gram. switch and pick-up connections) followed by two resistance-capacity coupled L.F. stages of which the second feeds into the loud-speaker through a choke-capacity feed system. This is a circuit which would be used for "quality" reproduction when a high-tension voltage of about 300 was available. Automatic grid bias is obtained for every valve by including a suitable resistance (R.2) in the cathode return lead, and every grid circuit is decoupled by means of a second resistance R.1. It is perhaps not very common practice to decouple the pick-up circuit, but it is certainly an excellent idea which makes for perfect stability, and it is one which should be tried when there are signs of slight L.F. oscillation when the pick-up is in use.

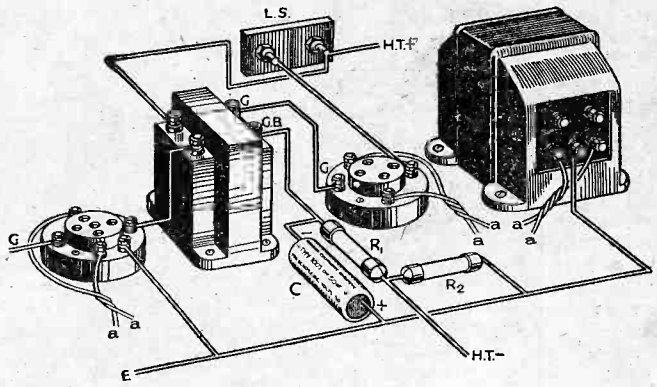


Fig. 8.—A good method of biassing a directly-heated valve which is used along with other indirectly-heated valves and whose cathode (or filament) is heated from the same source.

When Using a Directly-heated Output Valve

Somewhat different grid-bias arrangements have to be made when an output valve of the directly-heated type is employed in conjunction with others with indirectly-heated cathodes, and one very simple system is illustrated in Fig. 7. Here it is assumed that there is only a single heater winding provided on the mains transformer, and this has to supply the cathodes of both directly- and indirectly-heated valves. It will be seen that the bias is applied to the output valve by means of the usual resistance (R.2) but that this is connected between the centre point of a 30-ohm potentiometer (P) in parallel with the filament and the main H.T. negative lead. A decoupling resistance is again used, and this time it is wired between the lower end of the grid-leak (G.L.) and the earth line, a condenser being connected as before.

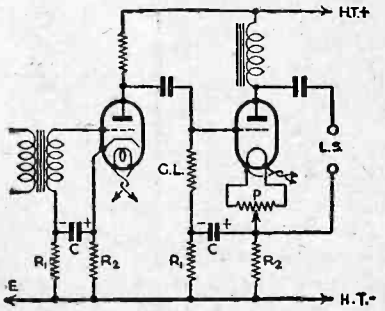


Fig. 7.—This circuit shows the methods of biassing and decoupling a directly-heated output valve in a mains set.

An Important Point

Another very important point is illustrated by this circuit, which is that the choke-capacity speaker-feed circuit is returned, not to the earthline, but to the centre point of the potentiometer. As a matter of fact, this applies to all circuits where an automatically-biassed output valve feeds a speaker through a choke-capacity circuit, because if that circuit were returned to H.T. negative there would be a fairly serious loss of signal energy across the bias resistance, which would form a part of the total valve load. This point is very often overlooked, with a result that the maximum output of which the last valve is capable is not realized.

Another way of biassing a directly-heated output valve which is used in conjunction with other valves of the indirectly-heated type is shown in Fig. 8. This is very similar to the battery circuit shown in Fig. 1, and has the disadvantage that the bias resistance passes the total anode current of all the valves in use. The resistance must therefore be of a comparatively high power rating if overheating is to be avoided. Another objection is that if the anode current of preceding valves is varied over wide limits (such as would be the case when several variable-mu stages were included in the receiver) the bias voltage would be varied at the same time and this might lead to distortion.

Where separate heater windings are provided on the mains transformer there is no difficulty whatever in using a directly-heated output valve with others of the indirectly-heated type. Bias is obtained by inserting a suitable resistance between the centre tap of the winding which feeds the output valve and H.T. negative, as shown in Fig. 9.

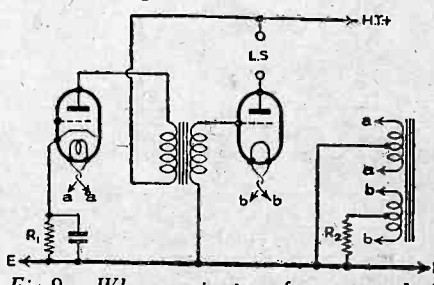


Fig. 9.—When a mains transformer is used which has separate heater windings for the directly-heated and indirectly-heated valves, grid decoupling is generally quite unnecessary, and a circuit such as that shown above can be employed.

BLUEPRINT NO.35

PRESENTED FREE WITH "PRACTICAL WIRELESS" DATED MARCH 3rd 1934

The LEADER 3

PUBLISHED BY GEO. NEWNES LTD. 8-11 SOUTHAMPTON ST. STRAND W.C.2

Price 1/-

Bracket Insulated From M.B.

M.B.

C_5

F

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Differential Reaction Condenser .00015 Mfd

Dial

S_1

Wavechange Switch

Bracket M.B.

M.B.

9

8

1 2 3 4

H.T.+2

H.T.

H.T.+1

L.T.-

L.T.+

Trimmers

Twin Gang Tuning Condenser .0005 Mfd Each Section.

C_1

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F

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Coil 1

7 6 5 E

M.B.

Condenser Chassis Earthed

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GB-2

Battery Clip

6

H.T.+ P

L.F. Transf'rmr.

G GB-

7

1 2 3 4

H.F. Choke

G.B.-1

G.B.+

Coil 2

To Anode Of V1

4

5

7 6 5 E

V3

V2

V1

M.B.

M.B.

3

2

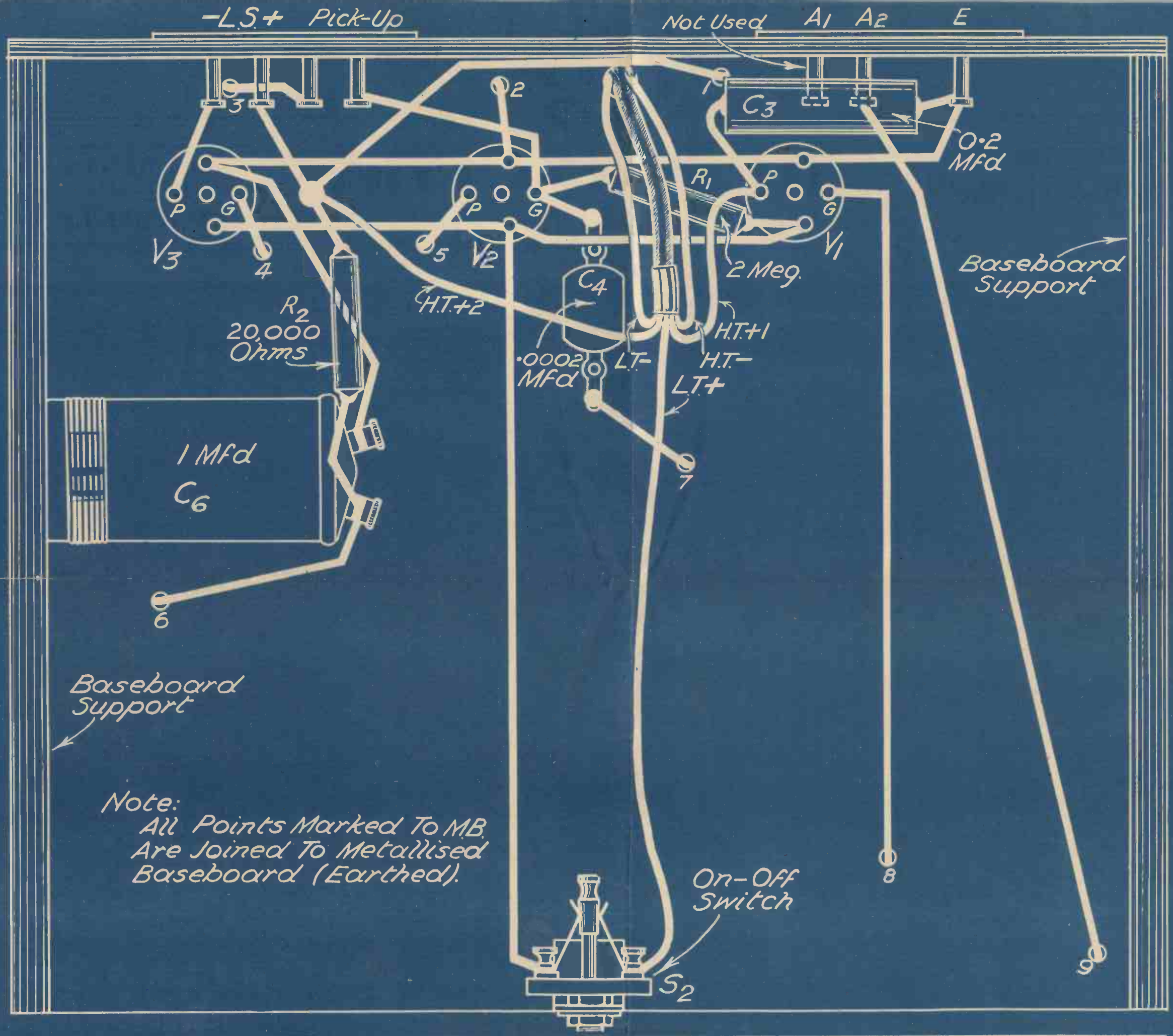
L.T.-

1

Fuse

H.T.-

Battery Cable



A NEW SET AND A NEW POLICY!

THE LEADER T

Once Again We Take the Lead, this Time in Demonstrating that Low Price and Efficiency CAN be Combined in a Home-Constructed Receiver. Our Latest Set, Dealt With Here, is Designed to Cover the New Lucerne Wavelengths, It Costs Only 60/-, is Ultra-Selective, Backed by Our Guarantee, and has Ample Power Output

A MODERN SET FOR 60/-

Neatness, compactness ar are the keynotes

THE LEADER THREE arrives at a time when the competition of the cheap receiver is giving the home constructor pause! It is an event of the utmost importance to every home constructor, for it marks the introduction of our new policy of designing our receivers on a competitive price basis. It has always been our sincere aim to cater absolutely for our readers, and we have pursued this policy with vigour and enthusiasm. There is no need for us to dwell upon the many examples of reader service which can be placed to the credit of this journal. It will be sufficient to say that scarcely a month has gone by but that we have produced something original, something outstanding, for the many thousands of home constructors who are our enthusiastic supporters. Nothwithstanding the fact that radio is rather more than twelve years old, it was not until the publication of this journal that home constructors had available a source of information and a free query service designed absolutely for beginner and expert alike. We now take the lead on the price question.

The Price Problem

Our policy has been sincere, and we have not hesitated to spend many thousands of pounds to give effect to it. Quite naturally and inevitably we have made considerable inroads into the complete receiver market, for this journal arrived at a time when many receivers offered to the public were sold without guarantee. We felt that the home structor was entitled to free advice and to the assurance that the receivers described in our pages would live up to our claims, and also he should be able to feel that he could build a receiver with the same confidence and assurance of service as he would obtain were he to purchase one of the better class of receivers. Notwithstanding the extremely low price at which it is possible to buy a receiver to-day, it is still necessary to pay a fair sum of money if satisfaction is to be obtained.

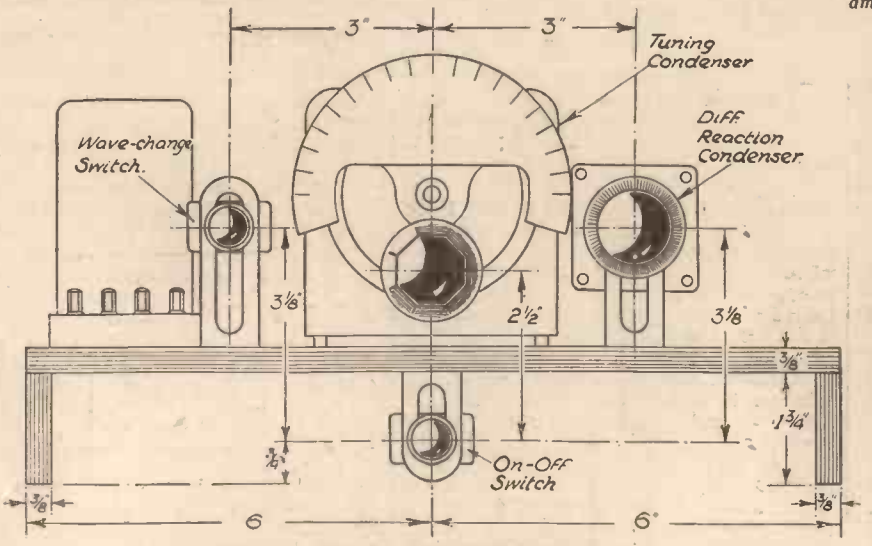
Cheap Receivers are Seldom Satisfactory

A large proportion of our correspondence is received from readers who complain in the bitterest of terms of their experiences with some of these cheap receivers, and from those who have failed to obtain the service to which they were really entitled from the manufacturers concerned. The policy of some of these manufacturers, we make bold to assert, is always to blame failure on the purchaser, and then to offer to service the receiver for a certain sum. Now we have taken the trouble to investigate some of the complaints of our readers on this score, and in every case we have found that no blame attaches to the reader concerned. In every case we have found that the set has been badly made, wrongly connected, has had components left out, has arrived with parts broken, has defective valves, and in a large majority of cases the receiver could not possibly have been put through any test before its despatch to the retailer.

This is a somewhat tragic state of affairs, but it is none the less true. We appreciate that price has a great appeal, and that readers may think in terms of price and to their sorrow consider the question of results and efficiency after the purchase, when it is too late to get their money back. Particularly is this

From this top view of the receiver the small amount of wiring may be seen.

OUR REPLY TO THE CHEAP, READY-MADE SET



Drill your cabinet front from these dimensions.

NOTABLE "LEADER" FEATURES

- THE LATEST COILS FOR THE NEW "LUCERNE" WAVELENGTHS
- AN EFFICIENT SCREEN-GRID STAGE FOR DISTANT RECEPTION
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- EQUALLY GOOD ON "RADIO" OR "GRAMOPHONE"
- COSTS ONLY SIXTY SHILLINGS FOR THE PARTS
- THE MOST POPULAR CIRCUIT ARRANGEMENT
- GANGED TUNING CONTROL FOR EASE OF OPERATION
- THE IDEAL SET FOR EVERY CONSTRUCTOR

THREE

LOW PRICE AND EFFICIENCY COMBINED!

d simplicity of control of the Leader.

so in the case of some Hire Purchase arrangements, when, once the retailer has concluded the Hire Purchase arrangements, the whole of the transaction is immediately passed over to some finance corporation which is entirely unsympathetic towards the complaints and presses for the money as soon as the customer shows signs of being awkward. This does not, of course, apply in every case, but the reader should assure himself by demanding that the receiver be submitted to his house for approval for a few evenings so that he can satisfy himself as to its capabilities.

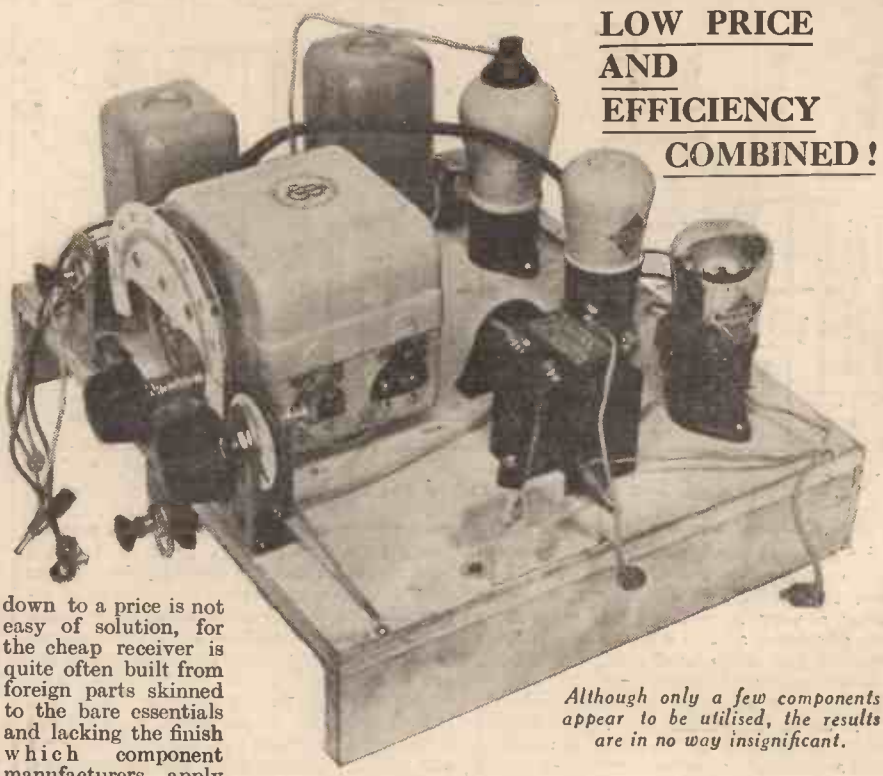
Sixty Shillings Only!

The LEADER THREE represents the first of the **PRACTICAL WIRELESS** Receivers to be designed down to a price, and the limit we set ourselves was 60s. We could have made an even cheaper receiver than this, but for the valve arrangement used we do not consider it desirable to go below this figure. It is our reply to the price question, and in future our receivers will be designed with the price question borne in mind, always remembering at the same time the question of efficiency.

This price question has been raised many times by our readers, but unlike the complete cheap receiver, we have attacked the problem from the point of view of service. We have mentioned many times before in these pages that we take a personal interest in receivers built by our readers, and we shall accentuate that interest in the LEADER. The only stipulation we make is the parts we specify must be used.

The problem of designing a receiver down to a price is not easy of solution, for the cheap receiver is quite often built from foreign parts skinned to the bare essentials and lacking the finish which component manufacturers apply to products intended for home constructors. Usually, the cheapest possible circuit arrangement is employed coupled with a cheap speaker and a cheap thin veneered three-ply cabinet and valves which have failed to come up to the valve manufacturer's tests.

In the LEADER, however, none of these objections apply, for we have been to a great amont of trouble and conducted very many experiments to ensure that the receiver has not suffered because of the paring down in price. And it is a remarkably efficient piece of work, specially designed to cover the new Lucerne wavelength arrangement. Although the coils are extremely cheap, we can accord them full marks for selectivity. There is no sign of break-through, and they have almost the efficiency, from the point of view of selectivity, of iron-core coils.

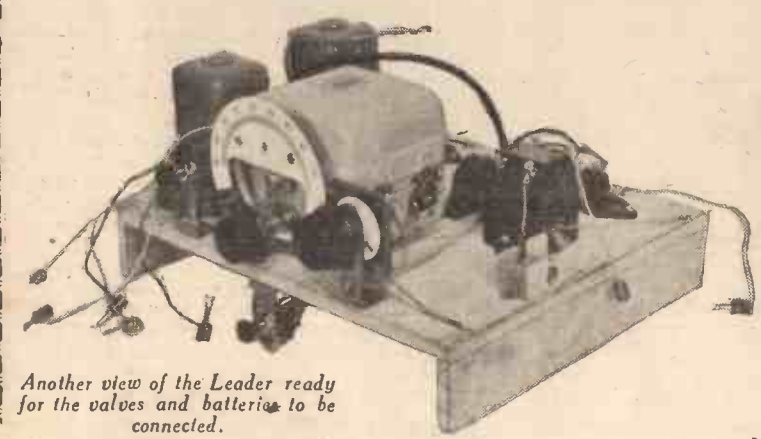


Although only a few components appear to be utilised, the results are in no way insignificant.

The Circuit

As was mentioned in the preliminary notes last week, circuit simplicity is the keynote, and as is so often the case (in wireless in particular) the simplest arrangement is conducive to the best results. Thus we have utilised a screen-grid valve of the ordinary type for H.F. amplification. Tuning has been accomplished by ordinary air-core coils in preference to those of the iron-cored type, and although selectivity would naturally have been higher with the latter type of coil, the principal consideration here was the accommodation of coils designed since the Lucerne Plan was put into effect. The very best may therefore be obtained from the reorganized wavelengths, and it will be noticed that the tuning range extends down to 150 metres

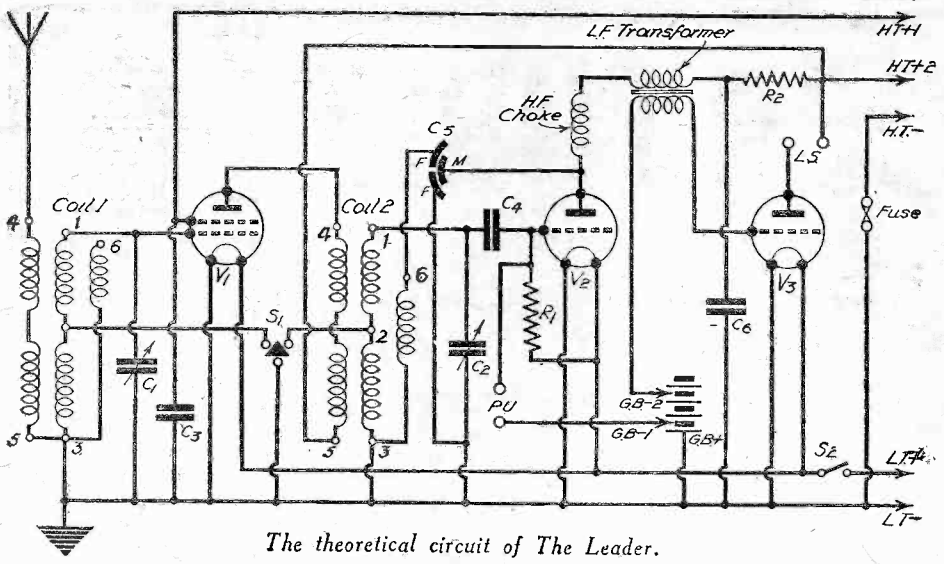
(Continued overleaf)



Another view of the Leader ready for the valves and batteries to be connected.

Use these parts for The LEADER and so make certain of excellent results.

One "Metaplex" Chassis, 12in. by 10in. with 1½in. runners (Peto-Scott).
One Double-Gang Condenser, "Nugang" Type A. .0005 mfd. (C1 and C2) (Jackson Bros.).
Two "Universal" Screened Coils (Wearite).
One .00015 mfd. Differential Reaction Condenser (C5) (Graham Farish).
One "Niclet" 5:1 L.F. Transformer (Varley).
Three Chassis Mounting Valve Holders (W.B.).
One "Snap" H.F. Choke (Graham Farish).
One 20,000 ohm 1 watt Electronic Resistance (R2) (Varley).
One 2 meg. 1 watt Electronic Grid Leak (R1) (Varley).
One .2 mfd. Tubular Fixed Condenser (C6) (Graham Farish).
One 1 mfd. Fixed Condenser, Type 9200/B.S. (C3) (Dubilier).
One .0002 mfd. Fixed Condenser, Type 665 (C4) (Dubilier).
Two Terminal Socket Strips; one marked "A" and "E," the other "L.S." and "P.U." (Clix).
Six Solid Plugs (for use with terminal strips) (Clix).
One Grid Bias Battery Clip Type No. 2 (Bulgin).
One Fuse Holder and Fuse Bulb, Type F.5 (Bulgin).
Two "Junior" On-off Switches, Type S.38 (Bulgin).
One 5-way Battery Cord, fitted with wander plugs marked "H.T.—" "H.T.+2," and "H.T.+" and spade terminals marked "L.T.+" and "L.T.—" (Belling Lee).
Three Component Brackets (two long and one short) (British Radiogram).
Three Valves: one S.G.215; one 210 Det., and one 215P. (Cossor).
One High-Tension Battery (Lissen).
One 9-volt G.B. Battery (Lissen).
One 2-volt Accumulator (Lissen).
One Cabinet (Peto-Scott).



The theoretical circuit of The Leader.

(*Continued from previous page*)

on the medium band, and from 750 metres on the long-wave band. Although air-cored, the method of winding these coils enables a very high degree of selectivity to be obtained, and in a simple set of this nature no greater degree of selectivity would be worth the additional expense.

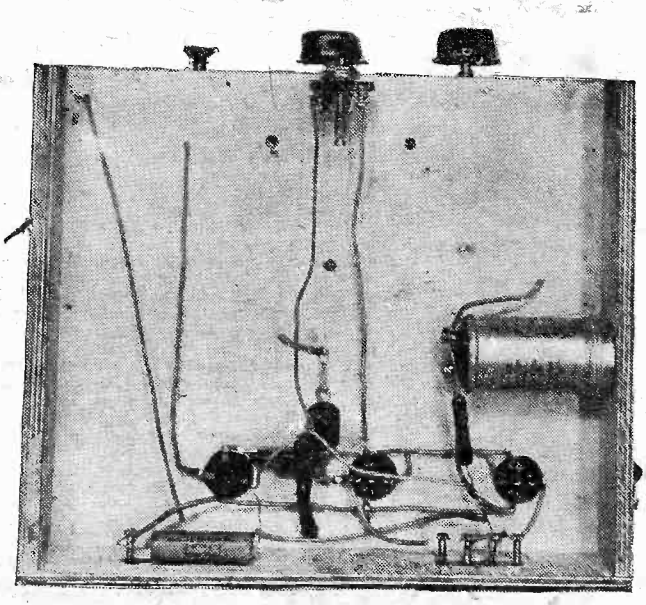
The output stage consists of a simple power valve which is fed by a highly efficient nickel-iron transformer. A pentode would admittedly give louder results, but it is more expensive, and would necessitate the addition of a tone-control arrangement which would lead to even more expense. To many listeners the output from a small valve of the type which is used is ample for the home.

There are only four controls on the panel—the main tuning control (operating a two-gang condenser), a wave-change switch, a reaction control, and the normal on-off switch. Operation is thus rendered extremely simple, and consists simply of turning the main control until the desired station is received, and increasing the signal strength if necessary by means of the reaction control.

Our standard chassis-form of construction has been employed, and this results in both ease of wiring and cleanness of appearance. The wiring will be found extremely simple, and should not take much longer than an hour to complete. It will be noticed that decoupling has been incorporated at certain parts of the circuit, and there is no risk of instability occurring when the receiver is employed with a dry battery or a mains unit.

The receiver is accommodated in a cabinet which is only just large enough to contain the chassis and this keeps the overall size of the apparatus down, but necessitates the use of an external loud-speaker. Many readers already own a speaker which they do not wish to part with, and the Leader may therefore be made up for use with that part of the equipment. The batteries may be placed behind the cabinet, or there may be room in the present loud-speaker cabinet for them.

We do not propose to devote any more space this week to test reports or other matters relative to this receiver, as we firmly believe that our readers prefer these constructional features to be restricted to a minimum of space. By doing this we can cater fully for those who are not, for one reason or another, interested in the particular receiver under discussion, and ample reading matter is afforded in the remaining pages of the issue. As we are continually pointing out, we exist to serve our readers, and whether the receiver is a multi-valve super-heterodyne or a simple one-valve set, we give the same guarantee of performance. You may therefore go ahead with the construction of the Leader in the full confidence that you will experience no disappointment from any point of view. The components are all selected for their efficiency in this circuit, and they are obtainable from Messrs. Peto-Scott, Ltd., whose advertisement appears on another page. The full-size wiring diagram which is presented free in this issue will assist you in carrying out the small amount of constructional work, and the finished receiver will be found absolutely fool-proof. In the unlikely event of a defective component causing trouble, or of any other difficulty which might arise through some unforeseen circumstances, the Free Service Bureau is at your service, and a letter will be promptly answered.



This view of the underside of the chassis will assist you in wiring.

TONE CONTROL

THERE are many receivers in use to-day which possess what is known as a tone control, but in many cases this term is erroneously applied. For instance, practically every circuit which employs a pentode output valve gives undue prominence to the higher notes in the musical scale, and to prevent a certain amount of shrillness it is customary to connect a fixed condenser with a resistance in series, across the output circuit of the pentode. This is known as a tone control, but it does not actually control tone. What it does do, however, is to limit the high-note response and thus enable a better balance of reproduction to be obtained. It has absolutely no effect on the lower notes and cannot, for instance, reinforce the bass, or balance up the strength of the reproduction of both treble and bass.

Tone control, to live up to its name, should enable the user of a receiver to adjust the reproduction so that any required degree of balance of tone is obtained, and the control should permit the bass to be strengthened, the lower and upper notes attenuated, or the upper notes to be strengthened at will, and should at the same time permit this to be carried out in a perfectly smooth manner, with one control which would not have to be turned through more than one complete revolution. The Multitone tone control transformer is a good example of complete tone control, and is designed for the purpose by a firm who have specialized in this type of work. The other four terminals on the transformer are connected in the orthodox manner. The high resistance then permits the reproduction to be varied over the complete range, giving reproduction which at one extreme is extremely deep, and at the other a high-pitched tone. Obviously, it is seldom normally necessary to carry the control to these extremes, but between them there is a complete variation which enables the reproduction to be adjusted so that the deficiencies of the receiver, the particular characteristics of the loud-speaker, or the personal prejudices of the listener may all be compensated for, and the resultant reproduction will be perfectly balanced. The inventor of this system, Mr. Poliakoff, has spent many years in investigation of sound reproduction, and, in addition to this special tone control transformer, he has also carried out some interesting experiments with regard to assisting the deaf to hear the wireless programmes, and the result of his experiments is embodied in a receiver which is being produced by Messrs. Multitone. This receiver is available in two models, one a five-valve self-contained battery receiver which requires no aerial or earth. It costs 20 guineas. The other model is for A.C. mains operation, and costs 24 guineas. In both of these receivers the circuit arrangements permit of the use of the apparatus in the standard manner, a loud-speaker being fitted to reproduce the programmes in the ordinary way. In addition, however, a special attachment is provided, at the inclusive cost, which permits the deaf to listen, at any required degree of volume to suit their particular comfort, without, however, affecting the volume required by others from the ordinary loud-speaker. In addition, the wireless receiver may be used by the deaf person to enable him to hear the conversations of friends, etc.

LEADER THREE

PILOT AUTHOR KIT
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See the PILOT on the carton. It's a real guarantee.

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Complete Kit of Parts in Sealed Carton, less Valves, Cash or C.O.D. Carriage Paid 29/6 or yours for 5/- down and 5 monthly payments of 5/3.
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If Peto-Scott Permanent-Magnet Moving-Coil Speaker required add 12/6 to Cash Price or 1/2 to each monthly payment.

These are the Parts the Author used

	£	s.	d.
1 Peto-Scott Chassis 12 x 10 x 1½ins.		3	6
1 J.B. 2 gang condenser type Nugang "A"		17	6
2 Wearite Universal Screened Coils		10	0
1 Graham Farish .00015 mfd. condenser diff. reaction		2	0
1 Varley Nicket Transformer ratio 5 : 1		7	6
3 W.B. 4 pin Chassis mounting valve-holders		1	6
1 Graham Farish Snap type H.F. Choke		2	0
1 Varley Electronic 1 watt type resistance 25,000 ohms.			9
1 Varley " 1 watt " " 2 meg.			9
1 Dubilier .1 mfd. condenser type 4404		1	4
1 Dubilier 1 mfd. condenser type B.S.		2	0
1 Dubilier .0003 mfd. fixed condenser type 665			6
2 Clix Terminal Socket Strips, A.E. & L.S. & Pick-up		1	3
6 Clix Solid Plugs (for use with the above)		1	0
1 Bulgin No. 2, G.B. Battery Clip			4½
1 Bulgin F.5 Fuse and holder		1	0
2 Bulgin Junior on/off switches type S.38		1	9
1 Belling Lee 5-way Battery Cord, marked H.T.x1, H.T.x2 and H.T. and spade terminals L.T.x& —		2	0
3 British Radiogram Brackets (2) 2in. and (1) 1¼in. with hole		1	9
Wire, Screws, Flex, etc.		2	3
Kit "A" Cash or C.O.D.	£3	0	0
1 Set of Specified Valves	£1	11	3
1 Peto-Scott Cabinet		17	6

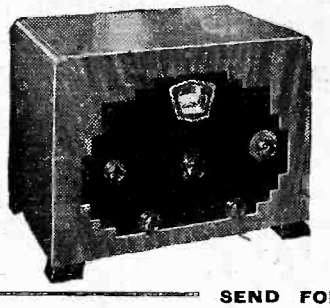
KIT "A" Author's Kit of Specified Parts, including Peto-Scott METAPLEX Chassis but less Valves. Cash or C.O.D. Carriage Paid Or 12 monthly payments of 5/6. **60/-**

KIT "B" As Kit "A" but with Valves only. Cash or C.O.D. Carriage Paid, £4/11/6. Or 12 monthly payments of 8/6

KIT "C" As Kit "A" but with valves and Peto-Scott Cabinet. Cash or C.O.D Carriage Paid, £5/9/0. Or 12 monthly payments of 10/-.

KIT "CC" As Kit "B" but with Peto-Scott Walnut Consolette Cabinet. Cash or C.O.D. Carriage Paid £5/16/0 or 12 monthly payments of 10/6. If Peto-Scott Moving-Coil Speaker required add 19/6 to Cash Price or 1/9 to each monthly payment.

FINISHED INSTRUMENT
Ready assembled **LEADER THREE**, complete in **PETO-SCOTT** Consolette Cabinet. With valves and speaker. Aerial tested. Cash or C.O.D. Carriage Paid, **£8-0-0**
Or 12 monthly payments of 14/9.



EXCLUSIVELY SPECIFIED
PETO-SCOTT WALNUT CABINET

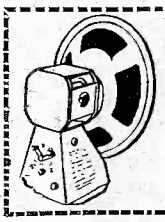
This handsome walnut-polished cabinet was specially designed by **PETO-SCOTT** at the request of PRACTICAL WIRELESS to house the Leader Three. Constructed throughout in first-quality material and beautifully finished by hand french-polishing macassar veneer set the seal of the piano trade. Cash or C.O.D. ***Packing and Carriage, 2/6 extra.*** **17/6**

WALNUT **CONSOLETTE MODEL** (as Telsen 323 illustration in left-hand column) with panel fretted as for Table Model. Cash or C.O.D. ***Packing and Carriage, 2/6 extra.*** **21/-**

NEW LISSEN 7-VALVE SUPER-HET CHASSIS MODEL, complete with Lissen Valves in sealed Carton. Cash or C.O.D. Carriage Paid, **£8/17/6.** Send **15/-** only
Balance in **11** monthly payments of **16/6.**

NEW BLUE SPOT PERMANENT MAGNET MOVING-COIL SPEAKER 29 P.M. With Input Transformer. Cash or C.O.D. Carriage Paid, **£1/12/6.** Send **5/-** only
Balance in **6** monthly payments of **5/-.**

NEW BLUE SPOT "CLASS B" OUTPUT STAGE. As advertised. Complete with Osram B21 "Class B" Valve. Cash or C.O.D. Carriage Paid, **43/6.** Send **4/-** only
Balance in **11** monthly payments of **4/-.**



W.B. P.M.4A. MICROLODE PERMANENT MAGNET SPEAKER
complete with switch-controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid, **£2/2/0.** Send **5/9** only
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AVOMINOR TEST METER. Cash or C.O.D. Carriage Paid, **£2/0/0.** Send **5/6** only
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NEW CARRARD MODEL 202A. 12-in. Turntable Electric Motor for A.C. mains Cash or C.O.D. Carriage Paid, **£2/10/0.** Send **6/-** only
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Converts your present Battery Set to Class "B" Amplification. Complete with all necessary components, **including driver transformer, Class "B" output Choke, W.B. 7-pin valve-holder, B.V.A. 240B valve,** wire and screws, etc. **Full-size Blueprint,** assembly instructions and diagrams. **Cash or C.O.D., 37/6.** Balance in **7** monthly payments of **5/6.**

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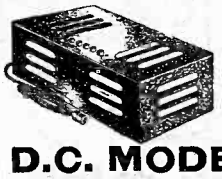

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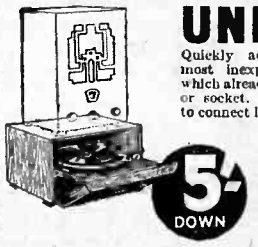

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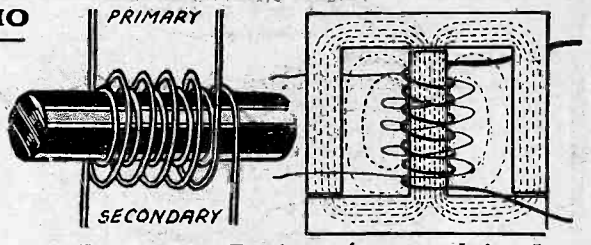
THE BEGINNER'S SUPPLEMENT



Figs. 7 and 8.—Two forms of iron core. Left, a simple iron rod; right, a core which completely surrounds the coils of the transformer.

THE TRANSFORMER SIMPLY EXPLAINED.

This Article Explains in a Clear and Interesting Manner the Theory of the Transformer and Describes the Construction and Use of the Various Types.

IF a wire carrying a fluctuating electric current is placed near another wire it will create an electric current in the second wire in spite of the fact that there is no electrical connection between the two wires. This fact is illustrated in Fig. 1. A wire is connected to a battery and a switch as shown, while another wire, which is placed near the first, is joined to a sensitive galvanometer (current-measuring instrument). As soon as the switch is closed current from the battery commences to flow through the wire which is connected to it. In a fraction of a second the current rises from nothing to its maximum figure, after which it continues to flow at a steady rate until the circuit is broken by opening the switch again, when, of course, it ceases as suddenly as it commenced.

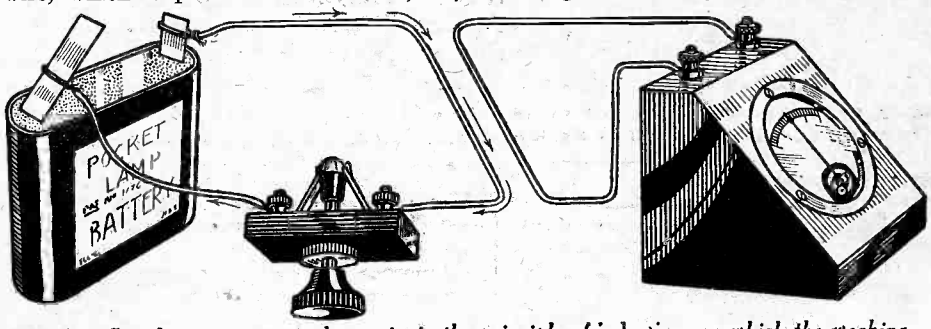


Fig 1.—Simple experiment to demonstrate the principle of induction, on which the working of a transformer is dependent.

The Principle of Induction

Now if you watch the galvanometer while you make and break the connection between the first wire and the battery, you will notice that the pointer of the galvanometer gives a "kick" each time the switch is opened or closed, thus showing that at those moments a current also flows through the second wire.

This experiment is a simple demonstration of the principle of *induction* and is the principle underlying all *transformers*. The reason why the current flowing through the one wire can produce a current in the other, is because whenever an electric current flows through a wire it produces what is called a *magnetic field* round the wire; that is to say, the wire exhibits properties similar to those of a magnet. Now, so long as the current flowing through the wire remains steady, the strength of the magnetic field will also remain constant; but if the current varies in strength, then, naturally, the intensity of the magnetic field will also vary. It is this variation in the strength of the magnetic field which is able to produce an electric current in any other wire which comes within its influence.

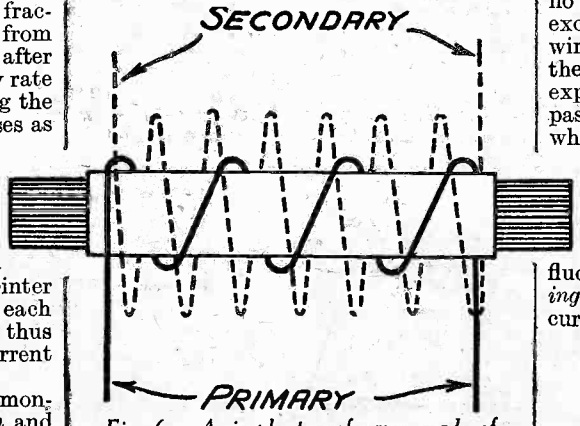
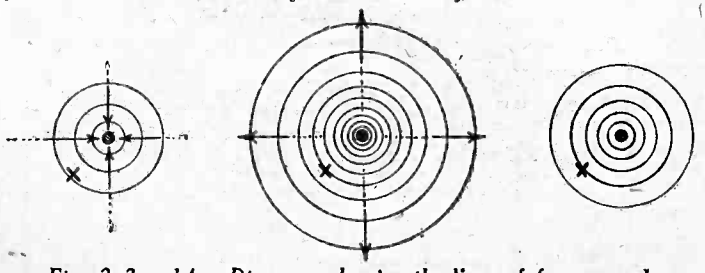


Fig. 6.—A simple transformer made of two coils of wire.



Figs. 2, 3 and 4.—Diagrams showing the lines of force round a wire carrying an electric current.

Lines of Force

Fig. 2 clearly shows how the magnetic field extends round a wire when a current is passing through it. The field is represented by *lines of force*, which are, naturally, closest together (showing the greatest intensity of the field) nearest to the wire. At the instant represented the current is flowing at a steady rate. Should the current suddenly increase, however, then the lines of force will expand outwards, followed by others which are still closer together until the field becomes stronger, as shown in Fig. 3. A decrease in current will have the opposite effect, and the lines of force will all contract inward until the field becomes correspondingly weaker, as shown in Fig. 4. Now suppose another wire be placed near this wire, say, at the point X, you can see clearly that a rise and fall in the current through the first wire, as shown in the three diagrams, will mean that the lines of force, in moving outwards and inwards, will pass through the second wire. In doing this they create a current in the second wire. When they move outwards they produce a current in one direction, and when they move inwards they produce a current in the opposite direction.

It should be clearly understood that *no current is produced in the second wire when the current through the first is flowing steadily.* It is only when it varies and so causes a movement of the surrounding lines of force that a current is produced in the second wire. This explains why, in the experiment just described, there was no movement of the galvanometer needle, except when the current through the first wire was started or stopped; that is, at the moments when the lines of force expanded outwards, and in doing so passed through the second wire, and again when they "collapsed" inwards and once more passed through the wire.

However, if instead of passing a steady direct current through the first wire and making and breaking the circuit with a switch, we use one which fluctuates all the time, such as an *alternating current*, then a similar fluctuating current will be produced in the other wire.

(Continued overleaf)

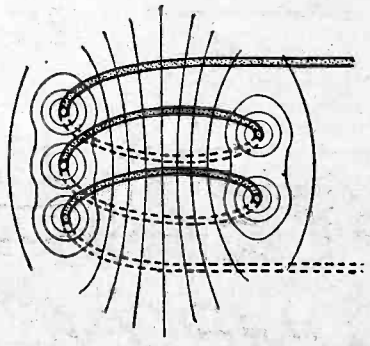
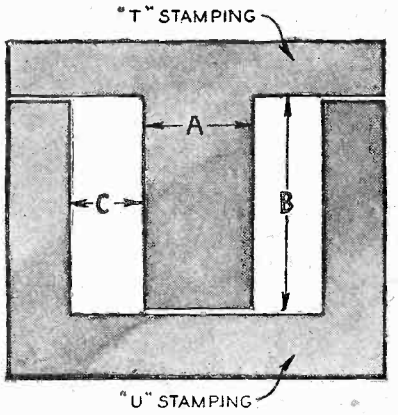


Fig. 5.—The magnetic field round a coil of wire.

(Continued from previous page)

A Simple Transformer

Now the magnetic field round a wire can be greatly intensified by making the wire into a coil, as in Fig. 5. Here you see how the lines of force, surrounding one turn, link up with those surrounding the next, and so produce an intense magnetic field whose centre or axis is down the middle of the coil.



One of the simplest forms of transformer consists of such a coil with another coil of wire placed inside it, as in Fig. 6. If a fluctuatung electric current is passed through the first, or "primary," coil, then a current will also be obtainable from the "secondary."

Now the current through the *primary* bears definite relationship to that obtained from the *secondary*, and this relationship is dependent on the number of turns of wire in the primary coil as compared with that in the secondary coil. Thus, if there are ten times as many turns in the secondary as in the primary, then the voltage (or pressure) of the current from the secondary will be ten times that of the primary. Conversely, if there are less turns in the secondary than in the primary, say, half as many, then the voltage of the secondary current will be less than that of the primary—in this case, half the voltage.

Step-up and Step-down Transformers

A transformer having more secondary than primary turns is called a *step-up* transformer, while one having less secondary than primary turns is known as a *step-down* transformer.

It must not be concluded from the foregoing that a transformer is a miraculous appliance which will give any desired increase in the power of a current by merely using sufficient turns of wire for the secondary. It is true, of course, that the voltage can be stepped up to almost any desired figure by this means, but this does not mean that the transformer is a creator of power or energy, for every increase of pressure (voltage) is accompanied by a corresponding decrease of current (amperage).

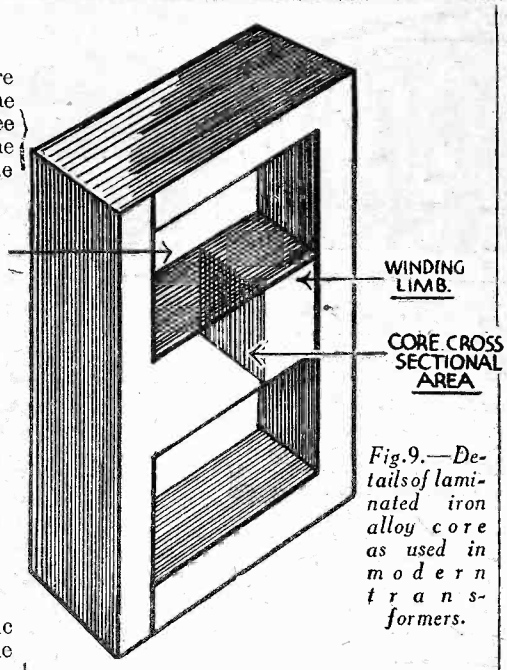


Fig. 9.—Details of laminated iron alloy core as used in modern transformers.

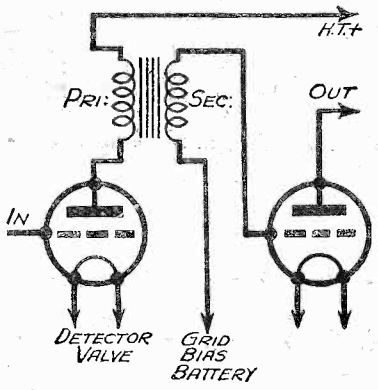


Fig. 10.—The commonest manner of connecting an intervalve transformer.

Whatever the design of the transformer the product of volts and amps. induced into the secondary cannot be greater than the product of volts and amps. flowing in the primary. Perhaps an example will make this clear. Suppose a transformer has a primary of 200 turns and a secondary of 800 turns, that is to say it gives a voltage step-up of four times. If it has, say, a current of 8 amps. at a pressure of 10 volts passing through the primary, then the current induced in the secondary will be (theoretically) 2 amps. at 40 volts. If the secondary turns are increased to 1,600 turns, giving eight times the voltage, namely 80 volts, then the current will be reduced to 1 amp. On the other hand, using less turns on the secondary will give a decrease in voltage, but an increase in amperage. Thus, 100 turns on the secondary will give 5 volts, but a current of 16 amps. The point is that the power given out by the secondary in each case equals that put into the primary, namely, 80 watts (volts x amps.).

Of course, these figures are those that would apply in the case of a *perfect* transformer, but since no transformer can be 100 per cent. efficient the power output is always slightly less than the input.

The Object of the Iron Core

To the radio enthusiast the most familiar type of transformer is the L.F. (low-frequency) intervalve transformer. This instrument has primary and secondary coils, but it is also fitted with an iron core. A simple iron core is shown in Fig. 7, and consists of an iron rod pushed through the middle of the coils.

Its object is to concentrate the magnetic lines of force round the coils so that the maximum number of lines cuts each turn of the secondary winding. The type of core used in an L.F. transformer is, however, more elaborate and completely surrounds the coils as in Fig. 8. The concentration of the magnetic lines of force within the core is shown by the dotted lines.

The core is not made of solid iron, but is composed of thin layers or laminations. This is to prevent the formation of electric currents called "eddy" currents which would otherwise circulate within the iron itself, due to the magnetic field. Such currents are merely a waste of energy and represent a loss in the efficiency of the transformer. Details of how the core of an L.F. transformer is built up are given in Fig. 9.

The coils of the transformer consist of many thousands of turns of insulated wire wound on a fibre bobbin. Usually one winding is wound on first with a layer of Empire tape or waxed paper as an insulating covering round it, and then the other layer is wound on top. Sometimes a layer of paper is also used between each layer of wire, apart from the layer separating the two windings.

Intervalve Transformers

L.F. intervalve transformers are usually of the step-up type and are used to

(Continued on page 1106)

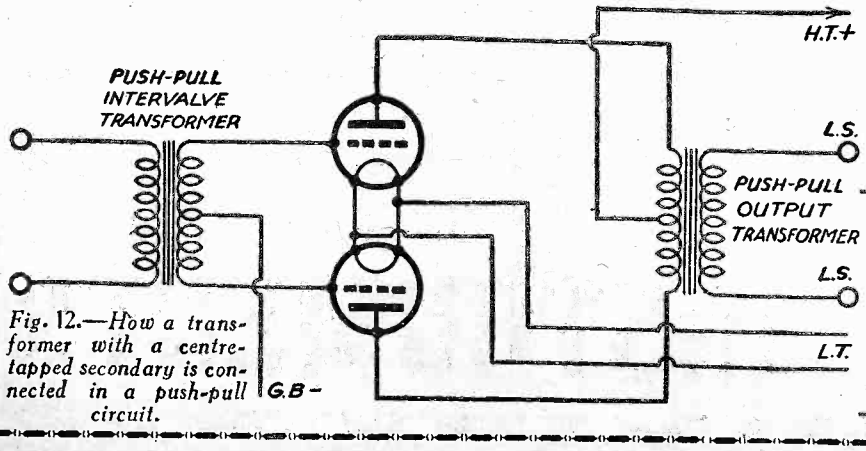


Fig. 12.—How a transformer with a centre-tapped secondary is connected in a push-pull circuit.

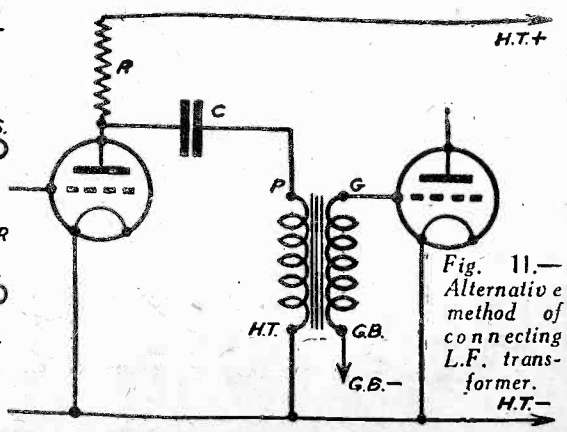


Fig. 11.—Alternative method of connecting L.F. transformer.

SOUND ENERGY

The Acoustic Output of a Gramophone

By F. W. LANCHESTER.

IN approaching this subject it is necessary to adopt certain conventions. The first is that we take as a basis the record of a pure tone, in which the form of the engraved needle track is a *sine curve*. The second is that we assume (from inspection of a number of records) a *maximum angle* of the needle track to the tangent or mean direction of same, calling this angle θ we take $\tan \theta = \frac{1}{6} = 0.166$. The third is that we take some definite velocity V as representing the velocity of the record under the needle point; actually this varies from 4 ft./sec. at the periphery of a twelve-inch record to about 2 ft./sec. at the centre. We shall take a mean value V = 3 ft./sec. The fourth is that the amplitude of movement of the needle is the maximum permissible, namely, assumed = .005in. The fifth is that the frequency is consistent with the foregoing; thus:—

Let a = the amplitude, namely .005in.
„ f = the frequency.
„ V = velocity of record under the needle point = 36 in./sec.
„ l = the length of an undulation $= \frac{V}{f}$ (inches).
„ θ = max. angle of track.

$$\theta = \frac{\pi a}{l} = \frac{\pi a f}{V}$$

$$\therefore f = \frac{V\theta}{\pi a} = \frac{36 \times .166}{3.14 \times .005} = 380 \text{ cycles}$$

per second.

That is to say, the frequency 380 is that which accords with the given values of a, V and θ.

There are two lines of approach open. The first of these is to compute the maximum possible output from the needle, the limit being reached when the needle jumps the track. This will give an upper limit. The second line of approach is to base our calculation on the amplitude of the acoustical wave in the throat of the horn, using the equation:—

$$\text{Watts} = \frac{(af)^2}{8}$$

For the first we require to know the limiting lateral force the needle can exert without leaving the track. By a simple experiment in which a weight is supported on three needle points on the face of a record, and the record tilted till the needles no longer hold, it is established a needle point will sustain a lateral force at least equal to its dead load; thus it is usually possible to tilt the record to 45 deg. or over before the needles lose their hold: for the present investigation *equality* will be assumed. A fair average figure for the weight borne by the needle is 4 oz., so we shall assume 4 oz. or 0.25 lb. as the maximum permissible lateral force.

According to the data already given, the maximum lateral velocity of the needle point is, $= V \tan \theta = 36 \times .166 = 6$ in./sec. $\therefore$ work done $= 0.5 \times 0.25 = 0.125$ ft. lbs./sec. That is the rate of doing work *on the steepest part of the sine curve*. The *mean value* is half this = 0.0625 ft. lbs./sec.

Converting this into electrical units, the limiting value of the power output is:—
0.084 watts,
or, 84 milliwatts.

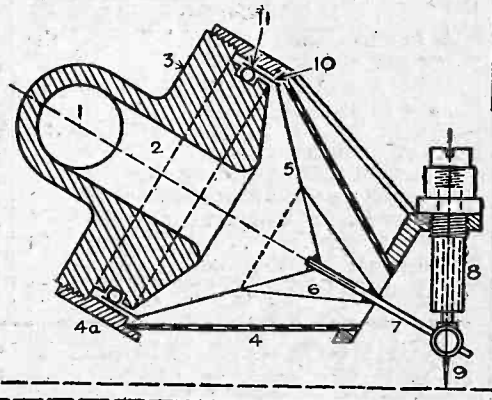


Fig. 2.—1 is an acoustic duct, leading to 2, Duct in tone arm forming first part of acoustic tube. 3, Main Casting. 4, Conical guard (perforated metal) held by 4a, Screwed ring. 5, Conical diaphragm or "piston." 6, Conical piston extension. 7, Piston rod, connecting to 8, Needle holder, and 9, Needle. 10, Piston skirt, supported by 11, India-rubber rolling ring or obturator.

Second Line of Approach

Some further data is required, and these concern the mechanical construction of the instrument. For this purpose the ordinary construction of gramophone is not well suited. In a gramophone designed and constructed by the author especially for the purpose of experiment and demonstration, the sound-box of which is illustrated in Fig. 2, a piston was adopted in place of the more usual flexible diaphragm, and the instrument was fitted with an acoustic tube of constant cross-section between the sound-box and the flare or horn; the disposition is in this respect similar to that shown in Fig. 3.

The data are as follows:—

Diameter of piston = 2.2in.
Area of piston = 3.8 sq. in.
Diameter (bore) of tube = 0.72in.
Area (bore) of tube = 0.40 sq. in.
Throat (area) ratio = 3.8/0.40 = 9.5.

The piston movement is *less* than the needle point movement, thus:—

$$\frac{\text{Piston movement}}{\text{Needle movement}} = \frac{2}{3}$$

$\therefore$ Piston movement $= \frac{2}{3} \times .005 = .0033$.

The amplitude of the sound wave in the acoustic tube, assuming no lost motion, is equal to the piston motion × the throat ratio: $= .0033 \times 9.5 = .0315 = a$. Now f we know = 380 $\therefore af = .0315 \times 380 = 12$ $\therefore$ watts *per sq. ft.* (in acoustic tube) $= 12^2 \times .125 = 18$.

And area of acoustic tube = 0.40 sq. in.

hence, Power $= \frac{0.40 \times 18}{144} = .050$ watts
$= 50$ milliwatts.

This is well within the limiting value 84 milliwatts determined by the other method of computation.

On test the instrument was found to carry its load quite comfortably, and in order to explore the possibilities a new sound-box with a larger diameter piston was fitted. Before discussing this it is of interest to check the foregoing on the basis of diaphragm pressure.

Now $af = 12$, therefore pressure = 12/210 = .057 pounds per sq. in. and pressure force on piston = .057 × 3.8 = 0.216 pounds. This gives: 2/3 × 0.216 = 0.143 pounds lateral force on needle point, or well within the permissible value.

The data relating to the second sound-box are as follows:—

Diameter of Piston = 3.4 in.
Area of Piston = 9 sq. in.
Diameter (bore) of tube = 0.75in.
Area (bore) of tube = 0.45 sq. in.

$$\text{Throat ratio (area)} = \frac{9}{0.45} = 20$$

$$\frac{\text{Piston movement}}{\text{Needle movement}} = \frac{2}{3} \text{ (as before)}$$

$\therefore$ Piston movement = .0033in.
Amplitude of wave in acoustic tube $= a = .0033 \times 20 = .066$in.
$af = .066 \times 380 = 25$.
$\therefore$ Watts per sq. ft. $= 25^2 \times .125 = 78$

$$\text{Power} = \frac{78 \times 0.45}{144} = .242 \text{ watts}$$
$$= 242 \text{ milliwatts.}$$

The pressure is: $af/210 = 25/210 = 0.12$ pounds/sq. in.
Force on diaphragm = 0.12 × 9 = 1.08 pounds, or, on needle point, 2/3 × 1.08 = 0.72 pounds.

Both the watts and the pressure-force are very much greater than permissible. On test, with a *fully-recorded* record, the

(*Continued on page 1106.*)

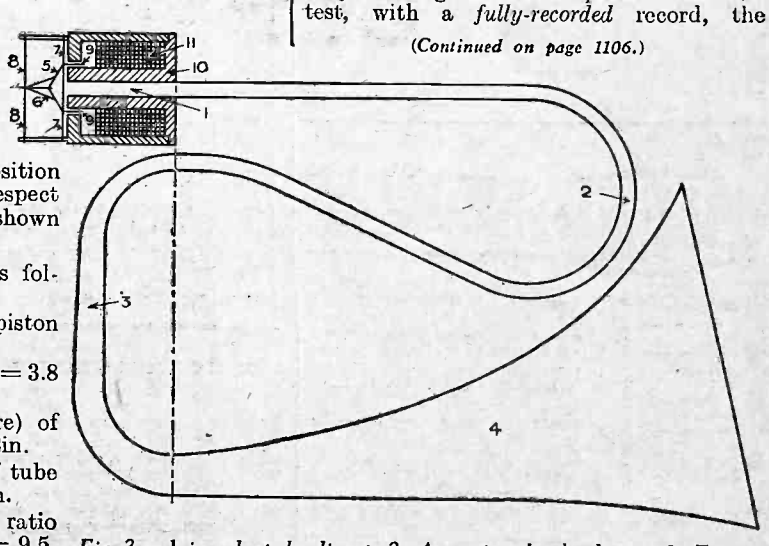


Fig. 3.—1 is a duct, leading to 2, Acoustic tube, leading to 3, Taper passage, communicating with 4, Final flare, or horn. 5, Conical diaphragm or piston. 6, Piston extension. 7 and 8 are Ligatures forming centring means. 9, Field gap with moving coil within. 10, Electro magnet (core). 11, Electro magnet winding.

SOUND ENERGY

(Continued from page 1105)

needle certainly would not hold the track, but with the load increased to 6 oz. (.375 lb.) the difficulty was overcome; theoretically it should have required far more. The discrepancy was undoubtedly due to the diaphragm or piston not being rigid—there is, in effect, "lost motion." Actually the conical part of the piston was intentionally made yielding (elastic) in order to give relatively greater amplification to the bass, and make good the deficiency in the lower frequencies which is usually an objectionable characteristic of the mechanical gramophone.

A computation on parallel lines of the power output on an H.M.V. "Exhibition" sound-box gave 22 milliwatts. The following is a summary:—

	Milliwatts
(1) Maximum possible estimate of power based on 4-oz. load on the needle point on assumption that lateral force may not exceed the dead load	84
(2) Author's special design with acoustic tube and 2.2in. piston	50
(3) Ditto, ditto, with 3.4in. piston and 6 oz. dead weight (certainly not realized)	250
(4) Corrected value for the foregoing based on highest possible lateral force on needle	60
(5) Computation of H.M.V. "Exhibition" sound-box..	22

If the theoretical figures could be realized, a good modern mechanical gramophone might be credited with a maximum acoustic output in the region of 20 milliwatts, when allowance is made for losses not taken into account in the calculation; the author would not feel disposed to credit a higher figure than 10 milliwatts as that actually reached.

Comparison with a low-power radio or electrical gramophone, having a power valve with an A.C. output of, say, 150 to 180 milliwatts, would suggest that either the above estimate is on the high side or the efficiency usually given for the moving-coil speaker on the basis of laboratory measurement is low. Both by theory and experiment the efficiency of a moving-coil speaker of the open cone type is not more than 5 per cent. This is an aspect of the subject that awaits further investigation.

BEGINNER'S SUPPLEMENT

(Continued from page 1102)

provide the coupling between valves in the low-frequency stages of a receiver. The transformer does not, of itself, amplify signals but steps-up or increases the fluctuations in the plate voltage of the preceding valve. These amplified voltage-fluctuations are then passed on to the grid of the following valve. The commonest method of connecting up the transformer is shown in Fig. 10, while the more recent "parallel-feed" method is shown in Fig. 11. In this latter method it will be noticed that a condenser C is connected in series with the primary winding. This serves to prevent the direct current from the H.T. battery from leaking through the primary of the transformer and the anode resistance R. It offers practically no opposition to the low-frequency impulses, however, which are imposed on this current by the speech or music being received, and which it is desired to pass on to the grid of the next valve.

A modification of the ordinary L.F. transformer consists in having *two* secondary windings. These are of equal size connected in series, thus giving three terminal connections, one of these being common to each winding. The two secondaries may be considered as one winding with a centre tapping, and are usually spoken of as such. A transformer of this type is used to operate two amplifying valves connected in "push-pull." The type of circuit used is shown in Fig. 12. The outer ends of the two secondary windings are each connected to the grid of one of the valves, while the third point or "centre tapping" is connected to grid-bias negative in the usual way. By using the valves in this way twice the signal strength can be handled, because the amplified voltage fluctuations induced in the secondary windings of the transformer are shared between the two valves.

Mains Transformers

Apart from coupling the valves, one of the most important uses of transformers in receiving sets is that of transforming the current supplied by the electric light mains into one of suitable voltage and amperage for working the receiver.

Mains transformers are very similar to intervalve transformers, but are larger. They usually have one primary winding and two or three secondary windings. The largest winding supplies the H.T. current for the valves; the next one has fewer turns of heavier gauge wire and supplies a comparatively large current at low voltage for heating the filaments of the valves, while a third winding is fitted when a valve rectifier is used. It provides the current for the filament of the rectifier.

Other iron-cored transformers are used to connect the last valve in a receiver to the loud-speaker. Usually the transformer is fitted to the speaker itself. It transforms the high voltage (but small current) from the valve into a lower voltage, but larger current suitable for working the loud-speaker.

BLUE SPOT LOUD-SPEAKERS

BLUE Spot loud-speakers are too well known to need any introduction to our readers. Ingenuity in design, high technique in construction, and quality of materials used combine to make these instruments amongst the finest obtainable. A full range is given in a booklet just issued by the Blue Spot people, which also includes particulars of the new Blue Spot pick-up with volume control, which sells at 35s. This instrument has all the latest improvements in pick-up design, including a cobalt steel magnet, perfect tracking, self-contained volume control, perfect balance and revolving head. Screened leads are also provided which are available for earthing. Particulars are also given of an extension loud-speaker system which enables listeners to receive the radio programmes in any part of the house. Copies of the booklet can be obtained from The British Blue Spot Co., Ltd., 94-96, Rosoman Street, Rosebery Avenue, London, E.C.1.

ILFORD AND DISTRICT RADIO SOCIETY

AT a recent meeting of this Society Mr. F. H. Haynes gave a lengthy and interesting talk on Duo-phase amplification, and Cathode Ray Oscillographs. This was followed by a surprise demonstration of a Cossor-Haynes tube, which was used to show the performance of the club receiver and convertor. The stages of the receiver were each tested, and using the wave-form of the convertor as a basis, it was easy to see what happened after it had been through the valves and associated components. The resulting diagnosis will cause some discussion later, on forms of intervalve coupling. Details of the Society may be obtained from the Hon. Sec. Mr. C. E. Largen, 44, Trelawney Road, Barkingside, Ilford.

Practical Television

Conducted by H. J. Barton Chapple, Wh.Sch., B.Sc., Etc.

MARCH 3rd, 1934. Vol. I. No. 9.

TELEVISION SWITCHING SYSTEMS

In This Article a Number of Methods of Switching Over from the Loud-speaker to the Television Receiver are Described

THERE are probably few experimenters who can afford to keep a special receiver for operating the television apparatus, and it becomes necessary to employ the same instrument for both "sound" and "vision" reception. Additionally, of course, it is generally more convenient to tune-in and make preliminary adjustments with the loud-speaker, rather than the machine, in circuit. On first thoughts it would appear to be a perfectly simple matter to insert a switch in the output circuit of the receiver to enable a rapid change to be made from speaker to machine, but when the question is examined rather more carefully and in detail there are a number of points which become evident. These can best be explained by considering a number of practical examples.

Series Feed

One of the simplest methods of connecting a disc-type machine is that shown in Fig. 1, where the neon and synchronizing coils are wired in series between the anode of the output valve and high-tension positive. There is a very appreciable voltage-drop across the neon and therefore it becomes necessary to provide an H.T. voltage well in excess of that actually required by the valve. Thus, if a switch were arranged simply to change over from the primary winding of the loud-speaker input transformer to the machine, an excessive voltage would be applied to the anode of the output valve, probably with disastrous results.

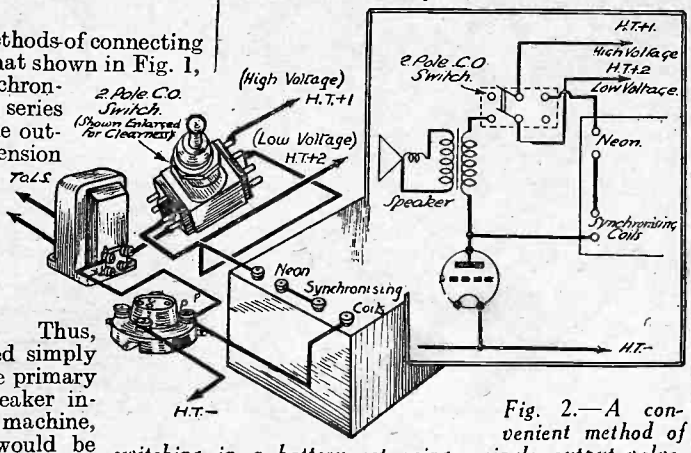


Fig. 2.—A convenient method of switching in a battery set using a single output valve, and where the apparatus is series fed.

In the case of a mains-operated receiver this difficulty can be overcome most conveniently by including a resistance in series with the speaker transformer, as shown at R. Clearly, the value of the resistance must be such that the same anode voltage is applied to the valve whether the speaker or apparatus is in circuit. In other words, the value of the resistance must be approximately equal to the resistance of the neon: the resistance of the synchronizing coils can be ignored since it will not be very much different from that of the primary winding of the speaker transformer. A suitable value for the resistance is about 8,000 ohms, and such a value will nearly always produce the required effect. But if a high-resistance voltmeter is available the exact value can be found quite easily by using a variable resistance of about 15,000 ohms for R. First of all, the voltage between the anode and cathode of the output valve can be measured with the machine in circuit, after which the resistance can be adjusted until the same reading is obtained when the switch is turned to the "speaker" position. In regard to the switch itself, this should preferably be of the Q.M.B. type, since this is the only one which is really suitable for use in high-voltage circuits.

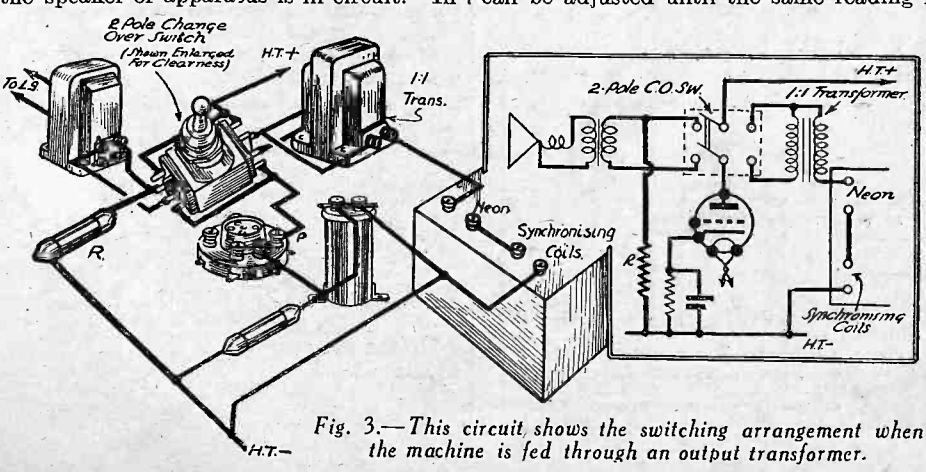


Fig. 3.—This circuit shows the switching arrangement when the machine is fed through an output transformer.

A Pentode Precaution

There is another point to bear in mind when the output valve is of the pentode type; this is that the set should always be switched off before changing over from speaker to machine, or *vice versa*. The reason for this is that when the anode load

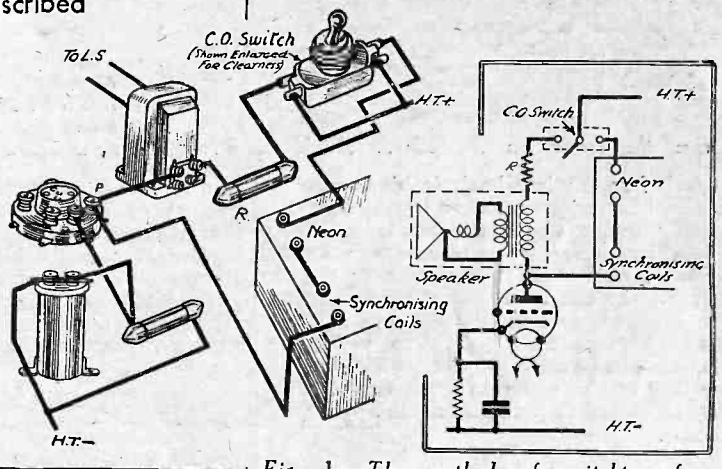


Fig. 1.—The method of switching from "sound" to "vision" when the apparatus is wired in series with the anode of the output valve.

is suddenly removed from a pentode, and when the suppressor grid is still positively biased, a high-voltage surge occurs which is often sufficient to ruin the valve. Of course, a multiple-switch could be employed that would automatically break the mains circuit when changing over, but the complication involved would not generally be justified.

Fig. 2 shows a similar arrangement to that already dealt with, but in respect to a battery-operated receiver where a separate voltage source is employed to supply the necessary "striking" voltage for the neon. A two-pole Q.M.B. switch is employed in this case, so that the normal H.T. voltage is applied when the speaker is in use, the additional voltage only coming into circuit on television. When the output valve is a pentode the same rule applies as was previously referred to.

Switching with Transformer Output

An entirely different method of switching is called for when the apparatus is fed through a 1 : 1 output transformer and the receiver is mains operated. Upon switching over to the speaker the high-tension load is reduced by the amount of current consumed by the neon, and therefore the supply voltage is increased; and, assuming an H.T. voltage of approximately 250, the load would be reduced by so much as some 25 milliamps, which is fairly considerable in proportion to the output of, say, a Class A rectifier. In order to maintain a uniform load a shunt resistance can be placed across the H.T. supply when the speaker is in use, and the method of providing for this is shown in Fig. 3. Here, the resistance R is in parallel with the H.T. supply during the time the speaker is in circuit. It will be obvious that R must have the same value as the neon and synchronizing coils, so that approximately 8,000 to 10,000 ohms will again be correct.

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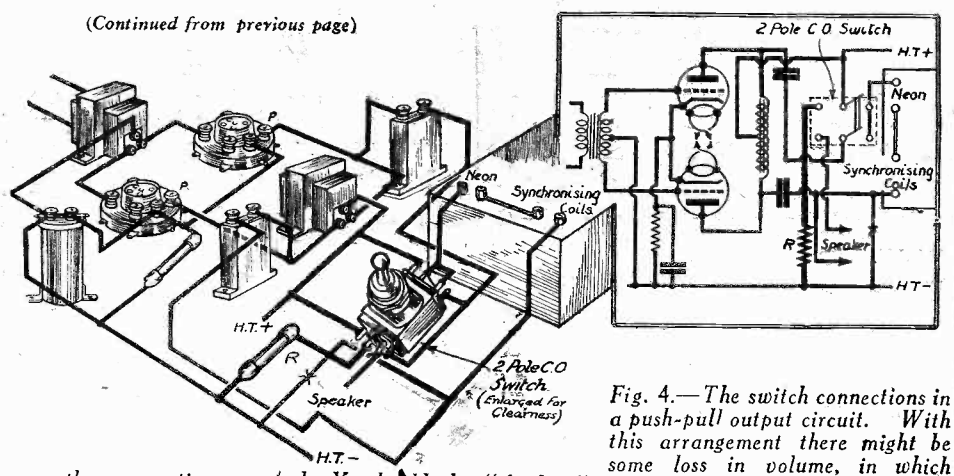

Fig. 4.—The switch connections in a push-pull output circuit. With this arrangement there might be some loss in volume, in which case the connection marked X should be "broken" by means of an on-off switch.

As before, it might be desirable to employ a variable resistance and to find the correct setting under working conditions. This could be done by measuring the anode voltage, as before, but a greater degree of accuracy can be obtained by measuring the total anode current with and without the apparatus in circuit. The resistance should then be adjusted so that the current reading is the same in both cases. The rule in regard to pentodes again applies, of course.

Switching in Push-pull Circuits

When a push-pull output circuit is employed, the system of switching over from speaker to machine is not greatly different from that just dealt with, and the connections are shown in Fig. 4. In this case it is assumed that a choke-capacity output feed is employed, whilst it can be seen that a double-pole change-over switch is used. When the switch is in the "television" position, the neon and synchronizing coils are fed with audio-frequency currents through the two fixed condensers, and the "striking" voltage is obtained from the normal high-tension supply. Changing over to the "speaker" position connects the loud-speaker to the two condensers and also brings the "balancing" resistance R into circuit between H.T. positive and negative, so maintaining a uniform load on the H.T. source. The method of determining the correct value for the resistance is precisely the same as was previously explained.

In the case of a battery-operated receiver, it will be obvious that the resistance is not required, and, in fact, must not be used, since it would merely cause a waste of current, and produce no good effect. The reason is, of course, that the output voltage of a dry battery is practically independent of the current load, whereas with nearly every form of mains-supply arrangement the voltage varies according to the load, becoming smaller as the current is increased, and greater when the current is reduced.

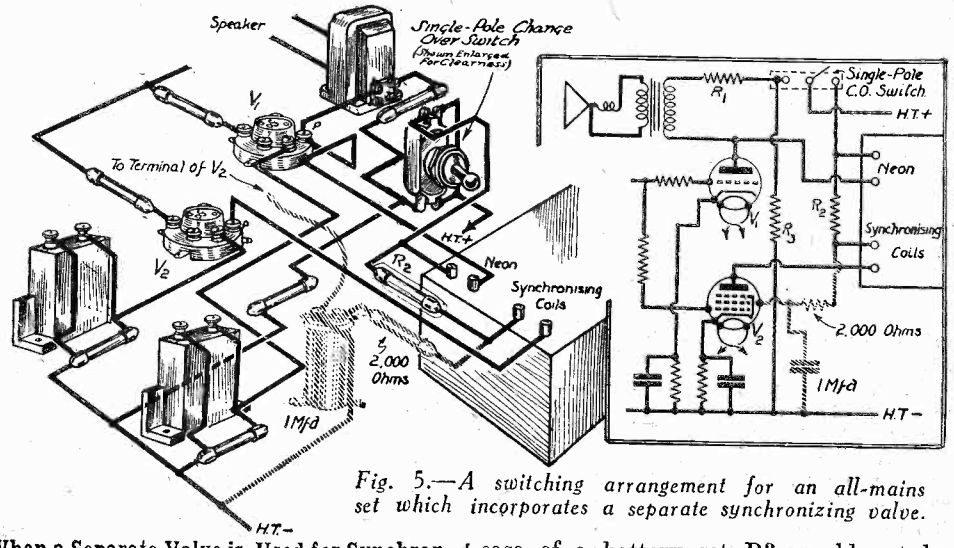

Fig. 5.—A switching arrangement for an all-mains set which incorporates a separate synchronizing valve.

When a Separate Valve is Used for Synchronizing

The switching arrangement becomes somewhat different when a separate synchronizing valve is employed, due to the fact that there are more circuits to consider. Fig. 5 shows one of the simplest arrangements, and this is entirely suitable for use with a receiver where the high-tension supply is from 350 to 500 volts. The circuit can more easily be followed if it is compared with Fig. 1, of which it is a rather more complicated form. Only a single-pole switch is employed. It is evident, for instance, that when the speaker is connected in circuit the voltage dropping resistance R1 is in series with the primary winding of the transformer, whilst the shunt resistance R3 "absorbs" a certain amount of current from the H.T. supply. The value of R1 is similar to that of R in Fig. 1; in other words, it is equal to the resistance of the neon. R3 must pass the same amount of current as the synchronizing valve V2 and the synchronizing coils. Its resistance can, therefore, be found by calculation when the normal anode current passed by V2 is known, or it can be found by inserting a milliammeter in the H.T. positive or negative lead and adjusting the value until the total current load is the same when the speaker is in circuit as when the apparatus is switched on. The resistance marked R2 is for the purpose of reducing the H.T. voltage to the correct value required by the synchronizing valve; the value can be found by calculation.

The arrangement shown is only suitable for use with a mains receiver, and in the case of a battery set R3 would not be needed, and it would be more economical to provide for the filament circuit of the synchronizing valve V2 to be "broken" when the loud-speaker was in use. Thus, a two-pole change-over switch would be required and should be connected as shown in Fig. 6.

It might appear that a similar arrangement would also be better even with a mains set, but there is a little difficulty which would have to be contended with. When the heater circuit was "broken" the load on the L.T. winding of the transformer would be reduced, so that there might be some danger of applying an excessive voltage to the heaters of the other valves. It is true that this difficulty would only appear when the "regulation" of the mains transformer was not all that it might be, but where any doubt exists it is always wise to "play for safety."

Another little point which should be considered in dealing with the arrangement shown in Fig. 5 is that if a pentode valve is used for synchronizing, the H.T. supply to its suppressor grid should be disconnected at the same time as its anode voltage; this can easily be provided for by employing the connections shown in broken lines.

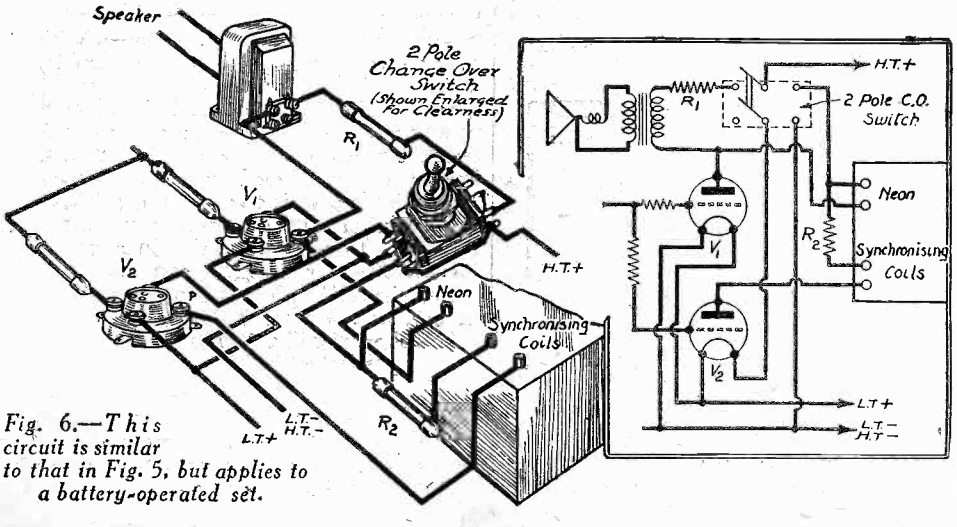

Fig. 6.—This circuit is similar to that in Fig. 5, but applies to a battery-operated set.

"Canned" Television

A Review of the Possibilities of Making Television Records, Accompanied by Some Practical Information

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc., A.M.I.E.E.

MANY have voiced the suggestion that it should be possible to record the television signals broadcast by the B.B.C. on some permanent or semi-permanent device which could be used to furnish images in the home at any convenient time. In other words, why is it not possible to duplicate for vision what the gramophone has done for sound?

It will therefore come as a surprise to most readers to learn that the principles and practice of such a method were established about six years ago, Baird being the particular pioneer in the work. Unfortunately, the scheme, while practicable, is full of difficulties, as I will explain after I have dealt with the arrangement.

the name which has been applied to this section of television work) we vary the process slightly.

This will be made clear by a reference to Fig. 1. The scanning device (either a mirror-drum or disc, the latter being shown in Fig. 1 for simplicity) is driven from a motor which in turn is coupled to a turntable through reduction gearing. On this turntable is placed the blank record, and the vision signals, after amplification, are passed to a recording or cutting needle run in the plain record grooves. This makes indentations corresponding to the vision signals, and if it is desired to make the transmission a dual one, then a synchronized record can also be made of the accompanying sound produced by the subject before the transmitter. An alternative to this is to have a double recording track made on one record, one recording needle handling the sound and a second one the vision.

Turning to Fig. 2 we see an illustration of an actual test record being made. On the left is a dummy's head fixed in front of the scanning device accommodated behind the partition, while in the foreground is the recording table. This is driven by a worm reduction gear coupled to the scanning motor shaft passing through the partition. The amplified signals are being fed to the recording needle in the normal fashion.

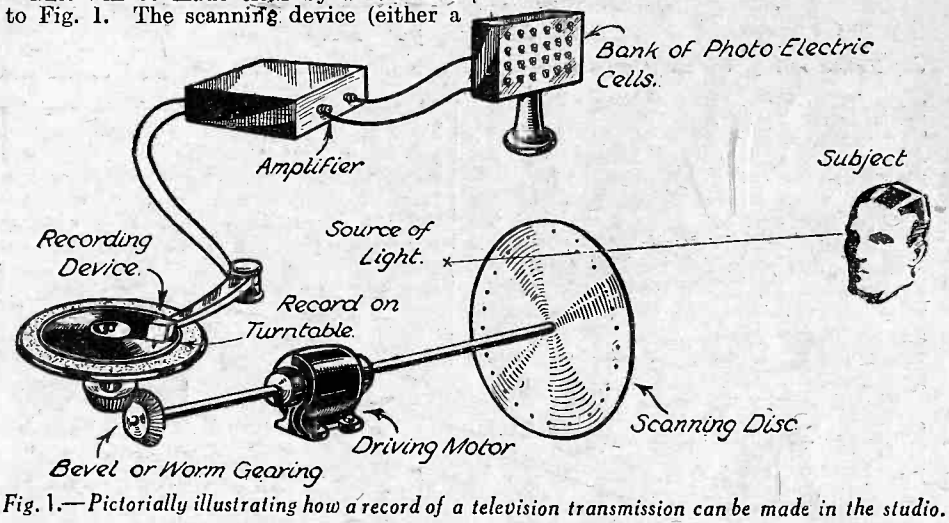

Fig. 1.—Pictorially illustrating how a record of a television transmission can be made in the studio.

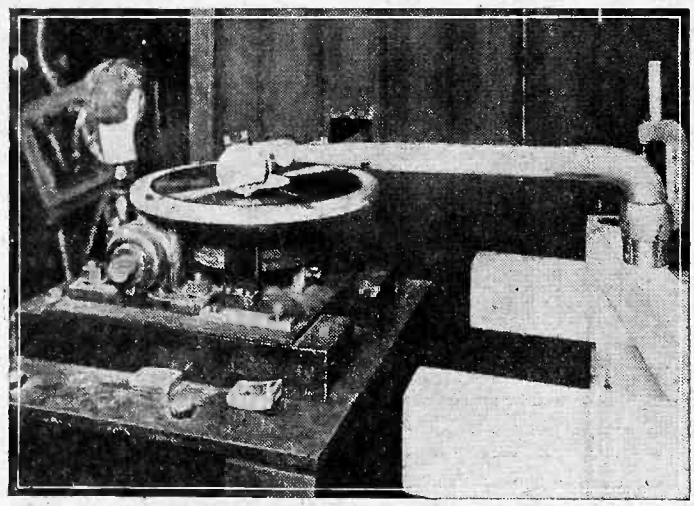

Fig. 2.—A dummy's head acting as the subject for making a test phonovision record, this latter process being visible in the foreground.

Making the Record

Our first concern, then, is the making of the record. From details which have been furnished in earlier issues of this journal the reader will remember that the subject or object to be transmitted is scanned by a regular and rapidly-moving spot of light, the reflections from the areas illuminated being made to operate photo-electric cells. This produces current effects which are proportional to the varying light effects, and being minute in character they are amplified in the normal way. These are the signals which are broadcast, but for our "bottled" images (phonovision is

Playing the Record

A completed vision record made in this fashion is illustrated in Fig. 3, and differs from an ordinary sound record by having a characteristic wavy appearance. At the receiving end the process is reversed and this will be seen by studying Fig. 4. As before, one motor drives the scanning device (mirror-drum or disc) and turntable through a reduction worm gearing of exactly the same ratio as that employed

(*Continued overleaf*)

Fig. 3.—An actual phonovision disc record. When "played" on the appropriate apparatus instead of song or music being heard, the movements of an actual artist can be watched in the vision apparatus.

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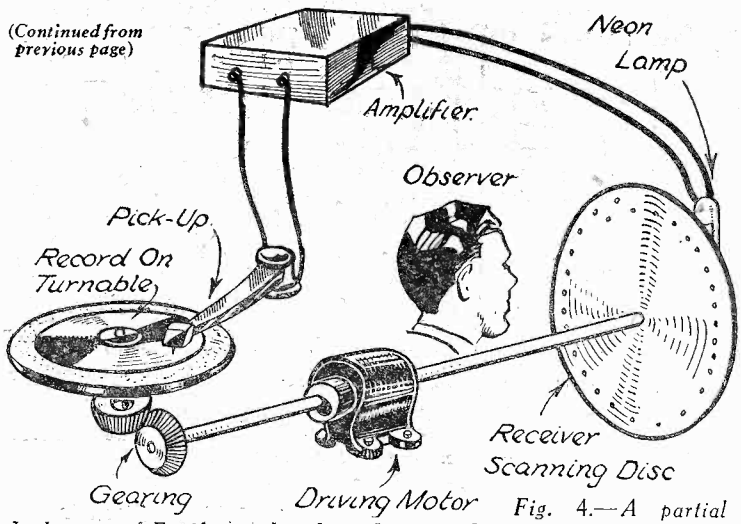


Fig. 4.—A partial duplication of Fig. 1 is undertaken when reproducing the recorded image.

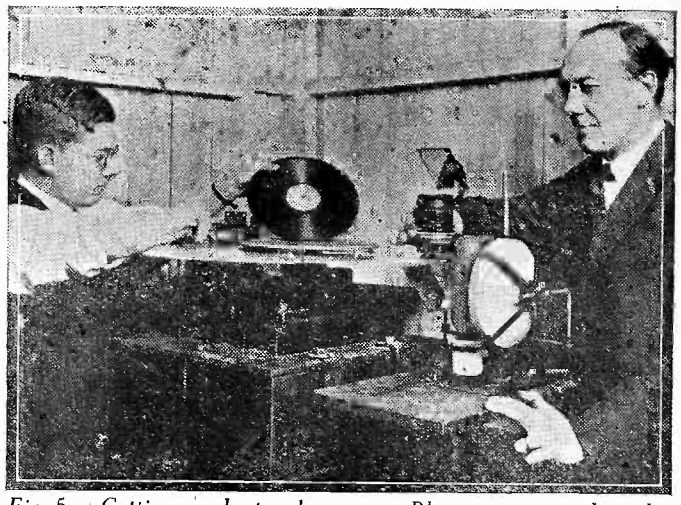


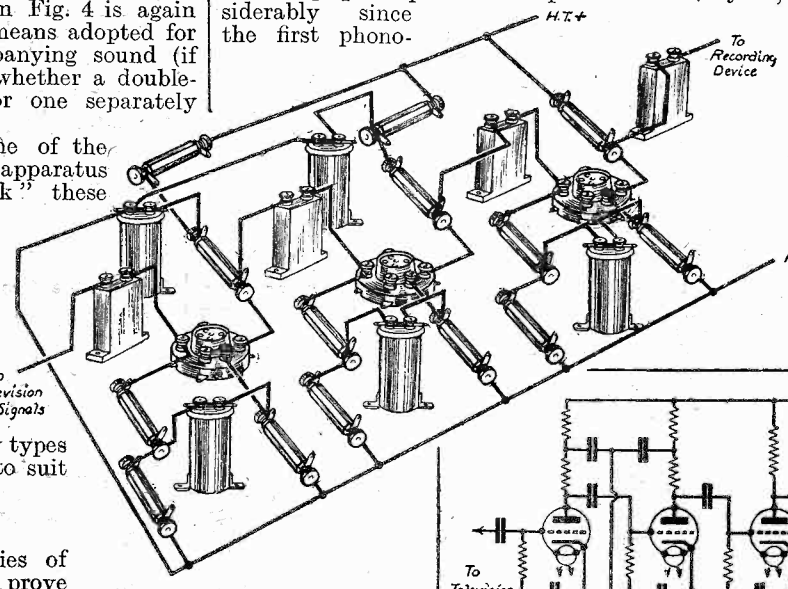
Fig. 5.—Getting ready to play over a Phonovision record so that the "bottled television" will be visible in the receiving apparatus.

by the transmitter (this should be marked on the record face itself to prevent error). An electrical pick-up "plays" on the record in standard fashion and the resultant signals, after amplification, pass to the light source and modulate it so that the images can be built up with the aid of the scanning device, which in Fig. 4 is again shown as a disc. The means adopted for reproducing the accompanying sound (if any) will depend upon whether a double-track record is used or one separately synchronized.

Fig. 5 represents some of the original experimental apparatus used in "playing back" these phonovision records. A particularly interesting illustration is that of Fig. 6, for it depicts how the resultant television image appears when built up from "canned" signals, the section of the receiver shown, of course, being one of many types which can be made up to suit individual taste.

Difficulties

Now why are supplies of such records, which would prove a boon to the experimenter, not available for general use? Well, first of all, one of the prime objects in employing these records is to test out home-constructed television apparatus at one's own convenience without being dependent on the B.B.C. It is, therefore, essential that the "bottled image" should be above suspicion. That is to say, frequency cut-off should not be present at either end of the wide range which has to be covered, and no resonance peaks must appear, otherwise they will be readily visible. Now, although recording pick-ups have improved considerably since the first phonovision records were made, they have not reached the stage of perfection demanded by television signals. Added to this, we have the fact that if an ordinary pick-up is employed to play back the record when carrying out tests at home, the results will fall short of those required for impartial investigation. The pick-up may be quite satisfactory for sound work, but the imperfections are very evident when "looked at" on the television screen. These, then, are the prime reasons why, at the moment, records are not made for re-sale, but this should not in any way prevent anyone from carrying out their own experiments, provided they appreciate that the results to be expected will not live up to "one hundred per cent."



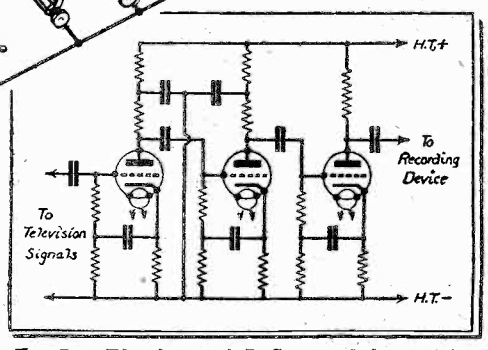


Fig 7.—The form of R.C. coupled amplifier suggested for recording and playing.

Home Recording

I have done this work several times myself, using one or two of the home-recording devices which have been on the market from time to time. The first criterion is to use a good low-frequency amplifier in conjunction with the recorder, preferably one embodying resistance-capacity coupling with low gain per valve stage. This same amplifier can also serve as the television signal amplifier when playing back the records after they have been mechanically indented in the disc.

A suggested circuit is given in Fig. 7, the method of connecting the amplified signals from the output valve naturally depending upon the type and nature of the recording pick-up, but this information is always furnished by the maker. A high-frequency-and-detector unit will obviously feed the received television signals into this amplifier. Although the arrangement of the unit required will be dependent upon the average reception conditions of the London National station, in the district in which the experiments are being conducted, as a general rule, within the service area of this Brookmans Park station, one variable-mu high-frequency pentode stage, followed by an anode bend detector valve coupling, without any form of reaction, will be suitable.

Whereas, in the case of studio-produced records, there is complete control over the synchronizing, as was indicated earlier in the article, when reliance has to be placed on the broadcast signals to be "bottled" for further use, difficulties creep in. Turntable speed must be dead steady, both when recording and when playing back, and even then, in the case of the latter an extra stage of low-frequency amplification, for feeding the superimposed synchronizing signals is advisable.

Fig. 6.—Showing how the "bottled" image appears in the television receiver when "played back from the record."

WILL THE PENTAGRID REVOLUTIONIZE THE SUPERHET ?

(Continued from page 1078)

a section of which has a five miles per hour speed limit; even if the road is the same width throughout its length it will be obvious that the speed limit portion will have more vehicles per yard upon it than any other part where speed is normal.

A very brief consideration will show that this theory is quite untenable: electrons will pass through the grid "OG" at a very fast rate, and as soon as they enter the field of the heavily positive grid S1 they will accelerate to a speed of at least 25,000 miles per second due to the terrific pull of S1. This being so, how can the electrons possibly slow down ? There is absolutely nothing to cause it; even the grid "T" is positive, what little there is of it. Quite obviously the electrons continue to hurtle towards their ultimate objective in space, which is the true anode "A," at a speed something like one-third of the speed of light (about 58,000 miles per second), which is the maximum speed that the electron reaches in a valve.

The true explanation of this valve runs on quite rational lines and is very easy to follow: Fig. 1 shows the electrodes referred to, while Fig. 2 shows how such a valve could be constructed. Reference to the first drawing will show that there are five grids and the heater, cathode and anode.

The heater "H" performs the usual function of warming the cathode "C." Next comes the innermost grid "OG," and then the grid "T," these two electrodes forming the oscillator portion of the valve, "OG" acting as the oscillator grid and "T" as the anode, just as if the other electrodes were not there.

As the inner grid will have a changing potential as the inner section of the valve oscillates, it will control the flow of electrons to the other valve composed of "DG" and "A," and will vary its slope; thus the incoming signal on "DG" will vary the anode current in proportion to the slope of this part of the valve. It has already been pointed out that the slope of the detector portion is controlled by the grid "OG," and in this way electronic mixing is brought about.

The working may be more readily understood if the incoming signal is a carrier wave only, and it is visualized in the following manner. The incoming signal swings up and down the characteristic curve of the valve, and at another speed the oscillator alternately makes the characteristic curve steep and flat. The anode current is controlled by the signal, but the degree of control is decided by the oscillator grid.

It is now evident how the pentagrid mixes the two waveforms by means of the electron stream *that is the only thing common to both portions of the valve.*

Turn to pages ii (cover) and 1073 for Special Offer relating to our famous Tool Kits.

REPLIES TO BROADCAST QUERIES

W. MACDONALD (Beddington): G6UB, S. W. J. Butters, "Walla Brook," 84, Guy Road, Beddington, Croydon; G6I0, T. Woodhouse-Rayner, 21, Solway Road, East Dulwich, G5KH, H. D. Cullen, 144, West Hill, Wandsworth. F. BARRETT (Hackney): No special stations; would suggest you listen first to fog beacons giving out simple combinations of letters on wavelengths between 940 and 1,040 m. Also GFA (Air Ministry) Meteorological Reports on 4,100 m. or GFB Croydon (1,260 m.), Coastal Stations (600 m.), and Aviation on 1,288–1,340 m. A. YOUNG (Newcastle): Ship—Shore telephony; regret, cannot trace call sign. ELJAIESSE (Bedminster): G6QW, W. B. Weber, 2, Balmoral Road, St. Andrews, Bristol; G6QP, J. Oxley, 282, Easter Road, Leith, (N.B.); Cannot trace call U2KCT, but if U2KT, amateur transmitter, Moscow (U.S.S.R.); EA5BC, Julian Yebenes, Pascualy Genis 16, Valencia, Spain; EA2AD, Julio Sanchez Peguero, Zurita 9, Saragossa (Spain); F8JD, J. F. Bastide, 26, Rue Taupin, Toulouse (France); G5KT, K. T. Harvey, 33, Howard Road, Westbury Park, Bristol; G6RV, W. B. Stirling, "Mossgrove," Bridge of Allan, Stirlingshire; OK2OP, Hans Woletz, Neustift bei Olmuetz (Czecho-Slovakia); Cannot trace IAOMD; write: *Associazione Radiotecnica Italiana*, Viale Bianca Maria, 24, Milan (Italy). C. WALSH (Leyland): Empire transmission No. 3 between G.M.T. 14.00 and 16.00 is given through Daventry GSE (25.28 m.) and GSB (31.55 m.); between 16.00 and 18.00 through GSB and GSA (49.59 m.); between 18.15 and 19.45 transmission No. 4 through GSD (25.53 m.) and GSB; between 19.45 and 22.40 through GSB and GSA. We can trace the following call signs: WSL, Sayville (N.Y.), on several wavelengths ranging from 13,587 m.—96.61 m.; YVR, Maracay (Ven.), 44.78 m.; HBL, Prangins (Switzerland), 31.27 m.; WIW, Sayville (N.Y.), 27.75 m.; WIV, Sayville (N.Y.), 28.06 m.; WNA, Lawrenceville (N.J.), 32.72 m.; WEC, Rocky Point (N.Y.), 33.37 m.; WIX, Sayville (N.Y.), 27.73 m.; WJE, Sayville (N.Y.), 27.7 m.; WJH, Sayville (N.Y.), 23.05 m.; WCC, Marion (Mass.), on wavelengths ranging from 13.453—26.96 m.; DIS, Nauen (Germany), 29.54 m.; DHA, Nauen (Germany), 27.47 m.; GBR, Rugby; OPL, Leopoldville (Belgian Congo), 14.97 m.; IRE, Rome; IRT, Rome, 45.72 m.; DFL, Nauen (Germany), 27.65 m.; JNA, Nagoya (Japan), 33.41 m.; LCJ, Jelöy (Norway), 30.06 m.; OER, Vienna, 29.9 m.; FZR, Saigon (French Indo China), 31.50 and 18.50 m.; FZT, Tananarive (Madagascar), 28.50 m.; FYC2, Paris, 40.37 and 30.48 m.; FTA, St. Assise, Paris, 25.125 m.; FTL, St. Assise, Paris, 30.09 m.

Random Jottings

By the Editor.

WE go to a lot of trouble to make the contents of PRACTICAL WIRELESS understandable to the beginner and expert alike. Now and again, however, we receive a letter from a reader who, without investigation of our information, jumps to conclusions. I had one the other day—Ah! here it is, from one W. R. Cumming, a wireless and electrical engineer of Dumfries. *Pace* Mr. Cumming:

"The theoretical diagram of the 'Reader's Wrinkle,' on page 988 of February 10th issue, entitled 'An Electric Bell Relay,' is wrong, for several reasons. Obviously if the theoretical diagram were used, it would be possible to arrange the bell batteries which are usually of higher potential than those in the normal receiver, either in parallel with, or in opposition to, those of the receiver. In the first case, premature discharge of the bell battery would occur, and in the second case, damage might be done to the receiver battery, since the resistance of such a bell circuit is normally negligible. The practical diagram is correct only up to a point, as the contacts will chatter, unless the frequency of the trembler is normally such that it vibrates synchronously with that of the bell. The result would be the reverse of the quietness suggested, which, it is stated, would allow the bell to be heard. A far simpler, cheaper, and more effective scheme is to run a lead from the bell circuit near the aerial terminal of the receiver, or if this does not produce a loud enough warning note in the speaker, then the lead may be connected to the aerial terminal through a small fixed or other condenser, having a value in the vicinity of .00001 mfd. to .0001 mfd., when it is usually possible to hear the 'Burring' note above the loudest passages of music. This latter method is well known and is very effective. With regard to 'A New Use for Old Transformers,' the secondary of one of the transformers is called upon to carry the anode current of the output valve. Secondary windings as a rule are not of sufficiently heavy gauge for this duty, so that the 'wrinkle' might be entitled 'Possible Way for Burning-out Secondary Windings of Old Transformers.'"

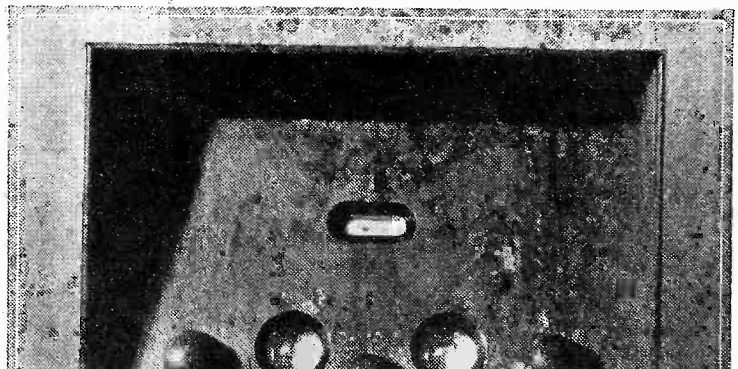
It seems necessary to point out to my critic that the theoretical and the practical circuits, as well as the text relating to this wrinkle, are quite correct and in order, but, as he is apparently unable to understand the scheme, may I say that he is quite wrong.

Firstly, no mention is made of a bell battery, simply because such is not required. Instead, the Low Tension accumulator is employed in the bell-wiring system, and if the circuit is examined it will be found that the customary make-and-break is not employed as in the usual bell system. Instead, the bell magnets are wired in series with the push, bell and accumulator. This means that when the push is operated, current will flow through the magnet system and the armature will be attracted and *held in contact with the poles of the magnet.* The accumulator is fed to the valves of the receiver, *viâ* the armature and the contact-breaker, which means that in the position of rest current may flow, and the switch on the receiver will enable the circuit to be broken at will. When, however, the armature is attracted to the magnets this current is broken, and therefore, as stated in the text, when anyone presses the bell push the set is switched off. If the striker is left on the armature this would give a blow on the bell gong as the set was disconnected, and although no continuous ringing of the bell is obtained this is unnecessary, as warning that someone is ringing the bell is obtained by the cessation of signals from the loud-speaker.

With regard to the second criticism, this reader may not know that transformers are capable of carrying quite a fair amount of current through the secondary winding. I have had some tests made in our laboratories and I give below the results of these tests:

Transformer No. 1 (5/6 List Price). Secondary resistance 8,000 ohms. At 12 m/A temperature rise only just perceptible. At 30 m/A temperature did not exceed 80 degrees (cent.) after one hour's use, and showed no signs of breaking down.

Transformer No. 2 (30/- List Price). Secondary resistance 32,500 ohms. At 12 m/A temperature rise appreciable but



The control panel of one of the new Ferranti receivers, which is fitted with magnifying lenses over the tuning scale. The horizontal opening at the top of the panel is the visual electric tuning indicator.

no ill effects apparent after one hour's use, the sealing compound remaining set and the taping round the windings remaining unaltered in appearance. At 30 m/A breakdown occurred after 15 minutes.

It is obvious that the above treatments are absurd, as in the first case the voltage drop at 30 m/A would be 240 volts, and this obviously prevents the average user from applying sufficient H.T. to the output valve to pass that high current. It is safe in this case, therefore, to adopt the scheme of connecting the two transformers in series as the total current would be restricted to a safe figure. Incidentally the output valve of the average battery receiver does not pass current which in any way approaches this figure.

In the second case, 30m/A at 32,500 ohms gives a voltage drop of over 900 volts, and we cannot visualize any listener connecting this transformer in the anode circuit of a valve so as to pass this magnitude of current.

"Lucerne Specials"

THE month of February has not been associated with any outstanding activity in the production side of the radio industry. This is due mainly to the fact that February has been regarded as the month in which the threshold of the slack period is crossed. It is always the aim of the industry to keep its production graph as straight as possible, and, as far as the Marconiphone Company is concerned, this has been achieved by the introduction of the instruments known as the "Marconi Lucerne Specials." The demand for these instruments is truly astonishing, and the attitude of the buying public towards them ensures full production for some time to come.

The customary January rise in unemployment does not apply to Marconiphone. Additional operatives taken on at the beginning of last season to cope with the seasonal rush are being kept on, and further hands have been engaged. The Marconiphone factory at Hayes is as busy now as it was during the peak months of 1933. The maintenance of production during these reputed "slack" months has repercussions throughout various trades in Great Britain. The buying of the raw materials for making the "Lucerne Specials" creates further employment in all the associated industries, and it is from beginnings like this that the gloom of depression is lifted and prosperity once more returns.

Simpler Tuning

AMONG the many novel tuning arrangements which have been recently introduced in commercial receivers, that illustrated on page 1112 is worthy of special mention. It is a Ferranti scheme, and is fitted to the Arcadia and Lancastria models. It will be seen that small circular openings are provided for the actual tuning scales, and these openings are fitted with a powerful magnifying lens. This greatly enlarges the markings on the scale, and it is thus a simple matter for anyone to identify the actual setting of the tuning condensers. The illustration does not show these magnifiers to the best advantage owing to various reflections, but in actual use they will be found extremely efficient.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

SLADE RADIO

A lecture by Mr. E. N. Shaw, of the Marconiphone Co., Ltd., was given at the meeting held recently. In this he described the radio section of the works at Hayes. At the conclusion of the lecture a demonstration was given of the Model 262, which is a 5-valve A.C. superhet.—Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

GOLDERS GREEN AND HENDON RADIO SCIENTIFIC SOCIETY

On Wednesday, January 24th last, a talk was given to this society by Mr. J. C. Emerson, B.Sc., on "The Design and Testing of Home-Constructed Radio Receivers."—H. Ashley-Scarlett (President), 60, Pattison Road, London, N.W.2.

THE SIDCUP AND DISTRICT RADIO AND TELEVISION CLUB

An interesting lecture, "Metal Rectifiers," given by Mr. D. Ashby, B.Sc., of the Westinghouse Brake and Saxby Signal Co., Ltd., proved a great attraction at the last meeting of the above club. Mr. Ashby began by describing, with the aid of a series of lantern slides, the construction of the Westinghouse metal rectifier and how it depends for its action on the different resistances at the junction of a metal and an oxide, and he then explained in detail the various ways of using these rectifiers when it is necessary to convert alternating current into direct current.—Hon. Secretary, Mr. W. F. Smith, 4, Rowley Avenue, Sidcup, Kent.

THE CHATBURN AND DISTRICT RADIO SOCIETY

"Modern Radio Practice" was the title to a very interesting lecture given before the above society on the 9th inst. by Mr. Deal, of Messrs. Mullard, Ltd. The lecturer dealt in a very lucid manner with the functions of a radio valve. The society extends an invitation to all PRACTICAL WIRELESS readers in the district.—J. Holden (Hon. Sec.), Downham Road, Chatburn, Lancs.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

An interesting discussion, entitled "Is Short-Wave Listening Worth While?" took place at the London Chapter meeting held at the R.A.C.S. Hall, Wandsworth Road, S.W.8, on Friday, February 16th. Mr. A. E. Bear, in opening the discussion, said that short-wave listening was definitely worth while. Short-wave stations were increasing in number, and such stations as W3XAL, W8XK and the Empire stations were certainly giving service.

Mr. F. G. Sadler, in opposition, said that one could not listen on short waves with any degree of pleasure. A Canadian member said what a boon short-wave stations were to one whose nearest broadcasting station was over 500 miles away.—A. E. Bear (Sec.), 10, St. Mary's Place, Rotherhithe, London, S.E.16.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY (Leigh Branch)

Readers, and others, in the Leigh, Lancashire, district are invited to attend the meetings of the Leigh Branch of the Anglo-American Radio and Television Society, which has just been formed by Mr. Harold Hughes, of 64, Siddow Common, Leigh, Lancs, from whom full particulars may be obtained.

This branch will hold meetings regularly, and television and other demonstrations will be given from time to time.

THE CROYDON RADIO SOCIETY

A loud-speaker night was held at St. Peter's Hall, Ledbury Road, South Croydon, on February 6th, the meeting being well attended.

The procedure was to find a speaker capable of challenging that of the Vice-President, whose instrument won at the last speaker night. This was his Baker moving coil, adapted specially by him and using 12 watts for energization. The Vice-President had entered a moving-coil designed, he said, on the Bitzoff principle.

At length a W.B. P.M.6 emerged triumphant in a final in which an energized dual unit, and several permanent magnet speakers participated. Finally, the Vice-President's was voted the best on all-round performance.—Hon. Secretary, E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

CLITHEROE ROYAL GRAMMAR SCHOOL RADIO CLUB

This club was formed on February 3rd, 1934, and has since had seven meetings. The club's activities for February included visits to the Palladium Cinema, Clitheroe, for a demonstration on sound apparatus and cine-projectors. On the 28th ult., a visit was paid to the North Regional Transmitter at Moorside Edge. Further particulars can be obtained from the Secretary, F. Duerden, Royal Grammar School, Clitheroe, Lancs.

INTERNATIONAL DX'ERS ALLIANCE

Under the auspices of this society the following special transmission will take place as follows:—

March 18th, 4.30–6.0 a.m. G.M.T., HIZ Santo Domingo, D.R. 6315 kc/s or 47.50 metres.—R. L. Rawles, Publicity Director, Blackwater Corner, Newport, Isle of Wight.

IN OUR LABORATORY

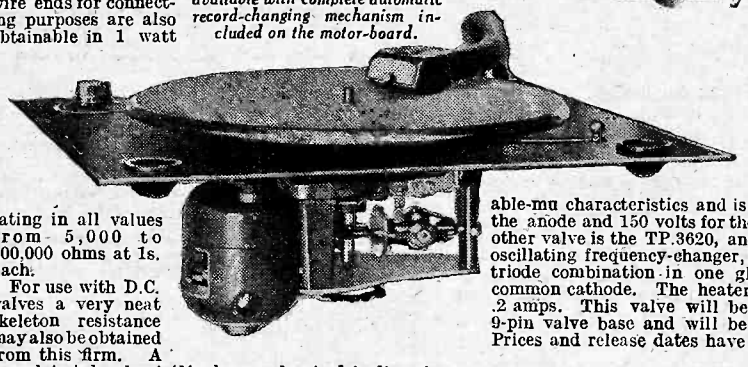
WHAT WE FOUND

Tests of the Latest Components.

BULGIN RESISTORS

WHEN constructing a Mains-operated receiver there often arises the demand for a number of fixed resistors having various wattage ratings. In the Bulgin range will be found resistors having ratings from 20 watts downwards. The 20 watt type is wound on a heat-resisting core which is provided with a spiral groove throughout its length, and the element is a special non-ferrous nickel-chrome wire. Although these have various standard ratings, the method of making connection enables various intermediate values to be obtained. Metal bands are clamped round the wire and are fitted with terminals, and the element is held in place apart from these bands, so that there need be no hesitation in moving them to obtain any desired value. This type of resistance may be obtained from 50 ohms up to 100,000 ohms, and the price varies from 2s. 6d. to 4s. 6d. A smaller type of resistor is also available in ratings from 5 to 250 ohms, and these cost 1s. A special asbestos compound is employed for the former and the element consists of nickel-alloy wire. Terminal connections are provided and non-listed values may be obtained by connecting the resistances in series or parallel. Resistors of standard pattern, namely non-wire wound, provided with wire ends for connecting purposes are also obtainable in 1 watt rating in all values from 5,000 to 100,000 ohms at 1s. each.

Two of the "Garrard" electric gramophone motors, which are ready for incorporation in a radio-gram. A model is also available with complete automatic record-changing mechanism included on the motor-board.



For use with D.C. valves a very neat skeleton resistance may also be obtained from this firm. A porcelain tube about 4½in. long and an inch in diameter carries a fine wire element round which are clamped metal bands at fixed positions according to various mains ratings. These resistances are intended for vertical mounting, and a small bracket is supplied fitted to one end for this purpose. As this type of resistance dissipates some 50 watts as heat, ample space must be provided when assembling a receiver incorporating one of these devices. For 16v. or 20v. valves, and from 2 to 7 valves, the price is 4s.

EMICOL MEASURING INSTRUMENTS

SOME time ago we gave a report of the neat measuring instruments which are manufactured in London by the Electrical Measuring Instruments Co., Ltd. This firm now informs us that the public have apparently been led away by the cheap instruments which have appeared on the market and which owe their origin to Japan. These instruments, they state, whilst of quite an attractive appearance are unsound electrically, inasmuch as the resistance of the meters is very low, and this naturally means a load on the battery when checking H.T. voltages. The Emicol instruments have been designed to enable the amateur to make voltage and current measurements without any detrimental effect to his apparatus. Further, Emicol meters are guaranteed against defective manufacture. Our readers should bear these facts in mind when next purchasing an instrument.

EXCEL H.T. BATTERIES

WE have received from the Excel Battery Co. a sample of their 120 volt battery which retails at 5s. 9d. (carriage paid to any address). A similar battery with a voltage of 60 volts sells at 3s. 6d. It is claimed that a new and improved formula is employed in the manufacture of these batteries, and that, in spite of the extremely low price, good service is obtained from them. We subjected the battery to a discharge test, and obtained 50 milliamps for nearly an hour, with a drop in voltage to just under 100. This is drastic treatment, and in ordinary use the battery should be found to have a long life. An important point is, of course, that the batteries may be obtained direct from the makers (at the prices given above) and therefore the user is assured of obtaining a battery which is absolutely fresh. Where a battery is purchased through the usual trade channels there is always the fact that the shelf-life may have been of one week or one month's duration and the user thus has no indication of the freshness of the battery. Grid batteries are also obtainable at 9 volts for 7d. and 16½ volts for 1s. The address of the Excel Company is 151, Wellingborough Road, Northampton.

NEW EDISWAN VALVES

TWO new valves are announced by the Edison Swan Electric Co., and these are of the universal A.C.—D.C. type. The first is the VP.1321, and this is of the indirectly-heated type rated at 13 volts .2 amps. It is an H.F. pentode having variable-mu characteristics and is rated for 200 volts at the anode and 150 volts for the screening grid. The other valve is the TP.3620, and this is special self-oscillating frequency-changer, having a pentode and triode combination in one glass bulb, fed from a common cathode. The heater rating is 26 volts at .2 amps. This valve will be fitted with the new 9-pin valve base and will be supplied metallised. Prices and release dates have not yet been fixed.

BRITISH RADIOPHONE LINE DISCONTINUED

MESSRS. BRITISH RADIOPHONE, LTD., announce that the Standard A type flat type variable ganged condensers (with the trimmers mounted at the side) is being discontinued and will not be available as from the 1st March.

BATTERY H.F. PENTODES FROM MULLARDS

FOLLOWING our recent note of the issue of the T.D.D.2, we are able to announce that the Mullard Company will shortly be issuing two H.F. pentodes, also for battery operation. These valves will be known as the V.P.2 and the S.P.2, the former having variable-mu characteristics, and the latter an ordinary high-frequency pentode. The V.P.2 has the following characteristics:—

Filament voltage	2.0 volts.
Filament current	0.18 amps.
Max. anode voltage	150.0 volts.
Max. aux. grid voltage	150.0 volts.
Mutual conductance	1.75 mA/V.

The S.P.2 has similar characteristics except that the mutual conductance is 2.2. mA/V. An important point about these two valves is that the auxiliary grid may have the same voltage as is applied to the anodes and this will enable the usual voltage-dropping resistance to be dispensed with, or alternatively will enable one battery lead to be removed. Even with this high grid voltage the anode current is still within reasonable limits being, in fact, approximately the same as that of a normal S.G. valve. The standard 7-pin base will be fitted and the valves will be supplied with a metallised coating only. This coating is connected to one of the pins on the base so that it may be earthed if desired.

A block condenser manufactured by the T.M.C.

WEARITE UNIVERSAL TYPE "A" COIL

WE recently reported on the Universal coil manufactured by Messrs. Wright and Weaire and selling at 5s. This coil is now available in a second type, known as Type A, and it differs only in that a tapping point is now provided on the primary winding. This tapping point is brought out to Terminal No. 8 on the base and thus enables a higher degree of selectivity to be obtained where this is found necessary. Other advantages of this tapping will occur to the experimenter. The price will be the same, namely 5s.

OSRAM HEPTODE COMING

A COMBINED frequency-changer of the heptode type is announced from the G.E.C. This will be provided with the standard 4 volt 1 amp. heater, and will follow the lines of the heptode valve recently described in these pages. A standard 7-pin base will be fitted, and the reference number for the valve is M.X.40. The advantage of this valve over the normal H.F. pentode or tetrode method of frequency changing is in the fact that the conversion conductance is controllable by the grid bias. This makes the valve invaluable in circuits which incorporate automatic volume control where the maximum control is required and the number of control valves is restricted.

NEW EVER READY H.T. BATTERY

A NEW radio H.T. battery, suitable for replacement purposes in the latest model McMichael Lodex 5, has just been introduced by the Ever Ready Co. (Gt. Britain), Ltd. It is a 126 volts battery tapped at 70 and 120 volts for H.T., and six volts for G.B. The dimensions of the battery are 8¾in. by 7¾in by 3¾in. The list number of this new battery is W.1252, and the list price 17s. 6d.

The Pifco All-in-One Test Meter.

A USEFUL ALL-RANGE METER

THE meter illustrated above is a Pifco product and enables the user to read volts in three ranges—0 to 8, 0 to 16 and 0 to 240 and milliamps up to 30. By using an external battery it is, of course, possible to take resistance readings. The instrument has a high degree of accuracy and is quite inexpensive.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

A Rival to "Q.P.P."

SIR,—The accompanying rare woodcut of the period illustrates a dramatic moment in the development of my latest brain-child, "Quiescent Scratch-Scratch," and was recorded by a televisitor through the infra-yellow haze. For obvious reasons, I cannot reveal too much of my new system, but I can hint that it is a remarkable

modification of "Q.P.P.," and that valves are unnecessary. The heart of the whole thing is the synthetic crystal "Chokite," a combination of the rare elements Nertzite and Aertite, fused by the Darkhousen's Curse method. Prodding-pegs, mounted on either side of the mounted crystal, do all the pulling and pushing, and these are worked by hand, no electric mains being required. Further information I cannot give, at present, but when the system passes the experimental stage, and is in general use, valves, batteries, and the B.B.C. will be a thing of the past, and listening-in a meaningless function. My remarkable success is entirely due to the wonderful self-igniting "Inspirator," without which I should not have developed "Q.S.S.," or anything else.—(Dr.) GASPARD HACKENOFF (Institution for Eccentrics, University of Timbuctu).

Q.P.P. *versus* "Class B"

SIR,—As a reader of PRACTICAL WIRELESS since No. 1 I have taken a great interest in the progress of your journal, and in the trend of set design, I notice the great popularity of Class B sets. I have heard several sets with this type of amplification, and nearly all of them suffer from a kind of "Class B" rattle. To come to the point, I think that Q.P.P. is better than Class B when properly adjusted. I have experimented with the former, and strange to say, was disappointed with regard to volume with my first venture, it being about the same as my former set with a 10–1 coupling unit and pentode output. I therefore tried an L.F. transformer "in front" of the Q.P.P. stage—result terrible! Not to be outdone, I pulled out the transformer and replaced same with an L.F. choke; results splendid, both as to volume and tone. Idling current is 8½ m.a.; not too bad for a S.G. det. L.F. and Q.P.P. set. Variable tone control is fitted to the first L.F., and all valves are Tungsrams with pentode output driving three balanced armature speakers, or rather two and one of the inductor type. The battery is a 120 volts Standard No. 3 wet battery which has the advantages of keeping its voltage; the tappings are at every 1½ volts, just right for Q.P.P.! It was installed last March, and still shows 115 volts under load, so I am certainly saving in H.T. On the other hand, a size larger accumulator would be an advantage! I fully believe that with the advent of the new Marconi valve, Q.P.P. will take its rightful place, and share the great popularity of Class B.—R. G. HARRISON (Newcastle).

Sets Designed by Readers

SIR,—For some time past you have embodied a very popular feature in PRACTICAL WIRELESS, which consists of original ideas contributed by readers. I consider it would be a good idea if you invited readers to contribute short descriptions of actual sets which they have designed and constructed themselves. This would add greatly to the knowledge of everyone, and would provide splendid material for the man who likes to try different kinds of circuits. The idea occurred to me after I had constructed a set from my own design, and I thought it would be interesting to read of other amateurs' experiences.

My set is a 4-valve superhet. Heptode frequency changer, var. mu H.F. Pentode as I.F.; D.D. Triode detector and 1st L.F., and Pentode (Catkin) Output. Iron core coils are used. Although the set is not in its final form, whilst it is on an experimental board, practically every worthwhile European Station, and also Pittsburg (KDKA) on 306 metres has been received.—E. H. GRIFFITHS (Barnet).

CUT THIS OUT EACH WEEK.

Do you know

—THAT the anode by-pass condenser in the detector circuit will govern the amount of high note cut-off.
—THAT the heater windings on a mains transformer act as earth screens if interposed between primary and secondary.
—THAT a push-pull stage will work with one of the push-pull valves removed from its socket.
—THAT a Class B valve will still work even though one half is defective.
—THAT in cases of serious distortion with this form of amplification each half of the valve should be tested with a milliammeter.
—THAT a rubber band round a valve will do a lot to prevent microphonic noises.
—THAT whistles in a superheterodyne receiver may be caused by an overloaded detector valve.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

WIRELESS GUIDE—No. 296A

A WELL-ILLUSTRATED booklet bearing the above title contains prices and particulars of many of the leading radio manufacturers' receivers and components. A comprehensive range of valves, loud-speaker units, accumulators, high-tension batteries, eliminators, gramophone motors, meters, in fact, everything the constructor is likely to require, is given in this 120-page booklet. It is issued by J. H. Taylor and Co., Macaulay Street, Huddersfield.

"WIRELESS AS A CAREER"

WIRELESS amateurs thinking of taking up radio as a career would do well to obtain a copy of a brochure entitled "Wireless as a Career," which gives particulars of the National Institute of Radio Engineering, methods of instruction, and full synopsis of the course for qualifying for the N.I.R.E. diploma. Particulars of a correspondence course are also given. The principal of the Institute is Mr. H. F. Yardley, A.I.E.E., and the address is 55-57, Guildhall Street, Preston.

NEW BLUE SPOT "CLASS B" OUTPUT UNIT

WE have received from the Blue Spot Co., Ltd., an interesting leaflet giving full particulars of a new unit which should appeal to all home constructors, particularly users of Blue Spot moving-coil speakers. The design of the unit has been carefully considered, so that an existing speaker can be fixed in a few seconds, the whole bolting together and forming a complete and rigid unit. Tone control is fitted, providing means for completely matching the speaker to the set, and also to minimize high-frequency disturbances and background noises. Provision is made for grid bias for the Class "B" valve, where required. The complete unit is of high-class manufacture throughout, and will enable a set to be converted to Class "B" output in a few seconds. The price of the unit, without valve, is 29s. 6d., or with an Osram B21 valve, 43s. 6d. Copies of the leaflet can be obtained from The Blue Spot Company, Ltd., Blue Spot House, 94-96, Rosoman Street, Rosebery Avenue, London, E.C.1.

HEAYBERD MAINS EQUIPMENT

THE well-known firm of Heayberd—manufacturers of practically all types of mains apparatus—have sent us a copy of their new 1934 Combined Handbook and Catalogue, "Mains Power for Your Radio." A special television supplement is included, and this new and enlarged edition should prove even more popular than the previous ones. The home constructor will find this a veritable mine of information, as, instead of being simply a list of their products and prices, this book gives technical hints, and complete circuit diagrams for making up various types of eliminator. With the diagrams is a list of all the components for these eliminators, with prices, enabling any constructor to make up a mains unit to suit both pocket and technical requirements. Particulars are also given of a new type portable battery charger which delivers an output of 1 or 2 amps as desired by means of a change-over switch. No constructor should be without one of these useful handbooks, a copy of which can be obtained for 3d., post free, from F. C. Heayberd & Co., 10, Finsbury Street, London, E.C.2.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications to receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

STROBOSCOPE WANTED

"Re your article on 'Stroboscopes' in "Practical Wireless" last year. Could you please tell me if there is a firm which makes accurate gramophone stroboscopes. I would require one suitable for 50 cycle A.C. mains, with a speed of 78 r.p.m."—A. L. H. (Bristol).

A stroboscope suitable for your purpose may be obtained free of charge from Messrs. Claude Lyons, Ltd., 40, Buckingham Gate, Westminster, S.W.1. Kindly mention this paper when writing for the Stroboscope.

SUP-HET CONVERTER PROBLEM

"I am going to build a superheterodyne converter, but am rather doubtful regarding the correct valves to use. I have read in one book that it would be best to use an ordinary S.G. valve for the detector with a small L.F. for the oscillator, and a friend has a converter similar to the one I wish to make up, but he does not use the S.G. type of valve in the detector position. He tells me that the S.G. valve will not be worth while and that the ordinary medium-impedance type is to be preferred. Could you please help me out and give an explanation of the difference which does exist."—T. Y. (Beckenham).

The valves you refer to may each be used, and the actual choice must be governed by the remainder of the circuit design. With an ordinary three-electrode valve you may find interference is difficult to eliminate, whilst the ordinary S.G. valve may result in double-tuning points. As you have not yet built the circuit we would suggest a modern high-frequency pentode of the variable-mu variety, as this will enable smooth volume control to be obtained and will prevent cross-modulation. The small L.F. type of valve will serve quite well as an oscillator and is probably the best type of valve for this position.

SUPER-HET GANGING

"I had a lot of parts very similar to those you used in the Premier Super. I had home-made L.F. transformers, and with a few new parts which I bought I assembled a circuit on the lines of the Premier. I do not want to claim that I have built your set, but it is to all intents and purposes similar. I find, however, that when I set all trimmers on Fécamp I get this station much too loud for home comfort, yet when I go up the scale the stations get weaker as I go up. London National is not too bad, but the Regional is only just audible. The Midland can be heard if you get right close to the speaker and above this there is nothing. When, however, I set the wavelengths to North Regional and adjust the trimmers, I can get this too loud for comfort, but when I go down to Fécamp I cannot get it. Can you tell me how to get this trimming so that it will remain for all stations."—A. F. G. (Hythe).

The cause of your trouble is in the relation between the tuning coils and the tuning condenser. The coils are wound in such a manner that they require a tuning condenser having a certain "law." If this is attended to you will find that once adjusted the settings will remain at all parts of the dial. If, however, you employ a condenser which does not maintain the correct ratio throughout the scale you will never succeed in ganging the receiver and will always have to adjust the trimmers at every setting. We presume, of course, that you have employed a tracking oscillator section on the ganged condenser, or alternatively have fitted a padding condenser to serve the same purpose.

QUESTIONS NOT TO ASK

1. "Will you please send me a complete circuit diagram incorporating the enclosed list of components?"

Our Free Advice Bureau is a generously interpreted service to readers, but we cannot undertake to design special receivers around individual components. Such queries cannot satisfactorily be answered in a letter.

2. "My wireless set will not work, can you tell me why?"

No one can answer a query of this sort. A doctor requires to know the symptoms before he can diagnose the complaint and suggest a cure. We desire to know, before we can be of assistance, firstly what remedies the querist himself has applied without results; secondly the style of circuit employed; and thirdly, the symptoms.

3. "I enclose a list of call signs. Can you please identify these for me?"

If more than three call signs are included the answer is "No!" We are compelled to place some limit upon this free service owing to the fact that we continually receive lists containing fifty or more call signs.

L.F. OSCILLATION

"I am in some little difficulty about my set. When I tune to weak stations they come through clear and distinct. When, however, I try to get the local or another station which has fair power it seems to choke the speaker and comes through indistinct. I cannot explain the effect any better than this and should be glad if you could assist me. The H.T., G.B. and valves have been tested and found in order. The speaker has also been tested on another set and will handle much more volume than I am getting."—H. B. (Finchley).

The symptoms point to L.F. instability, and you will probably find that a loud signal, or a large input to the output valve (which we suspect is a pentode) results in oscillation. Fit a resistance (about 50,000 ohms) in series with the grid of the output valve, and/or reverse the connections to the secondary of the L.F. transformer You will, no doubt, find this will cure the trouble. Can you detect a high-pitched whistle whilst the signals are being received? This will give you a certain indication of L.F. oscillation.

BIAS RESISTANCE RATING

"I have built a power amplifier, but am rather worried about the bias resistance. I used the set for two or three weeks with every satisfaction. I then noticed that quality was falling off, and on attempting to test the set I noticed that the output valve was glowing blue. I have read that this indicates over-running and I cannot see how this can be as I have carefully worked out all values. I enclose the circuit, with all ratings, etc., marked and should be glad if you could see where I have tripped up. I notice, by the way, that the covering of the bias resistance is turning brown and this gets very warm. Does it indicate over-running?"—L. K. (Peckham).

You have apparently overlooked the fact that the bias resistance, when connected in the common negative lead, carries the total current of the entire receiver. Thus, you have wrongly estimated its value, as you have (from your figures) worked on the anode current of the output valve only. In view of the greater current which is passed you should have used at least a 5-watt resistance, not the 1-watt which is at present fitted. The over-heating which this has resulted in, has altered the value of the resistance and it is not now giving sufficient bias to the valve. Thus you are damaging the valve by running it under these conditions. You require a 300-ohm resistance, and this should be of the 5-watt type.

TRANSFORMER DIFFERENCES

"I am rather puzzled by a fact which came to my notice recently. Whilst in a radio shop I saw two output transformers of identical make and both of which were of the same ratio. One, however, was provided with a centre-tapped primary, and, although it did not appear to be any larger in size, it was stated that it would carry double the current of the other one. I cannot quite see how this can be so without using heavier wire. Could you explain this point to me?"—G. B. Watford).

The difference lies in the fact that one transformer primary is intended to be connected direct in the anode circuit of an output valve, and the other is intended for use with push-pull circuits. In the former case the total current of the output valve passes through the winding and obviously when a certain value is reached saturation will occur. This, as you know, impairs efficiency and therefore the rating is that which will be the maximum advisable current before saturation. In the case of the push-pull valves, however, the two valves work in such a manner that the currents flowing through the two halves of the primary are in opposition, and therefore they balance out. This means that the same primary winding will obviously be suitable for use with valves which pass a much greater anode current.

FREE ADVICE BUREAU
COUPON

This coupon is available until March 10th, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 3/3/34.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word prepaid — minimum charge 3/- per paragraph—and must reach this office not later than Tuesday for the following week's issue. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8 Southampton Street, Strand, London.

PREMIER SUPPLY STORES

offer the following Set Manufacturers' Surplus New Goods at a fraction of the original cost; all goods guaranteed perfect: carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

PREMIER SUPPLY STORES announce the purchase of the entire stock of a world-famous Continental valve manufacturer. All the following types of standard mains valves at 4/6 each. H. HL. L. Power. Directly heated 6-watt Pentode. Directly-heated 9-watt Pentode. High magnification Screen-grid, low magnification Screen-grid. Variable-Mu Screen-grid. 250 volt 60 milliamp. full-wave rectifiers.

THE following types 5/6 each. Indirectly-heated Pentode. 350 volt 120 milliamp. full-wave Rectifier. 500 v. 120 ditto, 6/6. Dario Battery Valves 4v. filament. Set of 3, consisting of Screen-Grid, Detector and Power or Super-Power, 6/6 the lot. Power or Super-Power, 2/6.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, Dubilier condensers, resistances and diagram, 120v. 20 m.a., 20/-; trickle charger 8/- extra; 150v. 30 milliamps., with 4v. 2-4 amps. C.T. L.T., 25/-, trickle charger 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T. L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps. C.T. L.T., 37/6; 150 volts 50 milliamps, 27/6.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Premier chokes, 25 milliamps, 20 Henries, 2/9; 40 milliamps. 25 hys., 4/-; 65 milliamps. 30 hys., 5/6; 150 milliamps. 30 hys., 10/6; 60 milliamps. 80 hys., 2,500 ohms, 5/6.

HARLEY Pick-up, complete with arm and volume control, 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 3/6.

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 ma., 0-1, 0-5 amps.; all at 6/-.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-120v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amp., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v. 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v. 60 m.a., rectified with 4v. 3-5a. and 4v. 1a. C.T. L.T., screen primary, 15/-; with Westinghouse rectifier, 25/-.

4V. 3a. C.T., 6v. 2a. C.T., 9v. 1a., 12v. 1a., 7/6 each; 4v. 3-5a., 22v. 1a., 8/6 each; 10v. 3a., 14v. 4a., 10/- each.

PREMIER H.T.9 Transformer 300v. 60 m.a., with 4v. 3-5a. and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 20/-.

PREMIER Mains Transformers, output 135v. 80 m.a. for voltage doubling, 8/6; 4v, 3-4a., C.T., L.T., 2/- extra; Westinghouse rectifier for above, giving 200v. 30 m.a., 8/6.

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PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400v. 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-.

PREMIER Auto-Transformers, 100-110/200-250v., or vice versa, 100-watt, 10/-.

MULTI Ratio Output Transformers, 4/6, Twin Screened Wire 3d. per yard.

CENTRALAB Potentiometers, 50,000, 250,000 half meg., any value, 2/-; 200 and 400 ohms. 1/-.

RELIABLE Canned Coils with Circuit, accurately matched, dual range, 3/- per coil. Please state whether Aerial or H.F. required. Ditto Iron core, 3/6.

PREMIER L.T. Supply Units, consisting of Premier Transformer and Westinghouse rectifier, input 200-250v. A.C., output, 2v. ½amp., 11/-; 8v. ½amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp., 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in. cone, 18/6.

GRAMPIAN M.C. Loud Speakers, 2,500 ohm field, 9in. cone, handles 5 watts; 21/-.

GRAMPIAN P.M. Loud-speakers, 9in. cone, handles 4 watts; 18/6.

(Continued at top of column three)

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N.T.S. CLASS 'B' SPEAKER-AMPLIFIER

SEND FOR IT ON 7 DAYS' TRIAL

Gives Seven Times the Volume. Ready assembled with Class B Valve. Send only 5/- for 7 days' trial. If approved, balance in 11 monthly payments of 5/6. Cash or C.O.D Carriage Paid, £2/19/6. Simply plug-in to your existing battery set.

5/- DOWN

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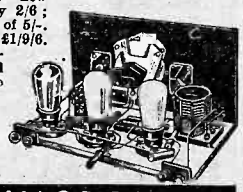
Complete Kit of Parts for new Telsen Straight 3. Send only 2/6; balance in 6 monthly payments of 5/-. Cash or C.O.D. Carriage paid, £1/9/6. If valves required, add £1/6/0 to cash price or 6/- deposit and 9 monthly payments of 6/-.

2/6 DOWN



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SENT ON 7 DAYS' TRIAL

With Switch Controlled multi-ratio input transformer. Send only 5/- for 7 days' trial. If approved, balance in 8 monthly payments of 5/3. Cash or C.O.D. Carriage Paid. £2/2/0. W.B.P.M.6. Send only 2/6. Balance in 8 monthly payments of 4/3. Cash or C.O.D. Carr. Paid £1/12/6.

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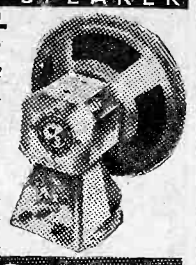

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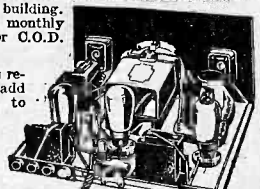
Complete kit of parts for building. Send only 4/6, balance in 9 monthly payments of 4/6. Cash or C.O.D. Carriage Paid. £1/19/6. If valves required, add £1/19/0 to Cash Price or 7/3 deposit and 11 monthly payments of 7/3.

4/6 DOWN



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SEND FOR IT ON 7 DAYS' FREE TRIAL. Model C.A. 25. Suitable for all outputs, including Class B and Q.P.P. Send only 3/6 for 7 days' trial. If approved, Balance payable in 11 monthly payments of 5/6 (or cash in 7 days) £2/19/6. Carriage Paid.

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(Continued from foot of column one)

B.T.H. Truespeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/-, complete. Type YH 100/250v. A.C. or D.C., 42/-.

WESTERN ELECTRIC Condensers, 250v. working, 2 mfd., 1/-. 2 mfd. 400v., 1/6.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 10,000 ohms. 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

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1,000 Ohm 150 m.a. Wire Wound Variable Resistance, 2/-; Burndept 2-watt resistances, all values from 0.5 to 50 ohms. 3d. each: holders, 2d. each.

T.C.C. Condensers, 250v. working; 2 mf., 1/9.

T.C.C. Electrolytic Condensers, 440 volts working, 8 mf., 3/-; 15 mf., 50v. working, and 50 mf. 12v. working, 1/-; 25 mf. 25v. working, 1/3.

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DUBILIER Condensers, 2 mf. 1,200v. working, 4/-; 8 mfd. dry electrolytic, 450v. working, 3/-.

THE Following Lines 6d. each, or 5/- per dozen.—Chassis valve holders, 5, 6 or 7 Pin, screened screen-grid leads, any value 1-watt wire end resistances, wire end condensers, 0.0001 to 0.1, R.I. .0005 varicaps, trimming condensers, T.C.C. 6mfd. 50v. electrolytics.

PLEASE mention PRACTICAL WIRELESS when ordering.

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REPAIRS—REWINDING—OVERHAULS. Loud speakers, 4/-; Blue Spots, 5/-. New cones fitted to Moving Coil speakers, 6/-. Eliminators, Mains transformers, etc., quoted for. Special components and sets made to order. Quick service. Laboratory tested. Repair Dept. C., Weedon Power Link Radio Co., 80, Lonsdale Avenue, East Ham, London, E.6. 'Phone Grangewood 1837.

OPPORTUNITY.—New "Fury Super" Kit. List, £6 3s.—£4.—151, Wellingborough Road, Northampton.

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THE "Lincoln Super" Permanent Magnet Moving Coil Loudspeaker, all purpose universal tapped transformer for Q.P.P. Class B. Pentode, Power and Super-Power output. Will carry 3 watts undistorted output. List price 42/-. Our price 19/6.

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IGRANIPAK complete tuning unit, comprising (1) Completely screened coils with built-in wavechange Switch; (2) Igranic 3-gang Condenser with cover; (3) Escutcheon and Disc Drive Assembly with pilot lamp attachment; (4) Mains Switch: (5) Three 5-pin Valve holders; (6) Grid Leak and Condenser; (7) Engraved Terminal Board. Complete with circuit; actually made for A.C. mains, but can easily be adapted for battery sets. List price 57/6, our price 27/11.

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IGRANIC Indigraph Vernier Dials. List price 6/-. Our price 2/11.

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IGRANIC tapped C.C. output unit. Acts as an auto-transformer giving either a step-up or step-down effect to suit any type of loudspeaker employed. List price 8/6. Our price 4/11.

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LINCOLN STEWART A.C. Eliminators, 200-250 volt input, 25 m.a. output, 3 positive and one negative tappings. List price, £2.19.6. Bargain, 32/6.

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IGRANIC Micro Variable Condensers. Capacity .00004 mfd., ideal for short-wave work, baseboard mounting. Price 1/6.

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EPOCH.—Great bargain in 11in. super P.M. speakers, the finest moving coil in its class; these units are brand new, perfect, and guaranteed 12 months; they are slightly different from standard in design, but equally as good in performance; optional with 10-ratio or Class B transformers; worth 45/-, to clear at £1 each, carriage paid.

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RADIOMART—Utility W312B 2-gang bakelite condensers with disc drive and concentric Uniknob trimming, 3/6.

RADIOMART—Utility 40mmfd. Ball-bearing Short-wave microvariables, 1/9, 2/6, snap switches, 9d.

RADIOMART—Utility Ball-bearing air-spaced Differentials, .0003 and .0005. List 11/6. Finest made, 2/-

RADIOMART—Utility bakelite tuning and reaction condensers, .0005, 10d.; .0003, 8d.

RADIOMART—Igranicore 1934 super, 12/6. Iron-core dual range short-wave inductance coils, 4/9. Ditto H.F. chokes, 1/-

RADIOMART—Set 4 Latest Igranic, 11/6. Short-wave inductance coils, 15-130 metres, 4/-

RADIOMART—Igranic boxed L.F. transformers, parafeed type, 3/-. Ditto, 3-1 and 5-1, 10/6. Nickel core, 3/11.

RADIOMART—Screened iron-core dual-range coils, with instructions, 2/11. Climax binocular HFC. 1/6.

RADIOMART—Genuine Varley "Niclet" nickel-core manufacturers' transformers, 2/-. Amplion speaker units, 2/-

RADIOMART—Philco heavy duty Class "B" 1-1 driver transformers, boxed, 2/9. Valve-holder baseboard, 9d.

RADIOMART—British Radiophone, 7/6. Wire-wound logarithmic potentiometer, with mains switch, 10,000, ditto 5,000; heavy duty no switch, either type 2/-.

RADIOMART—Lotus 3½-1 push-pull inter-valve manufacturing tag connections, 2/-. Special offer H.M.V., Philips, Lotus 1-watt resistances.

RADIOMART—New Purchase Met-Vick, 35/-. Super transformers, 250/250, 4v2a, 4v. up to 5 amps., fitted terminals, 9/6. 100v. or 230v., 25 cycles, 12/6.

RADIOMART—Western Electric sensitive microphone insets, 1/-. Paxolin type formers, 2d.; 2in. ribbed ebonite, 4d.

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RADIOMART—Guaranteed prompt despatch, perfect goods; no misrepresentation.—The Square Dealers, 19, John Bright Street, Birmingham.

AC. Eliminators, Alco, 105-250v. outputs 60v. .5G. 130v. 20 M.A., 24/-; with charger 35/-. Complete and guaranteed.—P. & D. Radio, 1, Goodinge Road, N.7.

"MELFO-RAD" Guaranteed Specified Kit Service. "The Leader 3," described within, 43/- complete. Orbit Three, £3 13s. 6d., ST.500, 78/-; Fury Super, £6 8s. 0d. Television Disc Receiver Kits, 50/- complete. Lists Free.—5, Queens Pl., Hove. (Trade supplied.)

WANTED Mains and Battery Valves, also clean surplus components.—Newport Surplus Stores, 24a, Newport Court, Charing Cross Road, W.C.2.

FIFTY 1934 Model Three-Valve Receivers, complete M.C. Speakers, Valves, Batteries. Beautiful Oak Cabinets. List £5 17s. 6d. Sample Set £3 17s. 6d. C.W.O., carriage paid. Makers' guarantee.—A. L. Burt, 11a, Kingsbury Road, Birmingham.

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RADIOGRAM Cabinets, manufacturers' clearance.—Brunswick (Model 70), 45/-; Zetavox (Model A.G.), 50/-; Table Radio Cabinets, Philco Model 237, 22 x 11 x 10½, 10/6; huge stock of all kinds of cabinets.—H. L. Smith and Co., Ltd., 289, Edgware Rd., London, W.2. Tel.: Pad. 5891.

RADIO Agencies, offer Set Manufacturers Brand New SURPLUS Rola Moving Coil Speakers in following voltages; state if Power or Pentode. All incorporate Humbuckers. 2,000, 2,500, or 6,500 ohms F6 (list, 35/-) at 18/-; F.7 (list, 47/6) at 25/-; Permanent Magnets, F.6 P.M. (list, 49/6) at 28/-; F.7 P.M. (list, £3) at 33/-; if class "B" Transformer, 2/- extra. Blue Spot lines: 66K Unit (list, 15/-) at 8/-; 66K unit and chassis complete at 13/6. Blue Spot Pick-ups, Type 88 (list, 3 guineas), with Volume Control, at 26/-; B.T.H. Senior, with control, de Luxe (list, 37/6), at 28/-. All goods Carr. Paid. Cash with order or C.O.D.—Radio Agencies, 4/21, Upper Marylebone Street, London, W.1.

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SPEAKERS.—Blue Spot permanent magnet, with Universal transformer for power, pentode, super power or class B, 23/- (list 39/6); D.C. mains energised, all voltages, 16/6; Celestion Soundex P.P.M. permanent magnet, 17/6 (list 27/6); Blue Spot 100U inductor, complete with chassis, 13/6 (list 39/6); Celestion permanent magnet type P.P.M.W. universal transformer, 25/- (list 49/6).

BLUE Spot, 66K, complete in cabinet, 16/- (list 42/6); G.E.C. Stork, in magnificent cabinet, 19/6 (list £3/15); all speakers new in original cartons.

PICK-UPS.—B.T.H. Senior 1934 model, with volume control, 28/6 (list 37/6); Blue Spot, model "88," with volume control, 26/- (list 63/-); Marconi No. 19 (1934), 26/- (list 32/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor "A" 3-valve screened grid kits, with cabinet and moving coil speaker, less valves, £3/7/6; with valves, £4/10 (list £8/7/6); Ready Radio S.T.400 kits, all specified components, by Scott Taggart, £2/19/6 (list £4/17/6).

FRAME Aerials.—Lewcos dual wave 235-550 metres and 1,000-2,000 metres, 10/- each (list 37/6).

IGRANIPAK complete tuning unit, comprising (1) Completely screened coils with built-in wavechange switch; (2) Igranic 3-gang Condenser with cover; (3) Escutcheon and Disc Drive Assembly with pilot lamp attachment; (4) Mains Switch; (5) Three 5-pin Valve holders; (6) Grid Leak and Condenser; (7) Engraved Terminal Board. Complete with circuit. List price 57/6. Our price, 26/-.

MISCELLANEOUS.—Ferrocart coils, G.1, G.2, G.3, with switch, 31/9 (list 39/6); Benjamin Class "B" universal output chokes, 6/6 (list 11/-); Ready Radio Instamat Universal transformers, for matching any value to speaker, 11/6 (list 37/6); Rotorohm and Radiophone volume controls, all values, 3/- each; with switch, 3/3 (list 10/6); S.T.500 coils, 5/6 per pair; Hellesen's 8 mfd. electrolytic condensers, 2/9 each; Westinghouse metal rectifiers, H.T. 6, 7, 8, 9/3 each; Amplion loud-speaker units, 2/3; Ferranti choke, 20 henry 60 m.a., 6/9 each; Kolster Brandes gramophone motors, dual, for A.C. or clockwork, complete with turntable and all accessories, 110-250 volts, 25/- each (list 63/-); Ready Radio L.F. transformers, 5-1, 3-1, 3/3 (list 8/6); B.T.H. transformers, 3/6; Lewcos superhet 8-way bases, complete with valve holders, grid leak, fixed condenser, type "48," 2/- each.

SPECIAL Bargain Offer of Lewcos Spaghetti Resistances. All sizes in originalse aled boxes, 4/- per dozen. Assorted. Special Price to the trade, 36/- per gross.

RECEIVERS.—G.E.C. Osram Music Magnet 4. A.C. Model, 110/250 volts, complete with "B.C. 1532" Power Unit and G.E.C. Permanent Magnet Speaker in magnificent Floor Cabinet and 4 Osram A.C. Valves. Brand New 1934 series in original sealed cartons, £8 15s. each (List, £21).

BURGOYNE "Popular" 3-Valve Battery Set. Complete with 3 Mullard Valves, Exide Batteries, etc., and Speaker in attractive transportable Cabinet. £3. Brand New, in original cartons. Every set guaranteed.

MAINS Transformers and Chokes.—Please send for complete list; specials can be supplied within 3 days of order.

ALL Transformer and Chokes Guaranteed for 12 months.

ALL Goods Guaranteed and Sent Carriage Paid.

BRANCHES at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle St., W.C.2; please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

GRAMOPHONES. Radiograms, 64 page. How to make 'm, 3d. Motors, Arms, Pick-Ups, Speakers, Horns, Springs, Repairs, Accordions. Regentprac, 120, Old Street, London, E.C.1.

MICROPHONES.—Buy from the actual makers at Rock bottom Prices. Button capsules complete for detectaphone and other experiments, only 1/-. Transformer, 3/6. No. 11 Home Mike, bakelite body, 2in. diam., unbreakable, 5/6. Table PW.11, a handsome announcer's rectangular model, 3in. by 3in., on brass stand, a self-contained Mike and Transformer, with switch, 10/6. Tall pedestal Broadcasting Model 12B, with Microphone hung in ring, 12in. high, 18/6. Complete Deaf Aid sets to assist those hard of hearing, 18/6. Special P.A. makes for Dance Bands and Public address. All parts in stock for Home Constructors, granules, blocks, diaphragms, mouthpieces, etc. Headphones, 2/6 pair. Write for Lists "N" 1 and 2.—Electradix Radios, 218, Upper Thames Street, London, E.C.4. Tele.: Central 4611.

SURPLUS Stock of Wireless Sets and Components for disposal. Send for list.—W. Burns and Co., 287, City Road, E.C.1.

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Practical Wireless

3D.

AND PRACTICAL TELEVISION

EDITED BY F.J.CAMM

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GEORGE NEWNES LTD.
Vol. 3.——No. 77.
March 10th, 1934.
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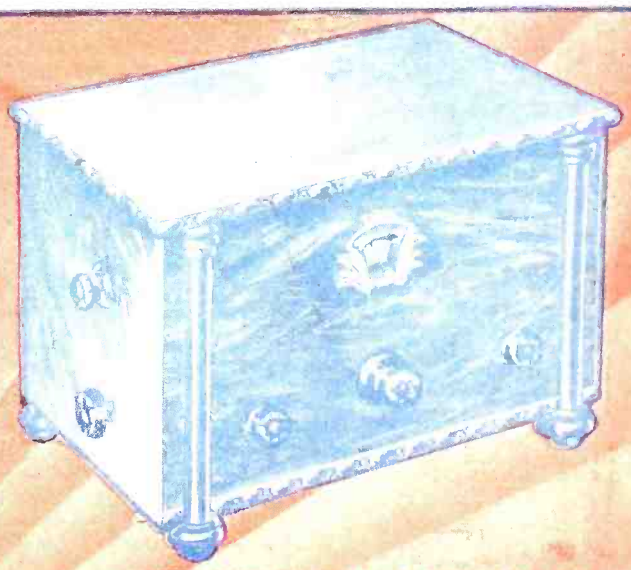
The Price Question Solved!

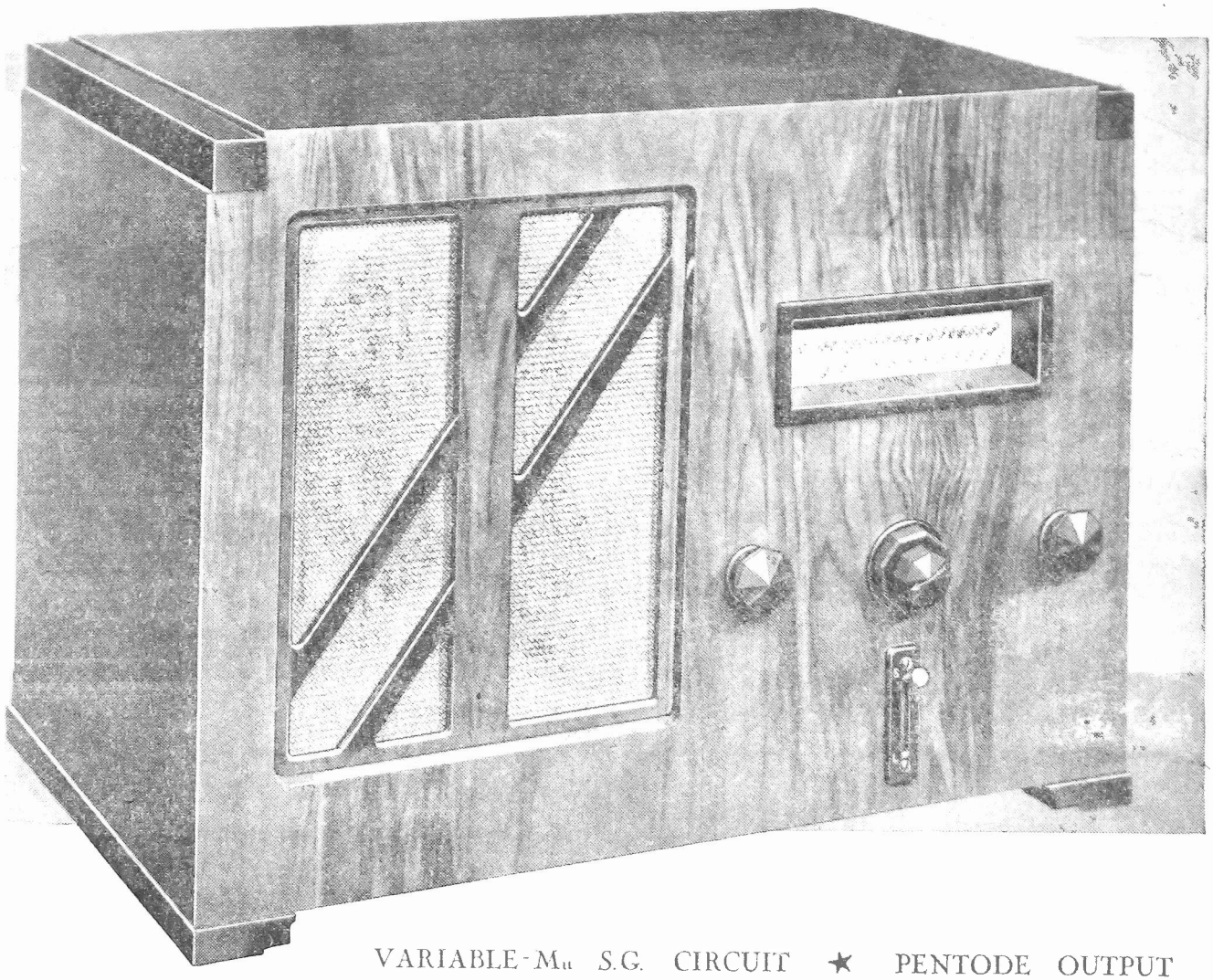
HOME-MADE OR READY-MADE?

The "PRACTICAL WIRELESS" LEADER 3



CHEAP HIRE PURCHASE RECEIVER

NEW *COSSOR All-Electric RECEIVER*



VARIABLE-Mu S.G. CIRCUIT ★ PENTODE OUTPUT

PENTODE DETECTOR ★ ENERGISED MOVING COIL SPEAKER

SPECIFICATION

Cossor All-Electric Receiver Model 435 as illustrated complete with Four Cossor A.C. Mains Valves, viz.: MVSG Variable-mu Screened Grid, MSPEN Screened Pentode Detector, MPPEN Pentode Output and 442 BU Full Wave Rectifier. Mains Energised Moving Coil Speaker, single-knob tuning, illuminated full-vision scale calibrated in wavelengths (200/540 and 900/2,000 metres), wave-change switch, combined volume control and on-off switch. Handsome walnut-finished cabinet 13 in. high, 17½ in. wide, 10 in. deep, with Gramophone Pick-up plug and socket, terminals for extension Loud Speaker and plug and sockets for connecting gramophone motor. For A.C. Mains only, 200/250 volts (adjustable), 40/100 cycles.

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Equipped with FOUR of the latest types of Cossor Valves—Variable Mu Screened Grid H.F. Amplifier, Screened Pentode Detector, Pentode Output and Full-wave rectifier—this new All-Electric Receiver incorporates the most up-to-date Radio-practice. Its powerful valve combination results in a really exceptional performance. An illuminated full-vision dial and single-knob tuning make programme selection exceedingly simple. Its energised moving coil speaker provides reproduction of a superb quality. Send at once for 16-page catalogue giving full details of this and other interesting Cossor Receivers—please use the coupon

COSSOR All-Electric RECEIVER

MODEL

435

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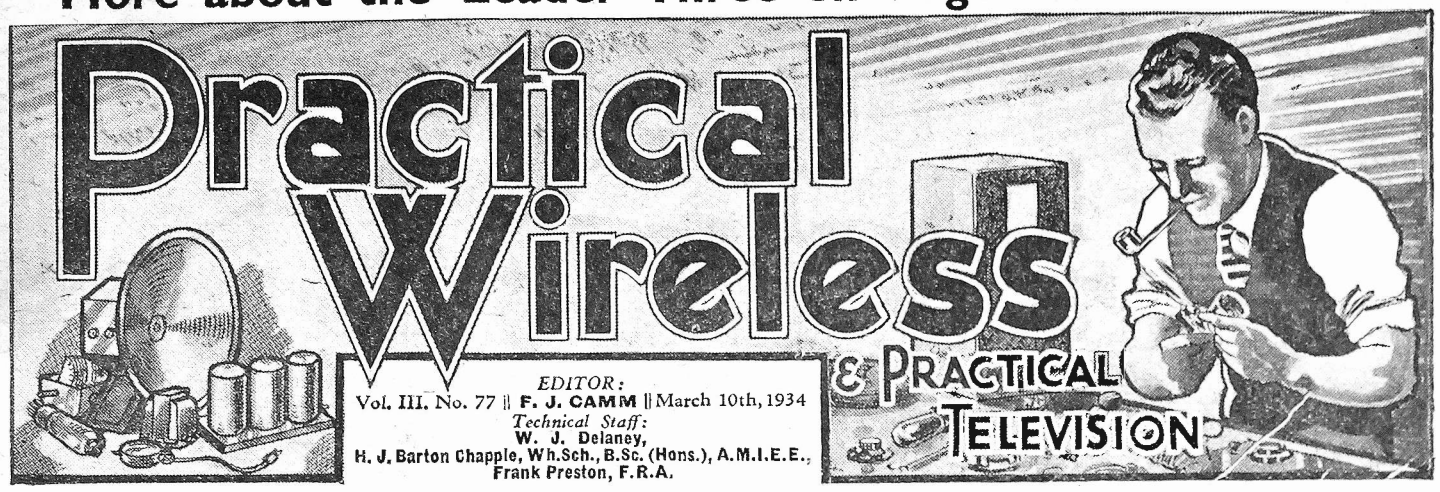
More about the Leader Three on Pages 1134 and 1135



ROUND *the* WORLD *of* WIRELESS

The Leader Acclaimed by Industry and Public

EVER since we made our preliminary announcement regarding our new set, the Leader Three, which, as all readers know, has been designed in conformity with our new policy of low price combined with efficiency, letters have poured into these offices from readers and manufacturers alike. All of them congratulate us upon our bold move and applaud our efforts in the interests of the home constructor. This receiver is, as with all our receivers, guaranteed to perform as claimed by its designer. *That is an important point to remember before you decide to build any receiver.*

New Cossor Pentagrid

WE understand that Messrs. A. C. Cossor, Ltd., shortly intend to place on the market an indirectly heated variable-mu pentagrid valve. The purpose of this valve is, of course, for frequency changing in the superheterodyne receiver, and it has the advantage over other somewhat similar valves that a screen grid is interposed on each side of the signal grid, so that the aerial circuit is completely isolated from the rest of the receiver which, besides preventing re-radiation from the aerial, prevents the annoying trouble known as "dragging," which is the pulling of the aerial circuit out of tune by the oscillator circuit and vice versa. The pentagid has, of course, five grids in addition to the anode, cathode and heater, and requires a 7-pin base (the anode being brought out on the top in a similar manner to a screen-grid valve). We hope to give technical details of this valve in a later issue.

The Boycott of Radio Advertisements

AS during the long winter months in many parts of Scandinavia the wireless entertainments are the sole source of amusement available to a large population, the listening public is strongly averse to any kind of radio publicity. As a strike was not feasible, a proposal has been made to boycott all firms who use the microphone to advertise their wares.

New Interval Signal

ALTHOUGH of relatively low power, broadcasts from the Geneva station (Switzerland) can now be well heard on 748 metres (401 kilocycles). The station can be easily recognised by the fact that it opens and closes its transmissions with the Morse letters R.S.R. (.—. . . .—.), followed by a short excerpt from an old Swiss melody: *Charles Emanuel à Etrembières*, played on a musical box. *R.S.R.* stands for the initials of the *Radio-Suisse Romande*, the Swiss organisation controlling the Lausanne and Geneva studios, of which the entertainments are also radiated through Sottens on 443.1 metres (677 kilocycles).

Soviet Radio Developments

THE sum of sixty-five million roubles has been earmarked for a further development during 1934 of the Soviet broadcasting system. Part of this amount will be expended in erecting a new 500-kilowatt transmitter at Khabarovsk (Eastern Siberia). With a view to increasing the number of listeners, the Government proposes to distribute sixty thousand crystal sets and one hundred and twenty thousand valve receivers in various parts of the country.

Where Outdoor Aerials are Forbidden

OWING to the increasing number of outdoor aerials erected on the roofs of flats in Vienna, the city authorities have decreed that no further licences will be granted to dwellers in apartment houses unless indoor or frame aerials are used. A request has also been made to listeners to take down all outdoor wires as soon as possible, as it is considered that their presence detracts from the appearance of the streets.

A Land Without Radio

OF all the European States Albania to-day is the only one which does not possess a broadcasting station. Wireless enthusiasts, of which there are a few, rely for their entertainment on Jugo-Slavia and Italy. Bari, for this reason, broadcasts daily a news bulletin in the Albanian language.

The Advent of the Radio Taxi

FOLLOWING the example set by New York a company has been formed in Paris to equip taxis with radio receivers for the benefit of passengers. The set would be placed near the driver in order that he may be given the opportunity of listening to the studio concerts and news bulletins whilst waiting on the rank or plying for hire.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

Explanatory Announcements

IT is now the custom with the German stations, when announcing programmes which are relayed to several transmitters, to state the name of the original studio from which they are actually broadcast. The explanation is a useful one, inasmuch as listeners are frequently puzzled by the list of stations taking the entertainment. It is a detail which might be copied by other Continental countries.

Batteries for Ekco Receivers

WE are informed that Britannia Batteries Ltd. have decided it is undesirable to imitate the small capacity of the battery in the Ekco set, and consequently they are bringing out in the maroon carton series a battery suitable for the Ekco set, but definitely of higher power than at present in the set. The price of this replacement battery is 18s. 6d. and the number is 330.

Radio Publicity in America

DURING 1933, the National Broadcasting Company received roughly twenty-one million dollars for publicity broadcasts; a large sum was also secured by the Columbia System. As against this, some units of the American Press interpret the N.R.A. emblem with the slogan, *We do our Part*, as *Nauseating Radio Advertising, We Kill our Art.* The Press and radio are not good mixers in the United States.

Berlin Short-Wave Transmissions

WITH the opening of the new beam stations for the broadcast of German programmes to Asia, Africa, and North and South America, alterations have been made in the time of the transmissions. The night programme through DJD (25.51 m.) and DJC (49.83 m.) is now carried on from G.M.T. 01.00–04.00. A further broadcast through DJB (19.73 m.) destined to North America is now also made between G.M.T. 12.55–16.00.

New Norwegian Transmitters

IT is anticipated that the new 20-kilowatt station now being built at Trondheim (Norway) will be ready for operating in April; its wavelength will be 476.9 metres, a channel to be shared with Lisbon. Bergen's new transmitter, on 352.9 metres, will not be open before the summer. The 10-kilowatt station which is being put up in the neighbourhood of Vardo, and for which the wavelength of 845 metres has been provided, is being rushed forward and may be testing at an earlier date.

War Against Interference

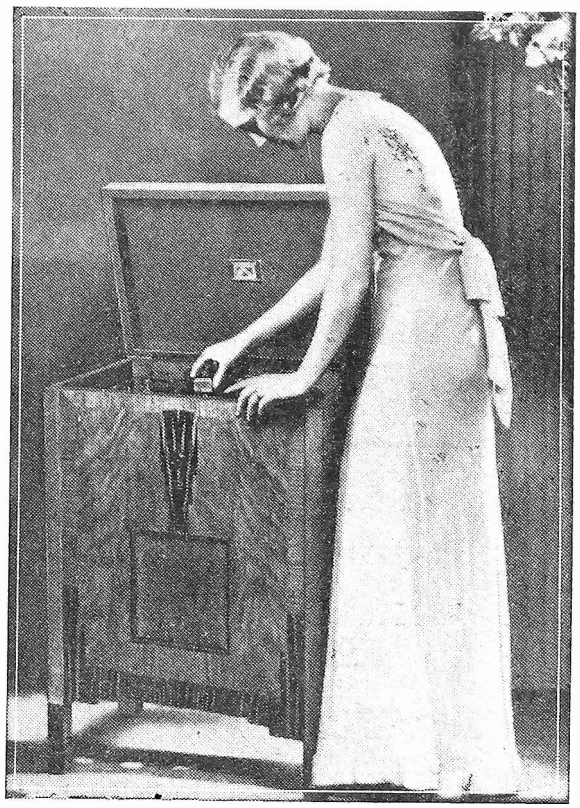
OF all European municipalities which have undertaken concerted action against electrical interference with the reception of radio programmes the town of Baden-Baden (Germany) would appear to have obtained the most successful results. Of 5,323 complaints made by listeners and investigated by the corporation engineers, 5,000, or more than 95 per cent. of the total number, were satisfactorily dealt with. According to local reports, Baden-Baden has become the paradise of radio fans.

INTERESTING and TOPICAL PARAGRAPHS.

Reykjavik on Short Waves

AT the best of times, except in North Britain, broadcasts from Iceland are difficult to receive in the United Kingdom. In the near future, however, many listeners may be given an opportunity of hearing the Reykjavik programmes more regularly as the Danish Ministry of Posts and Telegraphs is planning to erect a short-wave station which, in addition to a relay of the local radio entertainments, will be used at other hours of the day for a public telephony service.

ONE OF THE LATEST RADIOGRAMS.



Trying out the new "His Master's Voice" Superhet Five-Forty Radiogram.

Belgrade Broadcasts Suspended

UNTIL March 10th, Belgrade (Yugoslavia) will be off the air as the station is being dismantled prior to its reconstruction on a new site in the outskirts of the capital. Every effort is also to be made to hasten the installation of the 40-kilowatt station, which is to act as the key transmitter of the Yugoslavian network. The present small plant will then be transferred to Subotica to relay the main programmes.

"Queer People"

THE amazing adventures of John Mytton will be told in play form by John Wyndham in the second of the West Regional broadcast series, "Queer People," on March 15th. John Mytton was born at the end of the eighteenth century. As a child he came into a great fortune; later, he became M.P. for Shrewsbury, while his sporting exploits were world-famous. He died, however, in a debtors' prison.

Sunday Evening Oratorio Broadcasts

CONCRETE evidence of the Belfast music-lovers' enthusiasm for oratorio is afforded by the station's postbag, which invariably reacts most favourably to an oratorio broadcast. In consequence, these broadcasts are being continued on Sunday nights. The next one, which will be given on March 10th, consists of excerpts from different well-known works by Handel, Elgar, and Gounod. Astra Desmond (contralto) will be the soloist.

The Woollen Industry

MR. W. THOW MUNRO will speak on "The Woollen Industry" in the Scotland To-day and To-morrow series on March 13th. Mr. Munro, who has been President of the Scottish Woollen Trade Mark Association for many years, headed, in 1922, the largest Trade Delegation which has ever gone abroad to the United States and Canada. He studied conditions in the textile trade in Europe for the Government in 1931, visiting France, Belgium, Italy, Germany, Austria, etc.

Pianoforte Recital by Victor Hely Hutchinson

VICTOR HELY HUTCHINSON, who has been Music Director of Midland Regional since last October, gives his first pianoforte recital from the Birmingham studio, on Monday, March 12th. He has chosen the sixth of Bach's French suites, and the "Moonlight" sonata of Beethoven. Mr. Hely Hutchinson has been busy exploring the musical resources of the region, and has found several orchestras and choral societies for future programmes. Several of his own compositions are being broadcast on Midland, including "The Charcoal-burner's Son," for which L. du Garde Peach wrote the book.

SOLVE THIS!

PROBLEM NO. 77.

Smith had a mains three-valver which gave good results and which he thought justified the employment of a moving-coil energized speaker. He accordingly purchased one, and as he had read that the field could be used in place of the smoothing choke, he removed the latter component and connected his field in its place. Results were, however, very poor, volume being much reduced and accompanied by distortion. What was wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 77, and posted to reach here not later than the first post Monday, March 12th, 1934.

Solution to Problem No. 76

Jarvis overlooked the fact that the increased resistance connected in the anode circuit of the output valve resulted in a large voltage drop, and consequently the output valve was starved of H.T. If he could have increased the H.T. he would have obtained the improved results he desired.

The following three readers successfully solved Problem No. 75, and books have accordingly been forwarded to them:—

O. L. Crossley, 40, Parry Road, Sth. Norwood, S.E.25.
T. C. Bone, Schoolhouse, Lochfoot, Dumfries.
C. C. Lambourn, Nutfield Priory, Redhill, Surrey.

POINTERS in SET DESIGN

The Items to be Considered in Designing a "Quality" Receiver are Dealt With in This Article

By H. BEAT HEAVYCHURCH

IT would be a fair definition of perfect quality to state that it is obtained when the sounds issuing from the loud-speaker form an exact replica of the programme performed before the microphone. Unfortunately, such perfection is not obtainable in practice for many reasons.

In the first place, the broadcasting authorities exercise a certain amount of control prior to transmission. For example, much of the "light and shade," by which is meant the difference in volume between the softer and louder parts of a musical work, is introduced, or, at any rate modified, artificially, at the control panel. Then, in every stage of a radio receiver there are risks of distortion—some of them inevitable and due to inherent imperfections in various components, but many avoidable if the apparatus as a whole is correctly designed and operated. Again, it is not always desirable that the programmes shall be reproduced exactly as they "come over," for individual listeners have their own tastes in "tone," some liking a brilliant performance with plenty of treble response, and others a rounder, more "mellow" tone. Besides this, it is by no means certain that all ears hear exactly alike, and added power in the upper register may be necessary in order to compensate for some deficiency in hearing.

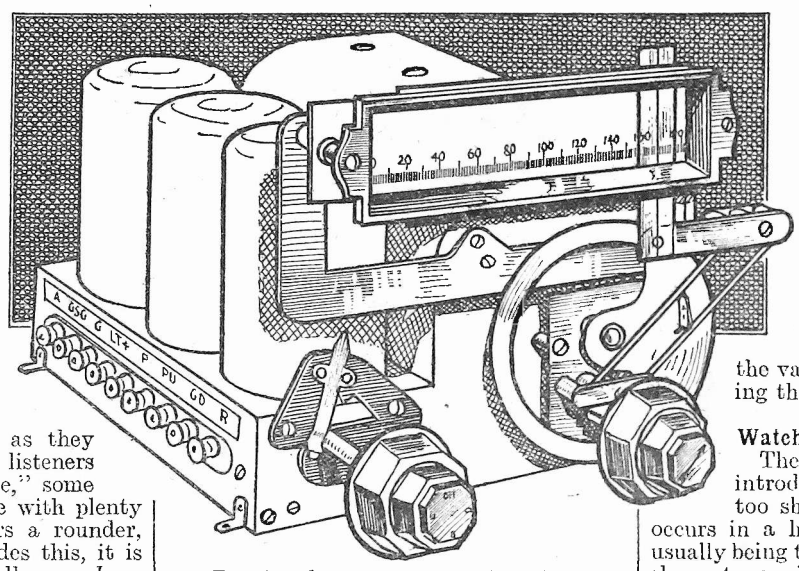


Fig. 1.—Illustration of modern H.F. tuning pack.

Careful Choice of Components

For really good reproduction it is essential that no avoidable distortion should be introduced. To this end, component values and individual pieces of apparatus must be selected very carefully, and optimum operating conditions observed. Moreover, it is often possible to balance out a tendency to faulty reproduction in one part of the circuit by a tendency in the opposite direction in another part of the circuit, while various methods of so-called tone-control are available for modifying the coloration of the final output, either to suit individual taste or to compensate for tonal distortion which has not been corrected elsewhere.

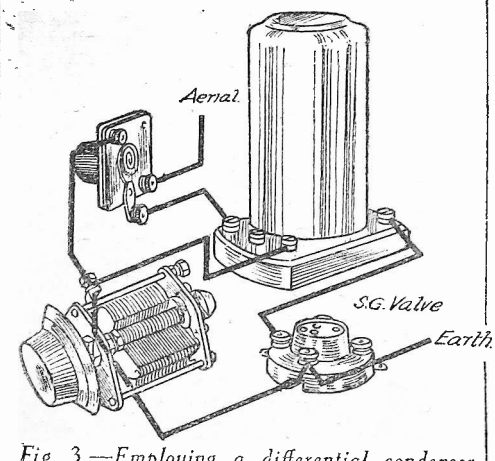


Fig. 3.—Employing a differential condenser for volume control.

On the H.F. Side

Little need be said about the design of the high-frequency stages, although serious distortion can be introduced here. To-day the design of high-frequency amplifiers is to a very great extent standardized. The efficiency of modern screen-grid and H.F. pentode valves is very great, but full advantage of them cannot be taken unless high-efficiency coils and very accurately ganged condensers are used. This necessity is reflected in the production of complete H.F. "packs" combining coils, variable condensers, and often valve-holders, switches and other components required to make up an efficient H.F. unit, such as that illustrated in Fig. 1. In most cases, therefore, the amateur constructor will be well advised to adopt one of the many standard H.F. arrangements, and to confine his designing activities to the detector and audio-frequency portions of his set.

The following points must, however, be kept in mind. First, it is essential to provide some means of avoiding overloading the high-frequency valves when strong signals are being received. Two main methods are available. The first is to fit a pre-H.F. volume control (or, more accurately, an input control) in the form of a potentiometer or a differential-condenser across the aerial circuit (Figs. 2 and 3). This must be provided when ordinary screen-grid valves are fitted. As, however, this form of control is apt to upset the ganging of the tuned circuits, the up-to-date method of employing variable-mu valves will usually find favour, the degree of amplification and the acceptance of the valve being controlled by varying the grid-bias—Figs. 4 and 5.

Watch the Tuning Circuits

Theoretically, distortion can be introduced by making the tuning too sharp. This fault very rarely occurs in a home-built set, the difficulty usually being to make the tuning sufficiently sharp to avoid interference by unwanted stations. But quite serious distortion may result from inaccurate tuning, and it is really well worth while, in a set designed for quality reproduction, to include permanently some device for giving a visible indication of tuning. This matter has been fully dealt with in recent articles in PRACTICAL WIRELESS.

(*Continued overleaf*)

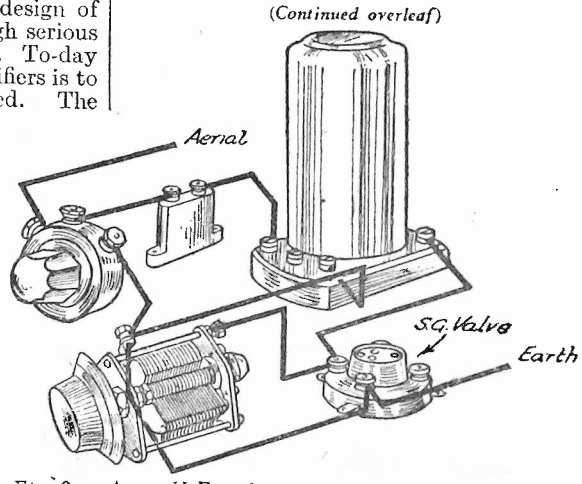


Fig. 2.—A pre-H.F. volume control using a potentiometer.

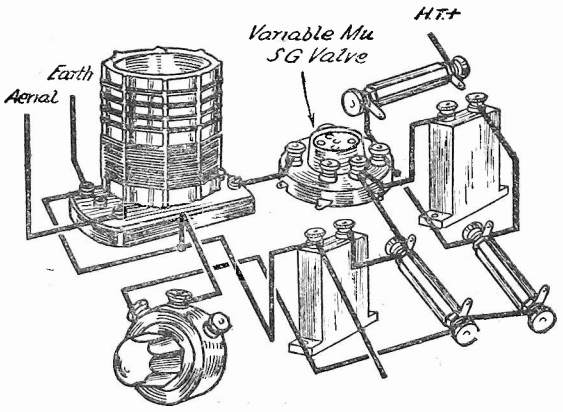


Fig. 5.—Gain control by variable-mu S.G. valve in a mains set.

(Continued from previous page)

Leaving the high-frequency amplifier, attention must now be directed to the detector stage. Reasonable use of input control or of variable-mu gain control, either manual or automatic, should avoid distortion due to overloading in this stage. But to be on the safe side, if the set employs one or more high-frequency stages, the detector, if of the three-electrode type, should be operated on the "power-grid system" when it will handle much greater inputs without distortion. Remember, too, that misused reaction will cause serious distortion. Provision for a touch of reaction may be made in a set having only one high-frequency stage, but with two high-frequency valves reaction should be avoided altogether. Any programme which two high-frequency valves cannot give at good volume without reaction is certainly not worth receiving.

L.F. Amplifier Design

It is in the low-frequency portion of his receiver that the amateur designer has the best opportunities of ensuring good quality reproduction. If the high-frequency and detector stages are built on sound conventional lines, as already described, the output from the detector valve should be reasonably free from distortion. It thus only remains to consider the L.F. portion of the receiver.

There are, broadly speaking, two main plans on which the low-frequency side of a radio receiver may be designed. In the first, the output valve immediately follows the detector stage; the alternative is to provide a further stage of audio-frequency amplification between the detector and the output valve—Figs. 6 and 7.

In the great majority of domestic receivers both battery and mains operated, the first system is employed. It is simple, inexpensive and electrically efficient, and gives reasonably good quality provided it is intelligently operated and its limitations are recognised. By this is meant that the listener should not try to obtain from the amplifier more than it is rated to deliver free from distortion.

Proper Loading

This statement calls for some explanation. If the output valve follows immediately after the detector, the signal energy available in the detector anode circuit will usually be sufficient to load only a comparatively small output valve, giving a maximum undistorted output of certainly not more than 1 watt for a battery set and about 3 watts for a mains receiver. The minimum output to give comfortably audible reception is about 50 milliwatts, and this must be considered as the minimum output during the softest passages of the weakest programme received. Actually, for satisfactory listening, with a high-grade speaker, an output of 250 to 350 milliwatts should be available with signals of average modulation.

But average modulation only represents those parts of a programme which are of moderate loudness—ordinary talks and the usual light orchestral performances. During the loudest passages of music, however, that is, the fortissimo parts, grand climaxes and so forth, the audio-frequency signal may be five or six times as great as during periods of average modulation. It is therefore necessary that the output valve be capable of handling fully-modulated signals without overloading, and this, in its turn, means ability to give a very high maximum undistorted output.

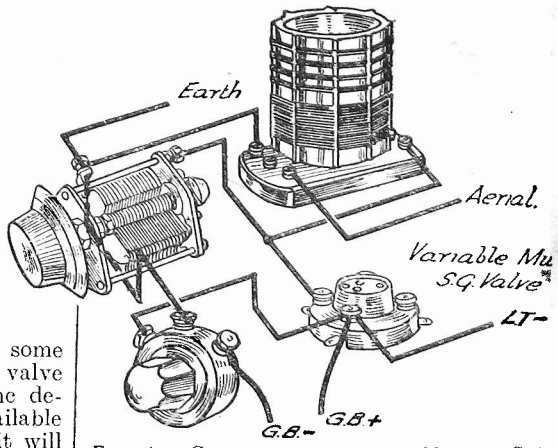


Fig. 4.—Gain control by variable-mu S.G. valve in battery set.

this sometimes makes things a little difficult in the case of replacements. Next, arrangements must be made for separate bias to each valve of the push-pull pair. In the case of an A.C. mains equipment, therefore, many designers prefer to adopt the alternative of using a large single output valve. For battery operation there is no alternative to a push-pull output stage or its more recent modification—Class "B."

Difficulties

If, as many listeners contend, the usual 2.0 or 3.0 watt output pentode, operated direct from the detector, does not provide a sufficient margin of signal-handling capacity and output to accommodate those more deeply-modulated passages of music, recourse must be made to a large output valve.

Immediately two difficulties arise. In the first place these large valves require an anode voltage of from 400 to 500 volts. This means larger and more expensive rectifier equipment—well worth while in the interest of quality, yet a matter to be reckoned with when contemplating the total cost. The second point is that most of these large valves are triodes, and therefore, comparatively insensitive, and requiring grid signal voltages for normal operation greater than can usually be

(Continued on page 1126)

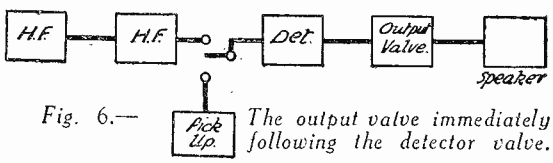


Fig. 6.—The output valve immediately following the detector valve.

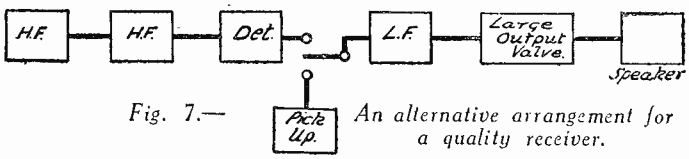


Fig. 7.—An alternative arrangement for a quality receiver.

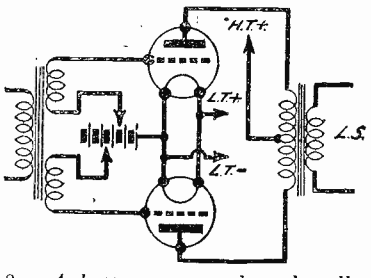


Fig. 8.—A battery operated push-pull stage.

Push-Pull Output

Better quality may be obtained if a bigger output stage is used. One method is to couple two output valves in push-pull, as illustrated in Fig. 8. The chief merit here is that in this arrangement much of the distortion is automatically cancelled out, the second, fourth and all *even* harmonic distortions in the two valves being opposite in phase.

There are a few points in connection with push-pull operation which have militated against the popularization of this system. In the first place, special push-pull input and output transformers are necessary; then the two valves should be fairly accurately matched as to anode current and characteristics, and

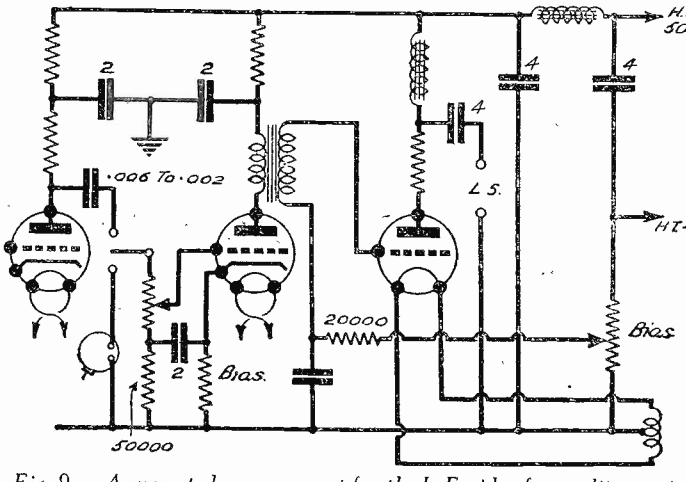
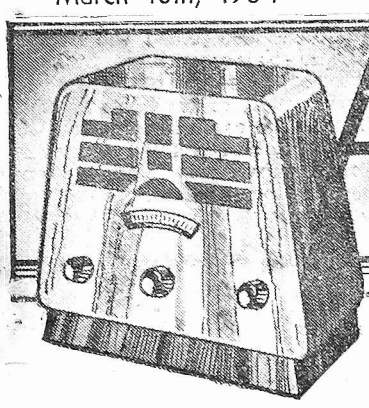


Fig. 9.—A suggested arrangement for the L.F. side of a quality receiver.



Anti-Interference Aerial Systems

Some Notes Concerning Unusual Aerial Schemes and Constructional Details of Various Effective Devices. By W. J. DELANEY

UNTIL a year or so ago it was customary to regard the aerial system of a broadcast wireless receiver as a length of stranded-copper wire suspended above, 30ft. from the ground, with connection to the receiver itself made by means of a continuation of that wire. This continuation, or more correctly the lead-in, might droop from a spot four or five feet from the house attachment of the aerial, or might run straight down the wall, the actual method depending upon whether or not the lead was of bare metal or of the insulated cable type. However, with the increasing use of electrical devices, and the increase in the efficiency of the high-frequency amplification given by the receiver it has gradually become essential to devise aerial schemes which, whilst permitting of the reception, at undiminished strength, of broadcast signals, will prevent the reception of the various forms of interference which are generated by the above-mentioned electrical devices, and which have been given the name "man-made static." Apart from various ingenious schemes, there are a number of devices which have carefully worked-out details based upon a sound theoretical study of the forms of such interference, and some of these have appeared commercially on the English market. I have experimented with some of these, and have also made up one or two arrangements to my own ideas, and the following notes will undoubtedly be of great interest to those who find their reception of the broadcast programmes is marred by cracklings, vari-pitched hums, and other forms of man-made static.

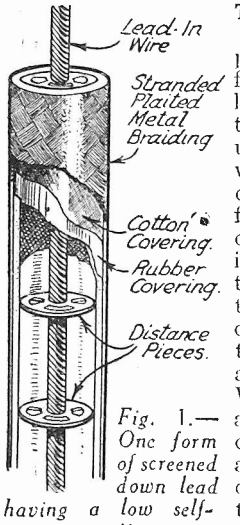


Fig. 1.—One form of screened down lead having a low self-capacity.

The Screened Lead-in

As a result of experiment it has been found that by far the larger part of the interference is picked up by the lead-in wire. In one or two cases it may even be found that this part of the aerial system is, in fact, actually the only effective portion which is in use, due to corrosion of the joint where aerial and lead-in are united. Where, however, the aerial wire is one continuous length, and is simply twisted or otherwise fastened to the "house" insulator and is then carried to the receiver, the total length of wire will no doubt be effective. In any case, where interference is experienced, the first step is to isolate earth and aerial. Perhaps it would be as well, before going any farther, to point out that I do not intend to deal with interference which is received *via* the electric-supply mains, which form of interference is easily overcome by the usual interference suppressor across the mains leads before connection is made to the receiver. When interference is experienced, therefore, the first thing to do is to remove the aerial and earth leads from the receiver in order to determine the source of the interference. If it ceases when these leads are removed, obviously the aerial or earth are responsible. If it continues, the mains are responsible, and the remedy is not so difficult. To continue, then. If the lead-in (or aerial) is introducing the interference, the easiest solution lies in screening, and although it is possible to screen a single lead in a wireless receiver by means of a close-fitting metal sheath, this cannot be adopted in the case of the aerial lead owing to the losses which will result. It must be remembered that the high-frequency currents which are generated in the aerial will take the easiest path to earth, and if we cover the leading-in wire with a close-fitting metal screen, and this screen is earthed, the resultant capacity effect between wire and screen will offer a much easier path for the H.F. currents than the tuning circuit in the receiver, and the result will be loss of signal strength. This is obviously undesirable. A simple way of overcoming this capacity effect is, however, to space lead and screen, and in Fig. 1 is shown one simple way of carrying this out. Here, the actual leading-in wire is fitted with small discs of good insulating material, and the screen is of much larger diameter. The insulating discs fit fairly closely inside this screen and if the discs are placed near together the screen is held away from the wire throughout its length and a much lower capacity results. The screen may consist of a length of metal piping (that known as electrical conduit is very suitable), or in certain cases it may be found possible to call into use a disused rain-pipe, for instance. Provided the lead is held at some distance from the earthed screen so that a low capacity results, the actual method of constructing the lead is not important.

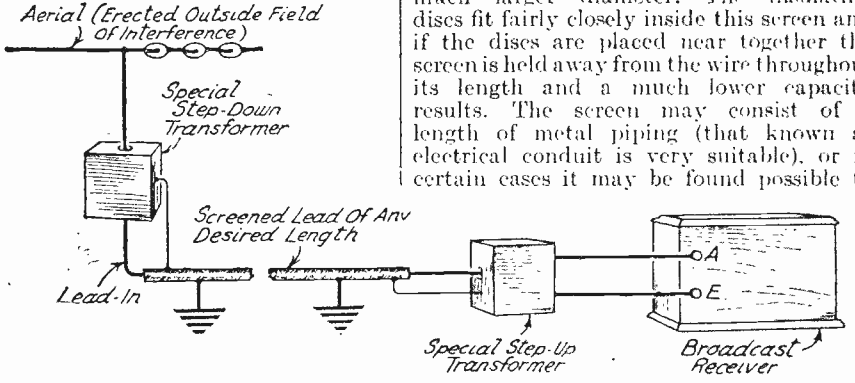


Fig. 2.—Diagram explaining the method of erecting an anti-interference aerial system employing special transformers.

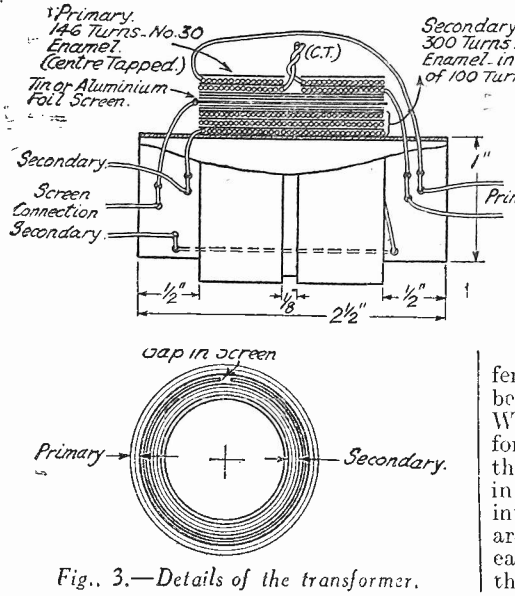


Fig. 3.—Details of the transformer.

Transformer Aerial Schemes

If the interference is picked up by the aerial, due to the proximity of the interference generator, it is obvious that the screened lead-in will not be effective in removing the interference, and it therefore becomes necessary, if long-distance reception is desired, to erect the aerial out of range of the disturbance, and this will probably entail a very long lead to the receiver. It is obvious that a long lead-in will result in inefficiency, and it therefore becomes necessary to introduce some device to maintain the over-all efficiency of the high aerial and short lead-in which

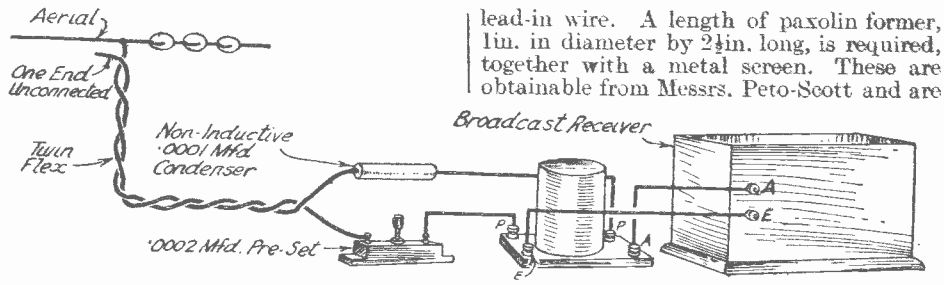


Fig. 5.—Connections for anti-interference device.

may be erected by those who do not experience the interference difficulty. Experiment has shown that this may be carried out very effectively by means of special H.F. transformers. The aerial is erected in some place free of interference, and interposed between the aerial and the lead-in wire is a specially-designed transformer. This has a step-down ratio, and the lead-in is then shielded and carried as far as required to the receiver, where a step-up transformer is interposed. By careful design it is possible so to arrange these components that the actual signal strength of distant stations is practically undiminished, but man-made static is completely removed.

Furthermore, owing to the interposition of the transformers, it is no longer necessary to arrange the lead-in wire on low-loss lines, and the metal screening may be separated from the wire by only a thin insulated covering. It must be effectively earthed, however. I have tried a number of these arrangements, and it is apparent that each individual case requires special treatment, dependent upon the strength of the interference, the type of receiver in use, and the length of the lead-in. In Fig. 2 the scheme is shown diagrammatically, and it will be seen that the transformers are untuned. With this arrangement, however, I found that a good deal of H.F. amplification was required in the receiver, and there was certainly a loss of signal strength. In extreme cases of interference, however, this must be tolerated as it becomes possible to hear stations free from interference which, without the scheme, are completely swamped by noises. The lead-in consists of ordinary flex (14/36's) covered with plaited copper braid, and this is obtainable from several firms at about one penny or three-halfpence a foot. In 100ft. lengths it works out at about 8s. or 9s. This is expensive, of course, but, in view of the advantages to be gained, the money is well spent.

Where only one H.F. stage is employed the loss of signal strength is too marked to make this scheme practicable, and a better device is now detailed.

A Single-transformer Scheme.

This owes its origin to America and has certainly been found to operate in a more accurate elimination of static than the double-transformer scheme, although the adjustment was found to be rather critical if optimum results were to be obtained. Altogether I made no fewer than seven of these transformers before I found one which appeared to act equally in all cases, but I should not like to guarantee that the following details would prove best in all cases. They will, however, form an admirable guide to the reader who wishes to carry out experiments in this direction, and as stated above, individual circumstances may necessitate modifications to either the actual windings, or the length and position of the lead-in wire. A length of paxolin former, 1in. in diameter by 2½in. long, is required, together with a metal screen. These are obtainable from Messrs. Peto-Scott and are similar to those used in the article on home-made coils which appeared in PRACTICAL WIRELESS No. 64, dated December 9th, 1933. The transformer is wound in the following manner. Starting half an inch from one end of the coil, 100 turns are wound on and these are covered by one thickness of thin note-paper, after which another layer of 100 turns is wound, covered with paper, and finally a third layer is wound, the end of this winding being anchored at the end as shown in Fig. 3. Next a strip of good dry brown paper is cut exactly 12in. long by 2in. wide, and this is tightly and carefully wrapped round the winding. The end is stuck down with good quality adhesive. To reduce the capacity between the secondary, which has just been wound, and the primary winding which must next be put on, an electrostatic screen has to be fitted, and this consists of a metal surface surrounding the winding, and fitted with a small air gap. As the exact diameter of the coil in its present condition will vary according to the thickness of the paper which has been used, no exact dimensions can be given, but the gap may satisfactorily be arranged by cutting a strip of aluminium—or tin-foil, obtainable from a cigarette or chocolate box. The width should be 2in., and the length such that the ends do not quite meet. Iron out the foil and wrap it round the coil and stick the end with adhesive. Cut the foil so that a space of about 1/16in. separates the ends and then stick the other end down. A further 1ft. length of brown paper is wrapped over this screen, and the primary is then wound in two sections of seventy-three turns each. The ends of these windings (which must be in the same direction as the secondary), must be level with the ends of the secondary, and this will leave a space of about ⅛in. between the two halves. Each primary therefore consists of two layers, a thin piece of paper separating each layer. Note that the leads for the primaries and the secondary are brought out at opposite ends. Mount the former on a small ebonite base, with the screen lid attached as described in the above-mentioned coil article, and bring the ends of the windings out to terminals. The screen is placed over the coil and this is connected to the terminal on the base, which is connected to one end of the secondary and marked Earth (Fig. 4). This terminal is joined to the earth terminal on the receiver, to which is also joined the normal earth lead. The other secondary terminal is joined to the aerial terminal of the receiver. The junction (centre) of the two primaries is joined also to the earth terminal on the transformer base, and a fixed condenser of .0001 mfd. capacity is joined to one primary terminal, whilst the other terminal is joined to a pre-set condenser having a maximum capacity of .0002 mfd. The lead-in consists of ordinary flex or other insulated twin twisted wires, and only one end of one wire is attached to the aerial. The other wire at that point is left disconnected, and to prevent its coming into contact with the aerial it should be cut and bent back and tied. The other ends of the lead are joined to the two condensers, and the pre-set is carefully adjusted on a weak station for maximum strength with minimum interference. The complete arrangement is shown in Fig. 5.

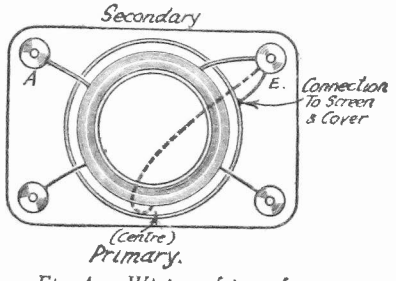


Fig. 4.—Wiring of transformer

POINTERS IN SET DESIGN

(Continued from page 1124)

developed by a detector alone. It is therefore necessary in most cases to interpose another low-frequency stage between the detector and output valve. Most receivers to-day are required to serve both for radio reception and gramophone record reproduction. If the output valve follows the detector, the circuit must be so arranged that the detector can also function as first L.F. amplifier for radio reproduction (Fig. 6).

A Weak Link

With a 2-stage L.F. amplifier, however, the switching from radio to gramophone may occur before the first low-frequency stage, thus avoiding interference with the detector grid circuit; this scheme is indicated in Figs. 7 and 9.

The one weak link in the chain is the low-frequency valve between the detector and the output stage. There is not a very wide choice of valves for the intermediate position. That is to say, most standard general purpose types have a rather small grid base for this service. As, however, most big output valves of modern design do not require the full amplifying power of two transformer-coupled stages before them, the difficulty can be solved either by using resistance-capacity coupling throughout, or resistance-capacity coupling in one stage and transformer coupling in the other.

On the other hand, with two resistance-coupled stages it may be found that the volume on the gramophone side may not be sufficient when using only one valve in addition to the output stage. In general, therefore, the best arrangement is to use a low or medium-gain resistance-capacity coupling between the detector and first low-frequency valve, thus reducing the risk of overloading this stage; and a good quality transformer, preferably resistance-fed, between the first L.F. stage and the output valve.

Good Quality

For the rest, some form of input volume control should be provided in the grid circuit of the first low-frequency valve, to counteract any risk of overloading in this stage with either radio or pick-up. Decoupling of all anode and screen circuits should be thorough and efficient, and grid circuits should also be well decoupled.

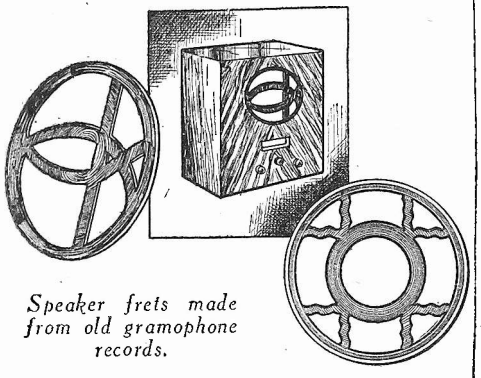
The output circuit should be accurately matched to the valve impedance, the calculation being based on the optimum load recommended by the maker of the output valve.

READERS' WRINKLES

THE HALF-GUINEA PAGE

A New Use for Worn-out Records

THE accompanying sketches illustrate a method of making speaker frets from old gramophone records. The simple

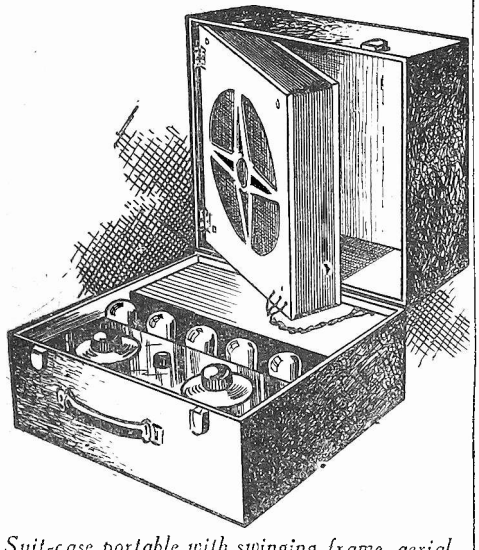


Speaker frets made from old gramophone records.

designs shown can easily be cut out with a fretsaw. A black fret will, of course, give a striking contrast to any cabinet, and a very pleasing effect is given by the groove markings on the record. In one of the most beautiful frets of this kind I have seen the grooves were filled up with various blending shades of sealing-wax to match a walnut cabinet.—W. CAPEWELL (West Norwood).

For Users of Suit-case Portables

SUIT-CASE portables have frequently to be placed in awkward positions for operating, owing to the frame aerial being directional. The following suggestion makes it possible to swing the frame aerial in the



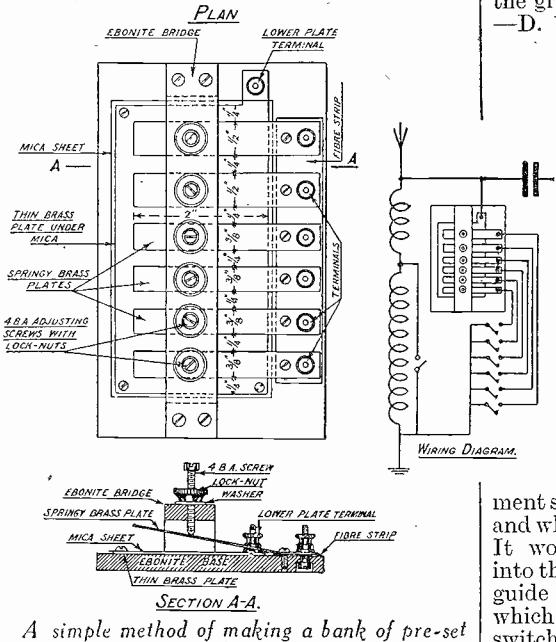
Suit-case portable with swinging frame aerial.

desired direction, without turning the controls away from oneself and greatly facilitates tuning. Remove the four screws from the speaker front and withdraw the complete frame aerial, speaker and baffle. Fix two 1in. hinges to the left-hand side of baffle, as shown in sketch, then lengthen the connecting wires to about 12ins.

When tuning in, the aerial and speaker can now be swung outwards in the direction desired. Flat back to right out will cover all the receiving directions, since the swing does not need to cover more than 90 degrees. To enhance the appearance, a strip of rexine or paper can be lightly glued round the frame aerial, and will also serve to protect it. It will be obvious that there must be some clearance between the edge of the frame and the inside of the lid to allow the former to swing freely.—L. GEORGE (Margate).

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.



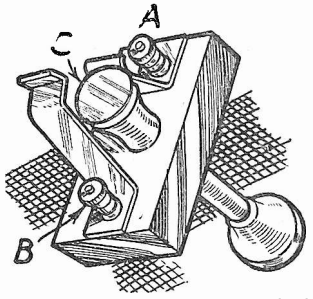
A simple method of making a bank of pre-set condensers.

Bank of Pre-set Condensers

THE accompanying drawings show an easily-constructed bank of pre-set condensers suitable for incorporating in a receiver for tuning in a number of desired stations, any one of which may be selected by the operation of its appropriate switch. Six condensers are shown, but any number may be provided to suit the capabilities of the receiver. If the overlap of the plates is made 2in. as shown, and mica .002in. thick is used, the condensers will have a maximum capacity of .0004 mfd. in the case of those with $\frac{3}{8}$in. wide top plates, and .0005 mfd. for those $\frac{1}{3}$in. wide; the former are intended for tuning stations on the lower wavelengths.—H. H. CRAWLEY (Summertown, Oxford).

Adapting an On/off Switch

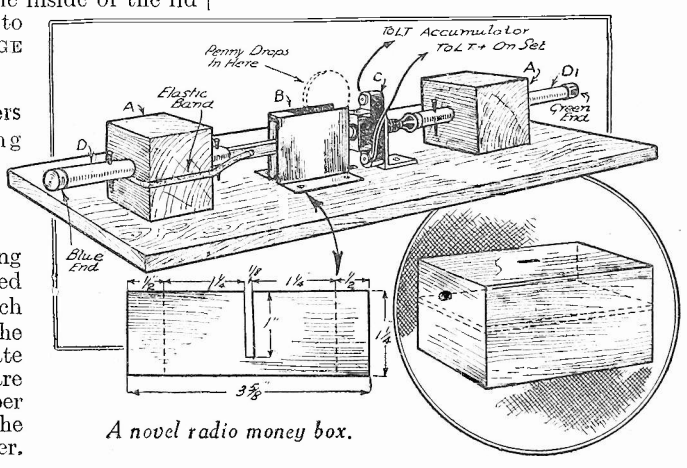
A GRID-LEAK clip, bent to the shape shown in the sketch, may be used to convert an ordinary on/off switch to a two-way switch suitable for changing over from radio to a pick-up. The bent grid leak is screwed under the switch terminal B in place of the original contact arm. A flexible wire soldered on to C is taken to the grid of the detector valve, A being connected to the grid condenser, and B to the pick up.—D. H. PENNINGTON (Marple).



Method of adapting an on/off switch.

A Radio Money Box

AS radio expenses were rather heavy, I devised the arrangement shown in the accompanying illustration, and which I have had in use for some time. It works as follows: A penny is dropped into the slot in the box, and is held in the coin guide B. The blue knob is then pressed in, which pushes the penny against the switch, switching set on. On releasing the blue knob, the elastic band pulls the plunger back to its original position, allowing the penny to drop into the box. To switch off the set the green knob is pushed in, and this puts the switch in the "off"

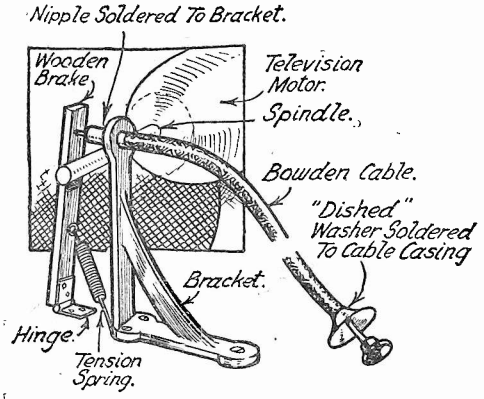


A novel radio money box.

position. The illustration clearly shows how the parts are assembled. The blocks marked A are cut from 1in. square wood, and the plungers are two pieces of dowel rod, the end of the one marked D being cut away, as indicated, so that it slides inside the coin holder. Cut the coin holder from a stout piece of tin, to the measurements given in the bottom left-hand diagram. The switch C is a Telsen push-pull switch, this type being used, as it has "knife" contacts. The two terminals are connected to two terminals on the box, and one is taken to L.T.+ on accumulator and the other to L.T.+ on set. Small pins should be put in the plungers to restrict their movement, and to save them from coming out.—J. F. STALLWORTHY (Catford).

Television Speed Regulator

A CONVENIENT speed regulator for use with television receivers not provided with synchronizing apparatus can be made as shown in the accompanying



Simple speed regulator for a television motor.

sketch. It will be seen that a "brake," made from a strip of hardwood, is fastened to the baseboard by means of a small hinge and is held against the motor spindle by a small coil spring. Mounted on the other side of the spindle is a panel bracket to which is attached the outer casing of a length of bowden cable. The inner wire is fastened at the same end to the wooden "brake." The other end of the cable has a "dished" washer soldered to it, a small knob being attached to the end of the inner wire, either by means of solder (when the knob has a brass inset), or by the side grub screw where this is provided.

The advantage of the scheme is that a reasonably good regulation of the motor speed can be obtained whilst the "looker-in" is sitting back at a comfortable distance from the lens or screen. It will be appreciated that the tension spring must be adjusted so that a suitable braking effect is applied to the spindle to reduce the motor speed a little below the normal one of 750 revolutions per minute. If soft wood were used for the "brake" there would be some danger of over-heating and of the wood charring; that could easily be avoided by fastening a strip of fibre to the face of the "brake."—P. F. (Hatch End).

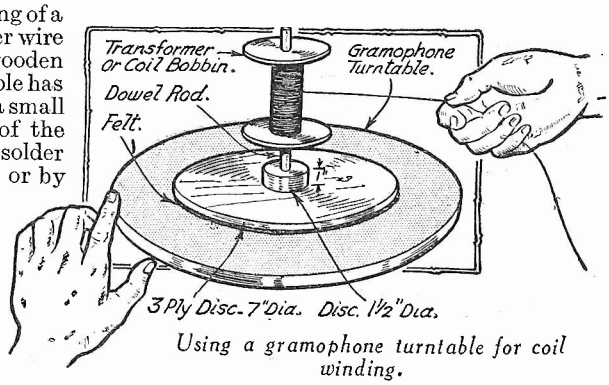
An Easily-made Microphone

THIS microphone consists of a piece of plywood with a circle cut out of the centre about the size of a penny. A piece of mica the same size has a strip of foil glued or merely pressed on it, as shown in Fig. 1, with projecting pieces of foil which make contact with flange "A." This is placed on the wood. The other side of the plywood has a similar piece of mica and foil, with the foil making contact to the second flange "A." The whole is riveted together, as shown in Fig. 2. Small tags are riveted on the flanges to which contact is made with the foil. The central hole in the plywood is filled with carbon granules from an old flash-lamp battery. Other details of construction are shown in Fig. 3. —T. DEAN (Cranwell).

An Excellent Coil Winder

A GRAMOPHONE of either the electrically driven or spring-motor type can be put to use as an excellent winder for tuning coils, transformer windings and the like as shown in an accompanying illustration. First of all a disc of ply-wood about 6in. diameter should be cut out, a hole the same size as the motor spindle being made in its centre and a piece of felt or baize being glued on one side. Next a disc of wood about 1in. thick by 1½in. diameter must be made to fit in the centre of the ply-wood and should be glued, or screwed, to the latter. A hole must be made in the underside of the smallest disc to take the projecting end of the motor spindle, and in the upper side to receive a length of dowel rod. The former of the coil to be wound can then be fitted on to the dowel so that the whole can be rotated by means of the gramophone motor. For larger coil formers a second rod may require to be fixed on the dowel so that it will fit tightly into the coil former.

The advantage of this type of winder is that the speed of winding can be regulated very easily by varying the pressure of a finger against the edge of the turntable as shown. By this means it is possible to wind even very fine wire without danger of breakage. Additionally the motor can quickly be stopped when required by pressing against the turntable.—P. F. (Hatch End),



Using a gramophone turntable for coil winding.

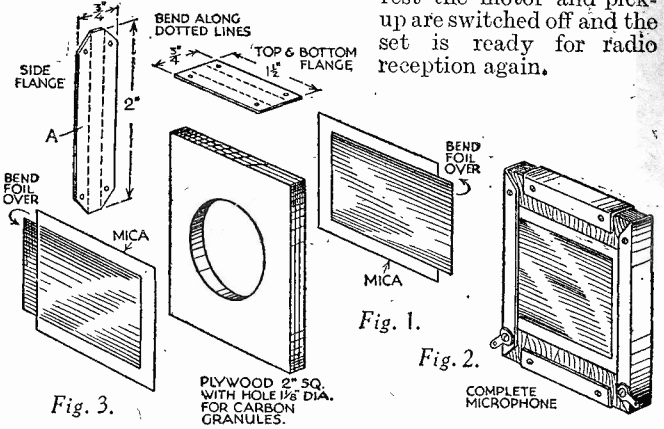


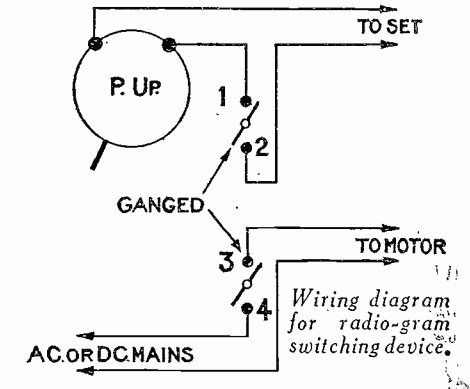
Fig. 3. *Fig. 1.* *Fig. 2.*

Constructional details for an easily made microphone.

An Excellent Radio-Gram. Switching Device

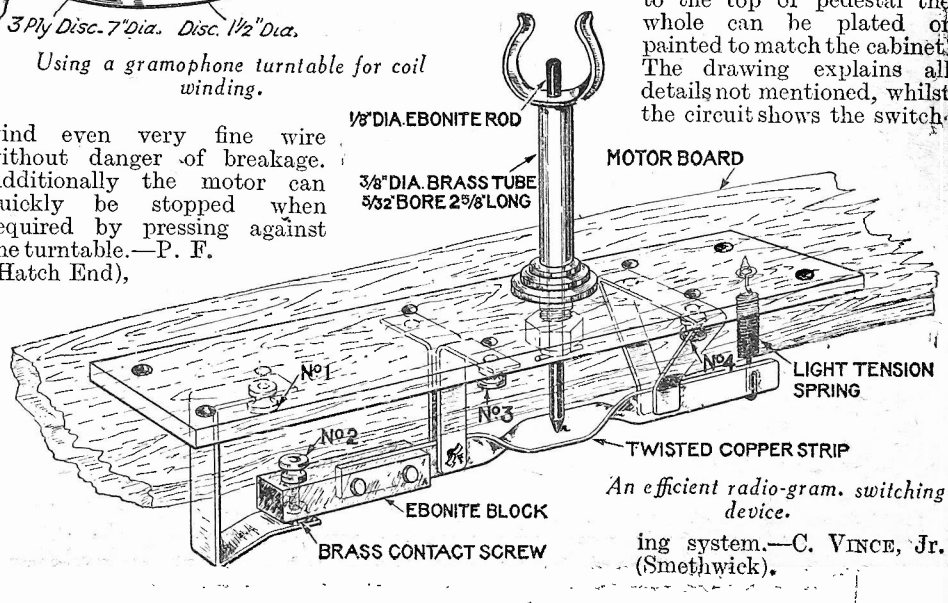
THE drawings herewith show the general constructional details of a combined radio-gram. switch for automatically switching the gramophone motor and pick-up into circuit as the tone arm is taken off the rest, prior to placing it on the record. When the arm is put back on the rest the motor and pick-up are switched off and the set is ready for radio reception again.

The parts required will be found in almost every junk box. They are: a length of brass tubing screwed at one end; A length of copper strip about ⅜in. wide, and 1/16in. thick; a piece of ebonite 4¾in. long by 1in. wide, and a length of ebonite rod.



Wiring diagram for radio-gram switching device.

The base of the pedestal is made up from three brass discs ⅝in., ⅞in. and 1⅛in. diameter respectively, which are all soldered together, after which a ⅜in. diameter hole is drilled through them. This is then placed on the rod in the required position and secured by solder. When the clip is secured to the top of pedestal the whole can be plated or painted to match the cabinet. The drawing explains all details not mentioned, whilst the circuit shows the switching system.—C. VINCE, Jr. (Smethwick).



An efficient radio-gram. switching device.

Pocket Portable

Constructional Details of a Simple Portable Receiver which can be Built in a Cigar Box

By "DIALOG"

THE little set about to be described was made in a cigar box measuring only 5in. by 9in. by 1⅞in.; a box which holds twenty-five cigars is of suitable size. Although small, the receiver works well, bringing in the Regional and National at good strength on the 'phones on a piece of wire 10ft. long as aerial. The set does not work on the long-wave band, as the coil was not wound for this.

The "Pocket Portable" actually has the necessary 2-volt accumulator of the jellied type fitted in the cigar-box, and the complete set will quite easily go into any coat pocket and so, with a 40 or 60-volt H.T. battery and a pair of head-phones, one has a complete receiver which is easily carried about.

Winding the Coil

The coil is made on a paxolin former 3¼in. long by 1¾in. diameter. About the middle of this former wind on a sufficient number of turns of 28 d.c.c. wire (closely wound) to fill up 1¼in., not forgetting to leave a reasonable length of wire for connecting up; this is the grid winding. Leaving a space of ¼in. from the start of the grid winding and using the same gauge of wire, and winding in the same direction, wind on enough wire to fill a space of ¾in., thus completing the reaction coil. A little shellac varnish painted over the windings keeps them taut and firmly in place. For details of the coil see Fig. 1.

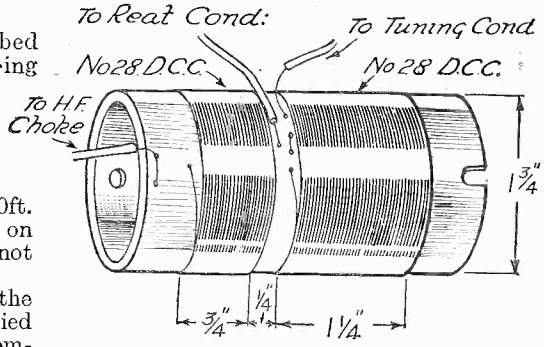


Fig. 1.—Winding details and connections for the coil.

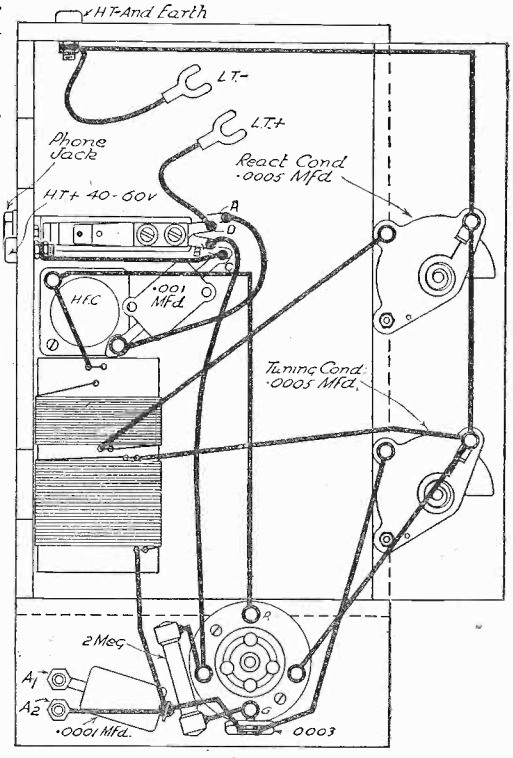


Fig. 2.—Wiring diagram for this neat little receiver.

COMPONENTS REQUIRED

1 4-pin Valve-holder (Benjamin).
2 Bakelite Dielectric Variable Condensers, .0005 mfd.
1 Fixed Condenser, .0003 mfd., tag type (T.C.C.).
1 Fixed Condenser, .0001 mfd., tag type (T.C.C.).
1 Fixed Condenser, .001 mfd., tag type (T.C.C.).
1 Grid Leak, 2 meg., with wire ends (Dubilier).
1 H.F. Choke (Graham Farish).
1 'Phone Jack, type P65 (Igranic).
1 'Phone Plug (Igranic).
3 Banana Plugs and Sockets, red (Clix).
2 Banana Plugs and Sockets, black (Clix).
1 Detector Valve, type 210 Det. (Cossor).
1 2-volt Accumulator, jelly type, small, to fit box (Exide).
1 Paxolin Former, 3¼in. by 1¾in. One ounce 28 D.C.C. Wire, Rubber-covered Wire, Spade Terminals, Screws, Crocodile Clip, etc.

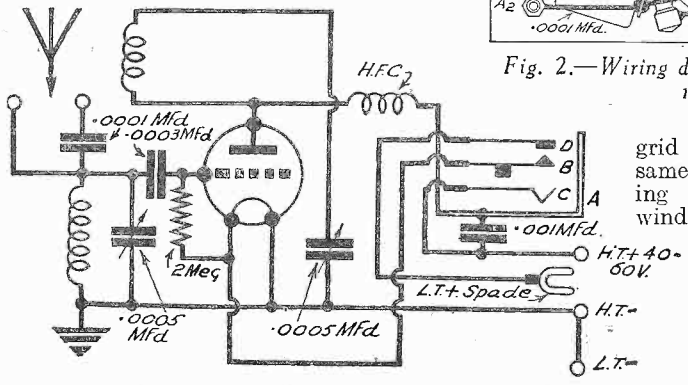


Fig. 3.—Theoretical circuit of the Pocket Portable.

Assembling the Parts

To make the receiver, first drill two holes, one above the other, the diameter of a banana plug socket, in the left-hand side of the cigar box, about 1in. from the back, and mount two red sockets. To one connect one side of the .0001 series-aerial condenser. Now, having wound the coil, place it lengthways in the bottom left-hand corner of the box, as close to the back as possible, and solder the input wire of the grid coil to the other side of the .0001 aerial condenser. Continue with this grid coil wire and solder to the other banana socket. Fasten the coil in place, and secure with a very small screw through the paxolin former to the bottom of the box. This can easily be accomplished by inserting the screw at an angle. Screw down at both ends, and it is as well to note that, owing to the thinness of the wood, all screws will protrude through and in consequence will need filing flat.

Next, take the valve-holder and screw this as close as possible to the coil, allowing for the width of the glass bulb.

The .0005 mfd. tuning and reaction condensers are now fixed into place, on the front of the box, and knobs attached. Connect the grid of the valve-holder to one side of the .0003 grid condenser, and the other side of this condenser to the coil and join this to the fixed vanes of the tuning condenser. Join a fine piece of wire from the moving vanes of the tuning condenser to the moving vanes of the reaction condenser, and allow sufficient length to reach to the right-hand side of the box, to be joined later to earth, the fixed vanes of the latter being now connected to the reaction winding of the coil. The other side of the reaction coil is joined to the plate or anode terminal of the valve-holder. A fine wire, insulated with sleeving, now joins the same anode terminal to one side of the H.F. choke. Solder the other side of the choke to the terminal marked A (see Fig. 2), and to one side of the .001 fixed condenser, the terminal C being joined to the other side of this condenser, and by a piece of thin rubber-covered wire to the socket (red) next to the 'phone jack.

Now solder the grid leak to the grid of the valve-holder, joining the other side of the leak to one of the filament terminals, and by means of some thin rubber-covered wire connect it to the terminal marked B on the 'phone jack. The remaining jack terminal D has now a piece of rubber-covered wire soldered to it—about 4in. long—at the end being fixed a small accumulator spade, which is for connecting to the plus side of the accumulator. There now remains a black banana socket; this is mounted towards the back of the right-hand side of the box. To a 4in. length of rubber-covered wire is fastened a black accumulator spade and it is soldered to this socket. Also, with a piece of rubber-covered wire, connect

(Continued on page 1132)

DESIGNING AN A.C. MAINS UNIT

A Number of the Lesser-known Points regarding the Choice of Components for A.C. Mains Units are Here Dealt With

By FRANK PRESTON

ALTHOUGH there are thousands of wireless amateurs who think nothing of designing and making their own battery-operated receiver, it is rather surprising to find how many there are who cannot trust themselves with the task of working out the main details of construction for a mains eliminator or complete mains receiver. As a matter of fact it is a far simpler and more straightforward undertaking to design a mains unit than it is to design a receiver. Provided that the amateur understands the elements of electricity and has knowledge of a few simple facts, there is little chance of going wrong, especially if safety fuses are employed with fair liberality.

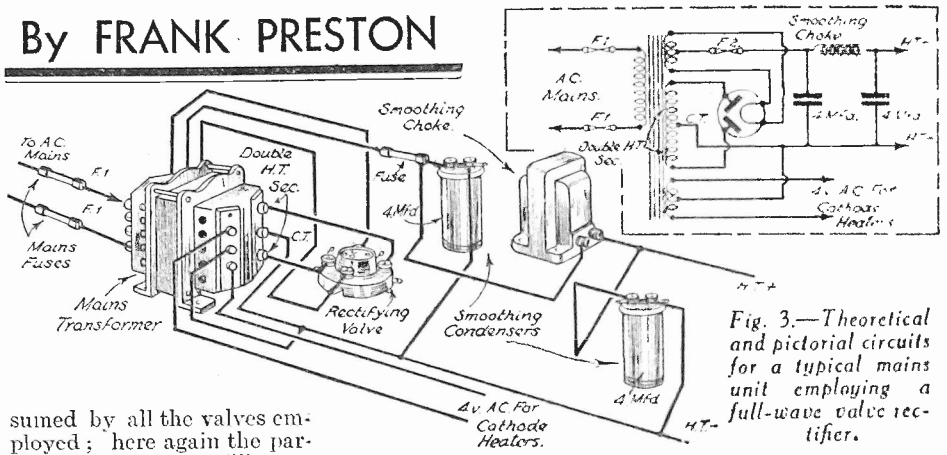


Fig. 3.—Theoretical and pictorial circuits for a typical mains unit employing a full-wave valve rectifier.

The Constituent Parts of a Mains Unit

Before passing on to the actual points of design it will perhaps be better to get a grasp of the underlying principles and also a working knowledge of the component parts of which a mains unit consists. The idea will more readily be understood if reference is made to Fig. 1, where the complete supply unit is divided up into different sections, each of which is represented by a non-committal rectangle. It will be seen that the sections are few in number, and comprise: (1) the mains transformer, the purpose of which is to isolate the actual mains supply wires from the receiver, as well as to change the voltage to that required by the rectifier. In the case of an eliminator or mains unit of the so-called "all-mains" type, the transformer also contains windings which give 4 volts A.C. for heating the cathodes of indirectly-heated valves. (2) The rectifier, the object of which is to change the alternating-current mains supply into direct current which can be used for high-tension purposes. (3) The smoothing system, which contains an iron-cored choke and two or three condensers. (4) The voltage-dropping system, for reducing the total output from the rectifier to the figures suitable for operation of the various valves in the set. This need not necessarily be considered as part of the mains unit, since it is usually (and more conveniently) made integral with the high-tension circuits of the set itself.

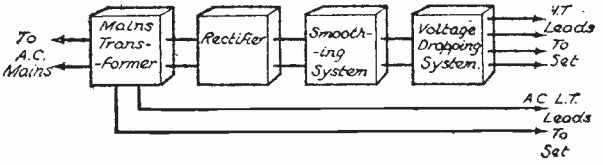


Fig. 1.—This diagram shows the principal parts of a mains unit arranged in their correct sequence. The last section—for voltage dropping—generally forms a part of the receiver.

The various parts will not be described in detail, nor will the theory surrounding their action be given very much attention, since these sides of the question have been adequately dealt with in numerous previous articles; in the present instance we are more interested in the purely practical aspects.

Estimating the Total Power Consumption

In deciding upon the type of mains transformer to be employed we must consider the amount of power required by the set in conjunction with the type of rectifier to be employed. The first item which comes in for consideration is the maximum voltage required by the receiving valves; in the case of a battery set this will be 150 volts, but for a mains set it might be any figure up to 500 volts, according to the particular valves in use. Next we must take into account the total amount of high-tension current which will be consumed by all the valves employed; here again the particular figure, in milliamps, will vary considerably from about 20 to 120. There is yet another point to be borne in mind, which is that the smoothing choke (or chokes) will have a certain resistance and so produce a voltage-drop. In other words, the output from the smoothing system will be at a lower voltage than the output from the rectifier. Smoothing chokes of suitable inductance—generally between 20 and 30 henrys *when passing the maximum current*—can be obtained in a variety of resistance values, but for any given inductance the price of the choke varies inversely as its D.C. resistance. It is often less expensive, therefore, to use a choke of comparatively high resistance, and hence productive of a greater voltage-drop, in conjunction with a rectifier giving a greater voltage output than it is to use a "smaller" rectifier and a lower-resistance choke.

Voltage Losses

For the moment we can leave that point and determine just what loss in voltage the choke will produce. By applying the ubiquitous Ohm's Law, we can find the voltage-drop by multiplying the H.T. current required by all the valves (in milliamps) by the resistance and then dividing the answer by 1,000. For example, if the set takes 25 milliamps and the choke has a D.C. resistance of 1,000 ohms (a fairly average value for a medium-priced component), the voltage-drop across the choke will be 25. This is very low and could often be ignored, but if the set took, say, 75 milliamps, the voltage-drop across the same choke would be 75, so that if proper allowance were not made for this, the set would probably be "starved" of H.T. current and performance would suffer heavily in consequence.

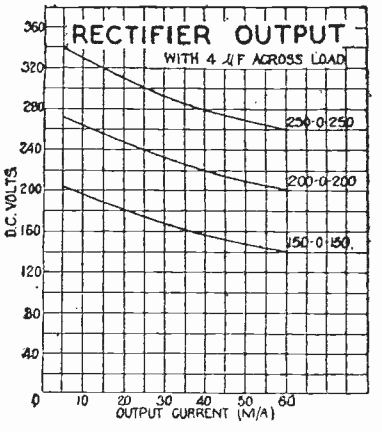


Fig. 2.—Regulation, or output curves for a typical Class A rectifying valve. These are referred to in the text.

The position would become still more serious if it were desired to employ the field winding of a moving-coil speaker for smoothing purposes, because, although this is an excellent system, the resistance of most speaker fields is 2,500 ohms. It can therefore be seen that with a set taking 50 milliamps the voltage-drop across such a field winding would be 125, and this must be allowed for in choosing the rectifier and transformer.

Another little point which must be borne in mind in the case of a unit for use with a set employing indirectly-heated valves is that the grid-bias voltage is also taken from the H.T. supply. Thus, if the set requires 250 volts for high-tension—this is the figure for most of the power pentodes—and the last valve requires 35 volts G.B., the total supply voltage should be 285.

Just as there is a voltage-drop across the smoothing choke, so is there a certain loss in voltage due to the loud-speaker or output transformer connected in the anode circuit of the output valve. But as this component does not carry the H.T. current for the whole set (but for the last valve only), and as the D.C. resistance is usually fairly low, the voltage-drop will not generally exceed 20 volts or so. At the same time, it is well to consider this point when making the necessary simple calculations.

Choosing the Rectifier

Having settled the question regarding the voltage output required from the

rectifier we can decide upon the type of component to be used in this position. Here there is some danger of our remarks becoming controversial, because some experimenters prefer valve rectifiers for every purpose, while others will have nothing but metal rectifiers. It is fairly safe to say, however, that for voltages up to about 200 the metal rectifier is to be preferred, but for voltages of 250 and over the valve is favoured. No hard and fast rule can be laid down in respect of this point, but it might be said that an indirectly-heated valve rectifier offers many advantages when comparatively high voltages are being dealt with, and these were pointed out in a recent article entitled "Important Points about Valve Rectifiers."

In any case, the rectifier should be chosen according to the maximum voltage and current required. At this juncture it might be pointed out that all rectifiers give a voltage in excess of their nominal rating when supplying a current lower than the maximum for which they are designed. The actual output voltages for various current "loads" can always be obtained from the "regulation curves" to be found on the makers' literature accompanying the rectifiers themselves. An example of one set of these curves—in this case it applies to a class A valve rectifier—is given in Fig. 2. This valve is nominally rated to give 250 volts at 60 milliamps when fed from a transformer giving an output of 250—0—250 volts (250 volts to each of the two anodes), but it can be seen that the output voltage is 330 when the "load" is only 10 milliamps, and even more than this at still lower currents. Another interesting point is explained by this curve, which is that the valve will give an output of 180 volts at 20 milliamps when supplied with only 150 volts from the transformer. Thus it is easily possible to obtain almost any required output by choosing the rectifier and transformer to work together. This point will more readily be appreciated if the reader will examine the curves printed in the instruction books issued by the various makers of rectifiers.

We started by referring to the mains transformer, this being the first "link" in the mains unit "chain," but it will now be appreciated that its specification can only be determined after first studying the other sections of the complete outfit. When the transformer is for use with a full-wave valve rectifier (and this type is always to be preferred) it must have an H.T. secondary winding which will give the voltage rating of the valve on both sides of a centre tapping, and it must be capable of supplying that voltage at the maximum current rating of the valve. In the case of a metal rectifier connected on the "voltage-doubler" principle (this arrangement also is nearly always to be recommended) the transformer requires to have only a single (not centre-tapped) secondary which should supply a voltage equal to about two-thirds of the rectifier's rated output and at a current of some three times that at which the rectifier is rated. These figures are only approximate and the makers' recommendations should always be followed implicitly.

The Smoothing Condensers

The only other point which remains to be dealt with is that of the smoothing condensers. In the case of valve rectifiers it is usually sufficient to connect one between each end of the smoothing choke and the H.T. negative lead. It should also be stressed that the condenser on the "rectifier" side of the choke has a good deal of effect upon the maximum rectifier output; increasing its value tends to increase the voltage output, whilst reducing it produces the opposite effect. As a matter of fact, a 4 mfd. condenser is in nearly every case assumed by the makers in stating the output of any particular rectifier.

A similar position occurs in regard to metal rectifiers, but with these, two condensers are used "before" the choke when the rectifier is wired as a "voltage-doubler." Both condensers should usually have a capacity of not less than 4 mfd., and the actual voltage obtained depends upon this. The condenser used "after" the choke is purely for smoothing and is the same as for a valve rectifier. All condensers used in any type of mains unit should have a rated working voltage of not less than twice that actually delivered by the unit, and it is generally better to "play safe" by choosing a "working" voltage of three times that of the output. This ruling is not so important in the case of the "voltage-doubling" condensers because these are wired in series across the output; each may therefore be rated at a voltage not less than one-and-a-half times the rectifier output.

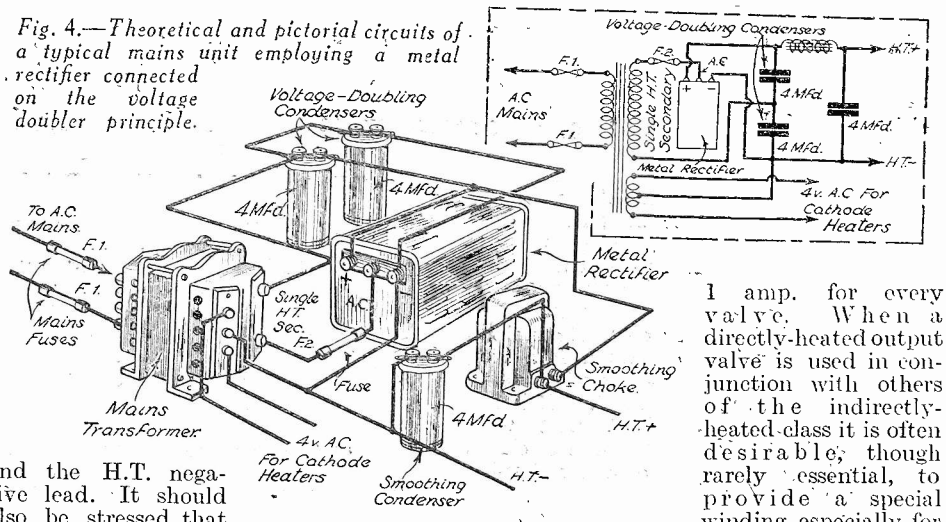


Fig. 4.—Theoretical and pictorial circuits of a typical mains unit employing a metal rectifier connected on the voltage doubler principle.

Two Typical Circuit Arrangements

By way of consolidating the above remarks two typical circuits of mains units are given in Figs. 3 and 4. The first is for a unit employing a full-wave valve rectifier, and the second shows a metal rectifier connected as a "voltage-doubler." The circuits given apply to units for any output, provided that the various components are chosen according to the rules laid down above.

It will be seen that, in both circuits, fuses are used rather liberally in order to avoid possible damage in the event of the failure of any component. With practically any type of unit the fuses marked F.1 should be rated at about 1 amp., whilst F.2 should have a rating equal to about four times the output of the rectifier.

Low-tension Windings

We have not yet given any thought to the matter of L.T. windings on the mains transformer, but these are naturally dependent entirely upon the set with which the unit is to be used. With indirectly-heated valves one secondary should be provided to supply 4 volts at a current of 1 amp. for every valve. When a directly-heated output valve is used in conjunction with others of the indirectly-heated class it is often desirable, though rarely essential, to provide a special winding especially for it. Also, in the case of a valve rectifier, another winding is required to heat its cathode, and it should supply a maximum of 1.5 or 2.5 amps. respectively, at 4 volts, for a class A or class B rectifier; the latter figure also applies to class C rectifiers. In every case there is no harm in using an L.T. winding having a maximum output greater than that actually required, so long as the transformer is a good one of massive design, but it is distinctly unwise to attempt to obtain a greater output than that for which the transformer was designed.

MAKING THE POCKET PORTABLE

(Continued from page 1130)

the remaining filament terminal on the valve-holder and the wire running from the earth side (moving vanes) of the two .0005 mfd. condensers to this same black socket. Fix to the black banana plug two pieces of flex; to one attach a small black H.T. plug and to the other a crocodile clip.

Testing Out

The set is now completely wired up and to test out place the small accumulator in the space left (a piece of wood screwed to the lid close enough to the accumulator will hold this from moving about); join the positive and negative spades to it. Attach to the aerial one of the red banana plugs, and to the other connect some flex. The black plug is put in the negative socket of the H.T. battery and the crocodile clip to an earth wire.

Plug in the aerial and 'phone jack and listen. If on turning the tuning knob nothing is heard, increase the reaction and you will soon pick up the Regional. Now take the aerial plug out of its present socket and replace it into the one with the .0001 series condenser in circuit. On returning, Fécamp and the London National should come in quite well, also with a good outdoor aerial other foreign stations. Drop the H.T. voltage to 40 volts if the reaction is too fierce. Withdrawing the 'phone plug automatically cuts off the L.T. and H.T.

With a good one-valve amplifier and extra H.T. the set works a speaker and occupies very little room.

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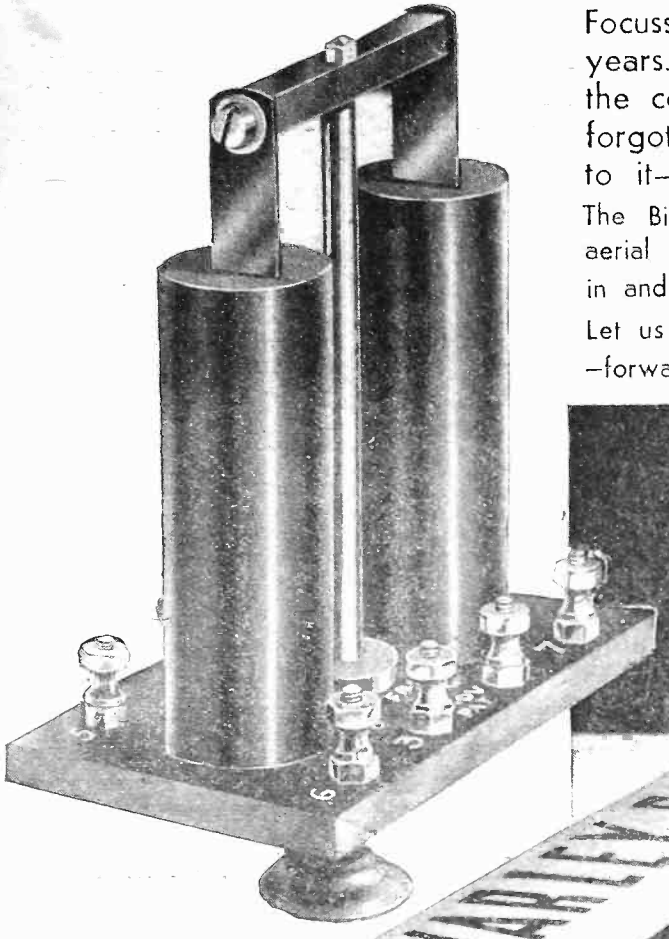

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The Bifocal Focussing Coil—a tuning device whereby the optimum aerial coupling can be selected by simply pulling a knob in and out—without altering the setting of the reaction control.

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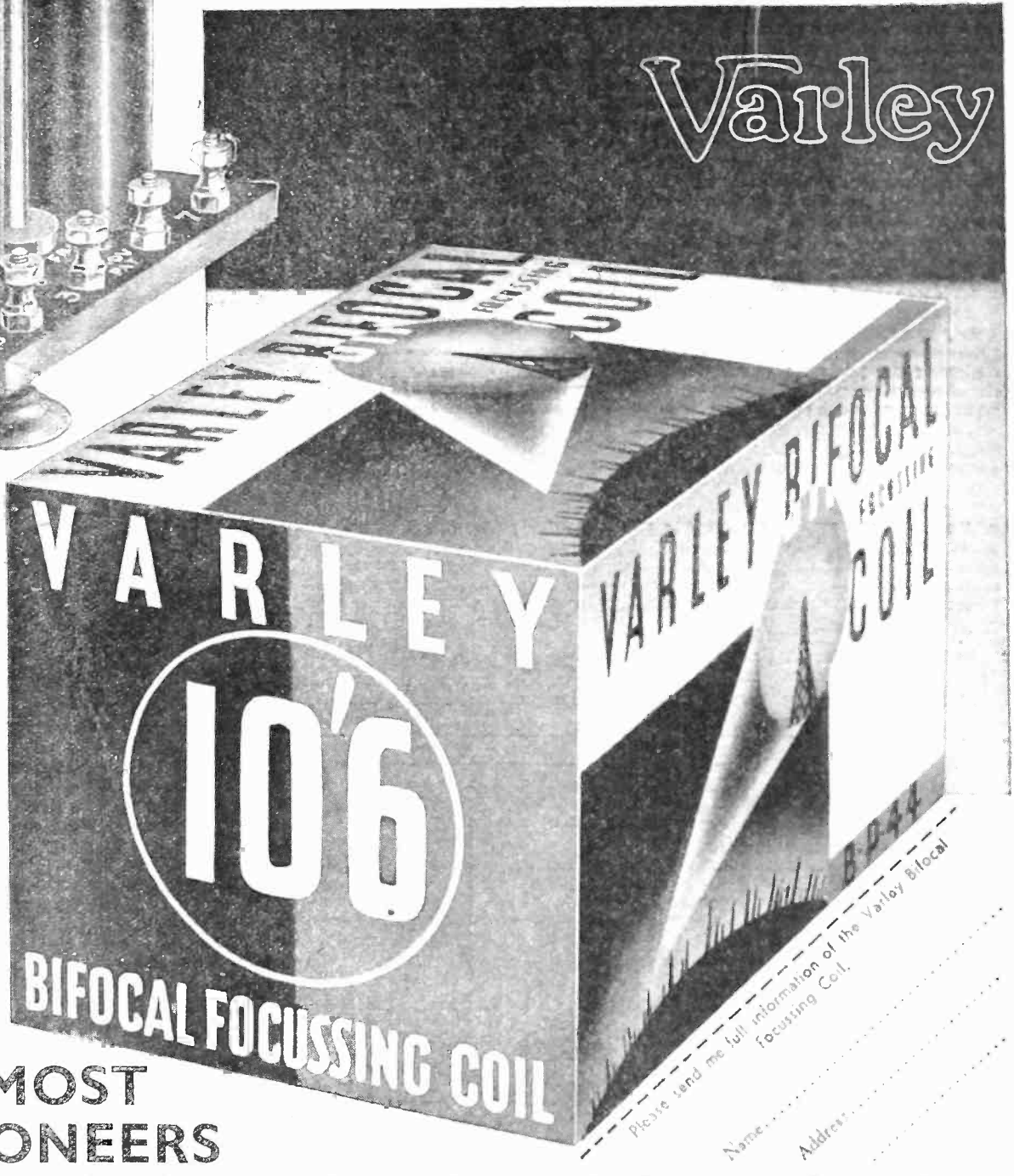

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OUR READERS AND THE RADIO THE LEADER

The New Set that Introduces a New Policy which is Being Acclaimed by

OUR post-bag has already shown that readers throughout the country are as delighted with the "Leader Three" as they are with our new policy which it symbolizes. As we have already explained, the "Leader" is the first of a new series of "Practical Wireless" receivers which will specifically be designed with the idea of low initial and running costs very clearly in mind. It is our firm belief that the recent slight falling-off in the home construction of receivers is entirely due to the fact that so many sets have been described which are good, but fairly expensive, especially when considered in conjunction with the remarkably low prices which now prevail for complete and ready-made receivers on the market.

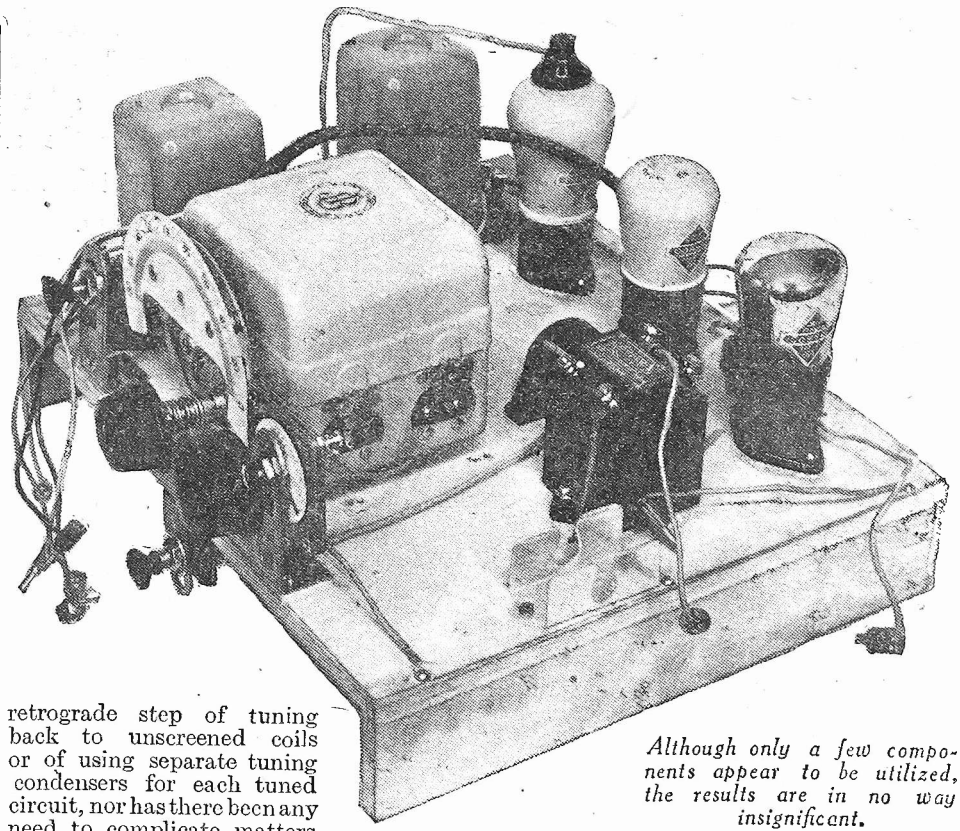
Not a "Stunt" Set

There has never been any doubt that the home-constructed receiver possesses innumerable advantages over the factory-produced one, but, even so, there are many amateurs to whom the question of price must come first and foremost. **It is to these amateurs that the "Leader" and nearly all future "Practical Wireless" receivers will appeal very strongly.** In designing the present receiver we made a definite and successful attempt to produce an instrument which could not only be made more cheaply than ready-made ones of similar type, but which would also be entirely modern and lacking in none of the refinements demanded by the up-to-date constructor. **The "Leader" is not a "stunt" set made to introduce some new component or "gadget," but is a really practicable receiver,** designed around standard components suitable for the keen experimenter and the ordinary listener alike.

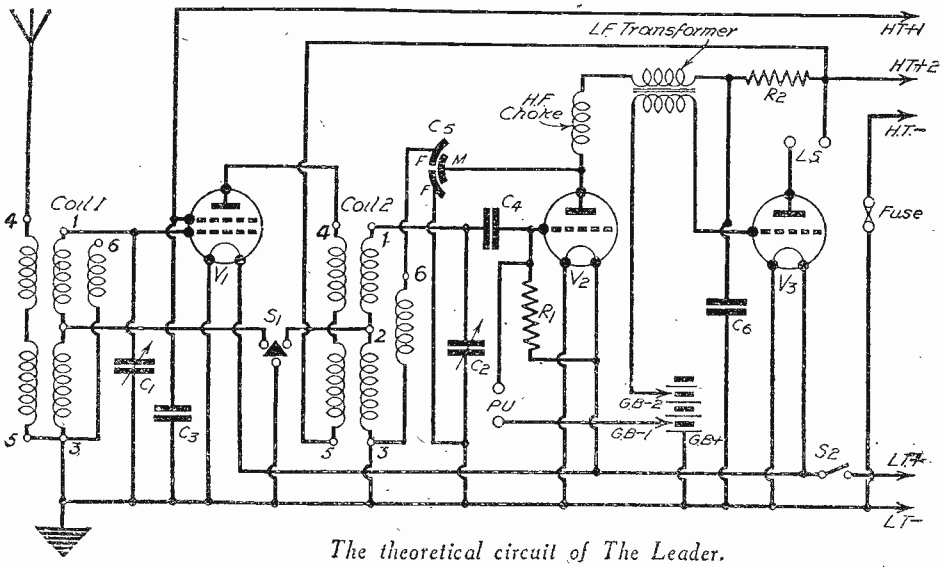
Nothing Sacrificed Except Cost

In other words, nothing of importance has been sacrificed in order to achieve low price.

It has not been necessary to take the retrograde step of tuning back to unscreened coils or of using separate tuning condensers for each tuned circuit, nor has there been any need to complicate matters by fitting a multiplicity of unnecessary control knobs. On the contrary, the "Leader" employs a really modern screened two-gang condenser (with separate trimmers, so that the maximum degree of sensitivity can be secured under all conditions of use) in conjunction with a pair of eminently up-to-date screened coils specifically designed to cover the new range of wavelengths as prescribed under the Lucerne Plan. Controls have been reduced to the minimum compatible with maximum efficiency and the set is built on a metallized chassis, so that it is in keeping with the most modern methods of construction. It has been claimed in some quarters that the constructor and experimenter does not like a receiver with few and simple controls. We do not agree with this point of view, nor do our readers from whom we are pleased to hear so often. So long as all the essential controls are provided we can see no valid reason why anyone should wish for more; the idea of using many knobs is generally dictated by a feeling of snobbishness and not by actual requirements.



Although only a few components appear to be utilized, the results are in no way insignificant.



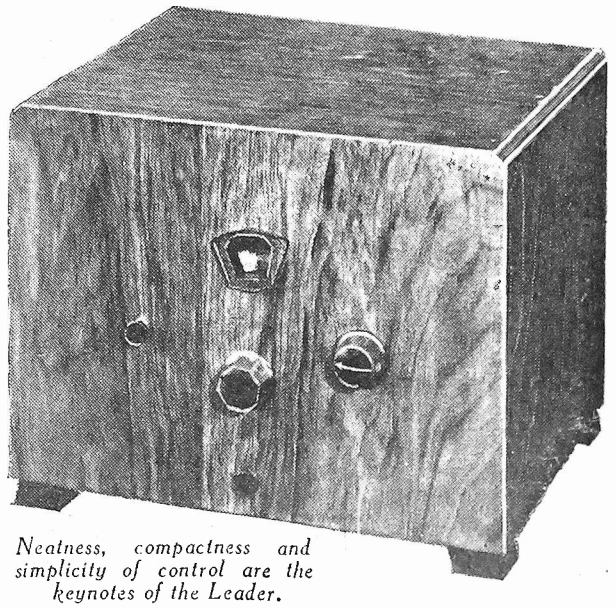
The theoretical circuit of The Leader.

Up-to-date Appearance

In addition to the above-mentioned features, we would add that the "Leader" is quite as up to date in its appearance as in its performance. This is largely accounted for by the fact that one of the latest designs in cabinet work has been adopted. The Peto-Scott cabinet which is illustrated *looks* like the "1934 model" which the set is. We might have saved a few shillings more by employing an old-fashioned cabinet and by dispensing with many other of the important features outlined above. **But that is not our idea of presenting "Practical Wireless" readers with a low-priced set. We prefer to consider quality and efficiency first, and we leave the matter of low cost to careful and skilful design—*not* to a "skimping" of price on a few components.**

INDUSTRY SUPPORT US IN PRESENTING THREE

Readers and Component Manufacturers Alike!



Neatness, compactness and simplicity of control are the keynotes of the Leader.

A Bold Policy

Readers will appreciate the importance and far-reaching influence of our new policy and will fully realize the boldness of it. At the same time, however, they will clearly understand that it is entirely in their interests. **We believe that we hold our readers' confidence and we feel sure that every home-constructor in the country will give us his support in furthering the interests of a policy which will represent to him a considerable saving of hard cash. Already we have received numerous letters of congratulation from all over the country; these have been not only from amateur constructors, but also from important representatives of the wireless trade who are just as interested in the constructor movement as we are ourselves.** We tender our thanks to all those who have expressed their appreciation of our efforts.

Simplicity of Construction

An important point in regard to the "Leader" which has not been stressed unduly is the extreme simplicity of its construction. The set can very easily be built by any person who is entirely new to wireless and who has probably never undertaken the construction of a receiver before. The full-size blue print which was given free with last week's issue shows how few wires there are and indicates the simplicity of lay-out. The arrangement is so "clean" and simple that no one could possibly feel afraid of tackling the construction. Added to this, however, is the backing of the entirely unique and valuable PRACTICAL WIRELESS FREE GUARANTEE.

That guarantee is the home constructor's surest safeguard, for it ensures that every builder of a PRACTICAL WIRELESS receiver, should he experience the slightest difficulty, is entitled to free and prompt advice. The only reservation is that the set is built around the identical components specified.

Simplicity of Control

After the receiver has been connected up, with the H.T.1 battery plug inserted into the H.T. battery at a voltage of about 60, and the H.T. 2 tapping at maximum volts (120 to 150), the lower knob on the cabinet front is pulled out and the left-hand knob pulled out if it is desired to listen to the Long Waves, and pushed in for the Medium Waves. The central control is then rotated until a station is heard, when the trimmer on the section furthest from the panel is adjusted to provide maximum results. It is then only necessary to rotate the tuning control to select the desired station. Should signals be weak, due to distance or low power, the reaction control (right-hand) is employed to build them up. The receiver is so simple that it may be handled by the youngest member of the household, and maximum results are always obtainable. Where it is desired to experiment a little, in order to ensure that every ounce is being obtained from the receiver, the battery lead H.T.1 may be moved about in the H.T. battery to find a voltage which gives maximum amplification from the S.G. valve, combined with perfect stability. This will be found to be somewhere between 55 and 70 volts, but it will generally be found that 60 volts will give satisfactory results with the majority of valves.

NOTABLE "LEADER" FEATURES

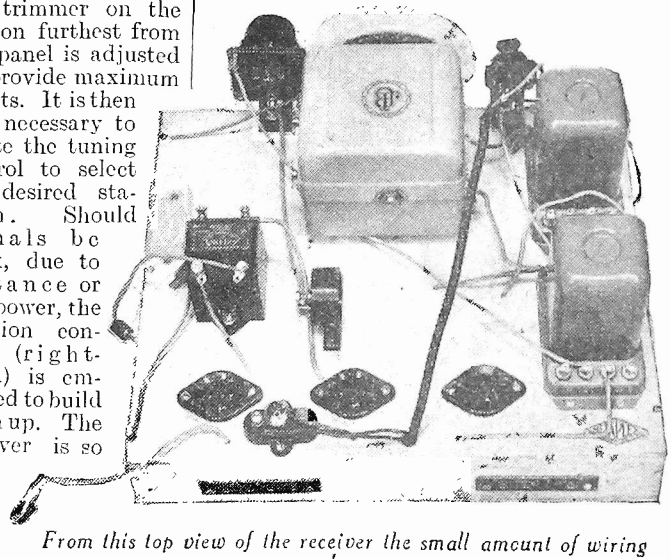
THE LATEST COILS FOR THE NEW "LUCERNE" WAVE-LENGTHS
AN EFFICIENT SCREEN-GRID STAGE FOR DISTANT RECEPTION
TUNED-TRANSFORMER H.F. COUPLING FOR MAXIMUM SELECTIVITY
SELECTIVITY *IN EXCELSIS*
AMPLE VOLUME FOR HOME RECEPTION
METALLIZED CHASSIS CONSTRUCTION
REMARKABLY EASY TO BUILD
EQUALLY GOOD ON "RADIO" OR "GRAMOPHONE"
COSTS ONLY SIXTY SHILLINGS FOR THE PARTS
THE MOST POPULAR CIRCUIT ARRANGEMENT
GANGED TUNING CONTROL FOR EASE OF OPERATION
THE IDEAL SET FOR EVERY CONSTRUCTOR

The Components

Before completing these notes we must thank the component industry for giving their whole-hearted support to this new policy, and especially Messrs. Wright and Weaire, the designers and makers of the coils; Messrs. Jackson Bros., designers and makers of the Nugang condenser; Messrs. Varley, Graham Farish, Dubilier, Bulgin, Belling-Lee, Peto-Scott, W. B. Electrical, Clix, Lissen, and Cossor.

Use these parts for The LEADER and so make certain of excellent results.

One "Metaplex" Chassis, 12in. by 10in. with 1¾ in. runners (Peto-Scott).
One Double-Gang Condenser, "Nugang" Type A. .0005 mfd. (C1 and C2) (Jackson Bros.).
Two "Universal" Screened Coils (Wearite).
One .00015 mfd. Differential Reaction Condenser (C5) (Graham Farish).
One "Niclet" 5 : 1 L.F. Transformer (Varley).
Three Chassis Mounting Valve Holders (W.B.).
One "Snap" H.F. Choke (Graham Farish).
One 20,000 ohm 1 watt Electronic Resistance (R2) (Varley).
One 2 meg. 1 watt Electronic Grid Leak (R1) (Varley).
One .2 mfd. Tubular Fixed Condenser (C6) (Graham Farish).
One 1 mfd. Fixed Condenser, Type 9200/B.S. (C3) (Dubilier).
One .0002 mfd. Fixed Condenser, Type 665 (C4) (Dubilier).
Two Terminal Socket Strips; one marked "A" and "E," the other "L.S." and "P.U." (Clix).
Six Solid Plugs (for use with terminal strips) (Clix).
One Grid Bias Battery Clip Type No. 2 (Bulgin).
One Fuse Holder and Fuse Bulb, Type F.5 (Bulgin).
Two "Junior" On-off Switches, Type S.38 (Bulgin).
One 5-way Battery Cord, fitted with wander plugs marked "H.T.—" "H.T.+2," and "H.T.+1" and spade terminals marked "L.T.+" and "L.T.—" (Belling-Lee).
Three Component Brackets (two long and one short) (British Radiogram).
Three Valves: one S.G.215; one 210 Det., and one 215 P. (Cossor).
One High-Tension Battery (Lissen).
One 9-volt G.B. Battery (Lissen).
One 2-volt Accumulator (Lissen).
One Cabinet (Peto-Scott).



From this top view of the receiver the small amount of wiring may be seen.

SOME REMOTE

It is Often Useful to be Able to Control the Receiver from Some Distant

Suggestions for Doing So

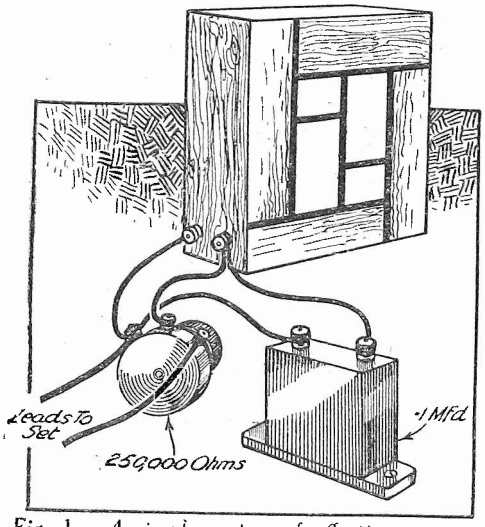


Fig. 1.—A simple system of effecting remote control of volume.

MOST set users and experimenters at some time or other wish to listen to a loud-speaker which is situated at some distance from the receiver, and whilst there is not the slightest difficulty in doing this, it is very trying to be unable to alter the volume or tone, switch off, or change over to another programme without leaving the speaker and going to the set itself. There has been at least one ingenious remote-control unit invented by means of which all the controls of the receiver itself were duplicated on a small panel which could be placed at any convenient place, and at any distance from the set, but the cost of this was far higher than that of the average modern mains-operated superhet. Obviously, such a unit, although extremely desirable in many ways, has little or no appeal to the average amateur, and in consequence, he must consider other ways out of the difficulty. It is therefore proposed in this article to make a number of practical suggestions, many of which have actually been used in some form or other by the writer, in order that the experimenter may try to, very probably, improve upon them.

Remote Volume-control

The control which is most frequently required, once the set has been tuned to the desired programme, is that which enables the volume to be varied according to the particular item being broadcast. Fortunately, it is a perfectly simple matter to provide such a control and to fit it to the loud-speaker so that it can conveniently be operated from one's armchair. The simplest arrangement, and one which can be applied to any set, consists of a potentiometer connected across the loud-speaker terminals as shown in Fig. 1. The value of the potentiometer should be about 250,000 ohms, although a lower resistance (down to 100,000 ohms or so) is sometimes rather better. This component should preferably be of the non-wire-wound type and perfectly "silent." It can be attached to the side of the speaker cabinet or, where permanent extension wires and wall-plugs are fitted, it might be mounted on a switch box fitted to the wall near the "point." There is a little "snag," which sometimes creeps in when using a potentiometer device as described, which is that the tone of reproduction is varied at the same time as the volume. This can easily be overcome, however, by connecting a .1 mfd. fixed condenser between the "dead" end of the potentiometer and the slider; this, also, is shown in Fig. 1.

When Using a Variable-mu Valve

When a set is in use which incorporates a variable-mu valve an even better, though slightly more complicated idea, can be employed. The arrangement in respect of a battery set is shown in Fig. 2, where it will be seen that the variable-mu potentiometer is removed from the set and mounted near the speaker. Three long flexible leads are used to connect it, and these should, preferably, be screened and the screening braid earth-connected. Also, in order to prevent any possible instability due to the long connections, a decoupling resistance of some 50,000 ohms is inserted between the slider of the potentiometer and the lower end of the tuning coil.

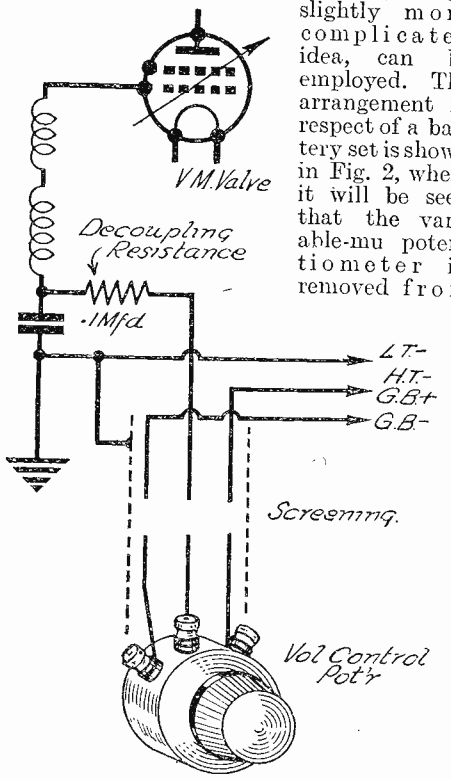


Fig. 2.—Remote volume control is easily arranged in the case of a set having a variable-mu amplifier. The connections shown above refer to a battery-operated set.

When a mains-operated V.-M. set is employed the connections are simpler still, since it is only necessary to take two long leads to the variable resistance normally employed to effect a variation in G.B. voltage, the resistance being fixed at any convenient point. Here again it is desirable, though not always necessary, to screen the extension leads. The general circuit arrangement is outlined in Fig. 3.

In both of the latter systems, there is some danger of upsetting the normal stability of the receiver, but in most cases any such tendency can be overcome by the insertion of extra decoupling resistances in the grid circuits of the V.-M. valves.

Remote Tone Control

A tone control is a useful fitting on nearly every kind of receiver, and a fairly effective one can be provided by connecting a variable resistance (about 25,000 ohms maximum), in series with a fixed condenser of .01 mfd. or .02 mfd.—depending upon whether the output valve is a triode or a pentode — between the two loud-speaker terminals. The connections referred to are clearly shown in Fig. 4, and it need scarcely be mentioned that the variable resistance may conveniently be mounted on the inside of the speaker cabinet, with the knob projecting through the side or back.

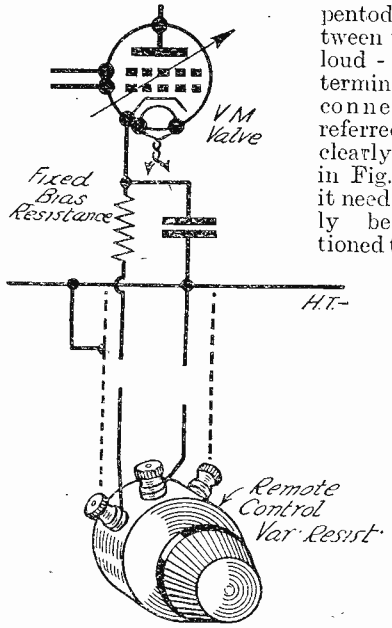


Fig. 3.—This skeleton circuit shows how remote volume control can simply be effected in the case of a mains set having a variable-mu amplifier.

A Useful Unit

Many readers will consider it a good idea to make a complete tone-control-

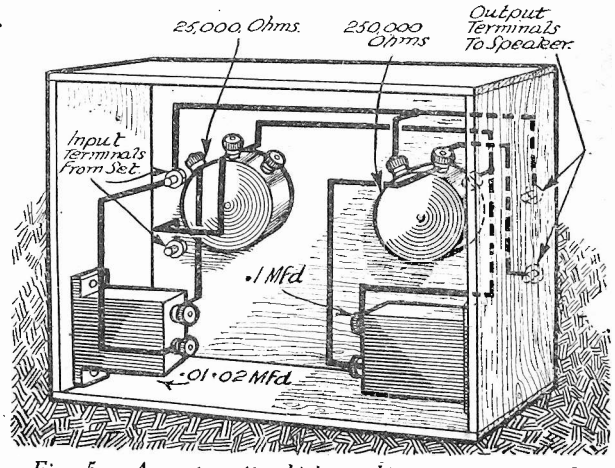


Fig. 5.—A neat unit which combines a tone control and volume control. The unit is connected between the receiver and speaker.

CONTROL IDEAS

Point, and the Writer Here Makes a Number of Useful and Practical

By FRANK PRESTON

plus-volume-control unit for attachment to the loudspeaker, and Fig 5 gives the necessary constructional details. It should be pointed out that the potentiometer used for volume-control should be of the "graded" type so that a smooth variation will be obtained over the complete range of movement of the knob; the connections given in Figs. 1, 2, 3, and 5 apply to a component of this type. The unit illustrated can be made up on a "chassis" of any convenient size according to the position in which it is to be fitted.

Remote Switching

The problem of switching the set on and off from a distance is rather more difficult than those of tone and volume control, which have already been dealt with. At least, that is true in respect of battery-operated sets, although the switching of a mains set can be accomplished very easily, simply by wiring the set to a mains plug in the same room as the speaker.

On first thought it might be considered that a similar arrangement could be employed for a battery set by taking a long wire from one accumulator terminal to one side of a remote switch, and connecting the other switch terminal to the L.T. terminal on the set by means of a second length of wire. This is impracticable, however, unless the length of the flex is only a few yards, because the resistance of the wire would otherwise be so great as to prevent the application of the correct filament voltage to the valves in the receiver. Even when the extension leads are only, say, five yards or so in length, it is well to use really stout mains flex or even vulcanized-rubber cable in order to ensure the minimum voltage drop along it.

A Switching Relay

A considerably better plan is to make use of a relay which can be mounted near the set and operated by means of a push switch. There are, or at least there were until recently, one or two suitable relays on the market, these generally being described as remote control switches. The experimenter will, however, prefer to make his own, and the main practical details are given in Fig. 6. It will be seen that a pair of electro-magnets (these may be taken from an old electric bell) are made use of, and they are mounted on an upright board attached to another horizontal board. Near the magnets is mounted an "L"-shaped strip of springy brass, riveted to which is a strip of soft iron, this forming an armature. The end of the horizontal arm of the brass is formed into a kind of hook and this bears on the teeth of a wheel (which is fitted with a pawl) attached near one end of a screwed-brass-rod spindle. The spindle also carries a wooden drum or bobbin with round-head brass wood screws fixed at equal distances round the circumference. Each of the screws is connected by means of a short length of thin wire to the spindle, which, in turn, makes contact with a brass spring bearing against it. Yet another contact spring is made from springy brass strip, and this is arranged to touch the heads of the screws in the drum. It is scarcely necessary to supply all the constructional details, since those readers who wish to make up the relay will no doubt have sufficient mechanical experience to work out the dimensions, etc., to suit odd parts which are on hand. It will suffice to describe briefly how the device works.

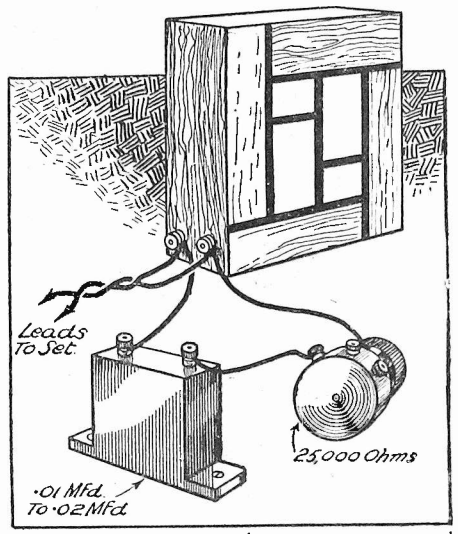


Fig. 4.—A simple and effective remote-control for varying the tone of reproduction. The .01 mfd condenser is not always necessary, but is generally desirable.

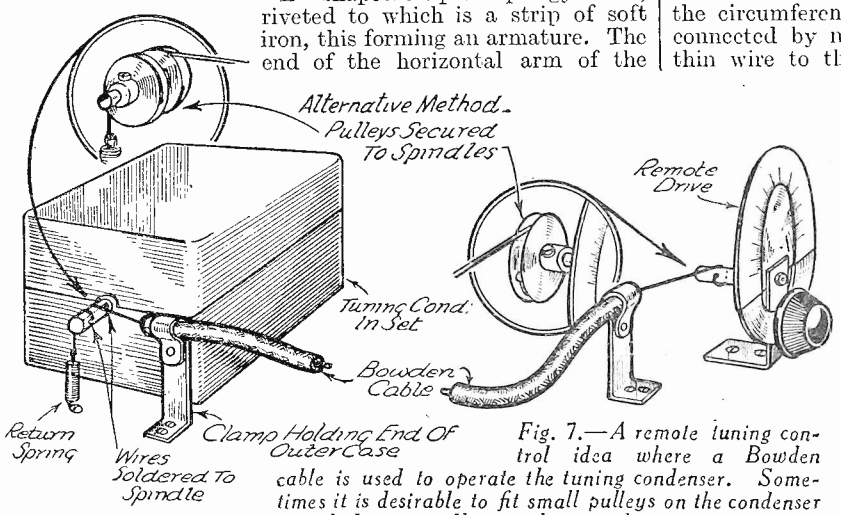


Fig. 7.—A remote tuning control idea where a Bowden cable is used to operate the tuning condenser. Sometimes it is desirable to fit small pulleys on the condenser and drive spindles to obtain a better movement.

In the first place, it should be said that the relay simply replaces the normal on-off switch fitted to the set. When the bell push is depressed current flows from the small dry battery through the windings of the electro-magnets, so causing them to draw the armature towards them. In moving, the armature drives round the toothed wheel and rotates the drum, thus causing the spring contact either to "make" or "break" contact with one of the round-head screws—contact will be "made" on the first depression, "broken" on the second, and so on. Thus, the set can be switched on or switched off simply by operating the push switch.

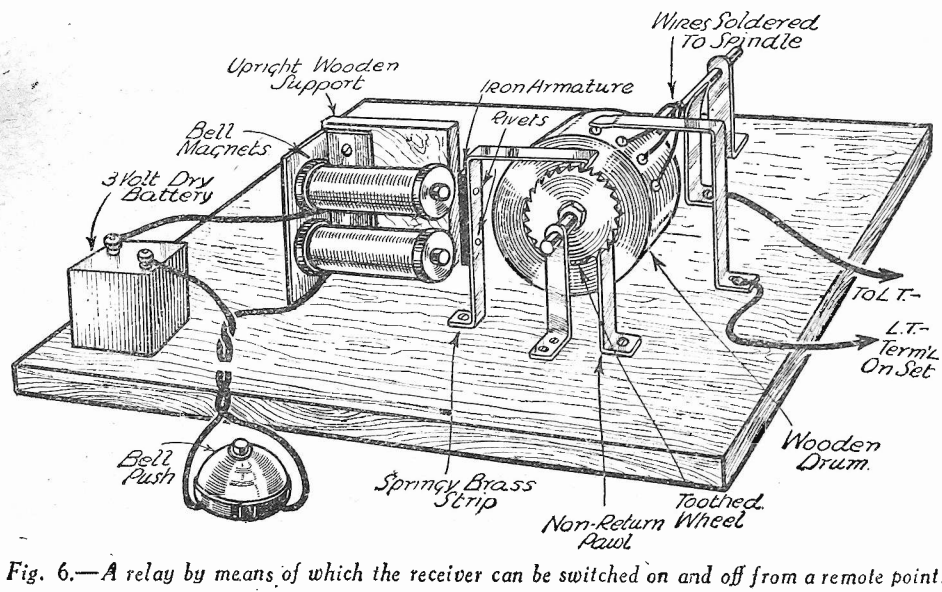


Fig. 6.—A relay by means of which the receiver can be switched on and off from a remote point.

Remote Tuning

There are no very simple methods of tuning the set to different stations from a remote point, although there are some devices which will exercise the ingenuity of the experimenter and which are well worth trying. One is illustrated in Fig. 7, where a length of Bowden cable of the kind used for motor-cycle and cycle brakes, is made use of. The outer casing is securely anchored at each end and the inner wire is attached to the tuning condenser spindle at one end and to a "duplicate" spindle, fixed to a condenser drive at the other. It will be seen that as the "duplicate" or "remote" control spindle

is rotated the condenser spindle is also made to turn. This is quite all right when rotating the spindle in one direction, but the cable does not allow a reversal of direction to be effected. A "return" spring is, therefore,

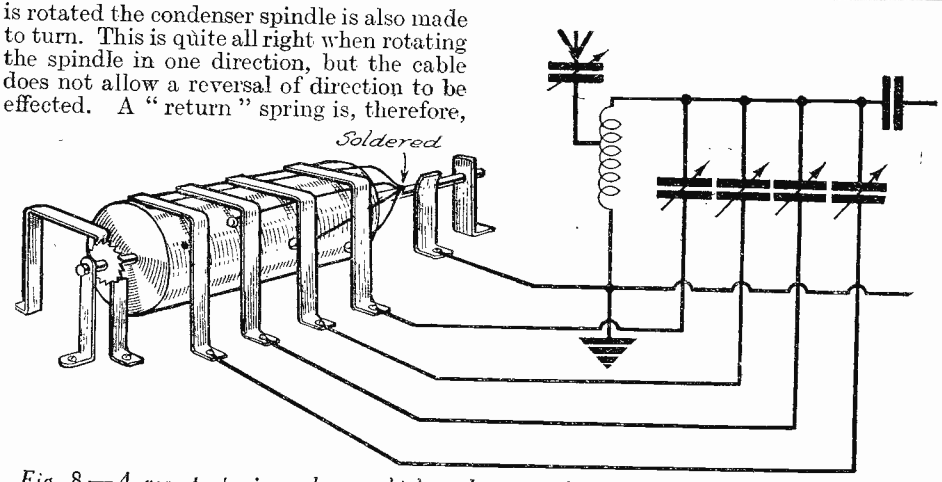


Fig. 8.—A remote tuning scheme which makes use of a relay similar to that shown in Fig. 6. This works in conjunction with a number of pre-set condensers.

mounted near the condenser, and this is attached to a short length of flexible steel wire wound once round the spindle. The whole secret in setting this arrangement into successful operation is to proportion the tension exerted by the spring and the friction of the remote drive assembly so that smooth working is obtained; this *can* be done, as I have proved in practice, but a little patience is called for.

To avoid spoiling the stability of the receiver the control cable should be effectively earth-connected—preferably at both ends.

Another remote tuning-control idea consists of using a relay similar to that shown in Fig. 6 in conjunction with a number of pre-set condensers which replace the usual variable tuning condenser. In this case the wooden drum should have screws arranged in spiral fashion, as shown in Fig. 8. The screws are all connected to the spindle and a number of spring contact arms (the actual number depends upon the number of pre-sets to be used) are arranged side-by-side to touch the screws at certain points of rotation of the drum. Each contact arm is connected to one pre-set as shown, so that each condenser in turn is connected in parallel with the tuning coil. It will be understood that the condensers must first of all be adjusted so that each one enables the coil to tune to a particular station. After that the change can be made from one station to another by pressing the plunger of the bell-push. One objection to this scheme is that one must always pass from one station to another in a definite and pre-arranged sequence, but this only means that in order to receive, say, London Regional, the plunger must be depressed three times when the set is tuned to Fécamp, or that it must be depressed perhaps twice to receive London National.

It is possible to combine the ideas represented by Figs. 6 and 8 by using a single relay and two sets of contacts; in that case the set would be switched off between each programme. The scheme is worth a trial, anyway, if you are mechanically inclined. The arrangement would obviously be somewhat complicated, but it lends itself to much interesting experiment.

A.V.C. at the B.B.C.

Novel ideas on automatic volume control have been devised by the Research Engineers of the Clapham Branch of the B.B.C., and this article, by A. Ashton Stewart, explains how A.V.C. is used on the short-wave super-hets. used for transatlantic relaying.

RECENT transatlantic relays done by the B.B.C. have been so successful that outside listeners have often thought that reception was being done with the Post Office super-hets. at Baldock!

Automatic volume control is used on the seven-stage Post Office sets, and the now-successful B.B.C. short-wave reception is largely the result of automatic gain control as applied to the experimental relaying set. B.B.C. engineers have tried a number of super-hets. for short-wave relaying, but at the end of last year it was felt that the time had come to fit up a really modern short-wave super-het. rack. Moreover, the introduction of new valves for variable-mu high-frequency working, and the popularity of diode detection and of automatic volume control, meant that the new short-wave super-het., when built up, would not be so very different from a really first-rate amateur home-built receiver. It is interesting to study the lay-out of this super-het. as being typical of the way in which automatic volume control is applied to B.B.C. apparatus.

The Receiver Employed

The receiver has a variable-mu stage preceding the first detector, which is of the ordinary triode type. The automatic volume control feeds back into the grid circuit of the variable-mu valve. A separate oscillator, tuned by a .00015 mfd. condenser, is transformer-coupled back into the grid circuit of the first detector. There are two transformer-coupled intermediate frequency stages and a diode second detector.

Diode Second Detector

Now we come to the automatic volume control section of the circuit. After initial experiments with quiescent automatic control it was decided not to use this system, and what is really a much more effective arrangement has been adopted. As a diode is used in the second detector position of the super-het. a separate valve is used for the automatic gain control. It feeds back a variable bias to the grid of the first H.F. valve, as already stated, and, in addition, it feeds back to the first valve in the I.F. stage. The automatic volume control valve itself is coupled to the second I.F. stage, which feeds the diode detector. The control valve is not fed from the same high-tension supply as that which feeds the super-het.; it has its own 120-volt battery. The control valve works as an anode-bend detector, and the setting of the detection point is controlled by a 1,000-ohm potentiometer.

The A.V.C. System

The automatic volume control arrangement is really very simple. The grid bias potentiometer is arranged so that the valve is fairly heavily over-biased in the negative direction. This means that there is no anode current flowing, and as the anode of this automatic volume control valve is connected through a leak to earth, it is virtually at earth potential. It must be remembered that this is only possible because of the entirely separate high-tension supply for the automatic gain control valve.

If the signal voltage increases above a certain amount (this depends, of course, upon the exact setting of the 1,000-ohm potentiometer), a small amount of anode current flows. This, owing to the unusual system of connections, means that the anode of the automatic gain control valve is negative so far as the super-het's earth connection is concerned. This bias is carried back through a suitable decoupling circuit to the grids of the first H.F. valve and the first valve in the intermediate frequency stage.

Manual Control

As a matter of fact, there is a two-pole switch which shifts this bias back on to the grids of the high-frequency and first I.F. valves, while in the other position it enables the hand-controlled potentiometer to be used. This helps the engineers when they are tuning in.

The B.B.C.'s automatic volume control system, it must be realized, is not for the purpose of giving even volume of all stations all round the dial (as is the case with ordinary receivers), but for maintaining an even signal on, say, the transatlantic transmissions, and to counteract fading. The American transmitters are tuned in with the additional 10,000-ohms potentiometer used as a hand volume control. The 1,000-ohms automatic volume control potentiometer is then adjusted so that the set gives the correct gain figure; the separate automatic volume control valve then counteracts all normal fading.

Component Values

A few values of the components used in the super-het. and automatic volume control systems may be of interest to home constructors. It should be noted that the automatic volume control valve, as well as most of the super-het. stage valves, is of the indirectly-heated mains type. The first detector and separate oscillator valves are of the ordinary battery type.

600 Kilocycles I.F.

So far as the super-het. is concerned, it should be noted that the minimum frequency at which the intermediate frequency stages are set to operate is usually 600-kilocycles. This cuts out second-channel interference, a bugbear of short-wave super-het. operation, to a large extent. The intermediate-frequency stages, however, are tuned by separate .0005-microfarad condensers, so that if there

(*Continued on page 1145*)

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

USEFUL DATA FOR THE WIRELESS AMATEUR

This Article Shows How by the Use of Some Simple Formulæ and Rules-of-Thumb Much Irksome Calculation connected with Radio May be Avoided

THERE is no doubt that the average constructor and experimenter dislikes his wireless mixed with "maths," and carefully avoids calculations and formulæ whenever possible. For this reason any short cuts for arriving at values of resistances, number of turns on coils, size of condensers, etc., are always welcome. In the following paragraphs are given a number of simple facts and formulæ which every serious constructor should know. They are expressed in a form which can be easily remembered, and so can instantly be applied when needed, thus saving the need for referring to books while in the middle of set building.

Rules Regarding Tuning Circuits

Let us first deal with some elementary facts concerning the aerial circuit. We are all familiar with the use of a condenser connected in series with the aerial and used as a selectivity device as in Fig. 1. Now, variations in the capacity of this condenser not only affect the selectivity of the receiver, but also its sensitivity and its wavelength range. It is worth while remembering that a decrease in the capacity of this condenser means: (1) An *increase* in selectivity; (2) a *decrease* in sensitivity; (3) a *lowering* of the wave-range of the receiver. An increase in its capacity, or its removal from the circuit (aerial joined direct to coil) gives the opposite effect.

If you are designing your own tuning coils much calculation can often be avoided by remembering the simple rule that the wavelength of a coil is very roughly proportional to the number of turns. For instance, if a 60-turn coil tunes the receiver to a wavelength of 300 metres, then a similar coil with three times as many turns, namely, 180 turns, would tune to approximately three times this wavelength, that is to 900 metres. In the case of a short-wave coil the same rule applies; thus, if a 3-turn coil tunes to 20 metres then a coil of 6 turns would tune to 40 metres, and so on.

Length of Wire for a Frame Aerial

If you are building a receiver using a frame aerial there is a very easy method of determining the amount of wire necessary. Naturally, the number of turns varies with the size of the frame, but the *total length of wire* remains fairly constant. Thus the length required for the medium-wave band under the Lucerne plan is approximately 70 ft., while for the long waves a total of about 210ft. is required. This is assuming, of course, that the frame is tuned with the usual .0005 mfd. variable condenser. With a knowledge of the length of wire required it takes but a moment to determine the number of turns for any size frame. For

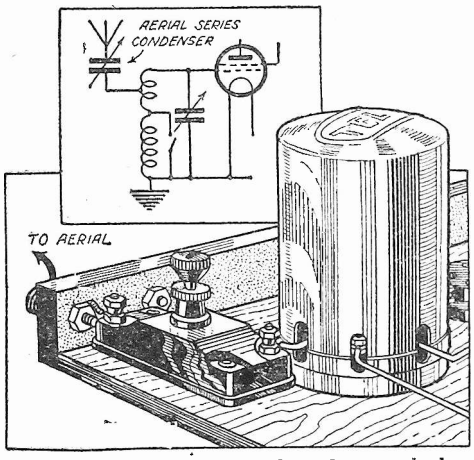


Fig. 1.—The series aerial condenser which is a valuable selectivity device.

example, you may decide on a frame 12in. x 14in. The total length for one turn round the frame is clearly 52in. This length, divided into 70ft. and 210ft. respectively, will give the turns necessary for the two windings, namely 16 and 48 turns.

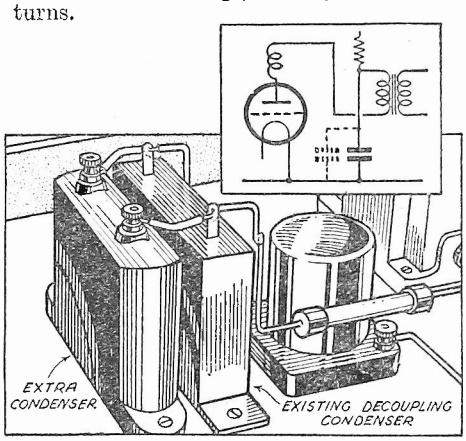


Fig. 2.—Improving the decoupling by increasing the capacity of the by-pass condenser.

Frequency and Wavelength

Nowadays the radiations of broadcasting stations are usually recorded both by their *frequency* and by their *wavelength*. However, it sometimes happens that you may know only the wavelength of a certain station when you wish to know its frequency, or *vice versa*. The key to the conversion lies in the number "300,000." This is worth remembering, for to convert wavelengths into frequency all you have to do is to divide 300,000 by the wavelength, while to convert frequency into wavelength you divide 300,000 by the frequency. *Example:* What is the frequency of a station whose wavelength is 250 metres? *Answer:* $\frac{300,000}{250}$ = 1,200 kilocycles. *Example:* On a receiver calibrated in frequencies a station is received at approximately 950 kilocycles on the tuning scale. What is its wavelength? *Answer:* $\frac{300,000}{950}$ = 315.8 metres.

Selectivity and Number of Tuned Circuits

Regarding the selectivity of a receiver a rough guide is provided by the number of tuned circuits. Thus a receiver with two tuning coils will be more selective than a set with only one similar coil. Similarly, a set with three tuned circuits will be proportionately more selective than one with only two tuned circuits. This is assuming, of course, that similar types of coils are used in each case. For instance, the rule does not always hold good when comparing air-cored coils with iron-cored ones, since the latter are usually more selective.

It does not matter very much what is the position of the tuned circuits. Thus the selectivity of a two-coil set is approximately the same, whether the two tuned circuits are placed both in front of the first valve, as with a band-pass input circuit, or whether one is used as the input circuit and the other as an inter-valve coil.

Another useful point to know regarding selectivity concerns band-pass tuners. If the two coils of a band-pass filter are coupled by means of a condenser, then the tuner will be more selective but less efficient at the short-wave end of the tuning range than at the long-wave end, while the opposite characteristics are manifested when the two coils are inductively coupled.

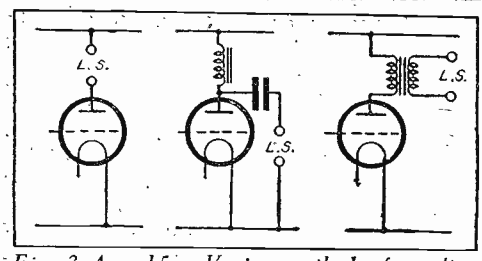
Transformer Ratios

Turning our attention to the low-frequency stages of the receiver there are one or two useful rules regarding coupling and decoupling.

When an L.F. transformer is used for coupling, the ratio of the transformer is chiefly dependent upon the impedance of the preceding valve. A high-impedance valve should be followed by a low-ratio transformer, and a low-impedance valve by a high-ratio transformer. This rule does not apply in the case of class B amplification.

In determining the values of decoupling condensers and resistances, remember that the higher the resistance which is used the smaller may be the condenser, and *vice versa*. Thus, if sufficient decoupling were provided by the use of a 2 mfd. condenser in conjunction with a 20,000-ohm resistance, then an increase in the value of the resistance to, say, 40,000 ohms would enable a smaller condenser, such as a 1 mfd., to be used. It is useful to know this, since sometimes it is quite permissible to use a large decoupling resistance (such as in the plate circuit of a detector valve, where it may combine the functions of

(*Continued overleaf*)



Figs. 3, 4, and 5.—Various methods of coupling the speaker to the output valve.

THE BEGINNER'S SUPPLEMENT

(Continued from previous page)

a voltage-dropping and a decoupling resistance). In which case a comparatively small condenser may be used with a corresponding saving in cost. On the other hand, when a set shows a tendency towards L.F. howling or motor-boating, and where an increase in the value of the decoupling resistances might upset the working conditions of the valves, additional decoupling may be provided by an increase in the capacity of the decoupling condensers, either by using larger ones, or by connecting additional condensers in parallel with the existing ones as in Fig. 2.

There is a very simple rule for finding the approximate grid bias for an L.F. amplifying valve of the ordinary triode type. It is obtained by dividing the H.T. applied voltage by twice the amplification factor of the valve. For example, suppose you have a valve, such as a Cossor 230XP, and want to know the correct grid bias, having mislaid the pamphlet issued by the makers. From PRACTICAL WIRELESS Data Sheet No. 10 you find that this valve has an amplification factor of 4.5. Using the maximum anode voltage of 150 volts, the grid bias required is 150 divided by 9=17 volts (approx.).

In the case of a mains receiver a knowledge of the correct bias voltage is not sufficient. The bias voltage is obtained by means of a resistance across which the required voltage is dropped. The value of this resistance is easily found by dividing the total anode current of the valve into the bias voltage and multiplying the answer by 1,000. Thus, if the makers state that the anode current of the valve is 10 milliamps at the maximum anode voltage of, say, 200, and the necessary grid-bias is 8 volts, the value of the required resistance is $\frac{8}{10} \times 1{,}000 = 800$ ohms. The value thus arrived at also holds good for lower values of applied H.T. voltage, since with a lower voltage the anode current becomes less and so the drop in voltage across the bias resistance becomes less. In other words, when a lower H.T. voltage is used the grid bias automatically adjusts itself to a lower figure. There is one warning needed when calculating the value of a bias resistor for a pentode valve, and that is that the "total anode current" must include the current taken by the screen. For example, to find the value of bias resistor for a pentode taking 60 m.a. anode current and 10 m.a. screen current and requiring a bias voltage of 22 volts you must add together 60 and 10 milliamps, divide this into 22, and multiply the answer by 1,000, thus: $\frac{22}{70} \times 1{,}000 =$ 314 ohms. Say 300 ohms, as the nearest round figure.

When we come to deal with the output stage of a receiver there are three very handy rules-of-thumb which are well worth knowing and which can easily be memorized. The first concerns the impedance of the external circuit when using an ordinary three-electrode valve. What is meant by the "external circuit" is either the speaker windings, when the speaker is connected directly in the plate circuit, as in Fig. 3, or the choke windings, when choke output is used, as in Fig. 4, or, again, the transformer primary, when transformer output is adopted, as in Fig. 5. In each case the impedance of the speaker, choke, or transformer primary should be one and a half to twice the impedance of the output valve. (The impedance of a valve is the same thing as its A.C. resistance).

If you do not know the impedance of your speaker, then you take it as a rule that in the case of a moving-iron speaker it is approximately equal to its resistance. With a moving-coil speaker its impedance if about twice its D.C. resistance.

When endeavouring to match your speaker with the output valve, by means of an output transformer, the ratio of the required transformer is given by the formula: Ratio = $\sqrt{\frac{\text{Optimum load of valve}}{\text{Impedance of speaker}}}$

The "optimum load" of the valve means the impedance of the external circuit which is most suitable. We have already seen that this, in the case of a three-electrode valve, is equal to one and a half to twice its impedance. In the case of pentode valves, however, there is no easy rule for finding the optimum load, and the makers should be consulted. As an example of how the formula is used, let us take the case of a speaker whose impedance is 2,000 ohms, and which is to be used with a valve requiring a load of 4,000 ohms. The ratio of the necessary transformer equals: $\sqrt{\frac{4{,}000}{2{,}000}} = \sqrt{2}$. The square root of 2 is 1.41, and, therefore, the ratio of 1.41 to 1. The nearest standard ratio of 1.5 to 1 would be suitable.—W. B. RICHARDSON.

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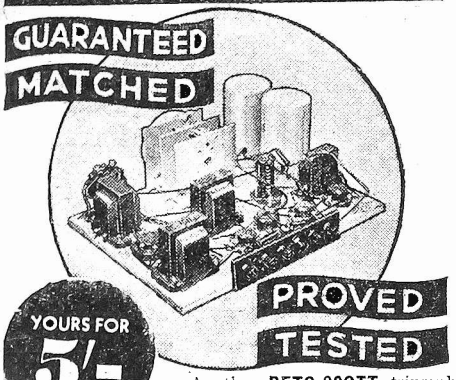

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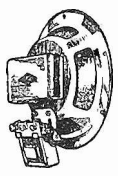

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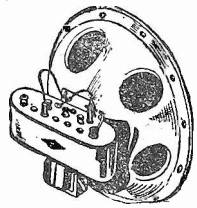

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Practical Television
Conducted by H. J. Barton Chapple, Wh.Sch., B.Sc., Etc.
MARCH 10th, 1934. Vol. I. No. 10.

CHOOSING YOUR TELEVISION MOTOR

A Description of the Functioning of an Electric Motor, with Some Useful Notes Regarding its Maintenance.

FOR nearly all forms of television receivers, the principal exception being those employing a cathode ray tube, a source of rotary motion is required, and the only practicable method of driving a scanning disc, mirror drum, mirror screw, or other form of exploring device, is by means of a small electric motor. Such machines are perhaps rather outside the experience of the average wireless amateur, so a few words of explanation concerning the principles upon which a motor works, the different types of motor available, and hints on the selection and operation of a suitable machine will prove of value to readers.

Electric Motor and Dynamo

To begin with, it is necessary to realize that an electric motor is merely a machine for converting electrical energy into mechanical energy, just as a dynamo is a machine for converting mechanical energy into electrical energy. In fact, the two types of machine are similar in design and a dynamo can often be used as a motor and vice versa. Fundamentally, a motor consists of an arrangement of coils of wire pivoted in a strong magnetic field, means being provided for passing an electrical current through the coils.

First Principles

The action of a motor can readily be understood by making reference to Fig. 1, which shows a single loop coil A, mounted within the circular space between the two poles N and S of a magnet. The reader must imagine a number of lines of magnetic force connecting the two poles, as indicated. Provided that no electric current is allowed to pass through the coil A, these magnetic lines will be undisturbed, but if a current is passed through the loop, the magnetic field will be distorted, as indicated in Figs. 2 and 3.

Here, the small circles A and B represent sections through the upper and lower limbs of the coil, and we will suppose that the current is going down into the page in the case of the top limb and coming out of the page in the case of the lower limb. The magnetic effects of these currents will be as indicated by the concentric circles, which represent the magnetic lines of force due to the current in the coil, the arrows showing the direction of the magnetic force. The diagram shows also the horizontal lines of force due to the poles of the field magnet.

Effect of Magnetism

It will be clear that above A and below B the magnetism due to the coil or "armature" is assisting the field due to the

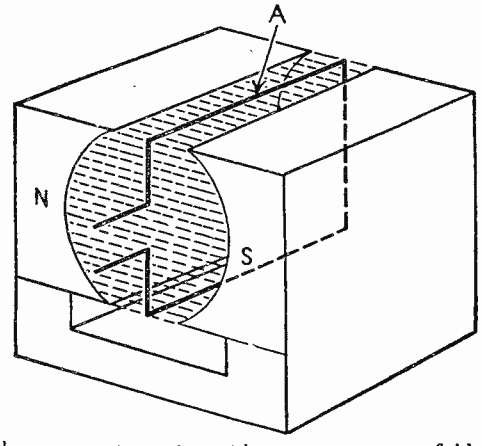


Fig. 1.—A simple coil loop in a magnetic field to illustrate the motor action.

magnet, while below A and above B the armature field is in opposition to the field of the magnet. The resultant field will therefore be something like that indicated in Fig. 3. Now, although it is not a strictly scientific way of thinking about these things, it is both correct and convenient to consider magnetic lines of force as always trying to shorten themselves, and we can imagine the "elastic" lines in Fig. 3 endeavouring to straighten themselves out, and in so doing driving A downwards and B upwards, as indicated by the arrows.

This is exactly what occurs in a motor, and the movement of A and B and of the corresponding wires of the other coils which go to make up the complete armature constitute the rotation of the motor. There is, of course, much more than this in the full theory of electric motors, but enough has been said to give a slight insight into the operating principle.

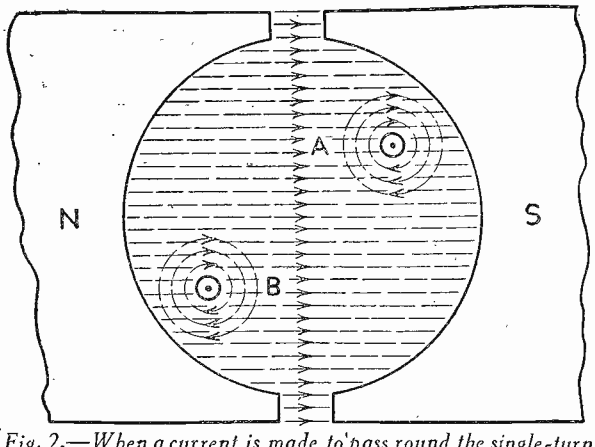


Fig. 2.—When a current is made to pass round the single-turn loop a magnetic field is created round each limb of the loop.

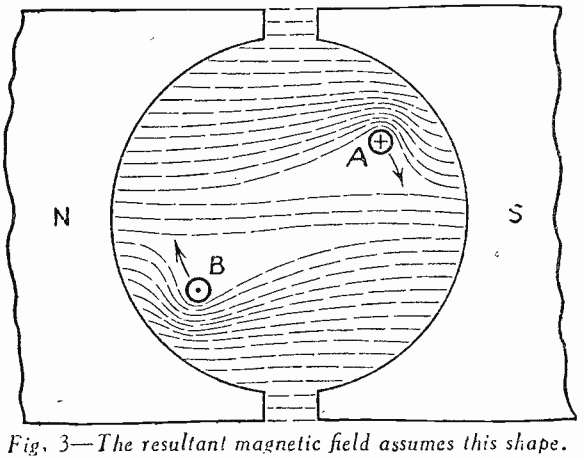


Fig. 3—The resultant magnetic field assumes this shape.

Suitable Types

Whether the motor be a tiny affair, suitable for driving a toy railway, or a machine of several thousand horse-power driving a rolling mill, similar principles are involved. For television purposes only a small amount of power is required, amounting to only a fraction of one horse-power, the average value being about one-thirtieth of a horse-power, although slightly higher ratings are likely to be more reliable—say one-twentieth to one-fifteenth of one horse-power.

In view of the fact that for satisfactory reception the motor has to be run in absolute synchronism with the scanning mechanism at the transmitting end, it is clear that what is required is a motor which normally runs at a steady and constant speed, thus requiring only a slight effort on the part of the synchronizing mechanism to keep it in step. Certain types of motor are better suited in this respect than others.

Considering first those motors intended for operation on direct current, either D.C. mains or some form of battery, there are two main types—those in which the field magnet is energized by a coil of wire connected in series with the armature (known as a series-wound machine) and those in which the field winding is connected in parallel with the armature (known as shunt-wound motors). It is the shunt-wound machine which is the more suitable for television purposes, because, in the first place, it runs at an almost constant speed, and secondly, preliminary speed adjustments can be made easily by connecting a variable resistance in the field circuit. Further reference to speed regulation will be made later in this article.

When we come to consider motors for running on alternating-current mains, there are several types from which to choose. The true synchronous motor is similar to a direct-current shunt motor, but the armature is fed with alternating current, while the field requires separate excitation from a direct-current source. This is a somewhat complicated arrangement for such a small motor, but the transmitter used by the B.B.C. includes one of these synchronous motors, and the end plate of this machine, together with the mirror drum it drives, and the associated optical equipment, are clearly shown in Fig. 4. Synchronous motors are ideal for those areas fed from the same network of A.C. mains which supply the power to this transmitting machine, but at the moment this area only embraces Marylebone and part of Hampstead. When other sections

of the A.C. mains are linked up shortly, however, it is anticipated that this area will be extended considerably.

The pure induction motor, in which the rotor is not connected to the supply, but is simply a short-circuited winding, while fairly constant in speed when running under a constant load, is not amenable to close-speed regulation, and must be ruled out for television, and we are thus left with what is known as the commutator-type A.C. motor, of which several types are made.

For television purposes, however, the most satisfactory is that commonly known as a "universal" motor, because it can be used quite satisfactorily on either an alternating or a direct-current supply. In construction it is almost identical with an ordinary direct-current motor, with the exception that the field magnet is built up from a large number of thin plates or laminations in order to avoid losses due to the generation of "eddy currents" in the metal of the magnet and a certain type of distortion of the magnetic field.

Avoiding Sparking

It should be explained that in both direct-current and universal machines of the type described, it is necessary to introduce the mains current into the spinning coils of the armature by means of contacts called brushes which bear upon a metal ring attached to the armature. This ring is termed the commutator, and is divided up into segments according to the number of windings in the armature, the segments being separated from each other by mica insulation. As the brushes (which are generally small blocks of soft carbon) make contact with successive bars or sections of the commutator, adjacent segments are momentarily short-circuited.

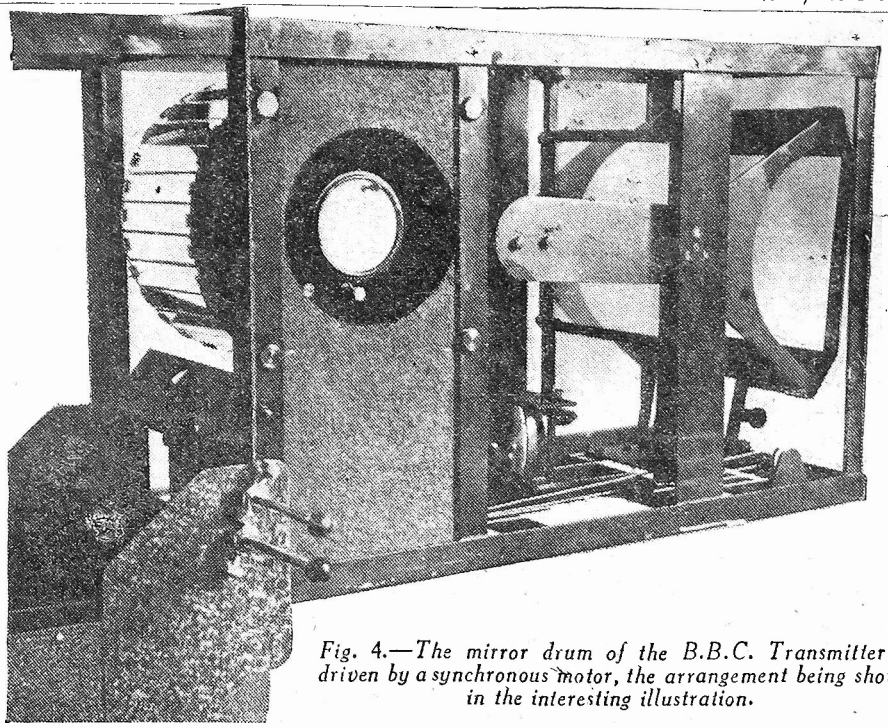


Fig. 4.—The mirror drum of the B.B.C. Transmitter is driven by a synchronous motor, the arrangement being shown in the interesting illustration.

It is therefore essential that the mechanical design of the commutator and brushes, and the electrical design of the machine is such as to avoid sparking at the brushes. In large motors many devices and tricks of design can be employed to this end, but in the small motor most of these are not practicable. For example, in big machines the brushgear can be "rocked" or moved in order that commutation shall occur in a strong magnetic field. Rocking gear cannot be fitted to very tiny motors, but a well-designed motor, whose commutator and brushes are in good condition, can generally be relied upon to run without sparking for long periods before any attention is required.

One device adopted in the design of many small motors is to incline the slots in the armature which hold the coils at an angle to the axis of the armature, and this is shown very clearly in Fig. 5, which depicts the armature of an actual motor I have used with great success in many of my experiments. This avoids certain periodic oscillation of the magnetic flux which is liable to cause sparking.

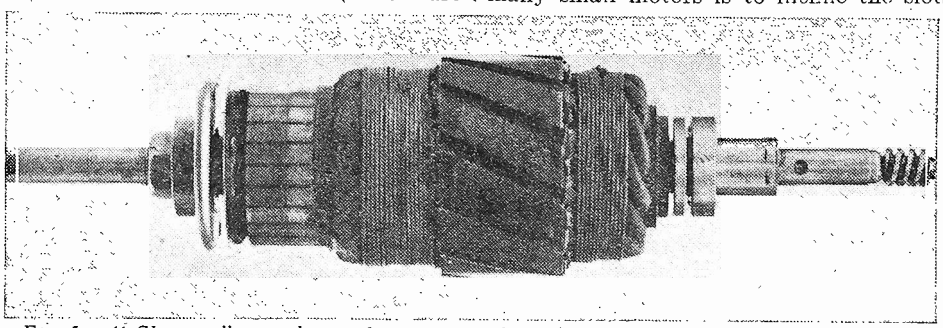


Fig. 5.—"Skewing" or inclining the armature slots of a television motor is sound practice.

Curing the Trouble

Sparking, if it does occur, has a bad effect on television reception, because the radiant energy of the sparks is picked up by the receiver and amplified, producing interference which is reproduced on the image screen as a series of white patches. The secret of sparkless running—provided the machine is of good design—is a smooth commutator, lightly lubricated, and well bedded brushes. The commutator should be cleaned initially with the finest emery cloth. Next, reverse the emery and turn the armature by hand so that the brushes are ground by the emery to the exact contour of the commutator.

Then wipe the commutator perfectly clean with a soft rag, and finally with a rag *very lightly* oiled. The motor should now be run for an hour or so on load, and the tension of the brush springs adjusted. Once running well, the only attention should be to hold a piece of dry, clean rag against the commutator very occasionally when running, to remove carbon dust which may have collected. After a period of use, the commutator will develop a hard, polished "skin," and will then run almost indefinitely without trouble.

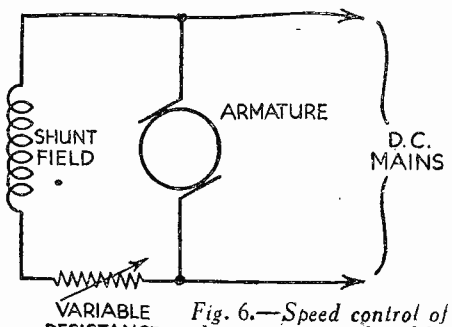


Fig. 6.—Speed control of shunt motors is effected by using a variable resistance in series with the field winding.

Speed Control

The normal speed for a television drive to suit the present transmissions is 750 revolutions per minute, which is rather slow for a small motor, but machines rated to run at that speed are obtainable. It is, however, necessary to provide some method of making fairly accurate speed adjustments. For shunt-wound motors, a variable resistance in the field circuit is the best, see Fig. 6. Increasing the resistance weakens the field and increases the speed, and *vice versa*. Care must be taken, however, to see that the speed regulator has no "off" position, for if the field circuit of a shunt motor is broken, the machine "runs away" and develops a very high speed, which may cause it to fall to pieces.

With the universal motor, speed is best controlled by varying the voltage applied to the motor, and this can be effected by including a variable resistance in series with the machine.

(Continued from page 1138)

is any tendency for the valves to pick up medium-wave interference, the whole of the intermediate-frequency circuits can be retuned.

While the I.F. stages are transformer coupled, parallel-feed is used between the first H.F. valve and the first detector. These circuits are tuned by .0001-mfd. condensers and the coupling is by means of a .001-mfd. condenser.

In the automatic volume control unit the indirectly-heated valve has its grid connected through a .001-mfd. condenser to the output of the intermediate frequency stages, and there is a 1-megohm leak and 2-mfd. condenser between the grid and cathode. The automatic volume control potentiometer has a winding of 1,000 ohms, while the hand control potentiometer for the bias of the two variable-mu valves is in series with a 10,000-ohms resistance. Both these resistance windings are shunted by a 2-mfd. condenser. There are 1-megohm leaks in series with each lead back to the grid circuits of the two variable-mu valves.

Just how effective this automatic volume control system is can be proved by listening to any transatlantic relay conducted by the B.B.C. engineers.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

DISTURBANCE SUPPRESSION

THE different kinds of disturbance met with in wireless reception, their causes and cure are dealt with in a booklet bearing the above title, and recently issued by Belling Lee, Ltd. Particulars are given of the Belling Lee condenser suppressor, and various diagrams show how this useful component can be connected in circuits. Particulars are also given of a D.C. ripple suppressor designed to eliminate hum and other L.F. noises from "rough" D.C. mains, such as those fed from mercury arc rectifiers. Chokes for H.F. mains disturbance are also dealt with in this useful booklet, copies of which can be obtained for 3d., post free, from Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

MARCONIPHONE PRODUCTS

PARTICULARS of the latest Marconiphone receivers and radiograms are given in an attractive folder just issued by the Marconiphone Company, Ltd. Amongst the receivers there are a 7-valve all-mains super-het; a 5-valve super-het; a 6-valve super-het battery portable with M.C. speaker and A.V.C.; a 4-valve battery receiver, incorporating Ferrocart coils; and 3-valve and 2-valve battery receivers, the latter model being priced at only 4 guineas, complete with a well-finished cabinet of modern design. The radiogram section includes 7-valve and 5-valve super-het models for A.C. or D.C. mains working, at prices varying from 50 guineas to 20 guineas. P.M. moving-coil speakers in cabinets, and the new Marconi pick-up are also listed. Copies of the leaflet can be obtained from the Marconiphone Co., Ltd., Radio House, 210–212, Tottenham Court Road, London, W.1.

THE COSSOR WIRELESS BOOK

A NEW edition of this useful little book has recently been issued by A. C. Cossor, Ltd. Its pages are packed with particulars of all the new types of Cossor valves, and various phases of radio technique. Besides assisting in the selection of the correct types of Cossor valves for a particular receiver, the book also helps to solve many problems that frequently arise in radio reception. Among the subjects dealt with are Resistances, Chokes and Condensers; Inter-Valve Coupling; Method of H.F. Coupling; Class B Amplification; and the Super-het—and How it Works. A useful table of Resistance Values for Decoupling and Voltage Dropping, and lists of European Broadcasting Stations and the Chief S.W. Stations of the World are also included, together with a miniature Broadcasting Map of Europe. At the end of the book seven pages are devoted to definitions of various radio terms. Readers are advised to write for a copy of this invaluable little book to A. C. Cossor, Ltd., Publicity Dept., Highbury Grove, London, N.5.

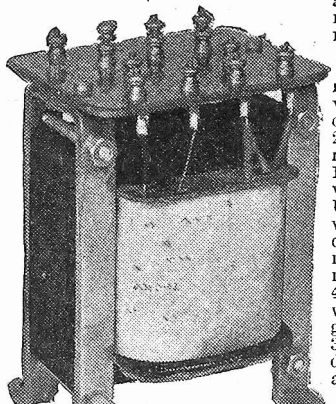
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

McDANIEL MAINS TRANSFORMER

THE transformer illustrated below is Type A.1, manufactured by G. McDaniel and Co., of Romford. As may be seen, it is of the unshielded type, and is provided with a substantial terminal board on its upper surface. The core is of substantial dimensions, and the frame bolts do not pass through the core, The model submitted for test was, unlike some unscreened models of this type which we have seen, firmly bolted up and no troubles were experienced from hum due to vibration of the laminations of the core. The windings are carried on a paxolin former, and care has obviously been expended in arranging the windings to ensure good insulation, etc. The terminals are rather on the small side, but provided the connections are soundly made this will not prove of much moment. The particular model under review is rated to deliver 250-0-250 volts at 60 m/A; 4 volts at 1 amp., and 4 volts at 3 amps. Under test it was found to be conservatively rated, and the regulation of the 4-volt windings was very good. The 3-amp. winding delivered 4 amps at 3.9 volts and would therefore satisfactorily operate four indirectly heated valves without trouble. In view of the price of this transformer, namely 22s., it represents very good value. Messrs. McDaniel make a number of other ratings, as well as transformers for model motors, lighting sets, etc., and a copy of their list should be obtained. The address is 178, Mawney Road, Romford, Essex.



The McDaniel mains transformer.

ANOTHER DRYDEX BATTERY

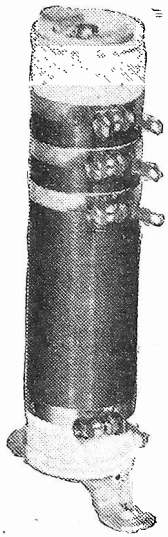
A NEW Drydex 132-volt battery, with tappings at 1.5, 3, 4.5, 9, 63 and 132 volts has been introduced as suitable for the Philips 834B receiver. The new battery is type H.1088, of the Yellow Triangle series, and its dimensions are 9⅞in. by 6⅝in. by 3 1/16in. The list price is 16s.

GOLTONE SHORT-WAVE COILS

THE illustration at the foot of this page shows a representative collection of the special Goltone short-wave coils, together with some special porcelain stand-off insulators, which, whilst not intended specifically for mounting the coils, will prove very useful for that purpose. The coils are manufactured from soft-drawn copper tube in either 3-16th or ¼in. diameter. The ends are flattened and drilled to take a quarter-inch screw. In view of the fact that these coils are intended for very high frequencies, where all resistance effects have to be avoided, the coils are lacquered to prevent oxidization. The diameter of the coil is 3ins., and they may be obtained in any number of turns from 1 up to 15, at 4d. per turn for the small size tube, and 5d. per turn for the quarter-inch tube. The insulators cost 9d. each, and the corrugations provide a large leakage surface, whilst the 2 B.A. thread at the upper end provides a convenient fitting for the short-wave coils. Many other uses will occur to the experimenter, such as an anchor for leading-in wires, etc.

EVRIZONE ALL-WAVE SUPERHET

DETAILS have been received of a super-heterodyne receiver which operates on all wavelengths from 13 to 2,300 metres. The receiver is self-contained and intended for A.C. mains operation. A special tuning system is employed and this provides for four sections on the short-wave band (13 to 33, 24 to 56, 48 to 100 and 90 to 160 metres), and the usual two broadcast bands, namely 250 to 600 and 1,000 to 2,300 metres. No coil changing has to be carried out, a special patent short-wave coil unit being fitted, and this is operated by a knob on the control panel. Rectification of the mains supply is effected by a metal rectifier and a moving-coil loud-speaker is fitted. Two I.F. stages of the variable-mu type are incorporated, and the price is £32 complete. A battery version, employing a Class B output stage is also obtainable at £25 complete with cabinet and batteries. The makers are S. Nott, Evrizone Works, 69, Albert Road, Bromley, Kent.



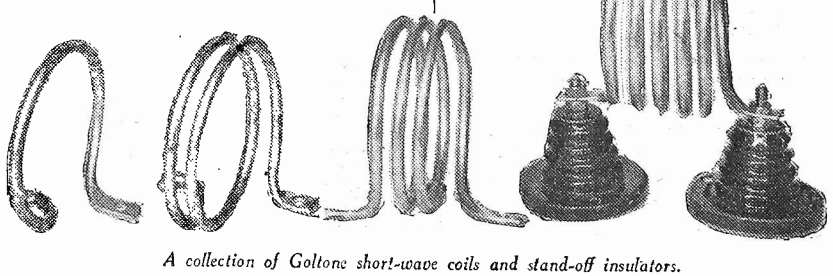
One of the skeleton D.C. mains resistances manufactured by Messrs. Bulgin, and described on this page last week.

"SME" SOLDERING PASTE

IN view of our recent discussion, "Soldering or Terminals," readers who favour the soldered method of connection will welcome the introduction of a paste which combines a flux and solder in one. The product is put up in tubes and dispenses with the necessity for a separate stick of solder. To use it, the part to be joined is cleaned, a small quantity of the paste smeared over the joint and a hot iron applied. The paste hisses for a moment and then suddenly clears away, leaving a neat blob of solder round the joint, which is firmly made and is no different in aspect or efficiency from a normally soldered one. The makers, in fact, guarantee it to be real solder, to electrical standard, and non-corrosive. It appears actually to be finely ground solder mixed with a paste flux, although it possesses the added advantage that it was found in a number of cases unnecessary to effect any preliminary cleaning of the joined parts. A badly corroded piece of copper and a rusty piece of steel, for instance, were thoroughly coated with the mixture and the iron applied, when a perfectly sound joint was made. The distributors of this material are A. R. Findlay, 17, Robertson Street, Glasgow, and a small tube costs 7½d. It may also be obtained in 1lb. tins.

"TONASTAT"—A CORRECTION

Owing to a printer's error in the advertisement of TX Products Co., which appeared in our issue of February 17th, 1934, the word "Tonax" was used. This, of course, should read "Tonastat."



A collection of Goltone short-wave coils and stand-off insulators.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Data on Output Valves

SIR,—I have been very interested in your paper, PRACTICAL WIRELESS, and have taken it since the first issue. I should like to ask you on behalf of other readers if you could publish either a "data sheet" or some other such supplement to "P.W." giving the names of all the various output valves obtainable, both pentode and triode, or A.C.-D.C. mains and battery operation, and *giving their max. undistorted output in milliwatts.* I know that such a thing is possible, and I think it would appeal to a lot of fellow readers, especially those who design their own sets.—C. SALTER (Ingleton, Yorks).

[*A data sheet giving the undistorted output, etc., of high voltage output valves was given in our issue of February 24th. A similar data sheet giving the required particulars of battery-operated valves will be published shortly.*—ED.]

Radio Ramblings and Jazz Music

SIR,—I wonder why people get so upset because you express your own personal opinion of jazz music? Cannot they realize that you are one of thousands who think the same, and they likewise are one of thousands who do not? Those who object can always switch off or tune to an alternative programme. I have always appreciated the fact that "Radio Ramblings" has always been devoted to your own views on any topic, but must agree with Robert J. Wright, of Ashford, whose letter you published on February 24th, that radio topics only are appreciated more than criticisms. However, it is your corner, and even a critic can be interesting, so carry on.—ERIC S. WALKER (Ilford).

Amateur Morse and Short-wave Work

SIR,—I think the statements of A. R. Coomber in the February 17th issue of PRACTICAL WIRELESS are very unjust. First of all his statement about amateur morse being very badly sent. It may interest him to know that before any amateur is granted a transmitting licence he must satisfy the G.P.O. that he can send and receive code at no less than twelve words per minute.

He says that short-wave work is not worth bothering about. I do not know the circuits he has tried, but I can say this, if he pays attention to the layout of even a two-valve receiver and uses the parts specified he will have a different opinion of short waves.—A. E. BEAR (Rotherhithe, London, S.E.16.).

W2GOQ "Replies to Broadcast Queries"

SIR,—I find on looking through "Replies to Broadcast Queries" during the past few weeks that there have been several inquiries for the address of W2GOQ, and note that you invariably reply "no details," or words to that effect, and I am taking the liberty of giving details of this station herewith.

"W2GOQ is attached to Radio WABC and W2XE, who are operated by the Atlantic Broadcasting Corporation, at Wayne, N.J., U.S.A. This station operates on the following frequencies:
CW—3,550 kcs., 3,817.5 kcs., 7,100 kcs., 14,200 kcs., 28,400 kcs.
Phone — 3,950 kcs., 14,200 kcs., 28,400 kc.
ICW—28,400 kcs."

I expect that most of your inquiries are regarding the 14mc band 'phone transmissions, which are usually well received in this country just after midday Sundays. For these an R.C.A. Xmtr is usually employed with an input of 1 kW. Eight different operators are on the active list, and I am told that the address, W2GOQ, Wayne, N.J., is quite sufficient. I have had several QSO's with this station, so that this information is quite first hand.—R. A. HISCOCKS (Radio G6LM, Chippenham).

The "Good Companions"

SIR,—I have received my "Good Companions" safely, in other words, the Pocket Tool Kit, and I must congratulate you on producing such a fine kit. It arrived just when I was occupied in constructing a set, and, of course, I began to use it at once, and it really speeds up the construction of a wireless set considerably.—D. A. S. SICHEL (Claremont, S. Africa).

CUT THIS OUT EACH WEEK.

Do you know

—THAT if a milliammeter is connected in the anode circuit of the output stage it will indicate distortion, and also the correctness of the bias applied.

—THAT general kicking of the needle in an upward and downward direction indicates overloading.

—THAT if the needle kicks upward, it denotes that too much bias is being applied.

—THAT if the needle kicks downward it denotes that the valve is under-biased.

—THAT L.F. instability may be cured by shunting the primary or secondary (or both) of an L.F. transformer by a resistance.

—THAT it is impossible to fit satisfactory A.V.C. to a "straight" short-wave receiver.

—THAT a temporary mains aerial may be obtained by twisting a piece of wire round any convenient mains flex.

—THAT under the new wavelength plan a number of stations giving the same programme are now fairly close together on the dial, and on powerful receivers may produce an effect of flat-tuning.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd.,* 8-11, *Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

HULL SHORT-WAVE RADIO SOCIETY

It may interest PRACTICAL WIRELESS readers in Hull and district to know that the above Society has recently been formed in Hull. Meetings are held fortnightly, the next one being on March 14th, when Mr. F. Dearlove (G2QO) will give a talk on his experiences with short-wave apparatus in Labrador. Anyone interested in the society is invited to apply for particulars to the Hon. Sec., R. G. Drewery, 274, Park Avenue, Hull.

THORNTON HEATH RADIO SOCIETY

A meeting of this Society was held a t St. Paul's Hall, Norfolk Road, on Tuesday, February 20th. Mr. S. J. Meares gave a talk and demonstration of a short-wave receiver constructed by himself, on lines suggested in recent lectures by some well-known amateur transmitters. Full particulars of future meetings can be obtained on application to the Hon. Sec., Mr. Jas. S. Webber, 368, Brigstock Road, Thornton Heath.

SLADE RADIO

"Short-wave radio communication" was the title of a lecture given by Mr. D. R. Parsons (Eddystone) at the last meeting of this Society. The lecture was divided into four sections. During the evening the following three receivers were exhibited and inspected by the members with great interest: Amateur-band two, All-wave four, and a five-metre receiver—Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

SMETHWICK WIRELESS SOCIETY

At the meeting held at the New Talbot Inn, on Friday, February 16th, Mr. Valentine, of the Mullard Technical Service Department, gave a lecture on "Modern Radio Practice." He began by referring to the history of H.F. amplification, through the triode, tetrode, and H.F. pentode, and briefly dealt with the various difficulties which had been overcome in each stage of the development. Passing on to the question of detection, Mr. Valentine gave the modern conception of the leaky-grid rectifier and an explanation of the action of the diode. From this, he proceeded to deal with the new double-diode triode valves, and discussed their use in various A.V.C. systems. —Hon. Sec., Mr. E. Fisher, 33, Freeth Street, Oldbury, Nr. Birmingham.

THE CROYDON RADIO SOCIETY

Mr. P. W. S. Valentine, D.F.H., A.M.I.E.E., gave a lantern lecture on "Modern Radio Practice," in St. Peter's Hall, South Croydon, on Tuesday, February 13th, the Vice-Chairman, Mr. C. L. Amos, presiding. The lecturer described how simple automatic-volume was obtained and showed how delayed control was effected.

Mr. H. Bevan-Swift, past president of the Radio Society of Great Britain, presided at the meeting of the above Society, held in St. Peter's Hall, Ledbury Road, South Croydon, on Tuesday, February 20th. The president, Mr. H. Rivers-Moore, lectured on "Re-diffusion systems as the solution of ether jamming for the ordinary listener." PRACTICAL WIRELESS readers are reminded that the Society's second half of session is now in full swing, and new members are welcomed.—Hon. Secretary, E. L. Cumbers, Maycroft, Campden Road, South Croydon.

UNIVERSAL RADIO DX CLUB

This organization was formed in December, 1933, to fill a long-felt want among DX enthusiasts. In short, to supply them with up-to-the-minute DX news. This is sent to members every week or so in a very interesting little paper. It is also broadcast from KPCB, Seattle, Wash. Subscriptions to this organization are as follows. First year $1.20 and 85 cents a year thereafter. Owing to the fluctuation of money values between the U.S. and Great Britain, it is necessary to send International money order for the amount in American money. Subscriptions should be sent to Mr. Charles C. Norton, 2559, Polk Street, San Francisco, California, U.S.A. Mr. Leslie W. Orton has been appointed a Vice-President of the U.R. DX Club.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

The lecture-demonstration held, under the auspices of the Uxbridge District Branch of the Anglo-American Radio and Television Society, at Denham Lodge Hall, Uxbridge, on February 21st, was a huge success, and the hall was crowded. The lecture-demonstration, delivered by Mr. J. Louis Orton, on "Personality and Radio," was illustrated by means of gramophone records of radio and other personalities, and experiments in which members of the audience joined. Full particulars of this Society can be obtained from Mr. Leslie W. Orton, 11, Hawthorne Drive, Willowbank, Uxbridge, by enclosing a stamped addressed envelope.

BOLTON RADIO CLUB

On February 23rd, Mr. J. E. Prescott gave a lecture and demonstration on speakers, from a small-battery model to a 12-watt Auditorium type, amongst which were Micro and Equilode models. The speaker

(*Continued on next page*)

(*Continued from page* 1149)

explained the advantages of the various units to an audience of 108 members and friends who were greatly interested. Before the meeting closed many questions were asked, and answered, on various radio topics. Meetings are held every Thursday—Mr. Prescott, Secretary, 125, Deansgate, Bolton.

EXETER AND DISTRICT WIRELESS SOCIETY

March
12th "Radio Receivers for 1934." Lecture by Mr. W. A. C. Maskell, of the General Electric Co., Ltd.
19th "Interesting Faults in Short-Wave Receivers." By Mr. H. A. Bartlett (G5QA).
26th "Radio Servicing (Causes, Cures, and Suggestions.)" By Mr. R. C. Lawes, M.I.W.T.

Hon. Sec., W. J. Ching, 9, Sivell Place, Heavitree.

MEDWAY AMATEUR TRANSMITTER SOCIETY

This society, which is approaching its second birthday, held a meeting on the 6th inst., at which Mr. Page (G6PA) gave a lecture upon a new type of transmitter control which he has developed in conjunction with Mr. Thomas (G5YK). This method of control, although eliminating the crystal usually employed, still ensures perfect stability as with the more orthodox methods. Meetings are held on Tuesdays at 8 p.m., and there is plenty of room for more members. Interested readers are invited to write for particulars to the Hon. Sec., S. Howell, 117a, Trafalgar Road, Gillingham, Kent.

INTERNATIONAL S.W. CLUB (EXETER CHAPTER)

The first meeting of the Exeter Chapter was held at 3 p.m. on February 11th, Mr. Bear, I.S.W.C. representative, and Mr. Hunter, the Chairman of the London Chapter, attended the meeting. An interesting lecture entitled "Short-wave Propagation" was given by Mr. Bear, and after this followed a demonstration of the possibilities of short-wave reception. Good results were obtained from VK2ME, Sydney, W3XAL, Boundbrook, W8XK, Pittsburg, and also the local European transmitters. A general discussion of the points raised in the lecture followed. Will all those interested in the club please write to the Secretary, Mr. W. Warner, 56, East Grove Road, Exeter.

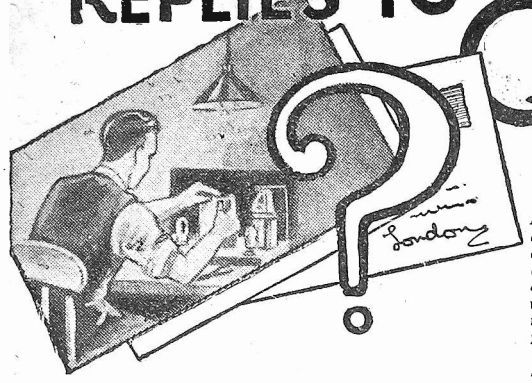
REPLIES TO BROADCAST QUERIES.

EDITOR'S NOTE: Querists must limit their queries to three per letter.

C. H. NOTHER (Portland): ZL4CM, M. A. Mathie, 20, France Street, Oamaru, New Zealand; ZL2FJ, W. R. Taylor, Makino P.B., Fielding, New Zealand; VK2XW, A. J. Voysey, 109, Bland Street, Ashfield, N.S.W.; XU5FM, write: Box 685, Shanghai, China; U5KDA, write: S. K. W., Ipatievsky Per 14, Varvarka, Moscow, U.S.S.R. CONSTANT READER (Coventry): F8OK, A. Jullien, 24, Boulevard du Roi René, Angers, France; F8JA, Francis Bonnal, 6, Allée de la Fontaine, Ermont (Seine et Oise), France; F8VT, Georges Guidon, 4, Rue des Ecôles, Aulnay-sous-Bois (Seine et Oise), France; ON4MNE, Belgian amateur call, but regret cannot trace, the latter part appears to be mutilated. NOSTUH (Boston): FZM, Bamako (French West Africa), 19.50; 19.51 m.; WKT, Sayville (New York), 16.949 m. GLT, believe Ongar (England). CLEVELEYS (Blackpool): ON4ND, M. Cheron, 18, rue Ferrer, Quaregnon, Hainaut, Belgium; ON4MAD, regret cannot trace; the latter part of the call appears to be mutilated as only *two* letters should appear after the figure; F8WM, Georges Vruchard, 47, rue des Deux Capucins, Chartres (E. & L.), France; F8AA, A. Riss, 56 (bis) Boulevard Sainte-Feuve, Boulogne-sur-Mer, France; F8LR, M. Cotteret, Billa Suzanne-Alice, Boulevard Châteaubriand, Paramé (Ile et Vilaine), France. S. F. NEWBY (Dalton): G6ZX, A. C. Brown, "Amulree," Clarkston, Glasgow; G2IN, given as: E. R. Radford, 33, White Hall Park, London, N.19; G2RA, F. F. Warner, 220, Folley Lane, Swinton, Manchester. ACID DROP (Aylesbury): G6PA, H. Page, Plumford Farm, Ospringe, near Faversham; G2IC, G. Chapman, 109, Cheriton Road, Folkestone; G6LL, J. W. Matthews, 173, Evering Road, Clapton, E.5. J. B. ELPHICK (Durham): Call given F8CS. P. Sergent, etc., correct; the second address given also correct, but was a typographical error, and should have been F3CS. L. J. STEVENS (Bristol): YI5KM, experimental amateur, Iraq; address not given; W2DEW, Jack Quinn, 39, Fielding Crescent, South Orange, New Jersey. L. NORMAN (Charlton-cum-Hardy): Budapest; the interval signal is a musical-box. E. WALKER (Sheffield): We can trace the following callsigns: F8VP, Chambat, Chemist, Pont du Château (Puy-de-Dôme), France; PAOAM, G. H. van Vliet, Ridderstrasse 40a, Rotterdam (Holland); G6RX, Rugby is on 69.44 m. working with CGA, Drummondville (Quebec); GBC, Rugby is on 60.3 m. J. ELPHICK (Durham): We can trace the following call signs: OK2AL, Miloslav Svejena, 180, Telc, Moravia, Czecho-Slovakia; F8UR, René Archambault, *Receveur de L'Enrègistrement*, Neuville (Vienne), France; G2DR, S. R. Wright, "Greenway," Lees Road, Bramhall, Stockport; G2FR, L. Fryer, 2, Murray Villas, Hough Road, Port Patrick (N.B.); If G2H*R*, H. Harte, 43, Earl's Court Square London, S.W.5; G2IL, H. R. Goodall, Winchester Road, Bassett, Southampton; G2JK, P. R. Coursey, 67, Queen's Road, Richmond (Surrey); G2MQ, P. W. Harris, 29, South Ridgway Place, Wimbledon, London, S.W.19; G2PO, N. C. Hardman, "Mayfield," Cloughfold, Rawtenstall, Rossendale (Lancs.); G3PA, W. F. Jones, 24, Maesglas Road, Newport (Mon.); G2QB, R. W. Bailey, "Baylea," Pitt Lane, Widnes (Lancs.); G2YL, Miss M. Corry, "Redholme," Walton-on-the-Hill (Surrey); G5QL, L. Herrington, 54, New Street, Ashford (Kent); G5DL, P. W. Simmans, 68, Netherfield Gardens, Barking (Essex); G5FV, W. A. Clark, "Lynton," Hull Road, Keyingham, Hull (Yorks.); G5JB, J. S. Bamford, "Craigvar," Liberton Brae, Edinburgh; G5TZ, W. G. Sherratt, 11, Bath Road, Cowes (I.O.W.); G6GL, G. R. Lee, 25, Boundary Road, Grange, West Kirby (Cheshire); G6TX, J. Fynn, 24, The Broadway, Woodford Green (Essex); G6TA, C. D. Abbott, 120, Cavendish Road, Balham, London, S.W.12; G6JT, J. D. Shrouder, "Beech Lea," Maghull, Liverpool; GLSQ, ss. *Olympic;* GMBJ, ss. *Empress of Britain;* GMPR, ss. *Quebec City;* HB9M, Hans Prechbuehler, Hotel Baeren, Muenchenbuchsee, Switzerland; Write to: *Ente Italiana Audizioni Radiofoniche, Rome, Italy.* Hamband (Bearsden): We can trace the following call signs: W2GOQ, experimental amateur, Wayne (N.J.); W2RM, Nathan Pomerand, 222, West 39th Street, New York City; W2TM, C. Davis Belcher, 20, East 14th Street, New York City; W3ZX, Carroll D. Kentner, 1,107, Park Avenue, Collingswood, (N.J.); VK2NR, J. Scott, 41, Carlingford Road, Epping, New South Wales; VE1BV, C. S. Taylor, "Stewiacke," Novo Scotia; ON4PA, Mons. Anthierens, La Pinte-lez-Ghent, Belgium; OK1AN, Experimental amateur, Czecho-Slovakia, write: *C. A. V., Box* 69, *Prague* 2, *Czecho-Slovakia;* G2DQ, H. G. Collin, Highfields Cottage, Rectory Grove, Southend Road, Wickford (Essex); G2HN, E. Howell, 6, St. Pauls Street, Chippenham (Wilts); G2MA, D. D. Marshall, 8. Roclair Gardens, Hillfoot, Bearsden; G2MG, C. C. Miller, "Arndene," Bearsden; G2NN, F. C. Crocker, "Deepside," 17, Cross Deep, Twickenham (Mdx.); G2YL, Miss N. Corry, "Redholme," Walton-on-the-Hill (Surrey); G6CV, T. S. Garrard, 50, Lambeth Road, Linthorpe, Middlesbrough (Yorks.); G6LL, J. W. Mathews, 178, Evering Road, Clapton, London, E.5; G6OX, R. H. Quentin, 10, Minden Place, St. Heliers, Jersey, C.I.; D4KA, experimental amateur, Germany; LA2N, Gunnar W. Bergstrand, 43, O. Storgt, Drammeu, Norway; OH5NG, Armas Wahlstedt, 36, Pontuksenkatu, Viipuri, Finland; SP1TI, experimental amateur, Poland, write: *P.Z.K., 6, Bielowskiego, Warsaw, Poland;* presumably U1AS, N. Scheptunoff, 75, Moskowskaia, Novosibirsk, U.S.S.R.; CT1TU and CT1HF, experimental amateurs, Portugal, write: *Emisores Portugueses,* 333, *Rua Primiro de Dezembro, Lisbon,* Portugal. M. U. D. (Tottenham): We can trace the following call signs: G2NP, F. A. Pride, 524, Anlaby Road, Hull (Yorks.); G2IS, J. W. Paddon, Bussock Hill House, Newbury (Berks.); G2AO, O. H. Relly, "Gavinwood," Willingdon Road, Eastbourne; G2AF, G. Bryant, 5, Creffield Road, Colchester (Essex); G2HN, E. Howell, 6, St. Paul Street, Chippenham (Wilts.); G2XS, H. W. Sadler, "Redways," Wootton Road, Gaywood, Kings Lynn (Norfolk); G2XK, E. Knowles, "The Caravan," Springfields, Hemsworth, Pontefract (Yorks.); G2DF, F. A. Vost, 26, Pinewood Avenue, Warrington (Lancs.); G5FR, J. L. Jeffree, 2, Fernhurst Road, Croydon (Surrey); G5HK, H. S. Beckett, 55, Mona Road, Crookes, Sheffield; G5YB, R. C. Ashton, 41, Sithney Street, St. Budeaux, Plymouth; G5KD, F. M. Smith, 253, Westbourne Avenue, Hull; G5XA, H. Ransom, 86, Seymour Road, Hornsey, E.8; G5UI, J. E. Perkis, 67, Arthur Street, Ryde, I.O.W.; G*I*5QX, J. N. Smith, 73, Oakland Avenue, Bloomfield, Belfast; G5XO, Captain L. Bratt, "Ravensdene," Holden Avenue, North Finchley, N.12; G5UF, A. A. Barrett, 14, Cliff Avenue, Cromer (Norfolk); G6JI, J. W. Ismay, 6, Douglas Avenue, Walthamstow, E.17; G6HR, W. D. Keiller, 21, Newton Way, Cambridge Road, Upper Edmonton, N.18; G6FR, A. Freeman, 2, Carpenters Road, Lozells, Birmingham; G6FK, F. A. Clarke, 48, Wilbury Road, Hove (Sussex); G6FM, D. Milner, 64, Bury Street, Lower Edmonton, N.9; G6PC, C. D. Price, "Ardath," Park Lane, Wednesbury (Staffs.); G6XF, C. Powell, 3, Monway Buildings, Holyhead Road, Wednesbury; G6MZ, F. S. Mizen, 28, Brunel Road, Bridgewater Road, Bristol; G6CV, T. S. Garrard, 50, Lambeth Road, Linthorpe, Middlesborough; G6AF, R. H. Rice, 79, Seaside, Eastbourne; G6AS, G. A. Swinnerton, 109, Shirland Road, Smethwick (Staffs.); W1BM, H. E. Nichols, 82, Elmwood Avenue, Bridgeport (Conn.); W5AQY, Texas A. & M. Radio Club, Box 1,666, College Station, Texas; W9BH, Kenneth H. Goode, 6,142, Kimbark Avenue, Chicago, Ill.; F3CO, G. Thomas, 9, rue du Chapitre, Saint Brieuc (Côtes du Nord) France; F8VX, Jacques Pogtioli, 2, rue d'Hangard, Villers-Bretonneux (Somme), France; F8VO, Petitier, 51, Rue du 11 Novembre, Savigny (Seine et Oise), France; F8HK, R. Dubreuil, Saint-Savinien (Charente), France; F8CO. G. Inchauspe, 106, Avenue de la République, Paris (11e), France; F8PE, A. Acedot, 11, Cours Valatour, Luner (Herault), near Montpellier, France; F8VT, Georges Gurdon, 4, rue des Ecôles, Aulnay-sur-Bois (Seine et Oise), France; F8UI, E. Potin, 62, Rue des Epis, Sotteville-lez-Rouen (Seine), France; F8UJ, Gauthier, Impasse du Jeu de Paume, Verdun (Meuse), France; F8VP, Chambat, Chemist, Pont du Château, (Puy de Dôme); F8RP, Jean Dort, rue Virginie Laurière, Bagnères-de-Bigorre (Haute-Pyrénées), France.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff



The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

MORSE RECORDER

"Could you tell me through the columns of your paper whether there is any gadget on the market that I can fit to my receiver (in the place of the loud-speaker) that will automatically record morse signals? Alternatively, would it be possible for you to publish such a circuit on making the above?"—M. B. (Brighton).

A simple morse recorder may easily be made at home. Full details will be found in "Simple Electrical Apparatus," published by this House at 1/-.

METAL RECTIFIERS IN SERIES

"I have got two metal rectifiers and several old mains transformers amongst my collection of apparatus. I wish to build up a mains unit to deliver 500 volts H.T., but the rectifiers which I have will only give 200. Could I connect them in series across a transformer giving an input of 500 volts to obtain a rectified 500 volts output? I should like you to give me the necessary connections in order to do this if possible, and if it is not, could you please state the reason?"—Y. S. (Bradford).

You do not state the actual type of rectifier which you intend to use. If they are of the voltage-doubler type, you could connect them in series across two separate mains transformers, each delivering an input to the rectifiers as required by the particular units in use. Alternatively, you could connect the two rectifiers in series with an input from a transformer exactly double that required for the individual rectifiers. With this method you will obtain just over double the total voltage of the two units, whilst with the first method the output will probably be slightly under double. The actual connections must be carefully made, and we would advise you to obtain a copy of the 'All Metal Way' from the Westinghouse Brake and Saxby Signal Company, in which connections for this method are given.

USING A NOVOTONE

"I have bought a Novotone compensator which was recently described in your pages, but it seems to have a peculiar effect on my set. When I was using the pick-up alone, fed into three good L.F. stages, I got very good quality and good volume. I am very keen on good tone, and, therefore, thought that the addition of the tone compensator would help me to still further improve the quality. I find, however, that there is distortion, the music being harsh, and bad hum. I do not believe it can be due to the tone device in view of your report, so should like to know whether it can be due to anything else."—A. H. G. (Kettering).

You have probably overlooked the fact that the tone compensator, in addition to improving the tone, adds to the volume slightly, the amount of amplification depending upon the model you have obtained. The increased amplification is no doubt resulting in overloading of the input valve, and you should fit a volume control across the compensator, the valve being chosen according to the maker's recommendation. The hum may be due to the fact that the leads are long, or may be a result of the improved low-note response which you are now getting. Screen the leads from the pick-up and earth the screening, as well as the case of the tone compensator. When you overcome these points you will find that there is an undoubted improvement in the use of the arrangement, and you should study the notes in the booklet entitled "Realism from Records," which is issued by the makers of the device.

QUESTIONS NOT TO ASK

"I have built the X receiver described in 'The Radio Journal,' but find difficulty in adjusting the preset condensers. Can you tell me how to test the circuit for best results, or how to improve on it.?"

When a receiver has been built from a design published in a contemporary journal we regret that we cannot give any operating details or suggest modifications. The designer of the receiver should be consulted in such cases. We are also sometimes asked to suggest how a certain receiver may be modified to incorporate a circuit published in this journal. The same remarks apply in this case.

"Can you send me a blue-print of the 'Famous Portable' manufactured by Messrs. Wireless Sets, Ltd.?"

We have no blue-prints of commercial receivers, and where it is desired to have a full knowledge of the circuit details of a commercially-made receiver the makers should be communicated with. If you are unable to find their address we shall be pleased to give it to you on receipt of a stamped addressed envelope.

"I heard a band playing the well-known 'Lazybones' last night just above the Midland Regional. Could you tell me what station it was?"

As Dance Music is transmitted from a number of stations in the evening it is essential to give some indication of the actual wavelength. In all queries relating to station identification it is necessary to restrict the search to a narrow band, and, therefore, the nearest stations on either side of the tuning-point, or some indication of the type of announcement or interval signal should also be given.

CALIBRATED DIALS

"I have purchased a tuning pack from a friend, and he guarantees that he has not tampered with it in any way, and yet I cannot get the dial to remain matched. The wavelengths are marked, and I have turned the trimmers in all directions, but although it gives the correct readings in some spots it is right out in other parts of the dial. Does the aerial make any difference? I do not see how the makers can guarantee the settings, as they do not know what aerial and earth will be used."—T. B. G. (Hackney).

The calibrations are carried out on the coils which are included in the detector stage (in the case of an H.F. tuning pack), or in any other coil in the unit which, unlike the aerial coil, has a constant load. The aerial coil is usually flatly tuned, owing to the damping of the aerial and earth, but it may be sharpened and actually matched to the other coils by the use of a series aerial condenser. You will find, therefore, that if you fit a pre-set condenser in the aerial lead, and adjust the trimmers on the remaining coils so that the calibration points agree, the series condenser, in conjunction with the trimmer on the aerial coil, will enable the adjustment to be made to hold good throughout the scale.

D.C. HEATER CONNECTIONS

"Is there any rule to be adopted in the case of wiring up the heaters of the D.C. indirectly-heated valves? I have noticed that in some commercial sets the valves are simply joined in series, whilst in other sets I have examined there seems to be a scheme which makes the detector valve the last in a chain, the other valves being arranged in all sorts of different ways. I should like to know whether there is anything definite."—W. D. E. (Pimlico).

Although there is no rule to be regarded in wiring D.C. heaters, it is advisable, in the interests of the removal of hum, to wire the circuits so that the heaters of all the valves act in the form of a smoothing circuit for the detector heater. Thus, a very good arrangement will be found to consist of wiring the output valve in the positive end of the line, and the detector at the negative. Obviously, where heaters of different voltage and current ratings are employed it will be necessary to modify this arrangement in order to supply each valve with the correct potential. Remember, generally, that the detector valve requires the smoothest supply, and similarly all valves, the output from which is subjected to subsequent amplification, must be supplied with hum-free sources of voltage.

MAINS TRANSFORMER WINDINGS

"In reading a recent article in 'Practical Wireless' dealing with the construction of mains transformers I noticed that the L.T. secondary winding was stated to have '32 turns, with centre tap.' Does this mean there should be 32 turns in all, or 32 on each side of the tapping."—R.B. (Reading).

There should be 32 turns in all, the tapping being taken after winding on 16.

FREE ADVICE BUREAU COUPON

This coupon is available until March 17th, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 10/3/34.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word prepaid — minimum charge 3/- per paragraph—and must reach this office not later than Tuesday for the following week's issue. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8 Southampton Street, Strand, London.

PREMIER SUPPLY STORES

offer the following Set Manufacturers' Surplus New Goods at a fraction of the original cost; all goods guaranteed perfect: carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

PREMIER SUPPLY STORES announce the purchase of the entire stock of a world-famous Continental valve manufacturer. All the following types of standard mains valves at 4/6 each. H. HL. L. Power. Directly heated 6-watt Pentode. Directly-heated 9-watt Pentode. High magnification Screen-grid, low magnification Screen-grid. Variable-Mu Screen-grid. 250 volt 60 milliamp. full-wave rectifiers.

THE following types 5/6 each. Indirectly-heated Pentode. 350 volt 120 milliamp. full-wave Rectifier. 500 v. 120 ditto, 6/6. Dario Battery Valves 4v. filament. Set of 3, consisting of Screen-Grid, Detector and Power or Super-Power, 6/6 the lot. Power or Super-Power, 2/6.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, Dubilier condensers, resistances and diagram, 120v. 20 m.a., 20/-; trickle charger 8/- extra; 150v. 30 milliamps., with 4v. 2-4 amps. C.T. L.T., 25/-, trickle charger 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T. L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps. C.T. L.T., 37/6; 150 volts 50 milliamps, 27/6.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Premier chokes, 25 milliamps, 20 Henries, 2/9; 40 milliamps. 25 hys., 4/-; 65 milliamps. 30 hys., 5/6; 150 milliamps. 30 hys., 10/6; 60 milliamps. 80 hys., 2,500 ohms, 5/6.

HARLEY Pick-up, complete with arm and volume control, 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 3/6.

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 ma., 0-1, 0-5 amps.; all at 6/-.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-120v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amp., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v. 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v. 60 m.a., rectified with 4v. 3-5a. and 4v. 1a. C.T. L.T., screen primary, 15/-; with Westinghouse rectifier, 25/-.

4V. 3a. C.T., 6v. 2a. C.T., 9v. 1a., 12v. 1a., 7/6 each; 4v. 3-5a., 22v. 1a., 8/6 each; 10v. 3a., 14v. 4a., 10/-each.

PREMIER H.T.9 Transformer 300v. 60 m.a., with 4v. 3-5a. and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER Mains Transformers, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; Westinghouse rectifier for above, giving 200v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.); with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400v. 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-.

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt, 10/-.

MULTI Ratio Output Transformers, 4/6, Twin Screened Wire 3d. per yard.

CENTRALAB Potentiometers, 50,000, 250,000 half meg., any value, 2/-; 200 and 400 ohms. 1/-.

RELIABLE Canned Coils with Circuit, accurately matched, dual range, 3/- per coil. Please state whether Aerial or H.F. required. Ditto iron core, 3/6.

PREMIER L.T. Supply Units, consisting of Premier Transformer and Westinghouse rectifier, input 200-250v. A.C., output, 2v. ½amp., 11/-; 8v. ½amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp., 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in. cone, 18/6.

GRAMPIAN M.C. Loud Speakers, 2,500 ohm field, 9in. cone, handles 5 watts; 21/-.

GRAMPIAN P.M. Loud-speakers, 9in. cone, handles 4 watts; 18/6.

WESTERN ELECTRIC Condensers, 250v. working, 2 mfd., 1/-. 2 mfd. 400v., 1/6.

B.T.H. Truespeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/-, complete. Type YH 100/250v. A.C. or D.C., 42/-.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 10,000 ohms. 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

POLAR 2-gang, with complete disc drive, padding condenser and trimmer, 0.0005, 6/6.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job, 15/-.

AMPLION Cone Loud-speaker Units, 1/9, complete with 12in. cone and chassis 3/11 each. Worth treble.

ORMOND Condensers, 0.0005 2-gang, semi-shielded, 2/6; brass vanes, with trimmers, 3/6.

WIRE Wound Potentiometers, 15,000 ohms, 1/6; 50,000 ohms, 2/-; 500,000 ohms, 3/-.

HOME Radio Microphone, complete, 5/-; simply plug in to pick-up terminals.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers, at a fraction of original cost for callers.

WESTERN ELECTRIC Mains Transformers, 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a. C.T., 4v. 1a. C.T., 19/6.

1,000 Ohm 150 m.a. Wire Wound Variable Resistance, 2/-; Burndept 2-watt resistances, all values from 0.5 to 50 ohms. 3d. each: holders, 2d. each.

T.C.C. Condensers, 250v. working; 2 mf., 1/9.

T.C.C. Electrolytic Condensers, 440 volts working, 8 mf., 3/-; 15 mf., 50v. working, and 50 mf. 12v. working, 1/-; 25 mf. 25v. working, 1/3.

T.C.C. Block Condensers, 250v. working, 2 x 2 x 2 x 0.1, 2/-; 2 x 2 x 2 x 1, 2/3; the above condensers at same price by Dubilier 300v. working.

H.M.V. Block Condensers, 400v. working; 4 x 4 x 1 x 1 x 1 x 0.1 x 0.1 x 0.1, 6/-; 4 x 2 x 1 x 1 x 1 x 0.5, 4/6.

DUBILIER Condensers, 2 mf. 1,200v. working, 4/-; 8 mfd. dry electrolytic, 450v. working, 3/-.

THE Following Lines 6d. each, or 5/- per dozen.—Chassis valve holders, 5, 6 or 7 Pin, screened screen-grid leads, any value 1-watt wire end resistances, wire end condensers, 0.0001 to 0.1, R.I. .0005 varicaps, trimming condensers, T.C.C. 6mfd. 50v. electrolytics.

PLEASE mention PRACTICAL WIRELESS when ordering.

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SPEAKERS.—Blue Spot permanent magnet, with Universal transformer for power, pentode, super power or class B, 23/- (list 39/6); D.C. mains energised, all voltages, 16/6; Celestion Soundex P.P.M. permanent magnet, 17/6 (list 27/6); Blue Spot 100U inductor, complete with chassis, 13/6 (list 39/6); Celestion permanent magnet type P.P.M.W. universal transformer, 25/- (list 49/6).

BLUE Spot, 66K, complete in cabinet, 16/- (list 42/6); G.E.C. Stork, in magnificent cabinet, 19/6 (list £3/15); all speakers new in original cartons.

PICK-UPS.—Blue Spot, model "88," with volume control, 26/- (list 63/-); Marconi No. 19 (1934), 26/- (list 32/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor "A" 3-valve screened grid kits, with cabinet and moving coil speaker, less valves, £3/7/6; with valves. £4/10 (list £8/7/6); Ready Radio S.T.400 kits, all specified components, by Scott Taggart, £2/19/6 (list £4/17/6).

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MISCELLANEOUS.—Ferrocart coils, G.1, G.2, G.3, with switch, 31/9 (list 39/6); Benjamin Class "B" universal output chokes, 6/6 (list 11/-); Ready Radio Instamat Universal transformers, for matching any value to speaker, 11/6 (list 37/6); Rotorohm and Radiophone volume controls, all values, 3/- each; with switch, 3/3 (list 10/6); S.T.500 coils, 5/6 per pair; Hellesen's 8 mfd. electrolytic condensers, 2/9 each; Westinghouse metal rectifiers, H.T. 6, 7, 8, 9/3 each; Amplion loud-speaker units, 2/3; Ferranti choke, 20 henry 60 m.a., 6/9 each; Kolster Brandes gramophone motors, dual, for A.C. or clockwork, complete with turntable and all accessories, 110-250 volts, 25/- each (list 63/-); Ready Radio L.F. transformers, 5-1, 3-1, 3/3 (list 8/6); B.T.H. transformers, 3/6; Lewcos superhet 8-way bases, complete with valve holders, grid leak, fixed condenser, type "48," 2/- each.

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RECEIVERS.—G.E.C. Osram Music Magnet 4. A.C. Model, 110/250 volts, complete with "B.C. 1532" Power Unit and G.E.C. Permanent Magnet Speaker in magnificent Floor Cabinet and 4 Osram A.C. Valves. Brand New 1934 series in original sealed cartons, £8 15s. each (List, £21).

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ALL Transformer and Chokes Guaranteed for 12 months.

ALL Goods Guaranteed and Sent Carriage Paid.

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MICROPHONES.—Buy from the actual makers at Rock bottom Prices. Button capsules complete for detectaphone and other experiments, only 1/-. Transformer, 3/6. No. 11 Home Mike, bakelite body, 2in. diam., unbreakable, 5/6. Table PW.11, a handsome announcer's rectangular model, 3in. by 3in., on brass stand, a self-contained Mike and Transformer, with switch, 10/6. Tall pedestal Broadcasting Model 12B, with Microphone hung in ring, 12in. high, 18/6. Complete Deaf Aid sets to assist those hard of hearing, 18/6. Special P.A. makes for Dance Bands and Public address. All parts in stock for Home Constructors, granules, blocks, diaphragms, mouthpieces, etc. Headphones, 2/6 pair. Write for Lists "N" 1 and 2.—Electradix Radios, 218, Upper Thames Street, London, E.C.4. Tele.: Central 4611.

RAD-AUTO-GRAM buy Modern Second-Hand Components for Cash.—39, Tulketh St., Southport.

A.C. Eliminators, Alco; 105-250 v. outputs, 60v. S.G. 130 v. 20 m.a., 24s.; with charger, 34s.; complete and guaranteed.—P. and D. Radio, 1, Goodinge Road, N.7.

ADVERTISEMENT INDEX

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See page 1121

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P.W. TOOL-KIT GIFT STAMP No. 2

Practical Wireless

3D.

AND PRACTICAL TELEVISION

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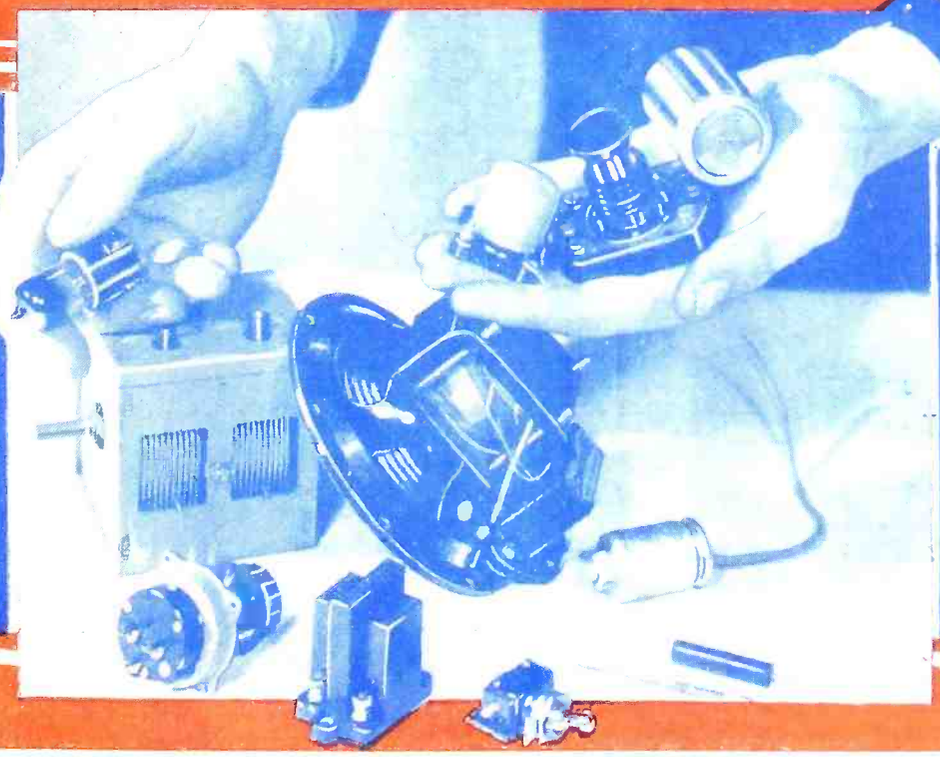


IF YOU ARE QUALIFYING FOR OUR POCKET TOOL KIT, TURN TO PAGE 1156

EDITOR:
Vol. III. No. 78 || F. J. CAMM || March 17th, 1934
Technical Staff:
W. J. Delaney,
H. J. Barton Chapple, Wh. Sch., B.Sc.(Hons.), A.M.I.E.E.,
Frank Preston, F.R.A.

ROUND *the* WORLD *of* WIRELESS

Reorganization of Spanish Broadcasting Net

ONCE again a scheme has been put forward in Spain for placing the broadcasting system on a sound basis. It is reported that the matter is being taken up by the Ministry of Posts and Telegraphs and that the network will be State controlled. The new plan calls for the construction of seven transmitters, of which one situated near Madrid would be of more than 100 kilowatts, and six regional stations in the provinces ranging from 20 to 30 kilowatts.

Lithuania's Proposed 120 Kilowatter

IT is reported that Lithuania proposes to erect a 120-kilowatt broadcasting station at Klaipeda, on the borders of the Baltic Sea. It would operate on the channel at present occupied by Kaunas, namely, 1,935 metres. The latter 7-kilowatt transmitter would act as a relay on 222.6 metres (1,348 kilocycles). Klaipeda is the native name of the Baltic port Memel, lying about ninety-one miles to the north-north-east of Koenigsberg (East Prussia).

The Empire Within the Sound of Bow Bells

AS an experiment the B.B.C. is using as a new interval signal a gramophone record which peals out the chiming of the famous Bow Bells. Although only recently introduced in the medium-wave broadcast, it has been used for some little time in the Daventry Empire transmissions. The B.B.C. does not promise that this signal will definitely replace the one-second metronome tock-tocks.

World Broadcast of Passion Play

LISTENERS the world over will be given an opportunity this year of hearing a unique transmission, as the German authorities propose to relay at some date in May an excerpt of the Passion Play presented at Oberammergau (Bavaria). The broadcast will be relayed to all German stations and will also be sent out through the Zeesen short-wave transmitters. It is expected that most countries in Europe will take this exceptionally interesting performance, inasmuch as 1934 will mark the tercentenary of the first performance. The Passion Play is given every ten years.

Small Portuguese Transmitters

IN addition to Radio Parede (near Lisbon), now testing on 401 metres, there exist four other private broadcasting transmitters on low power putting out daily programmes in the later evening hours. Three are situated at or near the capital—namely, CT1DR (216.6 m.), CT1DH (212.6 m.) and CT1AA (291 m.). In addition, a transmitter has also been opened at Porto under the call sign CT1HP which has been heard working on 245.9 metres.

Prague on Short Waves

THE Czech Ministry of Posts and Telegraphs plans to build at Podebrady a short-wave station with directional aerials for transmission to North America. The station will be used not only for ordinary wireless telephony, but also for the relay of broadcast programmes to the United States.

Altered German Programmes

IN future more relays will be carried out by the German stations of musical or other plays performed at theatres. The National Hour—a programme simultaneously broadcast by transmitters throughout the country—is now given every Monday, Tuesday, Thursday and Friday between G.M.T. 7.30–8.30 p.m.

Special Broadcast from Vatican

AT the conclusion of the Holy Year, His Holiness the Pope will broadcast an address, on April 1st, which is to be transmitted to the entire world through the Vatican short-wave station. It is expected that the Papal blessing and other portions of the ceremony will be also relayed to a number of European high-power stations on medium and long channels.

Startling Radio Cabinets at the B.I.F.

WHAT will the radio sets of the future look like? Startling developments were suggested by exhibits shown at the British Industries Fair by E. K. Cole, Ltd., the radio manufacturers. The Ekco Stand in the Plastic Section showed, among other exhibits, specimen radio cabinets moulded in red, green, walnut, blue, cream, ebony black, marble, amber, and in mosaics of brilliant colours. A new Ekco superhet which has just been introduced is supplied in alternative finishes of grained walnut or ebony with chromium plated inserts. Many of the novel and extremely pleasing effects which can be obtained by combining metals and bakelite were well demonstrated by the Ekco exhibits.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

Light Music by Midland Studio Orchestra

FOUR Midland composers are represented in a programme of light music which will be given by the Midland Studio Orchestra, conducted by Frank Cantell, on March 23rd. They are Sir Edward German (a native of Whitchurch, Shropshire), Leslie Bridgewater (who was born at Halesowen), Joseph Engleman (Birmingham), and Barrs Partridge (Stourbridge).

Wellesley Colliery Band Concert

ON March 24th the Wellesley Colliery Band, conducted by William Pegg, will give a concert for the Scottish Region. Wellesley Colliery, belonging to the Wemyss Coal Co., Ltd., is one of the most modern in Scotland, and is situated near Methil Docks, in Fife. In June, 1919, a meeting of the workmen was held at the colliery, and they decided to form a brass band and to allow contributions from their wages towards its support. In one year's time they gained honours at all contests in which they took part.

Broadcast by Band of R.A.F. College

THE Band of the Royal Air Force College, Cranwell, travel from Lincolnshire to Birmingham on March 18th for their first Midland Regional broadcast. They broadcast from Cardiff in 1923, three years after the College was founded by Lord Trenchard. Mr. A. E. Sims will conduct them in a programme which includes selections from Gounod's *Romeo and Juliet*, and from Wagner's *Lohengrin*. Louise Atherton, of Derby, plays four violin solos.

"Serenade" from the Midland Regional

MOZART'S eleventh Divertimento is not often heard. It is one of the features of a programme entitled "Serenade," which Birmingham Philharmonic String Orchestra, conducted by Johann Hock, are to give on March 20th. Haydn's Partita in F is another orchestral work to be given. Percy Underwood (baritone) will sing two groups of songs of the serenade type.

Massed Choirs Concert

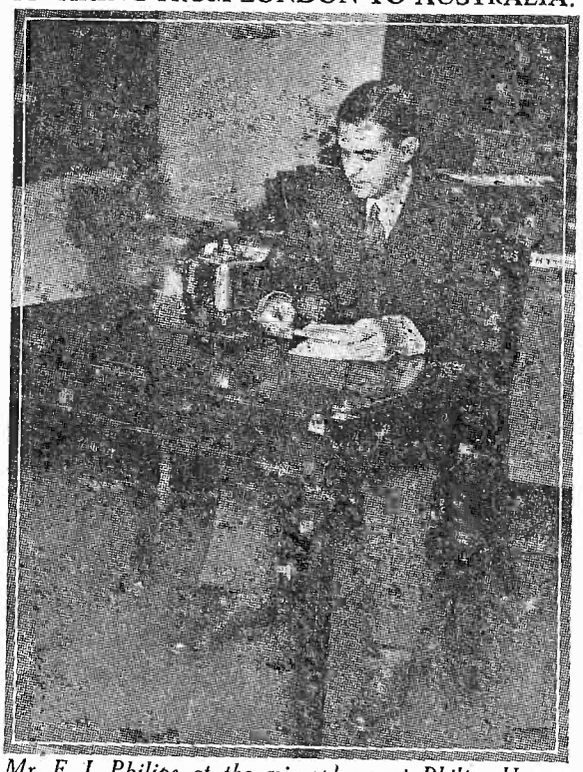
OVER a hundred school choirs take part in the non-competitive musical festival at Dudley. Cyril Winn, the composer, will adjudicate, and then on March 21st he will conduct a concert (which will be relayed) in the new Town Hall at Dudley by a massed choir of three hundred and fifty voices from senior and junior schools with percussion bands from infants' schools. The Schools Festival movement was inaugurated by U. C. Brunner, of Bridgnorth, and Dudley has had a Schools Festival since 1930.

Round the World in Thirty Minutes

SNAPSHOTS of a world cruise in dialogue and song are part of the lure employed by a travel agency in the amusing Midland Regional comedy, "Round the World in Thirty Minutes," which Martyn C. Webster is producing on March 22nd. A lady customer, portrayed by Alma Vane, is the chief beneficiary, although not in the way the young men of the bureau (played by Hugh Morton and Harold Clemence) have imagined. Laurie Devine and T. W. Rees are the authors. On March 24th Martyn Webster continues his "Don't Listen to This" series with two weird one-act plays abounding in grim atmosphere. These are *Hanged*, by Douglas Allen, and *The Last Survivor*, by W. Cumming Tait. Three experienced actors—John Lang, of Leicester; Stuart Vinden, the old Birmingham Repertory player; and Arthur Freeman, one of the founders of the Crescent Theatre, Birmingham, form the casts.

INTERESTING and TOPICAL PARAGRAPHS

SPEAKING FROM LONDON TO AUSTRALIA.



Mr. F. J. Philips at the microphone at Philips House, Charing Cross Road, London, from whence he addressed an audience at Sydney.

London to Australia

A SUCCESSFUL short-wave transmission marked the opening of the Australian Radio and Electrical Exhibition on Wednesday (Feb. 28th), when Mr. F. J. Philips, son of Dr. A. F. Philips, founder of Philips Lamps, Ltd., speaking from Philips House, London, W.C.2, addressed an audience gathered at Sydney. Mr. Philips's address, delivered at noon, was sent from the Rugby transmitter on 28 metres. Mr. A. den Hertog, chairman of the Australian Radio and Electrical Exhibition, and managing director of Philips, Australasia, replied from Sydney *viâ* the Baldock receiving station; his message was clearly heard at Philips House, Charing Cross Road, on the loud-speaker as well as through the headphones.

Blue Spot Speakers

IN the Blue Spot advertisement which appeared in our issue of March 3rd, the price for the Blue Spot Chassis was given incorrectly as 29/6. Actually there are Blue Spot Moving Coil Speaker Chassis available at prices from 27/- to 59/6, as well as Cabinet Speakers at prices from 45/- to 87/6.

New Scales for Ekco Receivers

WE are informed that replacement scales for the following Ekco receivers are now ready: SH25, C25, RG25. These models are, of course, from the popular range of 1933. New scales will be supplied in pairs of two sections at 9d. per pair, and will be available from all Ekco dealers, to whom application should be made as soon as possible.

Spanish Amateur Broadcasters

IN view of the number of low-power stations installed by amateurs in Spain for the purpose of broadcasting radio programmes and news bulletins, steps have been taken by the authorities to prevent mutual interference. There are already fifty-six stations working on various channels between 200 and 206 metres. In future, licences to transmit will no longer be granted unless the stations are at least twenty miles from one another! Power, for the majority, does not exceed 100–150 watts.

All Gipsy Orchestras Under One Control

AS complaints have been made in Hungary to the effect that the Gipsy Orchestras are gradually losing the true Magyar character of the compositions played, the bands are now being placed under a single control. In future, therefore, listeners to the Budapest broadcasts may have the assurance that they are hearing correct interpretations of old Hungarian melodies.

SOLVE THIS!

PROBLEM No. 78.

After building up a three-valver employing a capacity-coupled band-pass aerial tuner, Rogerson found that there was a lot of electrical interference received by his aerial. He, therefore, obtained an anti-interference aerial device, consisting of impedance-matching transformers for aerial and receiver, and connected these to the top of the lead-in and to the receiver. He found, however, that although interference was removed he got very few stations and could not tune in a number which he previously got at good strength. He found that many of these stations could be obtained by re-setting the trimmers on the ganged condenser, but this had to be done at nearly every setting of the dial. Why? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 78 and must be posted to reach this office not later than the first post Monday, March 19th, 1934.

Solution to Problem No. 77.

Smith overlooked the fact that the field of the moving-coil loud-speaker had a very high resistance, and consequently when the total anode current of the receiver was passed through this it gave a very appreciable voltage drop and prevented the application of the correct voltage to the receiver.

The following three readers successfully solved Problem No. 76 and books have accordingly been forwarded to them:—A. Edwards, Maybury Inn, Maybury Hill, Woking, Surrey. H. A. Bayley, 1, Hill Street, Hill Top, West Bromwich, Staffs. R. Harvey, 31, Boswall Drive, Edinburgh 5.

Problems *of the* Midget Set.—1

In This Article the Writer Outlines the Principal Points which come up for Consideration when Designing a Compact and Miniature Receiver. Next Week We Shall Deal with the Midget Components Now Available for Midget Receivers.

By FRANK PRESTON

THERE is always a fascination about a wireless set which is much smaller than has become conventional, and whether or not there are any real advantages to be gained by building a "midget" receiver the design of such an instrument offers many interesting and novel problems.

In the first place it seems necessary to define the word "midget," as applied to a receiver, because it is entirely a matter of comparison. Receivers which were considered to be small a few years ago are quite bulky affairs as judged by present-day standards, and it does not appear unlikely that in the very near future it will be possible to construct receivers of even smaller dimensions than those which at present are thought to be diminutive. The smallest commercial receiver known to the writer measures approximately 10in. long by 7in. high by 7in. deep, and this is a four-valve superheterodyne of American origin. This set, despite its Lilliputian size, is entirely complete and self contained, having its own loud-speaker and aerial built in. As a matter of fact, the "aerial"—if such it can be called—consists of a short length of insulated flex which can simply be thrown along the floor or hung from a picture rail. The speaker has a maximum diameter of about 5in., and although this cannot be expected to give really first-class reproduction, its performance is considerably better than one would expect from theoretical considerations alone.

These midget receivers were very much "in vogue" in America a short time ago and their containers were cleverly designed to represent trinket boxes, jewel cases, clocks, and all kinds of small ornaments. It would appear, however, that they have not found very much favour in this country. The reasons are indefinite, but, for one thing, the British public is accustomed to having the very best possible reproduction, whilst the Americans do not appear to be quite so critical on the whole, judging by the reproduction afforded by the average American receiver. Then again, the average Englishman is not ashamed to own a wireless set, especially when it is housed in a cabinet which is in harmony with the household furnishings. Perhaps another reason for the comparative unpopularity of the midget receiver in this country is that English people generally are not so interested in "novel gadgets" as are the natives of U.S.A.

Advantages of the "Midget" Set

But quite apart from the novelty aspect of the case, there are a number of things to recommend the miniature receiver, especially if it can be designed in such a form that it will give good reproduction. A set of this kind can be placed in any odd corner, it can be moved from room to room with the greatest of ease and may, if necessary, be used as a normal portable set for use in any house wired for electricity.

The Power Supply

When the question of designing a midget receiver is first considered it becomes obvious that the set cannot be battery operated since, no matter how compact it is made the batteries cannot be reduced in size to any appreciable extent. At the same time the set cannot be an A.C. operated one of the normal kind, because the essential mains transformer would occupy nearly the whole of the available space, besides adding considerably to the weight. A D.C. set is quite feasible, but has such a limited application that it is immediately ruled out, especially when it is considered that D.C. mains in every part of the country are being changed over to A.C. One might thus well ask: "How can the set be operated, then?" The answer is that it can be a "universal" instrument, employing "mains voltage" universal valves, which can be operated equally well, and without modification, from either A.C. or D.C., and without the use of a mains transformer.

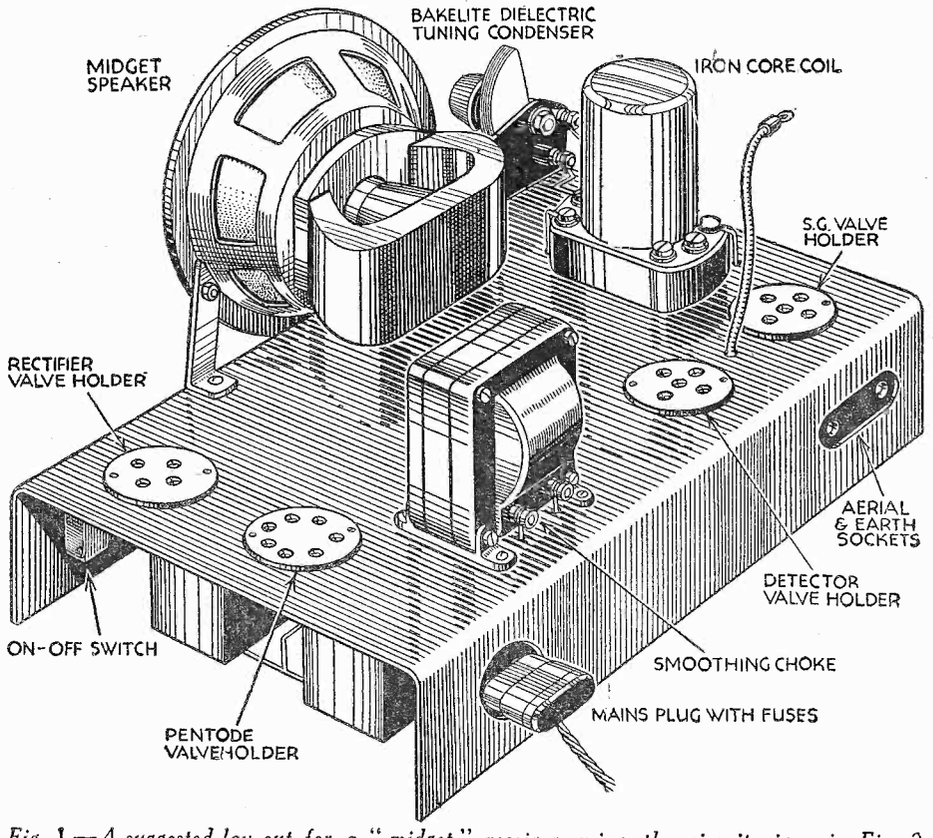


Fig. 1.—A suggested lay-out for a "midget" receiver using the circuit given in Fig. 2. The chassis would be about 11in. long by 7in. deep by 1½in. high.

A complete circuit for a three-valve universal "midget" set is given in Fig. 2, from which the simplicity of the whole scheme can easily be seen. The circuit arrangement is perfectly straightforward and comprises an S.G. H.F. stage, followed by a leaky-grid detector and a power pentode. The most important feature, however, is the valve rectifier which operates at mains voltage, carrying out its normal function when the set is connected to A.C. mains, and merely acting as a low resistance in the H.T. circuit when D.C. mains are being employed. All the valves are indirectly heated, and it is worth mentioning that they are quite as efficient as their "4 volt, 1 amp." A.C. counterparts. This point will be appreciated when it is pointed out that the mutual conductance of the screen-grid valve is 3.8, and of the detector, 3.5, these figures applying to two typical valves of well-known make. Added to this is the fact that the pentode has a maximum undistorted output of more than 2.000 milliwatts, and such an output can actually be obtained when using the valve combination shown in conjunction with a short improvised aerial situated within 20 miles or so of a main B.B.C. station.

Not only are the valves efficient from the point of view of the amplification they give, but also in regard to their current consumption. For example, the three receiving valves each require a heater wattage of only 6 (250 volts (max.) at .024 amp), whilst their H.T. requirements are similar to those of normal A.C. valves of the same types.

A Suitable Circuit

It has been said that the circuit arrangement is very straightforward, and it should be mentioned that the constructional details for a really compact receiver using the circuit are equally simple. By reducing the components to the least possible number compatible with efficiency, and by choosing modern parts of small dimensions, the whole set can be accommodated in less space than that required by a single-valver of the battery-operated type.

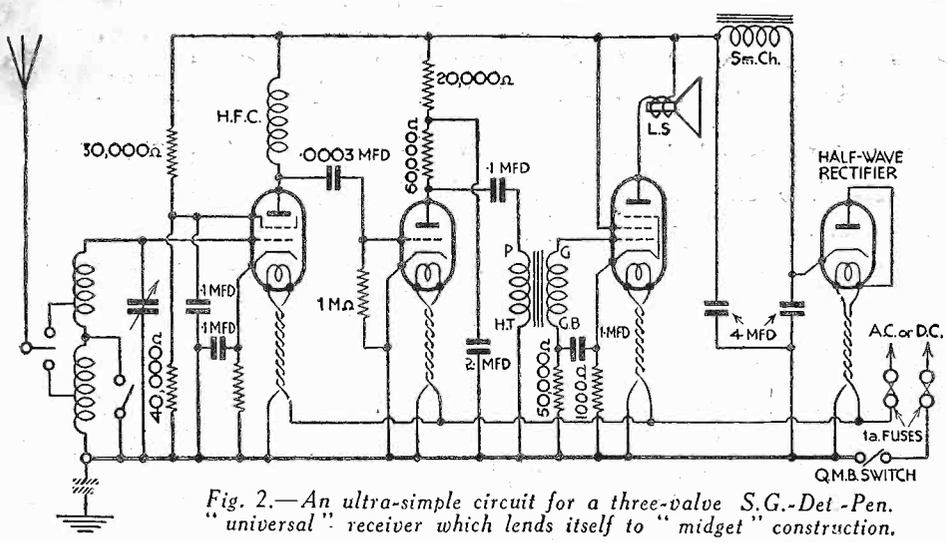


Fig. 2.—An ultra-simple circuit for a three-valve S.G.-Det.-Pen. "universal" receiver which lends itself to "midget" construction.

Grid bias is obtained in the usual manner by inserting suitable resistances in the cathode leads; the values of resistances shown are average ones which may require to be modified according to the particular valves employed. The tuning arrangements are not of the most efficient type, and the absence of reaction is not conducive to very good reception of comparatively distant stations, but this particular instrument is intended more as an example of what can be done in the way of simplifying things and making a really small set, than as an "ideal" receiver. The adoption of a single tuned circuit (in which one of the small iron-core coils would be used) serves to simplify the design and to economize in space by employing a single variable condenser of the bakelite dielectric pattern. Moreover, by using a good iron-core coil the degree of selectivity is ample for the purpose, especially when the set is "fed" from a short aerial. Provided that a really efficient screened H.F. choke is connected in the anode circuit of the S.G. valve a very useful amount of high-frequency amplification can be secured.

Resistance-fed transformer coupling is employed between the detector and pentode valves to ensure a high stage gain and the detector anode is adequately decoupled by means of the 20,000-ohm resistance. The cathode circuit of the pentode is decoupled by means of a 50,000-ohm resistance and, although this might not always be essential, it does eliminate the possibility of L.F. instability.

Another point in regard to the circuit is that, if the set is to be used in conjunction with an earth lead (which is frequently quite unnecessary due to the fact that the "earth line" is in direct contact with one mains supply lead) a fixed condenser must be inserted between the earth lead and the set as shown by broken lines.

Choosing the Components

It is obvious that the components for use in a "midget" receiver must be chosen with extreme care; not only must they be really small but they must be capable of withstanding the full voltage of the mains. As a matter of fact, however, there is a wide market from which to choose, especially since nearly all components are now made in more compact form than ever before. One should make a start by considering the loud-speaker. This component should preferably be a high-resistance moving-coil, in order to obviate the need for an output transformer, and should not have a greater diameter than 5 or 6ins. In most instances it will be necessary to employ a speaker of the permanent-magnet type, even though a field-energized one would be very helpful, due to the fact that it would remove the necessity for a smoothing choke. Unfortunately, however, so far as the writer is aware, there is no speaker on the market having a sufficiently-low field resistance that the magnets could suitably be energized without producing too great a voltage drop when the field is connected in the main H.T. lead. This difficulty would not exist if the constructor were prepared to accept a certain loss in efficiency by feeding only about 150 volts to the anode of the output valve. In such a case a standard field energized "midget" speaker with a field resistance of 2,500 ohms could be made use of, and this would produce a voltage-drop of 75 volts when the valves were consuming 30 milliamps high-tension current. The loss in this case would not be so very serious excepting when the set was operated from 200-volt D.C. mains.

When a permanent-magnet speaker is to be employed the smoothing choke presents a rather difficult problem, since it must have an inductance of not less than about 15 henrys when handling the full H.T. current, which might amount to nearly 40 milliamps. On the score of compactness it is best to choose a "stripped" component of the "manufacturers'" type; this is devoid of the usual casing, but is quite as efficient as one of the more usual kind.

There is not much difficulty in choosing a minute iron-core coil, and the same thing applies to the bakelite-dielectric condenser used for tuning it. All the fixed condensers with values of less than 1 mfd. might well be of the tubular type, while the two 4 mfd. and two 2 mfd. condensers might be obtained in the form of a compact "block" which could be of very small dimensions, since the condensers need have a working voltage of no more than 300. Fixed resistances are easy, for there are any number of small tubular ones with wire ends, some of these actually measuring no more than 1¼in. long by 3-16in. diameter. The L.F. transformer would be of the parallel-feed type.

A suggested arrangement of a "midget" set employing a circuit similar to that given in Fig. 1 is illustrated in Fig. 2. The valves must necessarily be placed near together, and the cabinet should have an open back.

The DETECTOR STAGE

HOW TO OBTAIN THE BEST RESULTS

The Detector Stage is the Most Important in the Whole Receiver, and This Article Deals with a Number of the Problems which Beset the Amateur when Designing This Section of the Set.

PREVIOUS and recent articles have dealt with the design of the high-frequency and low-frequency portions of receivers, and as those articles have proved very popular with readers it is felt that the detector section should now be dealt with in order to complete the series. It is not proposed to consider every form of detection, but simply to deal with the chief practical aspects of the grid-leak detector; the power-grid system is really a form of leaky-grid detection, so this will be referred to at the same time.

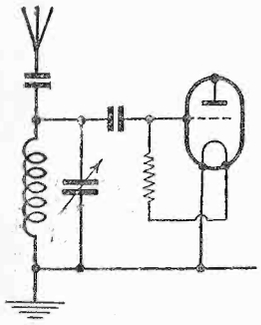


Fig. 1.—The usual form of aerial-grid circuit employed in simple receivers.

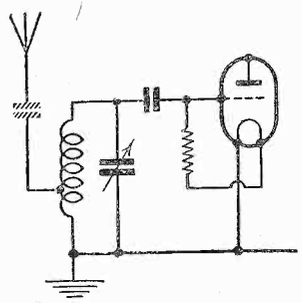


Fig. 2.—A better detector input circuit connected to a tapping about one-eighth of the distance from the bottom of the coil. A condenser may also be included in the aerial lead where a long aerial is employed.

Grid-circuit Coupling

The first point which the designer must consider in regard to the detector stage is the type of coupling which shall be used in the grid circuit. When the valve is not preceded by an H.F. stage the input circuit will generally consist of a single tuned coil to which the aerial is connected, either through a small condenser or to a tapping; the two arrangements are shown in theoretical form in Figs. 1 and 2. Both are standard tuning systems, although the first one is probably most widely employed. As a matter of fact, however, the latter is nearly always better, provided that the tapping points on the medium- and long-wave windings are chosen with care. Experiment nearly always proves that the optimum tapping positions for maximum selectivity, with the smallest loss in signal strength, is to be obtained by tapping the two windings about one-eighth of the distance from the "bottom" of the windings. The aerial is, of course, connected to the appropriate tapping for long- or medium-wave reception by means of a single-pole change-over switch. This should preferably be ganged with the main wave-change switch that serves to short-circuit the long-wave winding for medium-wave reception. Consequently, it is most convenient to use a two-pole change-over switch (of either the Q.M.B. or rotary type) wired up as shown in Fig. 3. The arrangement shown in Fig. 3 is, incidentally, readily applicable to nearly every type of tuner, home-made or ready-made, and the numbers of turns and diameter of former shown will be useful to those constructors who propose to make their own tuners. It should be stated that the dimensions apply to coils suitable for the "Lucerne" wavelengths, and covering the bands from approximately 190 to 500 metres and 800 to 1,800 metres when tuned by a .0005 mfd. condenser of good design.

Another form of aerial-grid coupling coil is that which makes use of inductive coupling only, and which has the connections shown in Fig. 4. This is very good from the point of view of selectivity on medium waves, but is not generally so satisfactory on long waves. In any case, the tapped coil previously described is nearly always to be preferred, especially if the constructor is prepared to experiment a little in regard to the most suitable tapping points.

When the detector valve follows an H.F. amplifier conditions are somewhat different, and there are three alternative methods of grid-input coupling. These are: tuned anode, tuned transformer, and tuned grid. Readers are frequently in doubt in regard to which of these is to be preferred, and the solution to the problem is not always very obvious. The question can best be tackled by pointing out the advantages and disadvantages of the three systems, and by quoting examples of different PRACTICAL WIRELESS receivers in which each was employed.

Tuned Anode

Tuned-anode coupling (see Fig. 5) is one of the oldest systems, and is probably the most efficient, provided that the anode tuning coil is a really good one. This form of coupling was used in the recent "Boom" set, where a maximum amount of high-frequency amplification was required from a single variable-mu stage, in order to derive the greatest benefit from the A.V.C. device connected in the anode circuit of the detector. The objection to tuned-anode coupling is that, due to its extreme efficiency, it tends to produce H.F. instability unless the set is carefully designed and the components chosen with care. It is, generally, a difficult matter to combine two stages of tuned-anode coupling without introducing some form of "artificial" damping to maintain stable operation.

Tuned H.F. Transformer Coupling

Tuned-transformer coupling (illustrated in Fig. 6) is actually very similar to the system just described, the only difference being that two windings are used, one of which is in the anode circuit of the preceding H.F. valve and the other in the grid circuit of the detector. By varying the number of turns on the primary (anode) winding, and modifying its position in respect to the secondary, it is possible to

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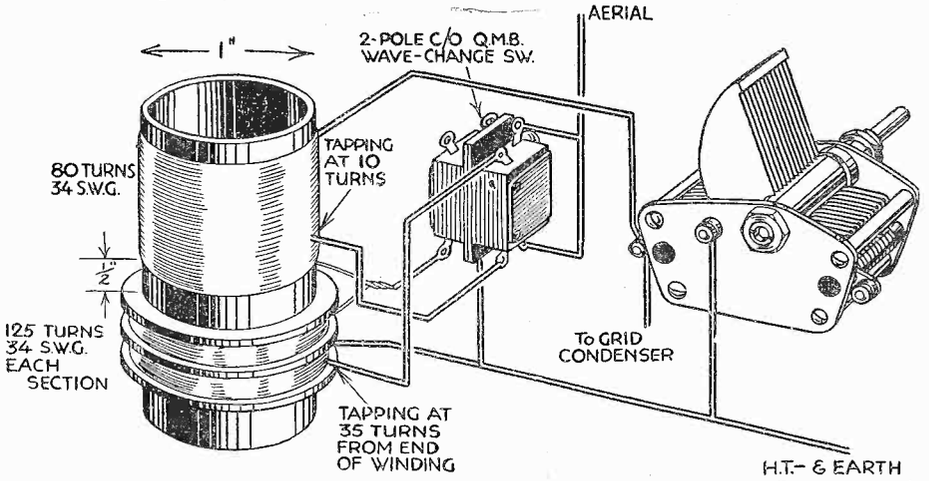

Fig. 3.—Details of an excellent aerial coil with aerial transfer tapping. Constructional details can be obtained from the article "Making Your Own Screened Coils," on page 633 of "Practical Wireless" dated December 9th, 1933.

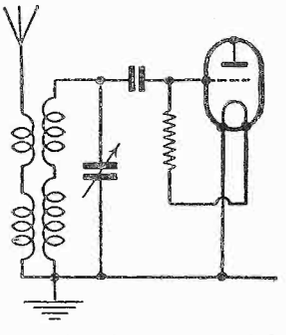

Fig. 4.—An inductively-coupled aerial input arrangement. This usually works well on medium waves, but is not quite so good on the long-wave band.

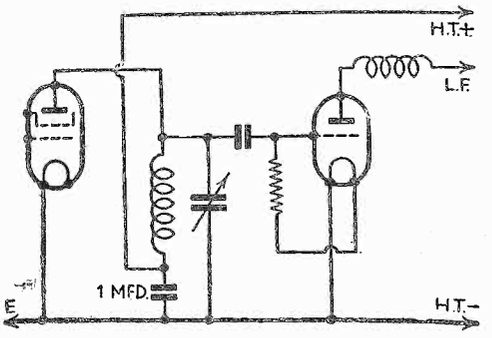

Fig. 5.—Tuned-anode coupling in its simplest form.

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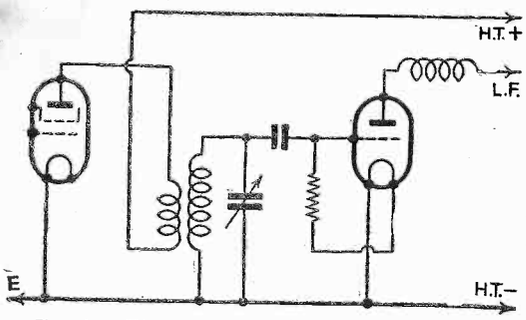


Fig. 6.—The connections for tuned-transformer coupling are similar to those for tuned anode, but an extra winding is used.

obtain a wide variation in the degree of selectivity. Thus, the tuned transformer, if made in selective form, is not quite so efficient as the tuned-anode coil, but is more stable and generally more selective. This kind of coupling was used in the "Quad-pak" (described in PRACTICAL WIRELESS dated November 25th and December 2nd, 1933), where two highly-efficient variable-mu pentodes were used in the H.F. amplifier stage. These valves themselves give an enormous amount of amplification so that if too efficient coupling devices had been employed instability would have resulted. Tuned-transformer coupling was also used in the "Leader" (described in PRACTICAL WIRELESS dated March 3rd, 1934), but in this case the transformers chosen gave fairly close coupling between primary and secondary, so that the overall amplification was not reduced. At the same time, the transformers obviated the need for an S.G. H.F. choke, such as would have been required in the case of tuned-grid coupling, or decoupling condenser and resistance which would have been called for in the case of tuned-anode coupling. As a result, high efficiency, selectivity and cheapness were all secured at the same time.

Tuned-grid Coupling

Tuned-grid coupling is very similar to tuned anode, but calls for the use of an H.F. choke in the anode circuit of the valve preceding the detector, a condenser being joined between the anode and the tuning coil in the grid circuit of the detector valve. Tuned-grid coupling can generally be considered to be just about as efficient as tuned anode, but it is less prone to instability. When using a very high-impedance H.F. valve (for example, an H.F. pentode) tuned-grid coupling is often preferable, owing to its greater freedom from instability. Tuned-grid coupling was used between the second V.M. valve and the detector in the "1934 Fury Four Super," and the circuit of that set will serve as an example for those readers who are not quite sure of the connections. The circuit appeared on page 904 of PRACTICAL WIRELESS dated 27th January last.

The Detector Valve

After having decided upon the form of input circuit to be employed we must make a choice of the detector valve. There are two general types of valve available; one of these has a comparatively low impedance and correspondingly low amplification factor (or mutual conductance, which is more descriptive of the "gain" provided by the valve), and the other is of high-impedance and higher mutual conductance. It depends very largely upon the general circuit arrangement as to which type shall be employed. If the detector is preceded by more than one H.F. stage and is followed by a pentode L.F. amplifier the former type of detector is to be preferred, since it will handle greater input signal voltages without overloading, and, because of its own comparatively low amplification, there will be less risk of overloading the pentode. On the other hand, if only a single H.F. stage is in use, and especially if the detector is followed by a low-amplification triode, it is better to use a detector of the high-amplification type. In order to differentiate between the different patterns of detector valve it might be stated that the average high-amplification detector is of the "H" or "H.L." type and has an impedance between about 20,000 and 35,000 ohms. The low-amplification detector, type "L" or its equivalent, generally has an impedance between 10,000 and 20,000 ohms.

Grid Condenser and Leak

When the valve has been chosen attention can be turned to the values of its associated components. The grid condenser and leak must first be considered, and the values of these depend partly upon the characteristics of the valve, and partly upon the voltage applied to its anode. In the case of the average high-amplification detector used under average conditions the somewhat stereotyped .0002 mfd. and 2 megohms can rarely be improved upon. At the same time it is frequently worth while to experiment with different values, bearing in mind that a reduction in capacity, or an increase in grid-leak resistance, tends to improve selectivity, whilst the opposite usually increases the power-handling capacity of the valve.

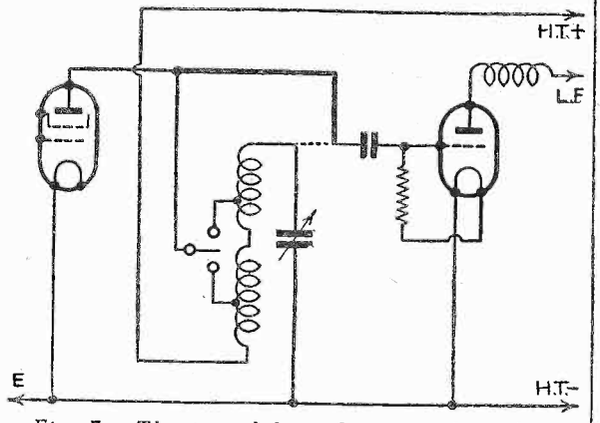
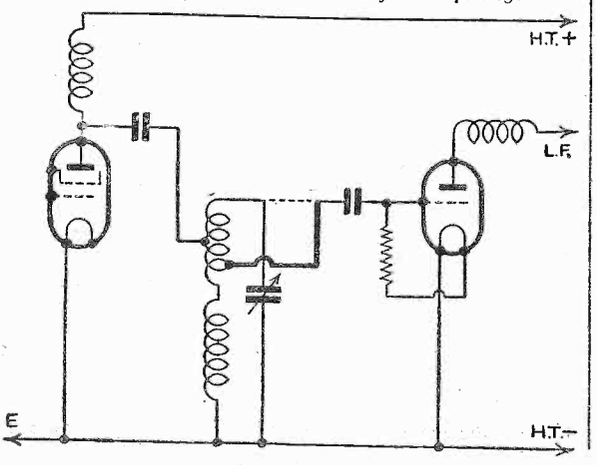


Fig. 7.—The two skeleton diagrams alone show simple methods of improving selectivity by connecting the detector grid condenser to a tapping on the preceding tuning coil. The usual connection is shown as a broken line. Wave-change switching is omitted from both circuits for simplicity.

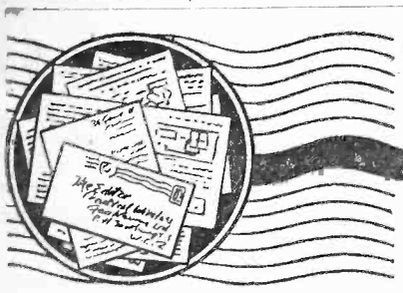


Power-Grid Detection

This introduces the question of power-grid detection. Although the variation in values just mentioned *does* increase the power-handling capacity, the mere alteration in capacity and resistance *does not* effect the change from leaky-grid to power-grid, as many amateurs seem to imagine. For power-grid detection it is necessary to employ a low-impedance detector and to supply its anode with at least 120 volts and 170 volts, for the battery- and mains-operated types respectively. Another "power-grid" fallacy is that this form of rectification produces an increase in volume; this is far from the truth. All that power-grid does is to increase the *power-handling* capacity of the valve. This entails the use of a low-amplification valve under the appropriate conditions, so that the volume would be less after changing over in a receiver giving a small amount of high-frequency amplification. Another disadvantage of power-grid is that it reduces selectivity, due to the fact that the lower-impedance valve imposes a greater load on the preceding tuned circuit. This can often be overcome, however, by connecting the grid to a tapping on the coil by one of the methods shown diagrammatically in Fig. 7. Incidentally, this idea can be used successfully to improve selectivity with any kind of detector, and is always worth trying.

The Detector Anode Circuit

The detector anode circuit may be considered last of all. The first requirement is an H.F. choke having an inductance of not less than about 200,000 microhenrys and a self-capacity of no more than 4 m.mfd. The choke prevents the leakage of H.F. currents into the L.F. amplifier, but in order to allow the choke to function to the best advantage a by-pass condenser (capacity between .0001 mfd. and .0003 mfd.) should be connected between the anode of the detector and earth; this provides an easy leakage path for H.F. currents which are "choked back." The anode coupling component (transformer, resistance, choke, etc.) has formed the subject of many previous articles.

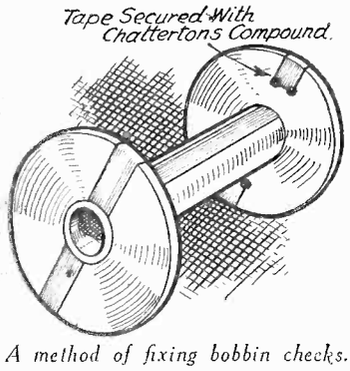


READERS' WRINKLES

THE HALF-GUINEA PAGE

Fixing Bobbin Cheeks

THE accompanying sketch shows a simple and sure method of fixing end cheeks to bobbins, used in the construction of transformers, etc. A piece of tape is fixed along the tube and brought



A method of fixing bobbin cheeks.

out round the flange and fixed with a dab of Chatterton's compound, two or more pieces of tape being used as found necessary. —H. DAINTON (Stanmore).

Trammel for Marking and Punching Television Discs

THE accompanying sketches show a trammel and gauge which I have found very useful in marking out a television disc. The trammel is made from 3/16in. square mild steel or brass, the end which fits the centre leg being filed round and a hole drilled in the leg to suit. Both are bored to take a tapered pin or grub screw when held parallel. The outer leg is bored up to take a gramophone needle. This should be ground square to size and is used to punch out the spiral of holes. The centre leg is made a good fit in the boss of the disc, the collar shown being used to adjust the height so that the punch just rests on the disc before punching. The gauge is made from light brass, copper, or tin, the hole being also the exact size as the one in the boss. To use the trammel and gauge the centre leg is passed through the gauge, then into the boss of the disc.

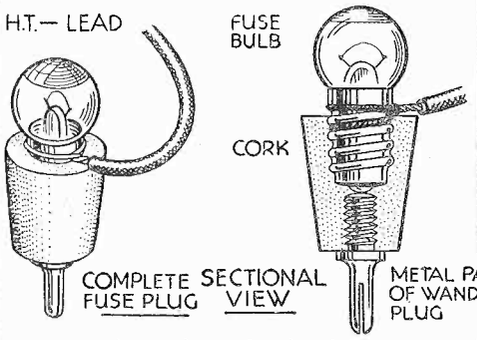
THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

Then adjust the collar for height, and punch hole No. 1. Set the punch until its outer edge is exactly over the inner edge of hole No. 1. Now the gauge comes into use. Place the edge till it just covers hole No. 1, then take the punch up until it touches the gauge and punch hole No. 2 and so on until all the holes are made.—W. HALL (Greenock).

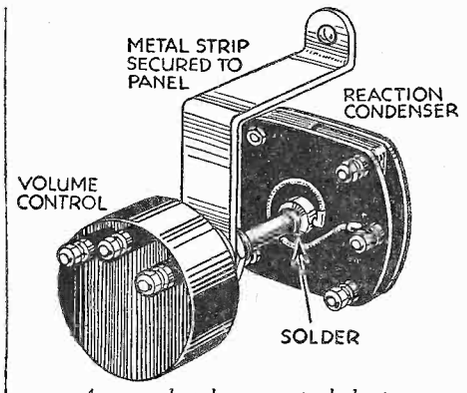
A Simple Wander-plug Fuse

AN easily-made "plug fuse" can be constructed in a few seconds with the following:—a cork bored at each end



An easily made plug-fuse.

to take one end of an ordinary wander plug and also the end of a fuse bulb. The fuse bulb is then connected to the H.T.—lead by twisting the wire round the fuse bulb as shown.—G. M. SHEWAN (Aberdeen).



A ganged volume control device.

A Ganged Volume Control

BY ganging the pick-up volume control to the reaction condenser, it will obviate the necessity of another control. The volume control potentiometer is held by a metal strip, bent to the shape shown in diagram.

The method of fixing is self-explanatory. The volume control spindle is then soldered to the condenser spindle.

In some cases a more satisfactory job will result if the ends of the two spindles are tapped, and a short length of screwed rod fitted. Solder should be applied to the screw-thread as the rod is being fitted.—C. GANTZER (Billericay).

Eliminating Long Mains Leads

I RECENTLY encountered a problem which has doubtless troubled many fellow readers, viz., how to operate a mains-driven set from a wall plug situated on the opposite side of the room. In my case, as in many others, there was just one logical position for the receiver, which resulted in the use of a long flex lead. It was very soon discovered that this method was not only unsightly, but that it was dangerous. At a small expense the difficulty was overcome as follows.

Two extra 5-amp. wall sockets (with bases), one 5-amp. plug and a Bulgin

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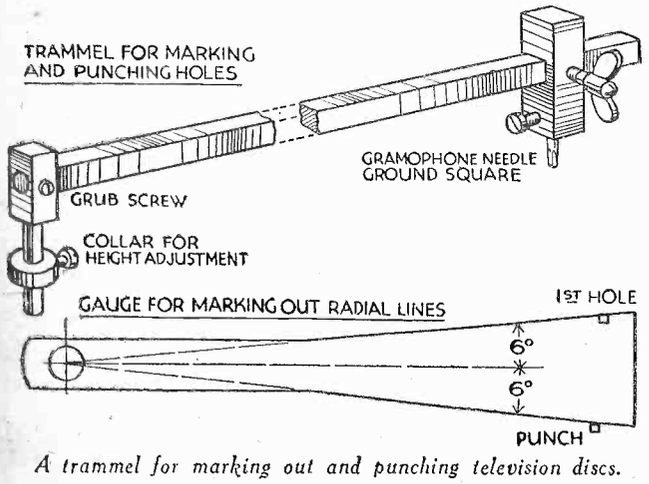
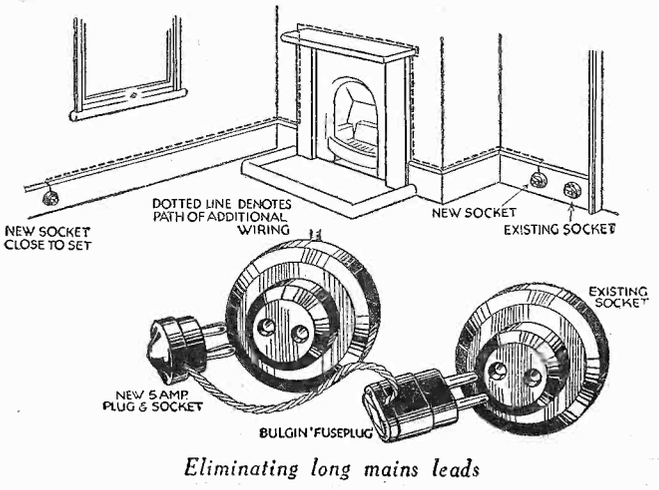


A trammel for marking out and punching television discs.



Eliminating long mains leads

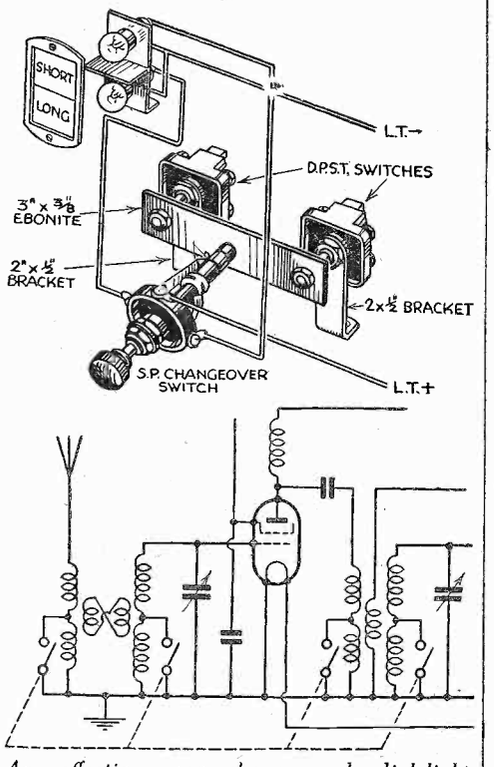
READERS' WRINKLES

(Continued from previous page)

fuseplug (for safety) were obtained. One socket was placed near the existing point, and the other on the skirting close to the set. Wiring was carried out with heavy workshop cable, secured by insulated staples. This was carried round the skirting of the room, and toned down to match the paintwork, and was inconspicuous. The "fuseplug" was, of course, used at the end adjacent to the mains point. A short connector, as shown in sketch, joined the two sockets.—J. S. SHELLEY (East Sheen, S.W.14).

A Convenient Wave-change and Dial-Light Switch

ONE movement of the switch illustrated changes the waveband and also lights up the glass panel fitted on the set



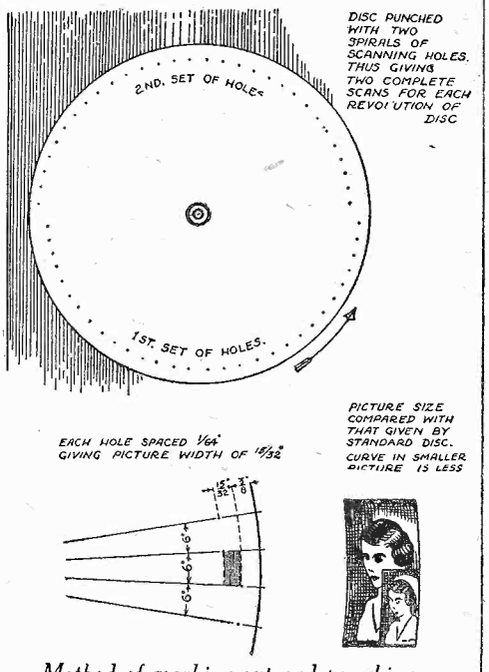
An effective wave-change and dial-light switching arrangement.

to show which wave-band is in use. Material required for the combination switch is as follows: One Lissen push-pull switch with ⅛in. of the insulation cut off the end, leaving the thread for screwing in the ebonite strip. The ebonite strip, of 3in. by ⅜in. by ⅛in. thick, has a 3BA hole tapped ⅛in. from each end. For the brackets, two brass strips bent at right angles at one end, giving a ½in. foot for screwing to base board, are required. The height of the brackets is 2in. Drill a 5/16in. hole ½in. from top of each for fixing the four point switches together by removing knobs and fitting ebonite strip with nuts. The light indicator comprises two low-consumption 2-volt bulbs, a small bracket with dividing piece and a small piece of thin opal glass with the words "long" and "short" printed backwards on the inside of the glass.—F. W. MARLOW (W.2).

Making a Television Scanning Disc

I FOUND the motor in my home-constructed television receiver was incapable of driving the scanning disc at the requisite 750 r.p.m. I, therefore, marked out another disc having two sets of scanning holes (60 in all), and was able to receive the picture at half speed, *i.e.*, 375 r.p.m. It is necessary to mark off the disc into 6 degrees sections, in place of the 12 degrees of the standard disc, and for accuracy I have found it best to mark off at 12 degrees and then bisect each section. If the first holes of each spiral are started ⅜in. from the outside edge of the disc, and each hole is spaced 1/64in., the resulting picture will measure approximately 15/32in. by 1-1/32in. which is about right for the 7/3 ratio. A needle of medium thickness can be used for making the holes. The resulting picture is, of course, smaller, but has an advantage of being almost straight sided, more so, in fact, than that of the standard disc. Amateurs who have motors incapable of reaching 750 r.p.m. may like to try out the idea, and will find *thin ivory board* both cheap and satisfactory for experimental purposes.—R. L. GRAPER (St. Albans, Herts).

[Whilst Mr. Graper is correct theoretically in his suggestion for a double spiral or holes in the disc rotating at half speed, the workmanship involved for accurate



Method of marking out and punching a television scanning disc.

results is beyond the average amateur. Similar quarter-size images are given by rotating a 30-hole disc at half speed, it being necessary to mask out the three redundant images also obtained. Each individual image under these circumstances has a scan of only fifteen lines, and is, therefore, coarser, but this will be preferable to an inaccurate double spiral disc for, unless each spiral is absolutely identical, image weaving will result. Another very important point omitted by Mr. Graper concerns the disc sizes, for it is on this factor and the image ratio that the exact hole size is calculated. Using the hole size given, the radius of the outside edge of the first hole is 10.464in., and unless this diameter is used, the image will be of the wrong ratio and give distorted results.—ED.]

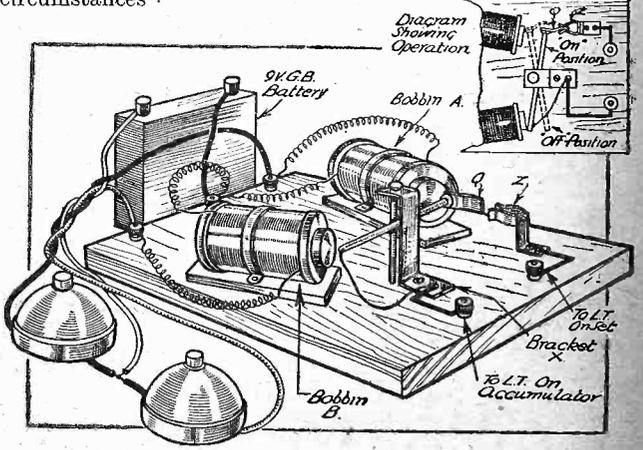
An Effective Remote-Control Relay

THE remote-controlled relay illustrated can be constructed for less than 2s. 6d., including battery, and is ideal for switching the set on and off from another room. Any number of control points can be used.

A piece of baseboard ply about 5in. by 3in. is first required, and on this are mounted two ordinary bell bobbins raised slightly on little blocks of wood and secured by brass strips in the position shown. Next, two nails about 1¼in. long are required. Take a piece of fairly stout brass ½in. wide and 2½in. long. Bend to shape as shown at X. Each of the bends should be ¾in. long, therefore the centre portion should be 1in. in length. Drill a hole the same diameter as that of the nail ¼in. from the edge of the top bend and insert one nail point first. Now solder the other nail horizontally to the first so that when the whole is mounted the head of the horizontal nail is toward the bobbin A. (See below.) A small piece of *thin*, springy brass or phosphor bronze (the latter for preference) about ¾in. long, and, say, ¼in. wide, and bent to the shape shown is then soldered to the nail head. To the other end of the horizontal nail solder a *single strand* from a piece of flex about 2in. long. Now mount the whole on the board in the position shown, the point of the nail being recessed into the wood to form a pivot, making sure that it swings easily. Now proceed to make the clip-shaped piece Z; this is made from a piece of the same brass as used for the first bracket. Now make the clip from a similar piece of brass 1¼in. long and bend as shown in the diagram, each side being ½in. long. Solder this to the top of the other as illustrated, and mount in position. The strand of wire soldered to the pointed end of the horizontal nail should be connected to one of the screws holding the base of the bracket X, and should be looped slightly to form a weak spring, thus holding the contacts Q and Z securely apart when the device is *off*; this also establishes a definite contact between the bracket and the nail. The actual construction is concluded by connecting the bobbin wires as shown in the diagram to three screws or terminals and the contacts (Q and Z) are connected to two more terminals at the other end of the base.

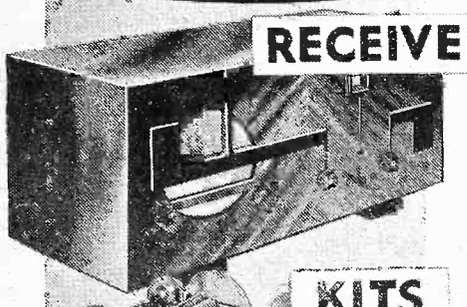
A 9-volt G.B. is needed to operate the device, and as the current used is only momentary this should last a long time. Triple wire is needed for the extensions, connected up as illustrated.—W. J. L. (Epping).

See page 1156 for instructions for securing the POCKET TOOL KIT.



A cheap but effective remote-controlled relay.

LISSEN



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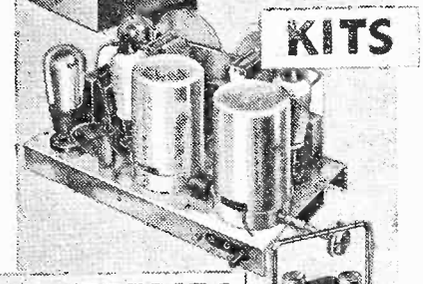

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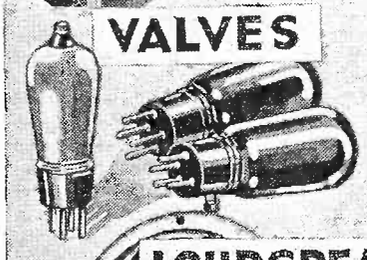

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SOLDERED CONNECTIONS

Our Readers Recently Voted Overwhelmingly in Favour of Soldered Connections. Some Very Useful Information in Regard to Correct Soldering is Given in this Practical Article which Explains the Process from the Amateur's Point of View.

IT is an unfortunate fact that the terminals fitted on some components are not all that they should be. The smaller sizes are almost invariably fitted with miniature nuts which have had their diameters reduced on the under side. These prove sometimes too small to hold even a closely-formed loop of 18-gauge wire, and attempts at tightening usually result in the nut forcing the loop open. Another snag frequently encountered is the terminal that is unable to accommodate more than one wire without making it difficult properly to screw on the nut.

Advantages of Soldering

After having spent an evening in wiring up to terminals of this description, how many readers have wished that they were masters of the soldering iron? Besides providing a definite solution to these troubles the wires, when soldered to tags, make much better electrical contacts. Soldering also permits the use of many small components fitted only with soldering tags. These may be connected and suspended in the wiring. Parts such as these are equally as efficient as those fitted with terminals, but, naturally, they are considerably cheaper. There is one other point in favour of soldering, and that is that where two or more wires run to one terminal in the ordinary way it is only necessary to take one wire direct to that point and join the other wires more conveniently to it.

Many people who have never yet attempted soldering are under the impression that it is a tricky job. This is not so! Let anyone who is doubtful have a try and see, if by following the instructions given below a perfect soldered joint is not made at the first attempt.

The Equipment Required

The most important tool required is a soldering iron. An electrically-heated one is eminently suitable for wireless work, but as there is no difference in the actual use excepting the method of heating we will confine our remarks to the flame-heated variety. The most serviceable type to buy is that illustrated, the copper bit being riveted between the forked shank. The actual copper portion should be about 8ozs. in weight. A 6in. or 8in. flat "second-cut" file, together with a stick of tinman's solder, a small bottle of non-corrosive soldering fluid, a tin of "Fluxite," and two small tin lids complete the outfit.

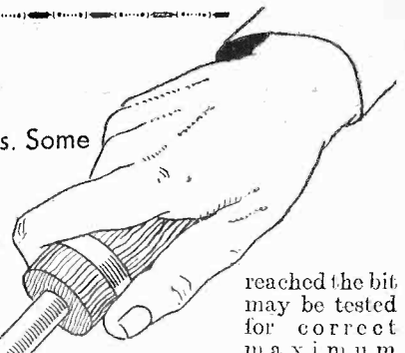


Fig. 1.—The most useful type of soldering iron for wireless work.

No doubt the gas ring will provide the heating agent, in which case it will be well worth while to make up a cowl as follows: Bend a piece of sheet iron to form a tunnel about 3in. high by 6in. long, wide enough to span the small burner, and at the same time rest on convenient grid bars. In the centre and 1in. up from the bottom on either side drill a hole to pass a 6in. wire rail. The object of this is to concentrate the heat and save wastage of gas.

Now examine the point of the copper bit and you will in all probability discover that it is shaped in the form of a pyramid. Should this be so, re-file it to a chisel point with a width of about 3-16in. See that the angle formed is less than 90 degrees, as shown in Fig. 4.

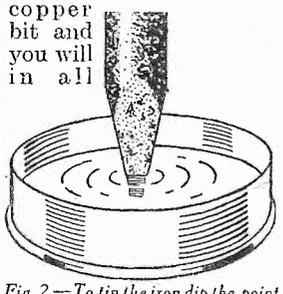


Fig. 2.—To tin the iron dip the point in non-corrosive soldering fluid after heating.

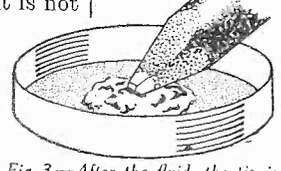


Fig. 3.—After the fluid, the tip is pressed into some solder, until the point is bright all round.

Tinning the Iron

Half fill one of the tin lids with the fluid. Lay the copper bit on the bar in the sheet-iron hood so that it is directly over the flame. Now watch the flame, and when the colour changes from blue to bright green, remove the iron and dip the point into the tin containing the fluid. Hold the iron against the stick of solder and melt a small heap into the other lid. Place the end of the copper bit into this heap and, upon removal, it will be coated with solder; in other words, it will be tinned. It must always be kept in this condition. For successful soldering the two important points are tinning and correct temperature of the iron. Anyone with experience can tell the correct temperature by holding the iron close to the cheek. But until this state of affairs is reached the bit may be tested for correct maximum temperature by holding it against a piece of newspaper held in the hand. The iron should char the paper, not merely scorch it, without burning a hole.

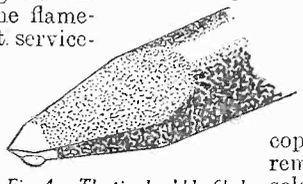


Fig. 4.—The tip should be filed as shown in this illustration.

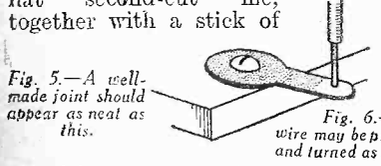


Fig. 5.—A well-made joint should appear as neat as this.

Fig. 6.—For strength, the wire may be passed through a hole and turned as shown here.

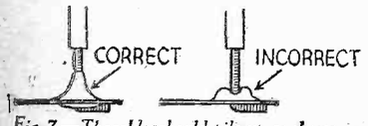


Fig. 7.—The solder should pile up as shown on the left. If it appears as shown on the right the joint is dry-soldered and therefore unsound.

Soldering Wire Connections

Prepare the end of the soldering tag and wire by smearing on a small quantity of "Fluxite." Dip the point of the heated iron into the solder. This will cause a little "blob" of melted solder to hang on the under side of the iron when withdrawn. Place the point of the iron on the tag where prepared, leaving it there for a second or so, and treat the wire in the same way. Touch the end of the wire with "Fluxite" and place in position. Pick up a little more solder and apply to the junction of wire and tag, again leaving the iron in contact for a few moments. A perfect joint should be the result. Figs. 1 to 7 show the various stages of preparation and soldering in the sequence named.

Actually the joints take no longer than thirty seconds each to complete. Failure of the solder to form a proper junction, as in the view marked "incorrect" in Fig. 7, is proof either that the tinning was not properly done or that the temperature of the iron was wrong.

Where wires have to be attached, as shown in Fig. 8, a small crook formed on the end of the wire will provide a greater area of contact for the solder, thus producing a much stronger joint.

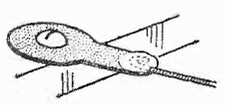


Fig. 8.—An alternative method of connecting a wire to a soldering tag.

Sweating

Sweating is another form of soldering, a typical example of which is illustrated in Fig. 9, which shows two spindles joined together by a sleeve. The parts are first tinned and then heated until the solder melts, assembled and allowed to cool.

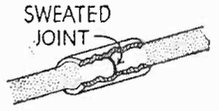


Fig. 9.—A neat method of joining two wires or rods end to end.

Hints On Wiring

When wiring up a set the following hints will be helpful:—

Tin all tags before fixing the components.

Place a piece of paper over exposed portions of components where a stray bead of solder is likely to cause trouble.

Use the "Fluxite" sparingly, and don't use the soldering fluid as a flux for electrical connections.

When joining one wire to another make a right-angle bend about ⅛in. in length on the end of the wire to be joined, and solder this alongside the other wire.

When tinning the end of a flexible wire press the bared and fluxed end into the solder with the heated iron.

In conclusion, do not let the iron remain on tags or parts adjacent to ebonite or moulded casings, since, apart from softening this material, there is the liability of the heat to travel down the screw to other soldered connections inside the component, with obvious consequences.

W. H. D.

FINISHING TOUCHES

Some Novel Suggestions are Made in This Article for Improving the Appearance of the Receiver.

By H. BEAT HEAVYCHURCH

MOST amateur listeners construct at least one receiver in a lifetime, and thousands build a considerable number; but how often is a set really finished off in a neat and workmanlike manner? A set is built, it is almost

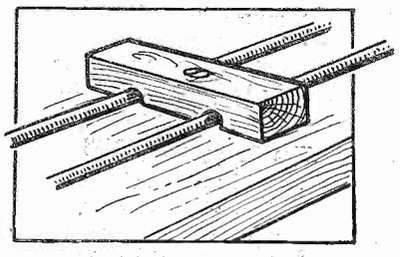


Fig. 1.—Small wooden cleats keep the base-board wiring neat.

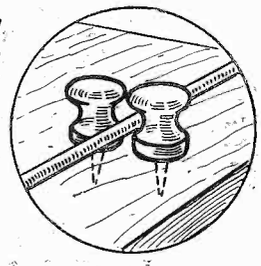


Fig. 2.—Glass-headed photographic pins are useful for anchoring wiring.

completely wired up and ready for service—and the builder, in his impatience to give it a practical test, cannot wait to give it the finishing touches but must make a hasty and sketchy job of the last few wires and start reception trials immediately.

Then, when the trials are completed and satisfactory, the set often remains for the whole of its existence really uncompleted. Or even if the wiring is made permanent, it will often occur that the receiver is never fitted into a respectable cabinet. So I am going to suggest ways and means for making a workmanlike job of your present receiver or the next one you build.

A Coat of Paint

If the baseboard is of the unmetallized type and is given a coat of absolutely matt black paint, what a difference is made in the appearance! (*All baseboards should be metallized or metal covered.*—ED.) The metallic parts and the different components stand out, and the whole construction takes on a professional appearance.

It has always seemed to me a pity that radio components are supplied in such a variety of colours. The low-frequency transformer may be dark brown, the fixed-condensers green, the cans of the coils battleship grey, and other components black, brown, or mottled.

Neat Wiring

It must be admitted that nothing looks better, especially against the black background, than bare tinned copper. This type of wiring, however, is a little risky for modern receivers with fairly high anode voltages, and has therefore gone out of fashion. One of the many excellent brands of insulated wire, or bare wire covered in systoflex is, therefore, suggested.

Some constructors consider it unfashionable at the moment to use the straight wires with neat right-angled bends which have been so popular.

There are always a certain number of wires that can best be run on the surface of the baseboard (when non-metallized), and they present something of a problem because they are apt to rise in the air, or sag and

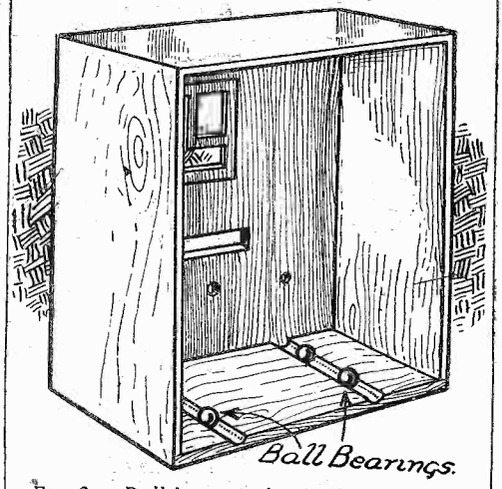


Fig. 3.—Ball bearings for facilitating entry of receiver into cabinet.

bend just sufficiently to spoil an otherwise neat job. They can be made permanently neat by clipping them down to the base with little wooden saddles which can be easily contrived by the handy constructor,

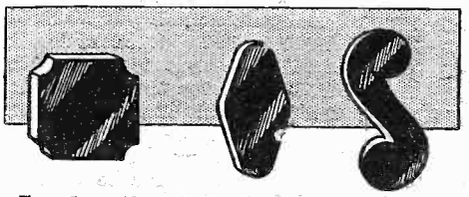


Fig. 5.—Alternative shapes for "knobs."

as illustrated in Fig. 1. Another plan is to use those glass-headed drawing-pins which are sold to photographers for hanging up prints to dry. A few of these, arranged in pairs at places where the wires make a change of direction act as guides and anchors and are quite inconspicuous, the scheme being shown in Fig. 2.

The Cabinet

Now we come to the question of cabinets. Have you noticed how difficult it usually is to slide a heavy set, complete with mains unit, into the average cabinet? Here is a little refinement which will make it easy. Cut a couple of shallow grooves across the base of the cabinet from back to front about an inch or so from the ends. Place one or two small steel balls such as those used in ball bearings in each groove (Fig. 3) and they will serve as rollers on which the baseboard of the set will slide easily as you insert it into the cabinet.

It is, of course, hopeless to expect that radio manufacturers will ever standardize the designs of knobs, and although it is not really a very difficult matter for the average amateur to purchase a complete set of knobs all of a type in view of the different diameters of spindles which have to be accommodated, there is an alternative. I recently saw a receiver which had only one round knob, and that was the knob of the tuning condenser. All the others were straight handles composed of round rod similar to that illustrated in Fig. 4. These could be made easily by anyone who possessed a drill brace, a few bits, and a small tap for forming the thread in the hole for the grub screw. They could be made from ebonite rod of half to three-quarter inch diameter, and then enamelled to match or tone with the cabinet if plain black was not acceptable. Alternatively, knobs of square, diamond, or fancy shape could be cut or filed up from a thick sheet of ebonite and decorated to taste. A few suggestions are indicated in Fig. 5.

Another finishing touch is some provision for moving the set. During the process of the daily dusting or the weekly "turn-out" it is usually necessary to lift the set from its normal position but this is frequently a difficult task. Fit four castors of some kind. For a cabinet set it is a more difficult matter to provide easy means of lifting, but in the case of a home-made cabinet such provision may be combined with ornament something after the style of the device shown in Fig. 6.

It will be best to fit your set with plugs and sockets for both aerial and earth connection so that these can be removed when it is desired to move the set.

This brings me to the final finishing touch—the flexible connections to aerial, earth, batteries, and speaker. Many an otherwise excellent installation is marred by long, untidy twisted flexes. The total amount of flex required for any set is only a matter of a few yards, so invest in new and good flex, fit it neatly to the terminals or spades, binding the insulation at the ends to prevent it from fraying, and cutting each length exactly to the right size to prevent it from drooping about in an untidy way.

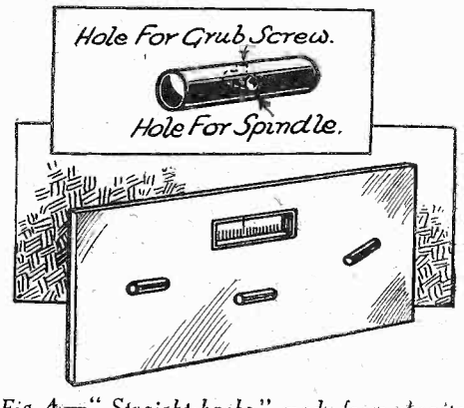


Fig. 4.—"Straight knobs" made from ebonite rod.

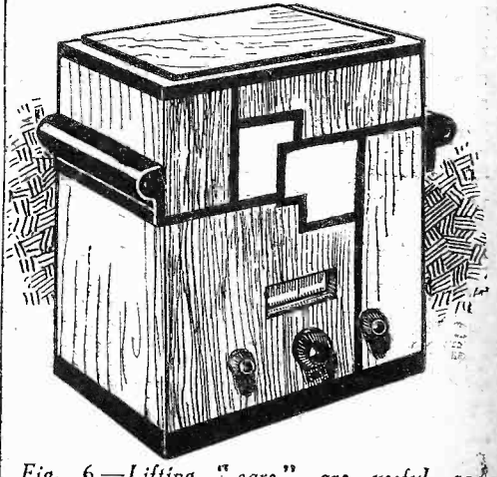


Fig. 6.—Lifting "ears" are useful and ornamental.

A.V.C. on SHORT WAVES

The Problems Involved in Obtaining Automatic Volume Control in a Short-Wave Receiver are Discussed in This Article

SINCE, generally speaking, fading is more pronounced on short waves than upon the broadcasting bands, it would seem that the use of some form of automatic volume control would be particularly desirable in any short-wave receiver. And yet, if a census were taken of the number of short-wavers fitted with A.V.C., it would probably be found that the number of such sets was very small indeed. There are many reasons for this, one of which is that none of the A.V.C. systems in use appears to be effective in coping with the "high-speed" fading which is peculiar to short-wave reception. I have tried various ways of overcoming this difficulty, but without success; the simple and usually excellent control unit which makes use of an H.F. metal-oxide rectifier is apparently quite useless at the higher frequencies, whilst the diode and double-diode valves prove little better in this respect. The reason for the ineffectiveness of these arrangements is probably that the essential decoupling condensers introduce too much "lag." This explanation would account for the fact that in some cases the normal A.V.C. schemes seem to make "high-speed" fading worse, rather than better.

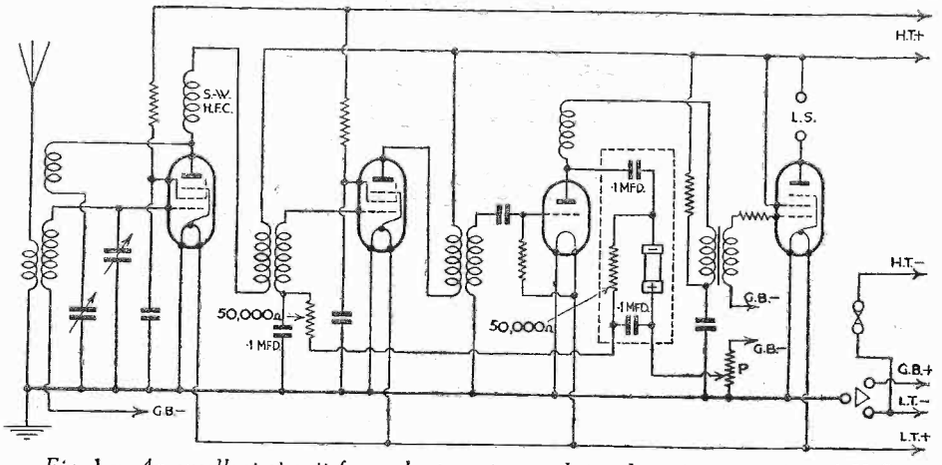


Fig. 1.—An excellent circuit for a short-wave superheterodyne incorporating A.V.C.

Very Little H.F. Amplification

Even if it is taken for granted that rapid fading cannot be overcome—at least by any method yet known—there seems to be no reason why the normal "slow" fading should not be cured by the use of an A.V.C. device. But there are a number of snags here, particularly when the popular type of S.W. receiver is being considered. For any A.V.C. system to operate it is essential to employ a variable-mu valve, the amplification of which can be varied by applying to its grid a changing bias voltage obtained by rectifying the H.F. signal voltages applied to the detector valve. On short waves, however, the S.G. or V.-M. valve gives very little amplification indeed, with a result that even if a varying grid-bias voltage were fed back to it the effect would be comparatively slight. A greater controlling effect would be obtained by using two variable-mu H.F. amplifiers, but a short-waver with two tuned H.F. stages is a most difficult piece of apparatus to control, so that the idea is by no means a good one.

Rectifier Efficiency Proportional to Wavelength

Another difficulty immediately presents itself in a set of this kind. The percentage efficiency of the type of automatic volume control unit (which makes use of the metal-oxide rectifier) is proportional to the wavelength of the signal voltages applied to it. In other words, the efficiency is inversely proportional to the frequency. Thus, although the unit might be a model of perfection at, say, 1,500 metres, its efficiency at, say, 20 metres would probably be just about nil. Besides, a unit of this kind, which is connected in the anode circuit of the detector, has a certain "damping" effect, which increases with the frequency of the signal voltages. Consequently on short waves there would be considerable difficulty in getting the detector to oscillate, and even then the efficiency would probably be quite low.

Diode Difficulties

It might be suggested that the latter difficulties would be avoided by using a double-diode triode, or similar valve, as detector and automatic volume control. Here again, though, there are many snags. One of these concerns the difficulty in providing a useful reaction control with the diode type of valve, and another occurs due to the fact that a diode has an appreciable "damping" effect at the shorter wavelengths. Both these are serious disadvantages, particularly the first one, since reaction is one of the greatest assets to good short-wave reception, and can almost be considered as an essential feature. Moreover, a circuit to include a diode detector would require to have several stages of H.F. amplification, and would be the very opposite of the simple arrangement which is preferred by nearly all short-wave experimenters.

The Solution

From the above remarks it might appear that automatic volume control in useful form is entirely out of the question in a short-wave receiver. The position is, however, not quite so serious as that, since a useful measure of A.V.C. *can* be obtained by the use of a super-heterodyne circuit, which may be a comparatively simple affair having no more than four valves. A good circuit of this kind is given in Fig. 1, and it can be seen that the first valve (an H.F. pentode) acts as a combined anode-bend first detector and oscillator, operating upon the autodyne principle. This is followed by a variable-mu pentode intermediate frequency stage, which is followed in turn by a leaky-grid second detector and a power pentode. Two normal 150-kilocycle I.F. transformers are used for coupling the first detector-oscillator to the L.F. amplifier and the latter to the second detector, whilst the tuning system follows standard practice.

The chief point of interest in regard to the subject under discussion is the insertion of an A.V.C. unit in the anode circuit of the second detector. This feeds a varying bias voltage back to the grid circuit of the L.F. amplifier, this voltage providing the required A.V.C. action. Additionally, there is a potentiometer, marked P, which serves as a manual volume control acting upon the variable-mu pentode.

A circuit of this kind really does give a reasonable and useful measure of automatic control over fading, and this effect can still further be increased where necessary by adding a second intermediate-frequency amplifying stage. The reason for the A.V.C. control working in a short-wave superheterodyne—although it will not do so in a "straight" short-wave circuit—is that the second detector operates as a constant (intermediate) frequency of 150 or 110 kilocycles, at which frequency the metal-oxide rectifier in the A.V.C. device is very efficient. It need scarcely be mentioned that a superheterodyne employing a diode or double-diode second detector would be equally good, although the arrangement illustrated is the simplest one and is to be preferred on that score.

Those who use a short-wave converter in conjunction with a normal broadcast receiver having one or more variable-mu stages can enjoy the same benefits by adding an A.V.C. unit to the set in the ordinary way. The unit will, of course, prove effective on both broadcasting and short waves. A skeleton circuit which shows how the A.V.C. unit should be connected is given in Fig. 2.

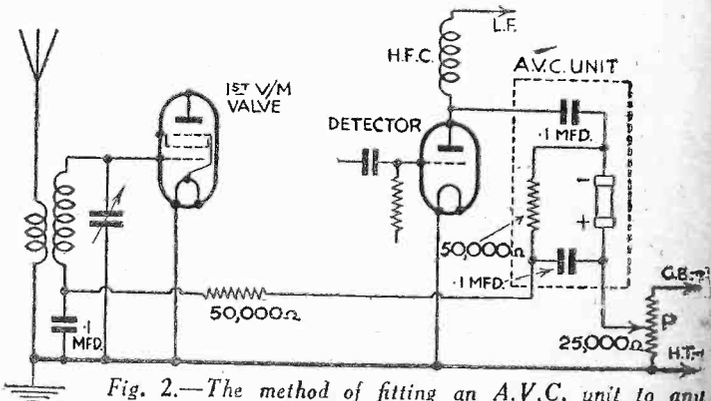


Fig. 2.—The method of fitting an A.V.C. unit to any type of variable-mu receiver.

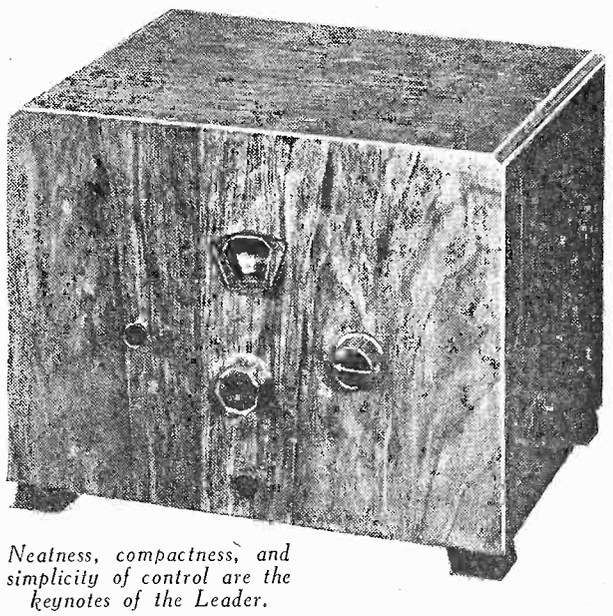
THE LEADER THREE

How to Use The Leader for Gramophone Record Reproduction

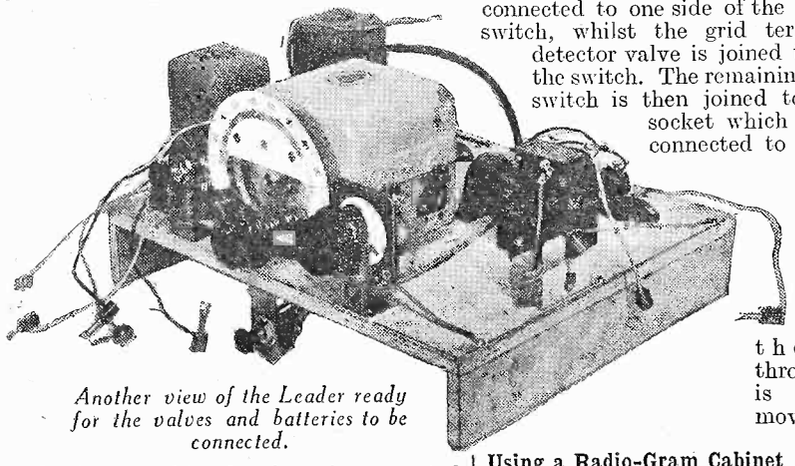
BEFORE dealing with the method of using the gramophone pick-up with The Leader, we wish to thank the hundreds of readers who have written and given us their appreciation of the new policy which we have adopted in the interests of the home-constructor. Whilst we knew that the policy would meet with approval with the majority of home-constructors, we had no idea that it would be productive of such enthusiasm, and we hope that the receivers which we shall describe in the future will be made in their thousands and will do much towards paving the way to better radio.

Connecting the Pick-up

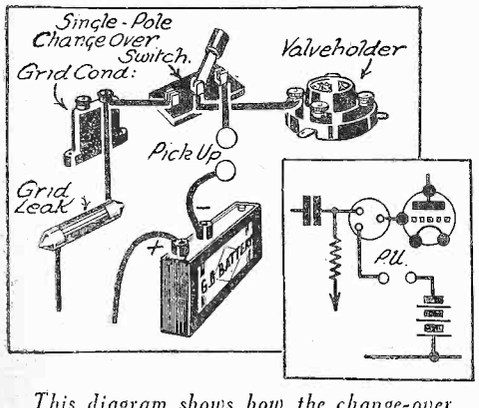
It will be seen that the terminal strip on the left-hand (rear) of the chassis is provided with sockets marked P.U. and that these two sockets are connected to the grid of the detector valve and to a grid-bias lead. No switching has been incorporated for this purpose, partly on account of the desire to reduce the cost, and partly because it is not entirely necessary to use such a switch. If a pick-up is plugged into these two sockets, and the pick-up bias lead is inserted in the grid-bias battery at about 3 volts, good record reproduction will be obtained, even although the grid-leak, grid condenser, and tuning-coil are all connected in parallel with the pick-up. If The Leader is being used within a few miles of a powerful broadcasting station it may be found, when the tuning dials are adjusted to the wavelength of that station, that the broadcast signals break through when the pick-up is being used. All that is necessary to overcome this difficulty is to turn the tuning dial to zero, or to some position on the scale where this interference is not experienced. If, however, it is thought worth while, a single-pole change-over switch may be attached to the rear chassis strip. It may be necessary to fit an insulating bush for the switch, but that will depend upon the type of switch which is employed. The lead from C4 and the grid-leak is then connected to one side of the switch, whilst the grid terminal of the detector valve is joined to the arm of the switch. The remaining point on the switch is then joined to the pick-up socket which is at present connected to the grid. If this is done, then when the switch is put over to gramophone, the tuning circuits are isolated and the break-through difficulty is entirely removed.



Neatness, compactness, and simplicity of control are the keynotes of the Leader.



Another view of the Leader ready for the valves and batteries to be connected.



This diagram shows how the change-over switch may be fitted.

Using a Radio-Gram Cabinet

It may be desired by some readers to mount the complete receiver in a radio-gram cabinet fitted with motor, etc. This will be quite in order, provided the receiver can be mounted fairly close to the pick-up. In some radio-gram cabinets the shelf for the receiver is rather low down, and this necessitates rather long leads from pick-up to receiver, with consequent risk of instability or induced hum. If, therefore, this difficulty is experienced when the apparatus is in use as a radio-gram, it will be necessary to enclose the pick-up leads in metal screening, with an earth connection joined to the screen. Any type of gramophone motor may be employed, and as the receiver is battery-operated, the listener who has no access to the electric mains may fit a good clockwork motor in order to complete the equipment.

Increasing the Output

Among the many letters which we have received there are quite a number from readers who, whilst they wish to build The Leader, desire to have a greater output than the 150 milliwatts which is provided by the present output valve. It is not possible to deal with every type of query individually, but it may be stated that the receiver in its present form is admirably suited to the addition of a Class B amplifier. The unit which was described in our issue dated April 8th last may be added to The Leader, under which conditions the present output valve becomes the Class B driver. No other alteration of any sort will be required. The input terminals on the unit are connected to the L.S. terminals on The Leader, which means that the primary of the driver transformer is connected direct in the anode circuit of the P.215 valve.

An alternative to the Class B output, for those who wish to have a little more volume, is the fitting of a pentode valve in place of the P215. To do this it is only necessary to purchase a pentode of the four-pin type. This is provided with a small terminal on the side of the valve base, whilst the four pins are connected in the normal manner. Thus, the pentode is plugged into the valve-holder and a length of ordinary flex is joined to the side terminal, and a wander-plug fitted to the end of the flex is then inserted in the H.T. battery at some point near maximum voltage. The exact position is not critical, but the total current consumption will be increased as this plug is moved towards the highest voltage. It was not thought desirable to fit Class B or a pentode output stage to the original model of The Leader, as the cost of upkeep was borne in mind, together with the initial outlay. These modifications are, therefore, only given for the benefit of those readers who desire to have a little more volume.

NOTABLE "LEADER" FEATURES

THE LATEST COILS FOR THE NEW "LUCERNE" WAVELENGTHS

AN EFFICIENT SCREEN-GRID STAGE FOR DISTANT RECEPTION

TUNED-TRANSFORMER H.F. COUPLING FOR MAXIMUM SELECTIVITY

SELECTIVITY "IN EXCELSIS"

AMPLE VOLUME FOR HOME RECEPTION

METALLISED CHASSIS CONSTRUCTION

REMARKABLY EASY TO BUILD

EQUALLY GOOD ON "RADIO" OR "GRAMOPHONE"

COSTS ONLY SIXTY SHILLINGS FOR THE PARTS

THE MOST POPULAR CIRCUIT ARRANGEMENT

GANGED TUNING CONTROL FOR EASE OF OPERATION

THE IDEAL SET FOR EVERY CONSTRUCTOR

REVIEW OF LATEST RECEIVERS

Tests of Standard Receivers On Our Aerial.

THE EKCO MODEL 74 A.C. CONSOLETTE.

IN this receiver we have a design which is based on the latest fashion in colouring and manufacture. Anyone who has seen the black and chromium finished cabinet must have been immediately struck by the beauty displayed by the severe simplicity of the scheme, and its arrangement is such that it will tone with any furnishings, although obviously looking at its best in a glass and chromium setting. The electrical side of the receiver is also absolutely up to date, and before describing this it would perhaps be worth while to describe the cabinet work. This is of bakelite, the pressing enabling a most clean appearance to be obtained. The corners are rounded, and the two rolls at the side, apart from relieving the plainness of the cabinet, enable the cabinet easily to be lifted when moving it from one place to another. The back of the cabinet is closed in by a sheet which is screwed into place, a further evidence of the care and thought which has been expended on the design being evident here. The screw-heads are provided with slots of such a width that they easily accommodate a coin such as a penny, so that no tools are required when adjusting the mains transformer tapping, or otherwise obtaining access to the interior. The speaker fret is removable, by the simple expedient of giving it half a turn to the left. It then comes free, and it is possible to remove the silk backing in order to replace it for cleaning or to insert some material which matches the normal room furnishings.

The Circuit

It would be obvious that where such care has been expended on the outward design of a receiver the interior should have received equal care and thought, and this is made apparent when the arrangement of the components and the actual circuit are examined. There are four valves (excluding the rectifier) and these consist of three pentodes and a duo-diode-triode. Two pentodes are of the latest type high-frequency valves, whilst the remaining one is an output valve, capable of delivering its full output of 3 watts. The first pentode valve acts as a combined detector-oscillator, whilst the second performs the function of intermediate frequency amplifier. This valve is of the variable-mu type and is controlled by one of the diodes of the duo-diode-triode which acts as second detector, automatic volume control, and first L.F. Fully delayed automatic control is employed, and this enables the manual volume control to be set to the best position and the main tuning control rotated throughout its complete movement without the inconvenience of a sudden blare as powerful stations are passed. It also renders all worth-while stations to be received at approximately the same volume, whilst removing many of the troubles which accompany fading. The screening is most comprehensive, the H.F. valve, for instance, being completely enclosed in a metal screen. Pick-up terminals are provided, and the gramophone circuit is brought into action by rotating the main selector switch. The loud-speaker is of the energized type, and is fully capable of handling maximum volume without distress and without the usual cabinet boom on loud bass notes.

The Controls

It will be noticed from the illustration that there are only three controls, and that there is no pointer or other indicator on the tuning scale. The right-hand control is for the manual setting of the volume and also brings the receiver into operation. When it is rotated a mains on/off switch comes into operation and immediately a dial light is illuminated behind the scale. Two such lights are provided, one behind the upper, or medium wave scale, and one for the lower, or long-wave scale. The lights are fitted to a travelling arrangement which throws on to the back of the scale a V-shaped lighted patch, with a small vertical shadow at the point behind the dial markings. As the main tuning control (centre) is turned the lighted section travels along, with the central line accurately showing the tuning setting. This is a very novel arrangement and proves most effective in use. When the left-hand control is turned the light travels from the upper to the lower section, or gives half illumination to both sections, denoting that the receiver is then adjusted for gramophone reproduction. Beneath the central control is a small tumbler switch which reduces the sensitivity of the receiver when tuned to a local station.

The Ekco Model 74 A.C. Consolette costs only 14 guineas in a black and chromium finished cabinet.

Test Report

The utility of this switch was experienced when the receiver was tested in North London. Here, in its most sensitive position the amplification afforded by the circuit was such that the output valve was easily overloaded and background noises were naturally very troublesome. A touch on the switch, however, and the noises disappeared as if by magic, and the local stations were received loud and clear. It was, in fact, not found necessary to use this switch on the aerial which is generally employed, unless very distant stations were required, and all of the B.B.C. main stations were heard without the necessity for operating the switch. Tuning was delightful, possessing that square-peak effect which is so often strived for but so often not obtained. A station could be tuned-in and as soon as the usual separation space was passed the station suddenly disappeared—there was no spread over five or six degrees. If the volume control was set to a suitable position, the main tuning control could be rotated and stations were heard at every point on the scale, all clear from interference (except where actually heterodyned) and all at sufficient volume for normal home-entertainment purposes.

On a small indoor aerial, and with the switch in the sensitive or "distant" position, dozens of stations were obtainable. The tone was full and clear, with no boom and no undue shrillness. Second channel whistles may be shifted so that they occur at a point on the dial where they do not interfere with the reception of a station.

Separate plugs are fitted to the rear of the chassis for the use of an external speaker. Hum was negligible, even with the earth lead removed, and when accurately tuned to a station was inaudible even in the silent parts of the programme.

For those who prefer walnut, a model is available at one guinea less. The console cabinet costs 18 guineas.

Practical Television
Conducted by H. J. Barton Chapple, Wh.Sch., B.Sc., Etc.
MARCH 17th, 1934. Vol. 1. No. 11

MAKING SCANNING DISCS

Details of a Simple Device Which Will Enable an Accurate Disc to be Quickly Made.

By W. H. DELLER

THE simplest form of television receiving apparatus is that which employs a scanning disc to reproduce the "light lines," into which the object being portrayed is broken up for purposes of transmission.

There is nothing complicated in any of the parts necessary to construct a receiver of this type, the main essential being a disc driven at 750 r.p.m. Near the edge of this disc are a series of holes, 30 in all. Each hole is spaced radially 12 degrees from its neighbour, and each successive hole is closer, by an amount equal to the width of the hole, to the centre of the disc. A line drawn through all the holes would thus form an involute curve.

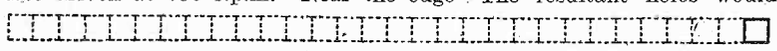


Fig. 1—This diagram shows how each hole in the scanning disc should line up with its neighbour to produce a clean strip of light.

Figs. 2 and 3.—These sketches illustrate the light patches which will be obtained by any overlap caused by inaccurate aligning of adjacent holes.

Fig. 4.—The irregular hole which is obtained if the hole is punched against a yielding substance.

If the completed disc was mounted on a pin, representing the spindle of the driving motor, over a piece of paper situated near the edge of the disc, and each of the radial lines brought up to a given point in succession, the result obtained by following the shape of the holes on to the paper, with a very sharp pencil, should be as shown in Fig. 1. the solid square representing the first hole and the dotted lines those which follow.

Accuracy Essential

From this it is apparent that each square should be exactly adjoining and accurately disposed in relation to the radial line, and in consequence it is impossible to produce a series of 30 holes so disposed by "rough and ready" means with anything like an approach to the desired and necessary accuracy. Consider for a moment the likely result from an attempt at punching with a square punch and a hammer, bearing in mind that the holes required are comparatively minute, and the fact that there are 30 of them, that the punch each time has to be exactly located against a previously made accurate marking on a radial line and struck with a hammer. The resultant holes would probably be, owing to an involuntary movement or movements of the punch by the operator while the hammer blows were struck, either as shown in Figs. 2 and 3 or both, in relation to each other. Fig. 2 represents three holes in the relative positions that they will occupy at a given point, the shaded portion showing how a staggered hole will cut into the track of the previous or next scanning line, thus producing an unwanted band of light. Fig. 3 shows the holes irregularly spaced, A leaving an unwanted band of metal in the light track, and the shaded portion B where two holes overlap. The holes must also be cleanly cut. Punching the holes in metal against a yielding substance would burst the metal, as illustrated in Fig. 4.

Constructing the Gauge

Doubtless many of these discs have been "hand made," as it were, with a more or less degree of success. To those, however, who intend to make this part of the apparatus, emphasis is again directed to the fact that it is an impossibility to punch the holes within the close limits of predetermined accuracy unless some mechanical means is employed for spacing and locating the punch in relation to the intended position of the holes. A simple device for this purpose is illustrated in Fig. 5. Briefly the method for using is as follows: The prepared disc, complete with boss, is placed in the position shown, the hole in the boss fitting on to a pin of the same diameter as the motor spindle. A close fitting steel pin pointed to an included angle of about 60 degrees, hardened for preference, is pushed into the 1/16in. diameter hole situated at the front of the guide plate, and held in contact with the disc with one hand and the disc rotated with the other hand. This will make a well-defined pitch line for the indexing holes on the face of the disc. The rim of the disc, by the way, should be made slightly wider for this purpose. Remove the disc, and with a pair of sharp-pointed dividers, space the pitch circle thus obtained into 30 equal parts. Providing that the dimensions given in the following text are adhered to the pitch circle should be 15½in. diameter. The exact chord distance between the marks on a circle of this diameter should be 1.6202in. Set the dividers at a shade (.005in.) under 1⅝in. and lightly plot off the circumference. The space left after making the thirtieth mark hould be exactly equal to the distance at which the points of the dividers are set.

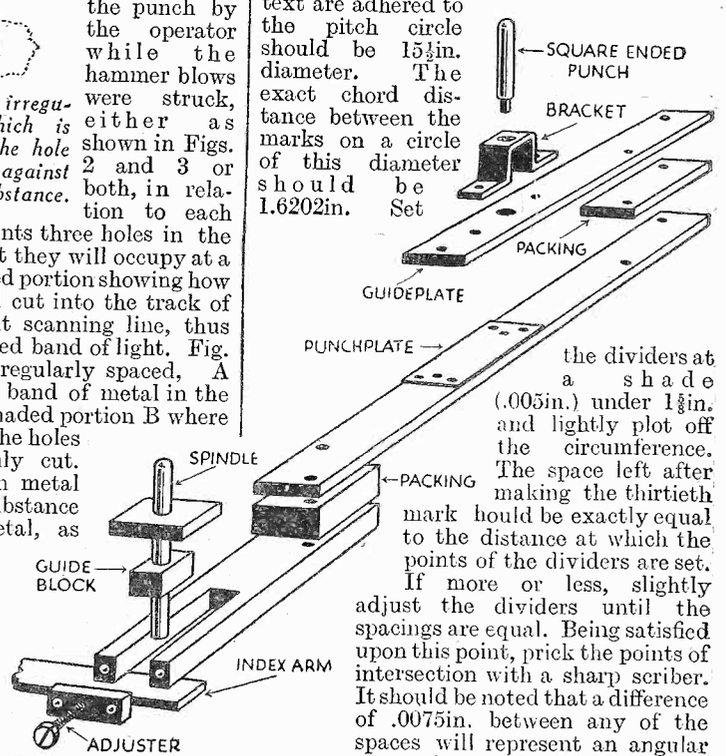


Fig. 7.—Assembly details of the complete apparatus.

If more or less, slightly adjust the dividers until the spacings are equal. Being satisfied upon this point, prick the points of intersection with a sharp scriber. It should be noted that a difference of .0075in. between any of the spaces will represent an angular error of approximately 3 minutes of a degree which will be reasonably accurate.

The following details relate to a 20in. diameter disc with the outside edge of the first hole 9½in. from the disc centre.

Replace the disc and punch the 30 indexing holes. To do this each of the markings are brought up to the small pointer, and the holes pierced with a 1/16in. diameter flat-ended punch, the punch passing into the

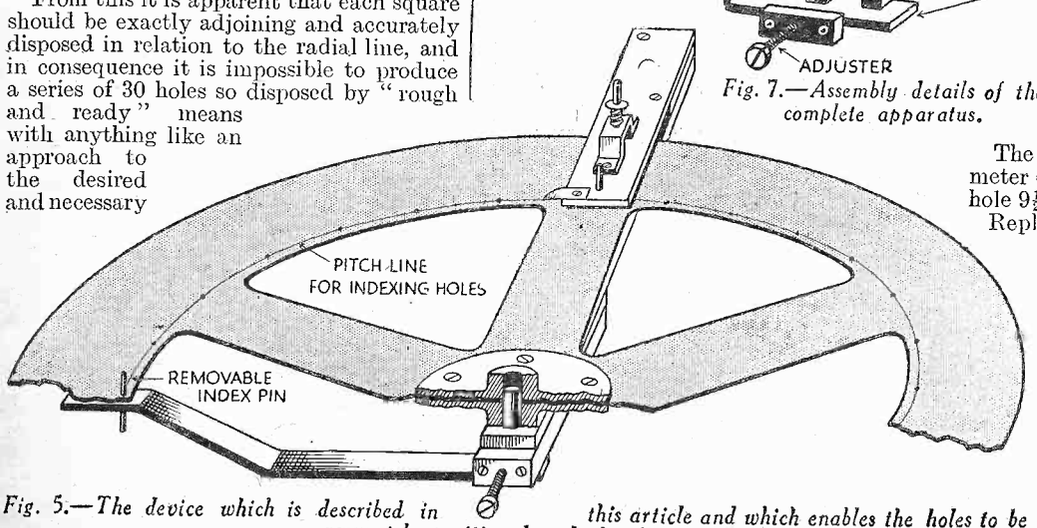


Fig. 5.—The device which is described in this article and which enables the holes to be accurately positioned and cleanly cut.

Fig. 6.—The alternative method of adjusting the punching device.

same hole that was used to scribe the pitch circle. Now locate the disc by means of a pin which fits both the holes made and that in the arm shown at the left-hand side of the illustration. The first square hole is then punched. Release the adjusting screw and remove one packing piece from the number that are clamped between the guide block and end of the slot, index to the next position and punch the second hole. Proceed in this order, removing a packing piece each time until the 30 holes are punched. Thus it will be noticed that the disc moves up to the punch each time by a predetermined amount, *i.e.*, the thickness of one packing piece. The index arm is attached to the spindle, and therefore also moves forward.

Fig. 6 shows an alternative method employing a 40-thread screw upon which is fixed a small gear wheel (¾in. diameter by 25 teeth). This is used in place of the adjuster, and a suitable locating pin is provided to fit the gear teeth. Where this is used the guide block would be backed up by a stiff coil spring, and the screw turned once completely plus the amount of three teeth each time to give a forward movement of .028in.

Constructional details are made clear in Fig. 7, and bright mild steel is the material mainly used. This is 1½in. in width except for the index arm, which is 1in. The guide plate, and that on which the punch plate is fitted, is ¼in. thick. The slotted plate is ⅜in. thick. The bar fitted with screws to this part is tapped for the adjusting screw. File the slot clean and parallel, with the block a good sliding fit in it.

Assembling the Parts

Fasten the index arm, block, and small top plate together with counter-sunk bolts nutted on the under side. This assembly should slide freely in the slot without shake. There should be sufficient space between this and the end of the slot to accommodate twenty-nine packings. These packings are made from bright rolled No. 22 S.W.G. metal. This should be checked by micrometer to ensure that it is up to gauge .028in. Cut the pieces tee shape, the heads of which overlap the edges of the slot. On the end of a piece of ¼in. silver steel file a short .028in. square projection to form the punch. The strip metal guide fits the body of the punch. This is mounted on the guide plate and the guide hole continued in the plate for a depth of 3/16in., the remaining 1/16in. being squared out to take the end of the punch. Make the punch plate or die from 1/16in. steel that is afterwards case-hardened, or if cast steel, hardened and tempered. Drill and countersink four fixing screw holes in this plate, also a 1/16in. diameter hole for punching the index holes, and a .028in. hole (No. 70 wire gauge drill). Both holes are counter-bored from the back, about 1/32in. diameter larger, half-way through for clearance and the smaller hole drifted out square with the hardened and tempered punch. The punch, by the way, should have previously been drilled for two 1/16in. diameter split pins. One of these is arranged to restrict the rise of the punch against the under side of the strip metal guide, so that the squared end does not leave the square hole in the guide plate. The other pin retains the return spring and washer. Clearance holes must be drilled in the plate to which the die is fixed to allow the punchings to fall clear. The parts are then firmly screwed and nutted together in the positions indicated on the drawing. It should be made clear that the distance from the centre pin to the die opening with the packings in position should equal the radius of the hole nearest the edge of the disc. Further, sufficient clearance must be left to allow the boss and the edge of the disc to travel a distance of approximately ⅞in. without fouling the packing pieces.

TELE-TALKIE TOPICS

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc., A.M.I.E.E.,

Continental Television Transmissions

EVIDENCE of the growing interest in television is furnished by the increasing number of television transmissions which emanate from countries on the Continent. Many of these are designed purely for experimental purposes or local reception, but that in no way disguises the fact that progress is being made. As far back as 1929 I participated in a number of television experiments between Witzleben and London, and during part of that period visited Berlin to install and operate some of the television transmitting apparatus used in that city for broadcast purposes.

It is therefore always interesting to pick up transmissions from Berlin, and to enable readers to do the same the particulars which follow will prove useful. No guarantee can be given as to the accuracy of the programme times, but from the latest information I have been able to secure, it is as follows :—

First of all, the station transmitting these low-definition signals is the high-powered long-wave one at Berlin (Königswusterhausen), working on a wavelength of 1.571 metres (191 kilocycles) and a power of 60 kilowatts. The times it is on the air are :—

Tuesdays, 8.5 a.m. to 9 a.m.
Thursdays, 12.45 p.m. to 1.45 p.m.
Saturdays, 8.5 a.m. to 9.45 a.m.

Although these periods are somewhat inconvenient for the average reader, I strongly advise all those who can at least to test the strength of the signal and compare it with that received from the London National Station.

Scanning Differences

If the transmissions are watched with a standard television receiver built for the B.B.C. transmissions, they will at first be almost unintelligible. This arises from two main reasons. First of all, although the same number of scanning lines—that is, thirty—are used, and the speed of rotation of the scanning mechanism is identical namely, 12½ pictures per second—the Germans scan horizontally and in a clockwise direction, whereas in England it is vertical and in an anti-clockwise direction. Any image received in this country is in consequence not only turned through an angle of ninety degrees, but it is reversed as well. The differences do not stop at that, however, for whereas the B.B.C. picture ratio is 7 vertically to 3 horizontally, the German ratio for broadcast band transmissions is 4 horizontally to 3 vertically.

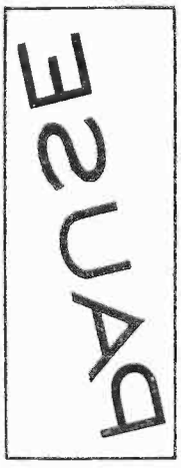


Fig. 1.—Indicating how a word transmitted by television from Germany would appear on a standard English Television receiver.

The resultant images therefore are also distorted when viewed on an English disc. This is shown by referring to Fig. 1. It indicates the German word PAUSE, representing an interval which is sent out while any changes are being effected during the course of a transmission, and instead of being a horizontal printed word it has the appearance denoted in the sketch.

German Disc Details

It is quite a straightforward matter to make an allowance for this, provided that certain important details are studied, and this can be done best by giving the reader dimensions and picture-shape data for German discs. The first point to note is that, although the rotation of the scanning disc is in the reverse direction to that used in this country, the scanning takes place from the outside and proceeds towards the centre. Referring to Fig. 2, the individual square apertures punched in the

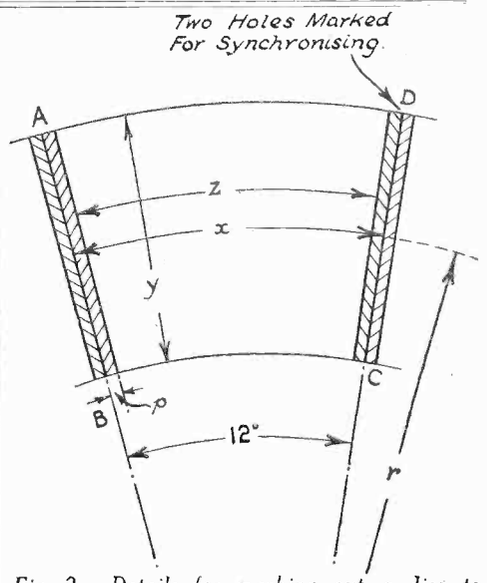


Fig. 2.—Details for marking out a disc to receive the German transmission.

disc in the form of a single-turn spiral traverse the field of light provided by the flat plate of a neon lamp mounted behind the disc so that they start at the top on the left—that is, at A—and finish at the bottom on the right—denoted by point C. This reasoning, of course, is based on the assumption that the " looker " is facing the front of the disc.

To provide the synchronizing signal of 375 frequency, the Germans definitely mask off one hole at each side of the true picture area, and this is shown by the double shaded lines at AB and CD. The picture depth is given by the radial distance y, which is the difference between the radius of the outside edge of the first hole and the inside edge of the last hole. The picture length, according to German reckoning, is the circumferential distance z measured on the *mean* radius circle (midway between arcs AD and BC).

On this reckoning we have $\frac{z}{y}=\frac{4}{3}$ Now as the picture is divided into thirty strips, and if we call p the size of each square

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1 Graham Farish Snap type H.F. Choke	2	9
1 Varley Electronic 1 watt type resistance 25,000 ohms		9
1 Varley ,, 1 watt ,, 2 meg.		9
1 Graham-Farish .2 mfd. Tubular Condenser	1	6
1 Dubilier 1 mfd. condenser type B.S.	2	0
1 Dubilier .0002 mfd. fixed condenser type 665		6
2 Clix Terminal Socket Strips, A.E. & L.S. & Pick-up	1	3
6 Clix Solid Plugs (for use with the above)	1	0
1 Bulgin No. 2, G.B. Battery Clip		4½
1 Bulgin F.5 Fuse and Holder	1	0
2 Bulgin Junior on-off switches type S.38	1	9
1 Belling Lee 3-way Battery Cord, marked H.T. x 1, H.T. x 2 and H.T. and spade terminals L.T. x 2	2	9
3 British Radiogram Brackets (2) 2in. and (1) 1¼in. with hole	1	0
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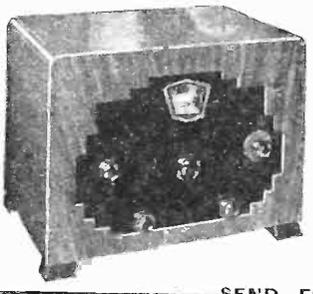

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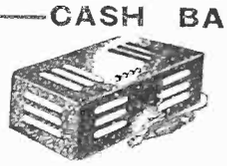

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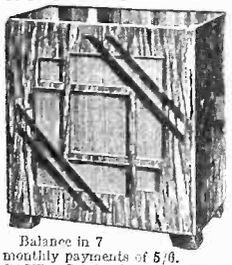

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hole, we have y=30p. But the *total* width of the picture area, allowing for the two holes masked off, is really z+2p, and for reference purposes we can call this x. Also x in one-thirtieth of the circumference of a circle having the mean radius r, and so

$$2\pi r = 30x$$
$$= 30\,(z+2p)$$

But $z=\frac{4}{3}y$ and $y=30p$

Therefore $z=40p$

and $2\pi r = 30\,(42p)$

Hence $p=\frac{2\pi r}{1260}$

From these simple equations it is, of course, a very easy matter to calculate all the data we require. As a general rule, the dimension which is decided upon owing to considerations of space available is the mean radius, that is r, and this gives all the other dimensions.

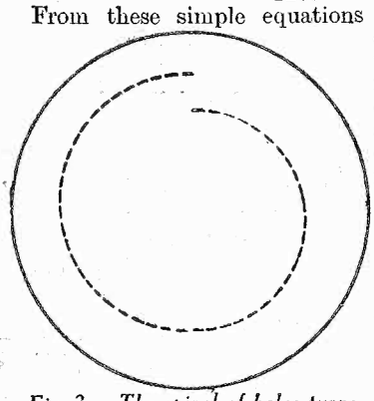


Fig. 3.—The spiral of holes turns in an anti-clockwise direction.

It will, no doubt, be a guide to readers if a typical example is worked out. First suppose we take the generally-accepted standard-size disc having an external diameter of 20ins. With this we can comfortably take a mean radius of 9ins. The size of each square hole then becomes

$p=\frac{2\pi\times 9}{1260}=.04488$ inches. Readers will at once see that the hole size is relatively large, for it is about 50 per cent. greater than that for an English disc of about the same mean radius.

The total picture height is now

$y=30p=1.3464$ inches,

while the circumferential width taken on the arc of mean radius r=9ins., that is, z in Fig. 2 becomes

$z=\frac{4}{3}y=40p=1.7952$ inches.

In marking out a disc for the German television transmissions do not forget that the spiral of holes turns in the manner shown in Fig. 3—that is, anti-clockwise—while the disc rotates in a clockwise direction. Furthermore, after having marked out the thirty radii each subtending an angle of 12 degrees at the centre, the outside edge of the first hole is distant from the centre by an amount $(r+\frac{y}{2})$, since the calculations are based on a mean radius dimension.

For example, in the case just worked out this distance is $\frac{9+1.7952}{2}=9.8976$ inches. Having marked off this hole, the others come automatically.

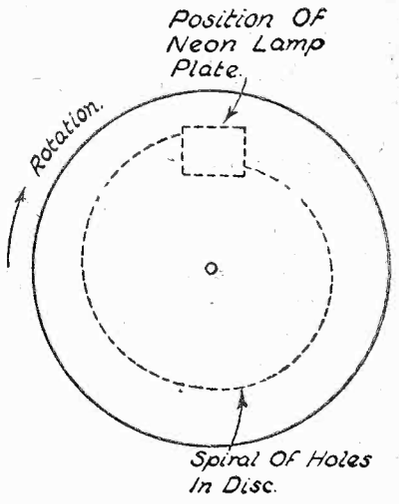


Fig. 4.—Mount the neon lamp centrally at the top back of the disc for reception.

Finally, remember to change the direction of rotation of the disc when compared with the English scanning direction. In the case of small universal type motors this is done very simply by reversing the leads which actually pass to the brush contacts. In addition, the neon lamp must be mounted at the back of the disc at the top with the plate in a horizontal direction (Fig. 4).

A Q.P.-P. CONVERSION

By E. J. R. MAY.

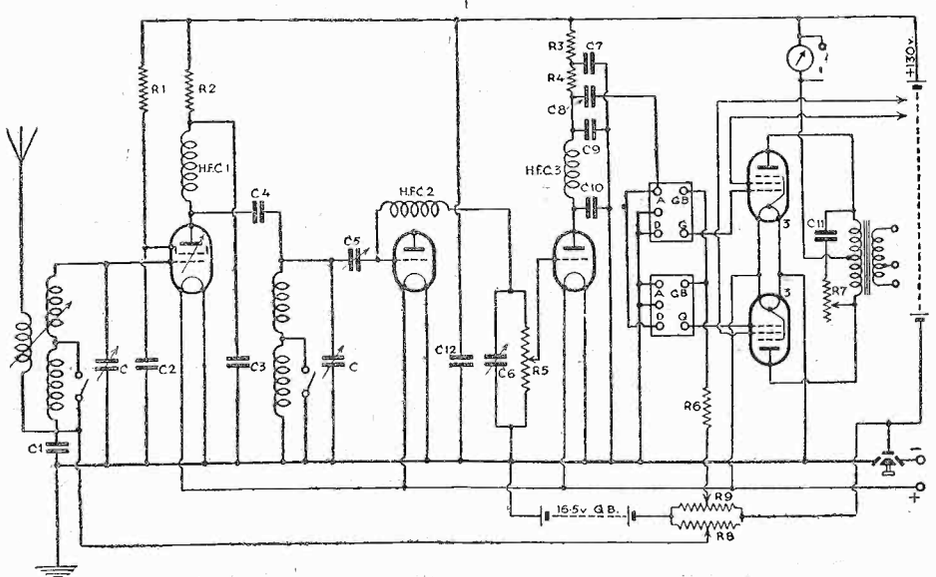
THE chief disadvantage—if one can call it so—of Q.P.-P. is the necessity of using a transformer having a step-up ratio of 8 or 9 to 1, in order to feed a suitable grid swing to the push-pull output stage. Transformers of this type on the market have a low primary-inductance value—of the order of 30 henrys with no D.C. flowing, with the result that reproduction of the bass notes especially is somewhat curtailed.

In the writer's receiver the L.F. stage was coupled by a parallel-feed transformer having an inductance value of 80 henrys. Another parallel-feed transformer was obtained and connected in parallel with the first, but with one primary reversed to effect a change of phase. The detector valve was replaced by a diode feeding an L.F. stage, resistance-coupled in its turn to the two transformers. All this can be seen in the circuit diagram.

In order that the grid-bias battery shall discharge at a rate comparable with that of the H.T. battery, and to obviate constant re-balancing of the circuit, it is fed through two 50,000-ohm potentiometers connected in parallel, one supplying the bias for the pentodes and the other forming a pre-detector volume control by varying the bias on the variable-mu H.F. valve.

An H.F. filter circuit, consisting of an H.F. choke and two .0002 mfd. condensers, is placed in the anode circuit of the L.F. valve in order, finally, to dispose of any stray H.F.

The two .0001 mfd. condensers C5 and C6 are of the pre-set type; and the .25 megohm potentiometer forms a post-detector volume control, as it is desirable that a fairly strong signal should be fed to the diode in order that it should work under the best possible conditions. The 50,000-ohm resistance forming part of the tone-correction circuit is made variable, so that it may be used as a tone control. The Drydex 130½-volt H.T. battery is used as it is tapped at 1½-volt intervals between 120 and 130 volts, and, therefore, provides considerable help in balancing the circuit. Care should be taken to see that the pins marked 3 on the pentodes are wired to the L.T. negative.



The circuit arrangement referred to in the above notes.

In setting up the circuit, the following procedure should be adopted:—

1. Plug in the anodes at 130½ v. and the grid-bias at 15 v. 2. Open the switch, thereby connecting the 0-10 m/a meter in circuit. 3. Insert *one* pentode in its valve socket and plug its priming-grid lead into, say, 129 v. 4. Adjust the meter reading to 2¼ m/a by adjustment of the bias potentiometer. 5. Remove pentode No. 1 and insert pentode No. 2, switching off the set before so doing, and, *without touching the grid-bias potentiometer*, vary the priming-grid lead in different tappings until it also reads 2¼ m/a. If it should not read 2¼ m/a, alter pentode No. 1 tapping and start all over again. 6. Having balanced the circuit, close the switch shunting the meter, since this will cause distortion if left in circuit, by providing a common impedance in the anode lead. 7. Adjust the pre-set condensers C5 and C6 to about half capacity and the L.F. potentiometer to nearly all in.

The total current consumption averages out at about 10 m/a at comfortable strength in a room 20ft. by 15ft. In the writer's case the old power valve—a Mazda P.240—is used in the L.F. stage, because this takes a larger grid-swing than the more usual P.M. 2DX. type.

The output is, approximately, 1.3 watts, but with 150 v. H.T., 21 v. grid bias, and the consumption of the pentodes adjusted to 2½ m/a *each*, an output of 2 watts can be obtained.

The Easy Road To Radio

BEGINNER'S SUPPLEMENT

EASY SWITCHING WITH PLUGS AND JACKS

WHERE there are two or more low-frequency stages of amplification in a receiver, sufficient volume will be obtained on the pick-up if it is plugged-in to the grid circuit of the first L.F. valve. Plugging it in to the detector would most likely cause overloading so that no advantage would result. Incidentally, when connecting to one of the L.F. stages the circuit is somewhat simplified since grid bias is already provided. All that is required then to enable a pick-up to be used is a single closed circuit jack and a plug.

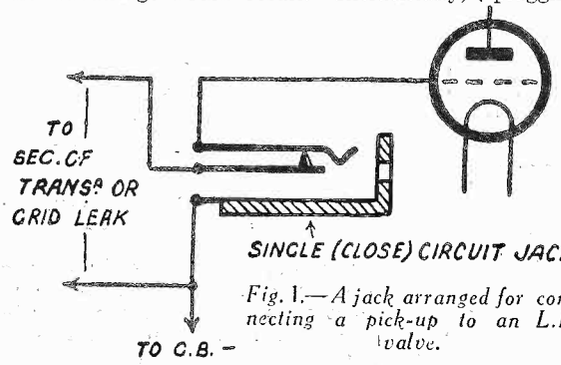


Fig. 1.—A jack arranged for connecting a pick-up to an L.F. valve.

Fig. 1 gives the circuit when using battery operated valves. Two of the lugs of the jack are connected to the secondary of the transformer (or across the grid leak if the coupling from the previous stage is by R.C.C.) and the third lug to the grid of the valve. For mains valves the circuit in Fig. 2 would apply. If desired, a receiver can be fitted up with a jack in the grid circuit of each of the L.F. valves as well as that of the detector. In this way one or more valves may be used at will by plugging-in the pick-up to the requisite socket.

Combining a Change-over Switch

Some constructors prefer to use an ordinary switch with which to change over from radio to gramophone, but at the same time like to be able to quickly disconnect the pick-up whenever necessary. To arrange this a single pole change-over switch of the rotary, or other type, is mounted on the panel of the set while the pick-up itself is connected to the set by means of a plug and jack arranged somewhere at the back or side of the cabinet. Ordinarily the pick-up is left plugged-in and the change over effected by means of the panel switch. If, however, it is desired to move either the set or the gramophone to another part of the house all that is necessary to separate the two is to pull out the plug. The circuit for such an arrangement when plugging-in to the detector valve is given in Fig. 3. Fig. 4 shows the circuit when plugging-in to one of the L.F. valves.

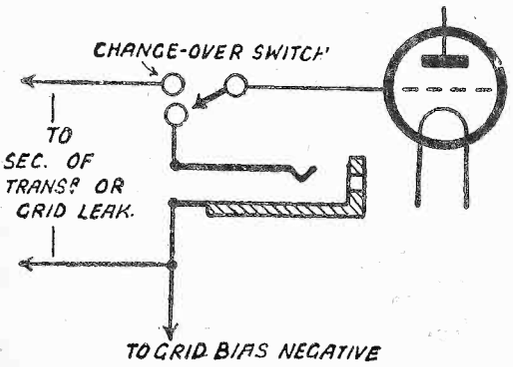


Fig. 4.—A similar arrangement to that shown in Fig. 3, in this case for an L.F. valve.

Ingenious Interstage Switching

In dealing with methods for cutting out one or more of the L.F. stages of a receiver, mention was made previously of a circuit for use with parallel-feed and resistance-capacity coupled stages, in which the anode resistance was cut out of circuit when plugging-in to the detector or first L.F. valve. At first sight this appears to be the obvious thing to do, since, when the speaker is plugged-in to one of the earlier L.F. stages the valve concerned will then become the output valve and as such would not be fully exploited if the coupling resistance were left in its anode circuit. However, to remove it would naturally increase the voltage on the plate. So far, then, all is well, but an increase in plate voltage would call for increase in grid bias voltage and here lies the difficulty. Clearly a compromise could be struck by using a value of bias which was rather on the high side when the valve was working as an intermediate amplifier, but would not be too low when it was functioning as an output valve. However, in the case of valves which are rather critical as regards bias values, a more satisfactory arrangement is to employ the circuit given in Fig. 5.

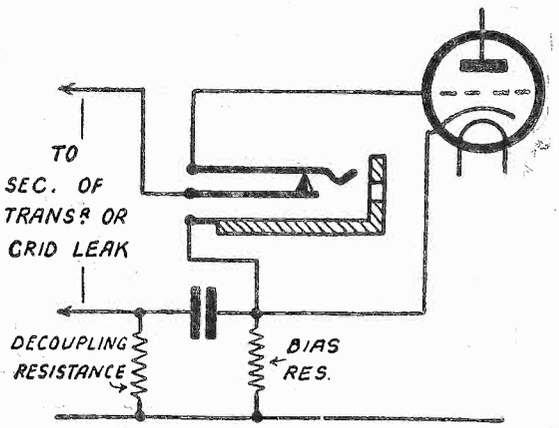


Fig. 2.—A modification of Fig. 1 for use with indirectly-heated valve.

Automatic Bias Adjustment

Here the difficulty is overcome by automatically adjusting bias directly the speaker is plugged-in. A five-spring automatic jack is used. It will be seen that the insertion of the plug joins the speaker directly between the anode and H.T.+ while disconnecting both the anode resistance and also the decoupling resistance

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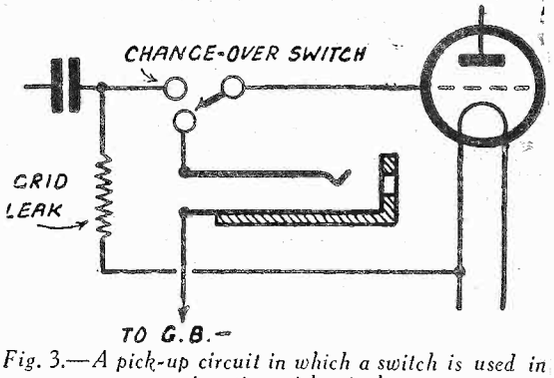


Fig. 3.—A pick-up circuit in which a switch is used in conjunction with a jack.

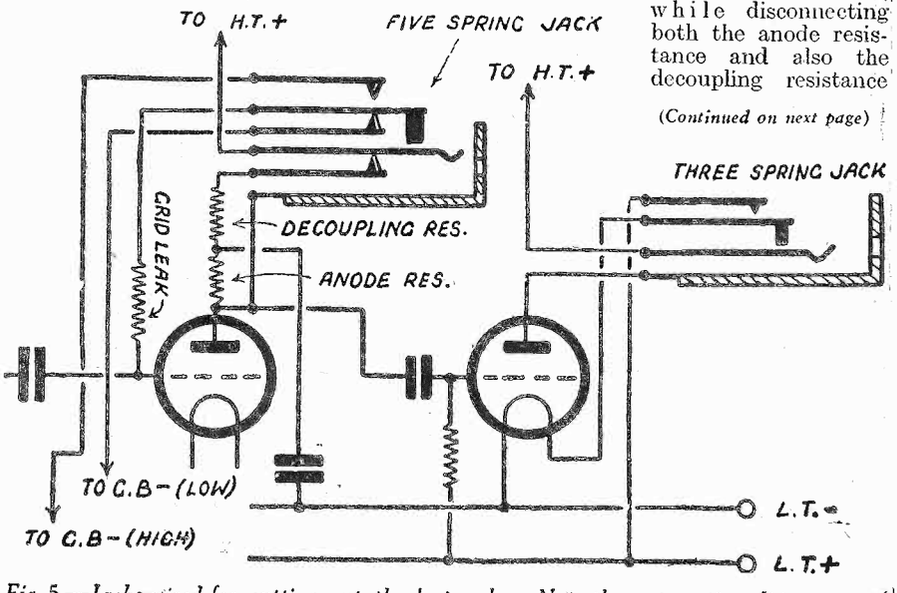


Fig. 5.—Jacks wired for cutting out the last valve. Note the automatic adjustments of H.T. and G.B.

(Continued from previous page)

(if one is fitted). At the same time the grid leak return is transferred to a higher negative bias value. With a battery set this will simply mean an extra tapping on the grid bias battery, but in the case of a mains set two bias resistances are used. Normally, only one is connected in the cathode lead, but on plugging the speaker in to the five-spring jack the second one is brought into operation in series with the first. Of course, a tapped resistance could be used in place of the two resistances if desired.

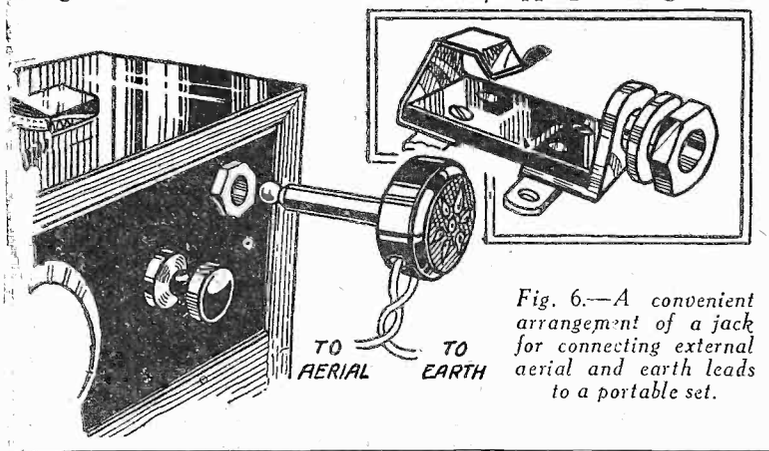


Fig. 6.—A convenient arrangement of a jack for connecting external aerial and earth leads to a portable set.

H.F. Circuits

Although generally speaking plugs and jacks are not suitable in H.F. circuits, there are nevertheless one or two low-capacity jacks such as the Bulgin illustrated in the inset (Fig. 6) which enables the use of jack switching to be extended to the H.F. stages of the receiver. One of the first uses for such a jack that suggests itself is in connecting a frame aerial to a receiver. By using two jacks so that one is connected to each of the frame windings the receiver could be plugged-in to either the long or medium wave winding, and so obviate the use of a separate switch.

In the case of a portable set, which is occasionally used on an outside aerial, the fitting of a low-loss jack to the set, and a plug to the aerial and earth wires, as in Fig. 6, enables it to be connected or disconnected with the least possible effort.

A SIMPLE ONE-VALVE TRANSMITTER FOR BEGINNERS

THE diagram, Fig. 1, illustrates a simple one-valve set employing two coils for aerial tuning and reaction. When the two coils are brought close together oscillation occurs, due to the feeding-back of the energy from the anode circuit to the grid circuit. To employ this energy for transmitting purposes it is necessary to ensure that it shall be passed into the aerial, and therefore the aerial and earth connections are changed round.

Fig. 2 shows practically the same circuit arrangements, with the exception that the aerial is now joined to the anode, instead of to the grid, and the earth connection is taken from the other end of the reaction coil. (The 'phones are naturally removed.) This method of connection ensures that the maximum current which the valve is capable of generating is fed into the aerial circuit, and if a milliammeter is inserted in series with the anode coil, a reading of the anode current is obtained. If this current (expressed as a decimal fraction of an amp.) is multiplied by the voltage of the high-tension battery, the figure obtained will express the power of the transmitter in watts.

A Simple Transmitting Circuit

This circuit is the basic arrangement of all transmitters, and it is only necessary now to insert a key for the transmission of morse signals, or a microphone for the transmission of speech or music. The most efficient way of breaking the circuit is to disconnect the wire linking the batteries, and therefore a tapping key should be inserted at the point marked X. When the key is depressed the circuit is completed and oscillations will be present in the aerial circuit. As soon as the key is released the oscillations will cease. The signals of the morse code may therefore easily be transmitted. For speech, the oscillations must be continuous in the aerial circuit, and the speech currents superimposed upon these oscillations. A microphone and a microphone transformer are the essentials required, and the secondary of the transformer (which should have a step-up ratio) is joined in the grid circuit at the point marked Y. The microphone is joined in series with the primary of the transformer, and to complete this part of the circuit a battery is necessary.

Fig. 3 shows how this microphone circuit may be completed by using the accumulator which supplies the filament of the valve, and also the method of including the secondary in the grid circuit. The value of the condenser across the secondary must be fairly carefully chosen in conjunction with the secondary winding and the frequencies which it is desired to transmit. It is also desirable to shunt the H.T. supply with a large condenser. This method of employing a microphone is not efficient, although it is the simplest method, and in actual modern practice a separate valve is used for the microphone. It is arranged so that part of the aerial energy is absorbed according to the speech currents in the grid circuit of the modulator valve. The first valve generates the oscillations (known as the "carrier wave"), and the second valve modulates these.

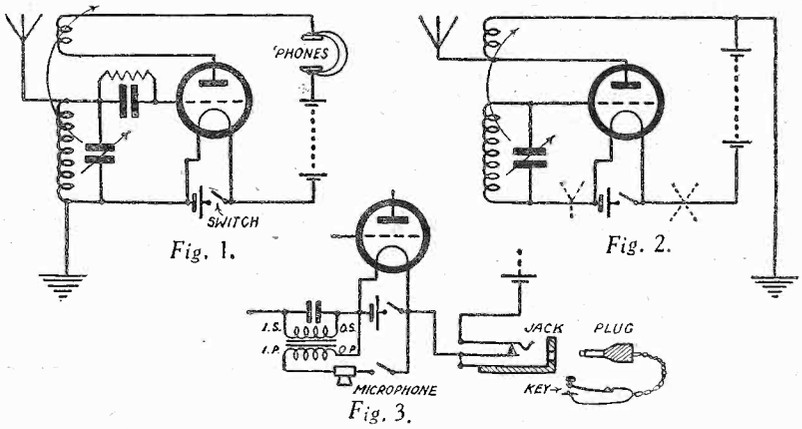


Fig. 1.

Fig. 2.

Fig. 3.

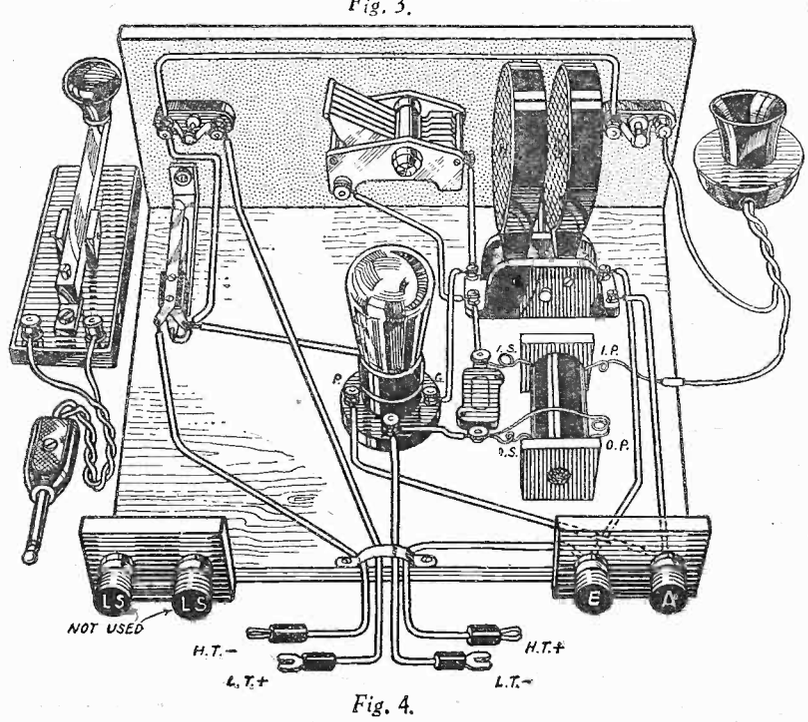


Fig. 4.

Circuit diagram and layout for a simple one-valve transmitter.

Fig. 4 shows the complete layout with the microphone connected and with the key complete with jack.

It should be pointed out here that on no account must any experiments in transmission be carried out without the sanction of the Postmaster-General, and a transmitting licence must be obtained before any attempts at transmission are undertaken.

A HETERODYNE WAVEMETER

In This Article Instructions are Given for Making a Cheap but Efficient Instrument.

By W. B. RICHARDSON

THIS useful instrument, for measuring the wavelength of a received signal, or setting a receiver to a predetermined wavelength in order to receive a particular station, consists of a coil tuned by a variable condenser, the latter having a calibrated dial. Across this tuned circuit is arranged a battery and small buzzer. If desired a switch may be included in order to avoid disconnecting the battery. When the buzzer is operated oscillatory currents are set up in the tuned circuit, and these can be picked up by a receiver over quite a considerable distance. If the dial of the wavemeter is set to a given wavelength and the buzzer put in action, upon rotating the tuning dial of your receiver you will find a spot where the oscillations from the buzzer are at a maximum. At this spot the receiver is tuned to the wavelength shown by the dial of the wavemeter. In order to enable sharp tuning to be carried out it is advisable to remove the wavemeter as far away as possible from the receiver. Furthermore, once the wavemeter has been calibrated, the coils and condenser should be enclosed in boxes so that they may not be damaged and the values altered. The accompanying illustration shows the circuit arrangement.

There are three types of wavemeter in general use. First, there is the "buzzer" meter, which is in reality a miniature "spark" transmitting station which can be tuned to known wavelengths. It consists of an oscillating circuit similar to the aerial circuit of a receiver. This is excited by a buzzer like that used in an electric bell. Secondly, there is the absorption wavemeter, which works by virtue of absorbing energy from the circuit of the set it is desired to calibrate. It consists essentially of a tuned circuit, comprising an inductance and a variable condenser. It is brought into close proximity to the circuit to be calibrated. This latter has to be oscillating, but when the wavemeter is brought near it ceases to oscillate on the particular wavelength to which the wavemeter is tuned. This kind of wavemeter is very simple and requires no batteries, but it has one drawback, that as it has to be brought very close to the circuit undergoing calibration it is sometimes difficult to use.

The heterodyne wavemeter is similar to the other two, in that it has a tuned circuit controlled by a variable condenser. This circuit, however, is made to oscillate by means of an ordinary valve. It might be compared to a one-valve receiver, in which the reaction is "turned on full" all the time. It is placed some little way from the set to be calibrated. The latter is then made to oscillate by advancing the reaction, and on tuning-in to the wavelength which the wavemeter is radiating, the familiar squeal one gets when passing a station with the reaction too far advanced is heard in the loud-speaker or 'phones. When this squeal is heard the wavelength of the meter is noted, and the same figure marked on the dial of the receiver opposite where the pointer is.

A glance at the illustration will be sufficient to show you that the little meter described here has just about the simplest circuit possible. It consists of two oscillating circuits—one for the medium, and one for the long waves. Each consists of a grid coil and a reaction coil. The long-wave windings are in the form of loading coils which are brought into use by a three-point wave-change switch. An ordinary on-off switch is used to switch on the valve.

If a wavemeter is to be reasonably accurate and, what is most important, remain accurate, it must be carefully constructed, and must include only good-class components which will not vary their characteristics in the course of time. It will be realized that any change in the value of the components will upset the readings and necessitate the recalibration of the meter. It is for this reason that one valve must always be kept for the meter. A different valve would most likely throw the readings right out. In fact, it is best not to remove the valve at all unless you are certain of pushing it right home in its holder each time. It is the same with the other components—once they are fixed leave them alone, and try by all means to avoid the accumulation of dust, especially when accompanied with moisture.

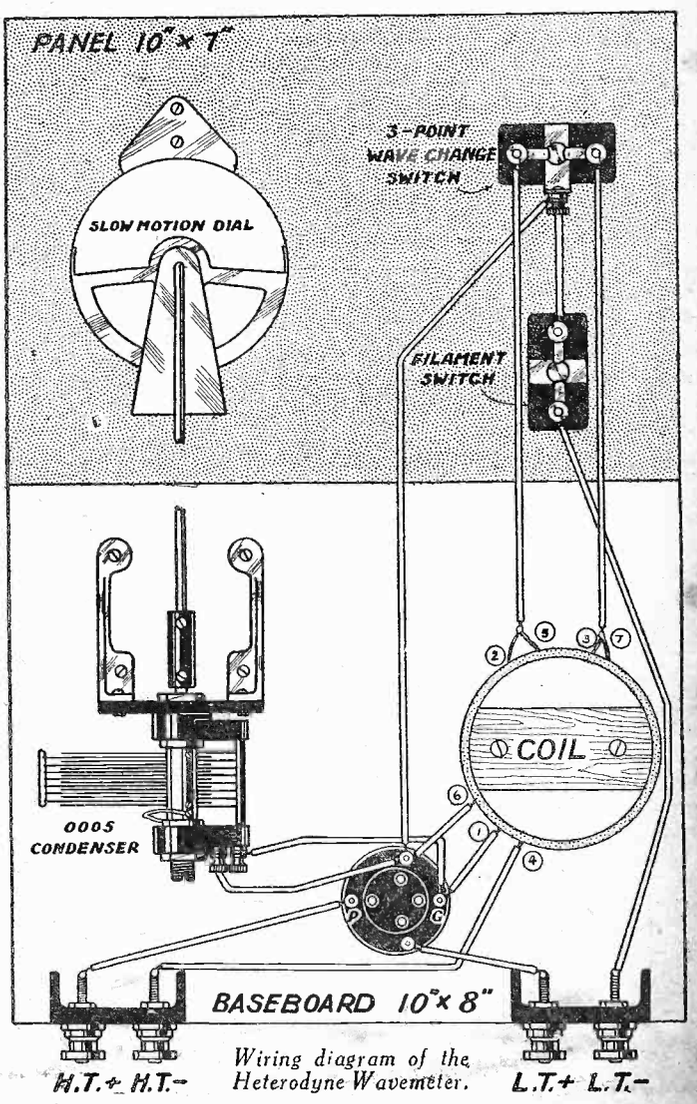
Winding the Coil

The only part to be actually "constructed" is the coil. This is wound on a 3in. diameter paxolin former 6in. long. Wind the wire as evenly and tightly as possible, so that it will not shift later on and alter the wavelength. Pierce two small holes about ¼in. from one end of the tube and leaving a short length for the connection, secure the wire through the holes. Then commence winding. Put on fifty-five turns, which by the way should consist of 24-gauge d.s.c. wire, and then make two more holes and finish off by threading the wire through the holes as before, leaving the short length for connections. This is the medium-wave grid coil. The reaction coil follows, and consists of twenty-five turns in the same direction composed of the same gauge wire. Leave a space of about ¼in. before starting the long-wave coils. These consist of 170 and 50 turns for the grid and reaction windings, respectively. Full details of the coil and its connections will be given next week.

Mounting the Components

The illustration gives a bird's-eye view of the layout, with the panel represented as lying flat. Probably the first thing that will strike you as being somewhat unusual is the mounting of the variable condenser. It is supported on a little ebonite panel of its own some way back from the panel. This is to reduce hand-capacity effects. If you are not familiar with heterodyne wavemeters you may not at once see the reason for this, but it is because there is no aerial or earth used with the meter. In a receiving set the moving vanes of the tuning condenser are connected to earth, so that bringing one's hand, which is also at earth potential, into proximity with them when tuning has no effect. The fixed vanes, which are at high potential, are screened by the moving vanes. Here, however, both the fixed and moving vanes are at high potential, hence the need for placing the condenser some way back.

(To be concluded next week—Ed.)



Wiring diagram of the Heterodyne Wavemeter.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

MULLARD VALVE GUIDE

OPERATING data and characteristics of the complete range of Mullard valves is given in the new season's Mullard Master Valve Guide, a useful book of pocket size. The application of each valve is simply explained and useful hints concerning such matters as grid-bias voltage, operating notes, and so forth are included for each type. The technical appendix, which occupies thirty-four pages, includes a useful article with many diagrams on automatic grid bias, an authoritative article on the operation of rectifier valves, a handy method of calculating the correct ratios for output transformers, a guide to the standard connections to the new seven-pin base, and many other informative articles. Copies of the handy book can be obtained from the Publicity Dept., Mullard Wireless Service Company, 111, Charing Cross Road, London, W.C.2.

LISSEN RECEIVERS

A FINE range of the popular Lissen receivers, including the "Skyscraper" series, is displayed in an attractive folder recently issued by Lissen Limited. There are models to suit varying tastes and purses, and from which the most discriminating listener should have no difficulty in choosing a receiver to suit his requirements. There is model 8005, a two-valve battery set with a "pentode" performance, and its price is only £3 19s. 6d., complete with batteries and valves. At the other end of the range there is model 8060, a fine six-valve all-mains superhet. Equipped with A.V.C., band-pass tuning, and an electro-dynamic loud-speaker, this high-class instrument is priced at £14 14s. Other models include A.C. and D.C. models with moving-coil speakers, and battery-operated portable and table sets, all housed in handsome cabinets of modern design, and at prices ranging from £4 4s. to £12 12s. Full particulars of all the receivers are given in the folder, copies of which can be obtained on application to Lissen Limited, Lissenium Works, Worple Road, Isleworth, Middlesex.

HIVAC DRIVER+B VALVE

THIS valve is the latest addition to the Hivac series of high-efficiency low-priced valves for battery sets. It combines in one bulb two separate systems operating respectively as Driver and Class B output. This latest development in design, which gives added efficiency, reduction in cost, and simplifies wiring, is the result of extensive experimental work in the Hivac laboratories. The new valve is of particularly robust construction, and embodies mica spacers and filament suspension springs, the anodes, grids, and filaments being housed between a side supporting framework. Interested constructors should write for a copy of the Driver+B leaflet, giving full particulars, prices, and characteristic curves, to The High Vacuum Valve Co., Ltd., 113-117, Farringdon Road, London, E.C.1.

REPLIES TO BROADCAST QUERIES.

EDITOR'S NOTE: Querists must limit their queries to three per letter.

ON4OX and ON4MAD, write: *Réseau Belge, 33, rue Alphonse Renard, Brussels X1, Belgium;* ON4UF, L. Richard, 32, rue Crespel, Brussels, Belgium; EA1DC, write: *Union de Radio-emisores Españoles, Apartado 262, Madrid, Spain;* CT1ED, Hernani, 9, Cesar de Sa, (Douro), Covelinhas, Portugal; PAOWQ, A. Wijkhuizen, Essenburgsingel 25, A., Rotterdam, Holland; OZ7CU, write: *Experimental Danish Radioamateurs, Box 79, Copenhagen, Denmark.* DE-EX (Cleveleys, Lancs.): G6KX, E. A. Carrington, 90, Derby Road, Heanor, Nottingham; F8VT, G. Guidon, 4, rue des Ecôles, Aulnay-sur-Bois (Seine et Oise), France; Regret, cannot trace the other call sign you give as it is mutilated. J. G. Aston (Dublin): G2MN, M. Nicholson 114, Thorpe Road, Norwich, Norfolk; W1DW, Kenneth J. Hovey, Sandy Lane, Warwick (Rhode Island); W9JRY, William P. Petersen, 1,632, Avenue B. Council Bluffs (Iowa); W1GHV, W. H. Dill, 84, Loring Street, Islington (Mass.); W2GOQ, Wayne (N.J.). A. G. Woods (Tottenham): CGA5, Drummondville (Quebec); write: *Canadian Marconi Co., St. Sacrament Street, Montreal (Quebec).* H. K. Hardy (Newbury): (1) W9LD, Robert M. Smith, R.4 N. Kansas City (Mo.); (2) W8CC, K. A. McGaha, 1,455, Franklin Avenue, Columbus (Ohio); (3) W2MB, Lester Spangenberg, 110, Belgrave Avenue, Clifton (N.J.). G. C. Eltoringham (N.W.11): W1BES, L. S. Bellem, Jnr., 143, Eastwood Avenue, Providence (Rhode Island).

RADIO RAMBLINGS

Jottings from my Notebook

By JACE

New Finnish High-power Station

LAHTI, which up to the present has been relaying the Helsinki broadcast programmes on 1,796 metres, with a power of 40 kilowatts, has been reconstructed and will shortly increase its power to 150 kilowatts. As, contrary to the Lucerne allocation of 1,145 metres, it has continued to work on 1,796 metres, the channel now occupied by Radio Paris, there is a possibility that an alteration in wavelength may be made when the new station comes into operation. France's contention that her second long-wave channel used by Eiffel Tower cannot be given up as long as the Radio Paris transmissions are not clear of interference would be strengthened if no change is made in Lahti's wavelength.

An "Ekco" of a Christmas Drama

DURING the last days of 1933, the two keepers of the Dutch Heartach lighthouse—one of whom had an injured leg—were marooned by gales. Their only means of communication was by wireless telephone, and by this link their wives kept in touch with them over the Christmas period. The men were eventually rescued by the lighthouse steamer *Hesperus*. The "skipper" of the *Hesperus* has now been presented with an Ekco Model 74 suitably embellished by an engraved plate.

Exide Cells in China and Australia

CHINA is not always associated with the immediate adoption of the most modern Western developments, and from what we read of conditions there it hardly seems credible that battery emergency lighting systems are in use. Yet a "Keepalite" emergency lighting equipment has recently been installed in the fine new Paramount Dance Hall in Shanghai. The installation consists of a "Keepalite" equipment of 17 cells having a capacity of 120 ampere hours, supplying current at 32 volts for the emergency lighting circuit.

Australia also has had its first "Keepalite" equipment, this being installed in the large new department store of Messrs. G. W. Coles & Co., Ltd., in Sydney. The actual "Keepalite" panel was shipped from this country, the 50 Chloride cells, having a capacity of 120 hours, being made in Sydney.

Two New Marconi Contracts

THE Rumanian Broadcasting Company have placed an important order with the Marconi Company for the supply of two broadcasting stations, one of the "super-power" variety with an aerial energy of 150 kilowatts, and the other of 20 kilowatts aerial power. This new success for the British wireless industry closely follows an order given by the Swedish Government to the Marconi Company for a 150-kilowatt station for Motala, and these contracts will supply work for many months for a large number of skilled craftsmen at the Marconi Works at Chelmsford. The 20-kilowatt transmitter is now temporarily operating at Bod until the 150-kilowatt station is completed, when it will be transferred to another site. The super-power station will operate on a wavelength of 1875 metres.

Service Department's Passports

IN order to ensure that no false representation is made when carrying out "His Master's Voice" service calls the Company is making arrangements for each engineer to be equipped with an identification card which will bear the photograph of the individual. "His Master's Voice" engineers will present these when making service calls. The identification cards will be about the size of driving licences, and it is hoped that they will remove difficulties that have arisen in the past when engineers have called to service or instal instruments at customers' houses and have been refused admittance owing to the maids only being in.

The Modern Call of the Muezzin

THE Egyptian authorities have intimated that when the new Cairo station takes the air special broadcasts will be made for the lower classes of the population, including the fellahin, or workers on the land. In addition, the Abu Zabal station will transmit every morning portions of the Koran, and may in this way replace the Muezzin's call to prayer.

AN "EKCO" OF A CHRISTMAS DRAMA.

Captain C. N. Forbes, of the lighthouse steamer "Hesperus," and his Ekco Model 74 Receiver.

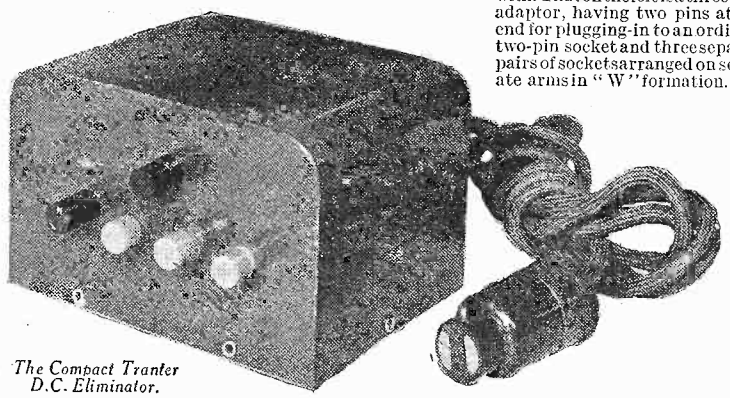
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

TRANTER D.C. ELIMINATOR

THE small D.C. mains unit illustrated below is manufactured by Norman Tranter, of 9, Gorse Road, Blackpool, and some idea of its compactness may be gauged from a comparison of the mains plug and lead. Actually the unit measures 5¼in. by 4in. by 3¼in. high. The mains lead projects through a grummet at the rear and is firmly anchored, whilst the various tapping points are brought out at the front to sockets. The plugs fitted to these are of the Belling type, wherein the necessary leads may be anchored through side holes and connection easily made by pushing the plug into its respective socket. The latter are identified, in addition to the usual red and black colouring; the upper socket is marked Earth, whilst the left-hand socket is H.T.—. The remaining red sockets are marked respectively S.G., Det., and Max. The latter socket delivers approximately 150 volts, whilst the S.G. tapping will deliver a suitable potential for the screening grid of the standard H.F. valve. The detector socket will supply a potential of round about 70 volts. The actual unit which we have tested gave 60 volts on the S.G. socket, 65 volts on the detector socket, and 135 volts at the maximum tapping, with currents of 8 mA, 3 mA, and 20 mA respectively. It will be seen, therefore, that the unit is admirably suited for operating the standard type of broadcast receiver.



The Compact Tranter D.C. Eliminator.

NEW TUNGSRAM CLASS B VALVE

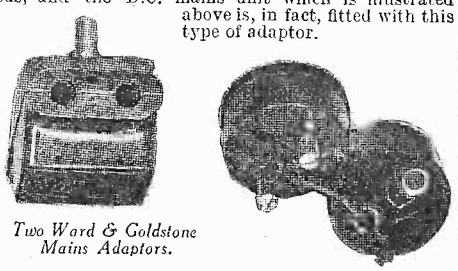
DETAILS have just been received of a new Tungsram high-power Class B valve for operation from a 2-volt accumulator. The filament consumption is 1.75 amps. with an anode voltage of 200, at which figure it will deliver an output in the neighbourhood of 10 watts (undistorted). It is thus admirably suited for small public address outfits and for super-quality receivers for home use, in view of its good signal-handling capabilities. It must be remembered that this is not the usual double type of Class B valve, but is one-half, under which conditions two such valves are required for full Class B working. The output is consequently doubled, giving just over 20 watts undistorted. The total filament current is then 3 amps. and the H.T. may advantageously be increased to 400 volts. The price of the valve is 14s. 6d.

MORE NEW EVER-READY BATTERIES

THE Ever-Ready Company have just produced three new high-tension batteries to meet the requirements of new radio sets just produced by Messrs. Kolster Brandes and Marconiphone, Ltd. The first of these batteries (which is marketed under list number W.1226) has a high-tension voltage of 120, tapped at 60, 72, 90, 99, 108, 114 and 120 volts. The battery also contains a grid-bias section of 9 volts, tapped every 1½. The measurements of the battery are 8in. by 7in. by 3in., and the list price is 12s. This battery is suitable for Kolster Brandes models 333A, 363, and 364. For Kolster Brandes model 393 a battery (list number Port.12) has been produced. This has 100 volts H.T., tapped 60, 70, 80, 90, and 100, and a grid-bias section of 7.5 volts, tapped every 1½ volts. This battery measures 8¾in. by 6in. by 3in., and the list price is 10s. For Marconiphone Model 285 (which utilizes an output stage of the Q.P.P. type) a battery of 175 volts has been produced. Its list number is W.1219. It contains a high-tension section of 166 volts, tapped 60, 72, 132, 140, 147, 155, 162, and 166. The grid-bias section of 9 volts is tapped every 1½. This battery measures 10¾in. by 7 9/16in. by 3¼in., and the list price is 16s.

GOLTONE MAINS ADAPTORS

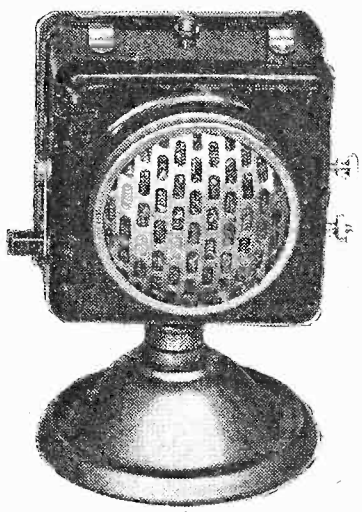
A NUMBER of convenient mains plugs and adaptors are manufactured by Messrs. Ward and Goldstone, two of which are illustrated herewith. That on the left is a three-way adaptor, having two pins at one end for plugging in to an ordinary two-pin socket and three separate pairs of sockets arranged on separate arms in "W" formation. The adaptor may be obtained for 5 and 10-amp. sockets at 8d. and 1s. respectively. On the right is a combined plug which is fitted at one end with a standard lamp (bayonet) fitting, and connection to the plug is made at the opposite end to two pins. This portion of the adaptor is removable, but to prevent loss is attached by a short length of cord. Thus, when the two halves of the adaptor are fitted together the apparatus to which it is attached may be plugged into an ordinary lamp socket, whilst if it is desired to connect to a standard 5-amp. socket of the two-pin type it is only necessary to separate the two portions of the adaptor and plug in the upper portion. This device costs 9d. It will be noticed, no doubt, that the majority of the manufacturers of mains equipment now fit an adaptor of this nature to their apparatus, and the D.C. mains unit which is illustrated above is, in fact, fitted with this type of adaptor.



Two Ward & Goldstone Mains Adaptors.

ELECTRADIX MODEL 11 MICROPHONE

THE microphone illustrated possesses a number of novel features, the principal one being that the small moulded bakelite case contains, in addition to a 2in. microphone, a complete input transformer. As may be seen from the illustration, a switch on one side and two terminals on the other facilitate the connection and switching of the mike. The switch arm is of the combined socket type and thus forms one of the connecting points. On the upper surface are two small lugs which may be employed when it is desired to suspend the microphone, the small pedestal base being then unscrewed if desired. The base and grille are finished in bronze, whilst the bakelite

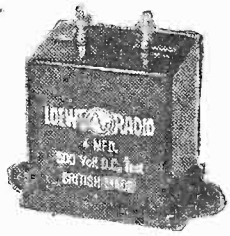


A new Electradix microphone.

is of dark colour, thus giving the complete instrument a very pleasing appearance. Sensitivity is very good, very little background noise being obtainable, and the instrument being very suitable for musical items. The case is filled in with pitch so that extraneous sounds are damped out unless directed into the front of the instrument. At 10s. 6d. this will be found a splendid piece of apparatus for home-broadcasting or small P.A. work. The makers are Electradix Radios, of 218, Upper Thames Street, London, E.C.4.

LOEWE CONDENSERS

WE have received some sample condensers from the Loewe Radio Company, Ltd., of Fountayne Road, Tottenham, London, N.15, makers of the well-known vacuum resistances and multiple valves, etc. The condenser illustrated below is of the paper type, contained in a brown bakelite case and fitted with neat terminals for connection. Moulded feet are provided for mounting purposes. These condensers are impregnated and sealed under vacuum, thus ensuring that moisture and air are, as far as possible, excluded from the finished condenser, with consequent stability of capacity and high insulation resistance. The samples submitted were tested and found to be very accurate in value, the makers' tolerance of ± 10 per cent. being a very good safeguard. The working voltage is 250 volts D.C., and the prices of the condensers in 1, 2 and 4 mfds. are 2s., 2s. 6d., and 4s. respectively. Condensers are also obtainable from the same firm in metal cases (with soldering lugs or terminals) and rated up to 1,500 volts D.C. test.



A Loewe Condenser.

Amongst the other interesting components which Messrs. Loewe manufacture may be mentioned pick-ups, volume controls, tubular condensers, and speakers. Readers desiring details of these accessories should write to Messrs. Loewe for copies of their lists.

STOP PRESS—NEW LINES.

MESSRS. FERRANTI.—New design of resistance consisting of tube of refractory material with high-conductivity surface. Paper condensers and electrolytic condensers, and potentiometers.

MESSRS. VARLEY.—New model A.V.C. Unit. Permits of delayed and controlled volume control. Improvement on original model.

THE HIGH VACUUM VALVE CO., LTD.—New S.G. Valve and a double pentode for Q.P.P. working.

WESTINGHOUSE BRAKE COMPANY.—New model Westector. Specially designed for use at radio frequencies up to 1,500 kc/s.

MESSRS. ELECTROLINX.—New 9-pin valveholder of the chassis-mounting type.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Radio Developments in Western Australia

SIR,—It may interest you to know that the only local development of note recently has been the introduction of the all-wave circuits for home constructors. These, of course, are all superhets, and complete kits can be purchased from £12 for a five-valve and rectifier, using separate oscillator valve, to £26, for a nine-valve and rectifier, using the converter principle. Short-wave reception has been very good—GSB being excellent.

The latest circuit published—I have not yet had time to get full details—is for a two-valve superhet.

The CA7 battery-pentagrid valve is now available here, together with the universal A.C.-D.C. valves, so that from the valve point of view we are well catered for.—R. E. PARRY (Perth, W. Australia).

Six-Seven Valve 230-Volt A.C. Mains Superhet.

SIR,—I am one of the regular readers of your paper, and I am pleased to note from your December 30th issue that Mr. Gordon Harrower, of Singapore, has taken the lead to write you for particulars and diagrams of a six or seven-valve A.C. mains superhet short-wave set. I agree with Mr. Harrower that your Eastern readers would very much appreciate such a design, and I sincerely trust that our hope will be fulfilled.—LOOI TIAN GEOK (Penang, Straits Settlements).

S.W. Transmission from Arizona

SIR,—Many thanks for the answers to my inquiries in the Broadcast Queries column. I recently received a verification QSL card from the amateur station W6DRE in Arizona. He requests short-wave listeners to keep a watch for him. He is on every day from 20.00-21.30 G.M.T., on 14,380 kcs, with 450 watts. His address is 80, W. Lewis Ave., Phoenix, Arizona, U.S.A.—A. E. DOWDESWELL (London, W.11).

D.C. Receivers

SIR,—With reference to a paragraph in the February 24th issue, replying to T. Y. (Hackney), regarding D.C. circuits, I feel I must write in support of him. You state that D.C. mains users are in the minority. According to articles published in PRACTICAL WIRELESS appertaining to mains users since No. 1, the D.C. mains' man has been given about 1 per cent. and the A.C. mains' man 99 per cent. Surely the D.C. minority is not so low as all this. I personally have been waiting for a good D.C. circuit since the advent of PRACTICAL WIRELESS, but have so far been sorely disappointed. The A.C. man has been given two, three and four-valve circuits, while the D.C. man has had to be content with only a two-valve circuit.

Please let us have some good D.C. circuits, including three, four and five valves.—J. McRAE (Poplar).

[*You are in error in stating that we have only dealt with one D.C. receiver. We have dealt with the D.C. ACE (three valves), the A.C.-D.C. Two, and the D.C. two-valver. We have other designs in hand. We have also described D.C. units for several of our battery receivers.*—ED.]

Wireless Sets in S. Africa.

SIR,—I beg to draw attention to the fact that out here we have windows full of foreign wireless sets—mostly American. This is a great pity, and it reflects sadly on the enterprise of British manufacturers.

There are many good British sets that are not even obtainable in South Africa—why they neglect this market is a mystery—at present I should say that twenty foreign sets are sold to one British.

Could you bring this matter forward in the right quarter. Your fine journal is a real live book.—J. HAYNES (Pretoria).

[*Radio manufacturers please note.*—ED.]

Jazz *versus* Strauss

SIR,—A question arousing much controversy of late seems to be that of Dance Music. I quite agree with Jace that the majority of the great B.P. under the age of forty seems to be dance-music mad. Nearly all the youth of to-day seem to know a good number of dance tunes, but I wonder how many of the waltzes of Strauss they are acquainted with. Might I suggest "hideous and cacophonous" coupled together as more useful and descriptive epithets.—A. J. CROSLAND (Huddersfield).

CUT THIS OUT EACH WEEK

Do you know

—THAT the delay voltage for A.V.C. in a mains receiver may be obtained from the biasing resistance of the L.F. valve.

—THAT heterodyne whistles may be cut-out by including a filter circuit in the L.F. stages.

—THAT the above filter circuit consists of a choke and condenser, or combination of chokes and condensers.

—THAT a close-wound coil of wire is of no use as a screen unless all turns are short-circuited.

—THAT between six and eight times is the maximum amplification which may be expected from an aperiodically-coupled H.F. stage.

—THAT the aerial lead should not be permitted to pass close to the output side of a receiver, that is, near the output valve or the loud-speaker leads.

—THAT, similarly, the batteries should not be arranged so that they are close to the aerial or leading-in wire.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

PORTSMOUTH AND DISTRICT WIRELESS AND TELEVISION SOCIETY

Apart from its normal lecture and demonstration this Society hopes to acquire a suitable room for fitting out with the necessary facilities to afford up-to-date research and experiment in short-wave, ultra short-wave, television, micro-wave, modern receiver and transmitter design and so forth. In this way it is hoped to provide an avenue whereby the large number of experimenters, otherwise limited in home facilities, may develop their ideas under laboratory conditions.—Hon. Sec., Mr. S. Holland, 54, London Road, Portsmouth, Hants.

THE SIDCUP AND DISTRICT RADIO AND TELEVISION CLUB

Members of this Club at their last meeting had the pleasure of listening to a lecture by Mr. N. Partridge, B.Sc., A.M.I.E.E. The subject was "The Design of Mains Transformers, etc." Mr. Partridge began by explaining the theory of the transformer, and then passed on to their design and manufacture. The Secretary of this Club is Mr. W. F. Smith, 4, Rowley Avenue Marlborough Park, Sidcup, Kent.

SLADE RADIO

The last meeting of this Society was devoted to "Questions and Answers." A considerable number of questions were raised, but in every case a ready answer was given by either Mr. G. T. Peck or Mr. N. B. Simmonds. Many of the questions were of a very interesting nature, and the replies provided much valuable information. Anyone interested who desires full information concerning membership, etc., is requested to write to the Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

THE INTERNATIONAL SHORT-WAVE CLUB (LEICESTER CHAPTER)

It may be of interest to readers in Leicestershire who are interested in short-wave work to know that a Chapter of this club has been reorganized in Leicester by Mr. W. Vendy, of 9, Cecilia Road, Leicester. Several members of this Chapter received the special transmission arranged by Mr. E. A. Bear, the British Representative of the International Short-Wave Club, from PAOASD on Sunday, February 25, at 03.00 G.M.T. Anyone interested in this club is invited to apply to Mr. Vendy or to the Hon. Sec., Mr. C. Cramp, 49, Avenue Road, Leicester, who will be pleased to supply particulars of the Chapter.

THORNTON HEATH RADIO SOCIETY

A joint meeting of the Thornton Heath and Croydon Radio Societies was held at St. Paul's Hall, Norfolk Road, on Tuesday, the 27th ultimo. Mr. Keasley introduced Mr. L. H. FitzGibbon, of Messrs. J. J. Eastick and Sons, who proceeded to give a demonstration of the Eelex M4 Super short-wave converter.

Mr. FitzGibbon explained the circuit of the converter and the difficulties which had had to be overcome in order to obtain the greatest efficiency over its range, which is from 15 to 115 metres.

The Hon. Sec. of the Croydon Radio Society is Mr. E. L. Cumbers, 14, Campden Road, Croydon.

The Hon. Sec. of the Thornton Heath Radio Society is Mr. Jas. T. Webber, 368, Brigstock Road, Thornton Heath.

LEICESTER AMATEUR RADIO SOCIETY

On Tuesday, Feb. 27, the above Society held their fortnightly meeting. A lecture on Public Address Amplifiers was given to the members by Mr. H. A. Hughes. The construction of amplifiers and components was described, and then gramophone records were played and amplified; the different musical instruments and their reproduction commented upon. The amplifiers used were 2½, 5, and 10-watt output. The Society extends an invitation to all PRACTICAL WIRELESS readers in the district. Particulars can be obtained from the Secretary, A. Stimpson, 88, Welford Road, Leicester.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

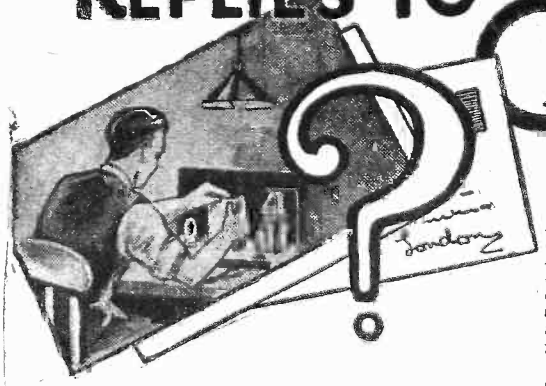
Enthusiasts from Osterley, Eastcote, Ruislip, Ealing, and Beaconsfield attended the second television demonstration held by the Uxbridge District Branch of the Anglo-American Radio and Television Society on February 28. The receiver employed was of the scanning disc type, and was unusual in that it employed a gramophone governor to keep the speed constant. Mr. Leslie W. Orton announced that a third television demonstration would be held in the near future. The U.D. branch holds meetings at 11, Hawthorn Drive, Willowbank, Uxbridge, at 7.30 p.m., each Wednesday. There are no charges, and everyone interested should write to Mr. Leslie W. Orton, at the above address, enclosing a stamped addressed envelope for details.

THE CHATHAM AND DISTRICT RADIO SOCIETY

At a meeting of the above Society, held on the 26th ult., an interesting lecture was given by Mr. Power, of Messrs. Clarke and Co. The lecturer outlined the uses of an eliminator and described in detail all the various components and their functions, explaining the principles of rectification and smoothing. Inquiries for membership should be addressed to the Hon. Sec., J. Holden, Downham Road, Chatburn, Lancs.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff



The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

UPKEEP COSTS OF MAINS SETS

"I am anxious to get a set to work from the A.C. mains, but would first like to know the respective upkeep costs of the following types of receiver: 1. Battery-type set operated from mains eliminator. 2. Mains set operated with metal rectifier. 3. Mains set with half-wave valve rectifier, and 4. Mains set with full-wave valve rectifier. The initial cost does not interest me much."—T. Y. (Blackheath).

The battery set with mains eliminator will necessitate a trickle charger in order to keep the accumulator in condition, although it will in all probability employ a metal rectifier for the H.T. voltage. Thus this will cost more for upkeep than the second alternative you give. The half-wave valve rectifier will require a separate secondary winding to heat the filament of the valve and thus will be slightly more expensive than the metal rectifier, although if a voltage-doubler circuit is employed with the metal rectifier the H.T. secondary winding might consume slightly more current than the half-wave valve. The full-wave valve will require a larger secondary for H.T. and will take slightly more current. Therefore, the mains set with metal rectifier will probably be cheapest, although there will not be found to be very much difference in actual expense over a long period.

CORRECT PICK-UP CONNECTIONS

"I have a two-valve commercial set with a one-valve amplifier attached to it. I get plenty of stations at full volume, but when I connect a pick-up volume is too low. The pick-up is new and has been tested. The pick-up works best on the L.F. valve. Can you tell me how to get more volume from it?"—A. C. (Briton Ferry, Glam.).

You should connect the pick-up in the grid circuit of the detector valve. Join one side of the pick-up to the detector grid, and connect the other side to the 1½-volt grid-bias tapping. To prevent radio breaking through simply turn the tuning dial to a spot where no station is heard. Volume should then be ample.

METALLIZED OR UNMETALLIZED?

"I am going to build Circuit No. 17 in the Constructors' Enclyclopædia, but I have an unmetallized S.G. valve. Could I use this in place of the recommended one? Also, I have a pentode-matched M.C. speaker. Could I dispense with the L.F. choke in the plate circuit of the pentode valve?"—W. R. (Seven Kings).

The non-metallized valve will no doubt work satisfactorily in place of the recommended metallized one, but if instability is experienced you will have to fit a metal (earthed) screen round the valve. As your speaker has an input transformer fitted to it, it may be joined in place of the L.F. choke. Simply connect one end of the transformer to the plate of the valve, and the other to H.T. positive. The filter condenser will not, of course, be required.

SIGNALS GETTING WEAKER

"I have a five-valve A.C. receiver with two H.F. stages and a push-pull output stage. Until recently the set has been working satisfactorily, but now a great falling off in strength has taken place. I can only get the local stations and no long wave stations. All valves are O.K., as I have had them tested. Can you please offer any solution?"—W. McG. (Renfrewshire).

If the valves (including the rectifier) have been tested, we can only suggest that you check the anode voltage of each valve by means of a good high-resistance voltmeter. If this is normal in every case, then you must look to your aerial and earth system and the tuning circuits. Make certain that no aerial joints have come adrift and you could try a temporary new aerial and earth lead, the former consisting of a length of ordinary wire simply carried down the garden without the trouble of raising it on the present mast. A different earth, say a water-pipe, if you are using a buried earth, will enable you to check the efficiency of that connection. If these prove in order, the coils should be checked for breaks or disconnection.

WHAT TYPE OF ELIMINATOR?

"I have a commercial Q.P.-P. receiver at present working off H.T. batteries, with a 15-volt Grid-Bias battery. I am shortly having electric light installed and wish to operate the set from the mains. Can you tell me what type of eliminator I must get and how to connect the grid bias to it?"—J. C. F. (S.W.1).

You should obtain one of the newly-introduced stabilized eliminators, designed especially for Class B and Q.P.-P. working. The grid bias will be obtained most satisfactorily from batteries, and the connections will be exactly the same as at present, that is, grid-bias positive will be joined to H.T.— on the eliminator, instead of to H.T.— on the H.T. battery. A suitable eliminator, if you wish to make your own, was described in PRACTICAL WIRELESS No. 65.

WRONG MICROPHONE CONNECTIONS

"I recently purchased a microphone and connected it to my mains set, but it would not work. I took it back to the shop and was told that it was tested when I bought it and worked satisfactorily, and the shopkeeper said I must have dropped it or otherwise damaged it. I tried it on my friend's set (battery) and it worked all right. Can you tell me how to get it to work on my set?"—E. A. T. (Cricklewood).

As the mike works on your friend's set it points more or less to the fact that it is in working order, and you must, therefore, have joined it to your set in the wrong manner. You will have to connect it between cathode and grid, not earth and grid. Did you do this?

L.T. FIRST

"I have an H.T. unit which gives also the grid bias, and I find that the set switch does not work when in the off position, as the set goes on playing until the unit is switched off from the mains. Is this in order? If so, can I disregard the set switch and remove same without doing harm to the set. Also I am trying out a second-hand coil which has ten tappings controlled by contact studs and a movable coil inside the former which controls the volume. Am I using the right circuit (straight three) for this coil?"—T. C. W. (Thornton Heath).

It is obvious that the set switch is not disconnecting the accumulator. You must not, of course, leave the filaments burning when the set is not in use owing to the drain on the accumulator. If the H.T. unit is supplying also the heater voltage (with indirectly-heated valves), then the set switch may be ignored and left in the "on" position or removed and ignored. If an accumulator is employed, the set switch should be pulled on first, then the H.T. unit should be switched on. When listening is finished, the H.T. unit should be switched off, then the set. We regret that you give insufficient details to enable us to advise you concerning the coil.

QUESTIONS NOT TO ASK

"I wish to buy a ready-made receiver and have narrowed my choice down to the Betta Super and the Radiogrande. Which of these do you recommend?"

We cannot undertake to recommend any commercial make of receiver in view of the difficulty of knowing what the users' local conditions are likely to be. The only advice we can give in such cases as that quoted above, is to go to the nearest radio dealer and ask for a demonstration, if possible in your own home. In this way you are more able to judge just what pleases your individual requirements than are we, who have no knowledge of your musical tastes, etc.

"I noticed a Wrinkle from A. B., of Shipley Marsh in last week's issue, but cannot see how he gets the idea to work. However, can you put me in touch with him so that I can write and ask him if he wishes to dispose of the unused valves."

We cannot give any reader the name and address of contributors, as it will be appreciated that some readers may not care to be bothered with communications from others. Therefore, we can only suggest that we will forward on any communication which is addressed to the contributor, c/o this office, and then the contributor will be able to decide whether or not he desires to enter into correspondence.

FREE ADVICE BUREAU COUPON

This coupon is available until March 24th, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 17/3/34.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word prepaid — minimum charge 3/- per paragraph—and must reach this office not later than Tuesday for the following week's issue. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8 Southampton Street, Strand, London.

PREMIER SUPPLY STORES

offer the following Set Manufacturers' Surplus New Goods at a fraction of the original cost: all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

PREMIER SUPPLY STORES announce the purchase of the entire stock of a world-famous Continental valve manufacturer. All the following types of standard mains valves at 4/6 each. H. HL. L. Power. Directly heated 6-watt Pentode. Directly-heated 9-watt Pentode. High magnification Screen-grid, low magnification Screen-grid. Variable-Mu Screen-grid. 250 volt 60 milliamp. full-wave rectifiers.

THE following types 5,6 each. Indirectly-heated Pentode. 350 volt 120 milliamp. full-wave Rectifier. 500 v. 120 ditto, 6/6. Dario Battery Valves 4v. filament. Set of 3, consisting of Screen-Grid, Detector and Power or Super-Power, 6/6 the lot. Power or Super-Power, 2/6.

ELIMINATOR Kits, including Transformer, choke, Westinghouse metal rectifier, Dubilier condensers, resistances and diagram, 120v. 20 m.a., 20/-; trickle charger 8/- extra; 150v. 30 milliamps., with 4v. 2-4 amps. C.T. L.T., 25/-, trickle charger 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T. L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps. C.T. L.T., 37/6; 150 volts 50 milliamps, 27/6.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Premier chokes, 25 milliamps. 20 henries, 2/9; 40 milliamps. 25 hys., 4/-; 65 milliamps. 30 hys.. 5/6; 150 milliamps. 30 hys., 10/6; 60 milliamps. 80 hys., 2,500 ohms. 5/6.

HARLEY Pick-up, complete with arm and volume control, 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 3/6.

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 ma.. 0-1, 0-5 amps.; all at 6/-.

SPECIAL offer of Mains Transformers, manufactured by Philips, input 100-120v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amp., 4/6; 200-0-200v.. 4v. 1a.. 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v. 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers. 250v. 60 m.a., rectified with 4v. 3-5a. and 4v. 1a. C.T. L.T., screen primary, 15/-; with Westinghouse rectifier, 25/-.

4V. 3a. C.T., 6v. 2a. C.T., 9v. 1a., 12v. 1a., 7/6 each; 4v. 3-5a., 22v. 1a., 8/6 each; 10v. 3a., 14v. 4a., 10/- each.

PREMIER H.T.9 Transformer, 300v. 60 m.a., with 4v. 3-5a. and 4v. 1a. C.T., L.T., and screened primary. 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER Mains Transformers, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; Westinghouse rectifier for above, giving 200v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.); with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a, 4v. 1-2a (all C.T.). with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400v. 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-.

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt, 10/-.

MULTI Radio Output Transformers, 4/6, Twin Screened Wire 3d. per yard.

CENTRALAB Potentiometers. 50,000. 250,000 half meg., any value, 2/-; 200 and 400 ohms., 1/-.

RELIABLE Canned Coils with Circuit, accurately matched, dual range, 3/- per coil. Please state whether Aerial or H.F. required. Ditto iron core, 3/6.

PREMIER L.T. Supply Units, consisting of Premier Transformer and Westinghouse rectifier, input 200-250v. A.C., output, 2v. ½amp., 11/-; 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp., 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in. cone, 18/6.

GRAMPIAN M.C. Loud-speakers, 2,500 ohm field, 9in. cone, handles 5 watts; 21/-.

GRAMPIAN P.M. Loud-speakers, 9in. cone, handles 4 watts; 18/6.

(Continued at top of column three)

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Complete Class B Amplifying Unit, with Valve and Rola P.M. Moving-coil Speaker. Send only 5/- for 7 days' trial. If approved balance in 11 monthly payments of 6/6. Cash or C.O.D. Carriage Paid. £3.11.0

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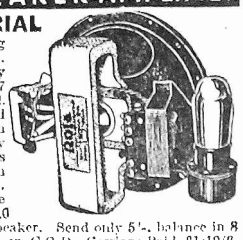


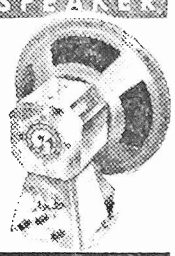
ROLA F.R.6 P.M. Class B. Speaker. Send only 5/-, balance in 8 monthly payments of 4/9. Cash or C.O.D. Carriage Paid, £1/19/6.

W.B.P.M. 4 MICRODE MOVING-COIL SPEAKER

SENT ON 7 DAYS' TRIAL

With Switch-controlled multi-ratio input transformer. Send only 5/- for 7 days' trial. If approved, balance in 8 monthly payments of 5/3. Cash or C.O.D. Carriage Paid, £2/2/0. W.B.P.M.6. Send only 2/6. Balance in 8 monthly payments of 4.3. Cash or C.O.D. Carriage Paid, £1/12/6.

5/- DOWN



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SEND FOR IT ON 7 DAYS' TRIAL

A very popular P.M. Moving-coil Speaker for operation from Power or Pentode. Send only 2/6 for 7 days' trial. If approved, balance in 8 monthly payments of 4.3. Cash or C.O.D. Carriage Paid. £1/12/6.

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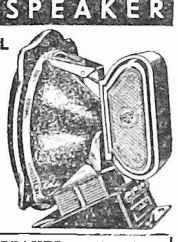

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TELSEN S.G.3 KIT

Complete kit of parts for building. Send only 4/6, balance in 9 monthly payments of 4.6. Cash or C.O.D. Carriage Paid, £1/19/6. If valves required, add £1/19/0 to Cash Price or 7.3 deposit and 11 monthly payments of 7/3.

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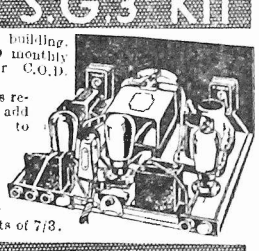

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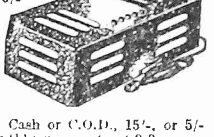
25 m/a., 120 volts, 4 tappings. Suitable for all outputs, including Class B and Q.P.P. Send only 5/- for 7 days' trial. If approved, balance in 8 monthly payments of 4/6. Cash or C.O.D. Carriage Paid. £1/17/6. D.C. MODELs. Cash or C.O.D., 15/-, or 5/- down and 3 monthly payments of 3/9.

5/- DOWN



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(Continued from foot of column one)

WESTERN ELECTRIC Condensers, 250v. working, 2 mfd., 1/-; 2 mfd. 400v., 1/6.

B.T.H. Truespeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/-, complete. Type YH 100/250v. A.C. or D.C., 42/-.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 10,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

POLAR 2-gang, with complete disc drive, padding condenser and trimmer, 0.0005 6/6.

CYLDON Capacitors (Double Trimmers), 1/-. Utility .0005 2-gang Bakelite Condensers, concentric Uniknob Trimming and Disc Drive, complete, 3/6.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job, 15/-.

AMPLION Cone Loud-speaker Units, 1.9, complete with 12in. cone and chassis, 3/11 each. Worth treble.

ORMOND Condensers, 0.0005 2-gang, semi-shielded, 2/6; brass vanes, with trimmers, 3.6.

WIRE Wound Potentiometers, 15,000 ohms, 1/6; 50,000 ohms, 2/-; 500,000 ohms, 3/-.

HOME Radio Microphone, complete, 5/-; simply plug in to pick-up terminals.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers, at a fraction of original cost for callers.

WESTERN ELECTRIC Mains Transformers, 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a. C.T., 4v. 1a C.T., 19/6.

1,000 Ohm 150 m.a. Wire Wound Variable Resistance, 2/-; Burndept 2-watt resistances, all values from 0.5 to 50 ohms, 3d. each; holders, 2d. each.

T.C.C. Condensers, 250v. working; 2 mfd., 1.9.

T.C.C. Electrolytic Condensers, 440 volts working, 4 mf. or 8 mf., 3/-; 15 mf., 50 v. working, and 50 mf. 12v. working, 1/-; 25 mf. 25v. working, 1.3.

T.C.C. Block Condensers, 250v. working, 2 x 2 x 2 x 0.1, 2/-; 2 x 2 x 2 x 1. 2 3; the above condensers at same price by Dubilier 300v. working.

H.M.V. Block Condensers, 400v. working: 4 x 4 x 1 x 1 x 1 x 0.1 x 0.1 x 0.1, 6/-; 4 x 2 x 1 x 1 x 0.5, 4,6.

DUBILIER Condensers, 2 mf. 1,200v. working, 4/-; 8 mfd. dry electrolytic, 450v. working, 3/-.

THE Following Lines 6d. each, or 5/- per dozen.—Chassis valve holders, 5, 6 or 7 Pin, screened screen-grid leads, any value 1-watt wire end resistances, wire end condensers, 0.0001 to 0.1, R.I. .0005 varicaps, trimming condensers, T.C.C. 6 mfd. 50v. electrolytics.

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ERICSSON 3/1 L.F. Transformers. List Price 17/6. New and guaranteed. Our price, 2/3 post free U.K.—Pioneer Radio, Coptic Street, London, W.C.1.

REPAIRS RE-WINDING—OVERHAULS. Loud speakers, 4/-; Blue Spots, 5/-. New cones fitted to Moving Coil speakers, 6/-. Eliminators, Mains transformers, etc., quoted for. Special components and sets made to order. Quick service. Laboratory tested. Repair Dept. C., Wordon Power Link Radio Co., 80, Lonsdale Avenue, East Ham, London, E.6. 'Phone Grangewood 1837.

GRAMOPHONES. Radiograms, 64 page. How to make 'm, 3d. Motors, Arms, Pick-Ups, Speakers, Horns, Springs, Repairs, Accordions.—Regentprac, 120, Old Street, London, E.C.1.

RAD-AUTO-GRAM buy Modern Second-Hand Components for Cash.—39, Tulketh St., Southport.

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VARIABLE Condensers.—Lotus 3-gang 0.0005, 12/6; Lotus 2-gang, 0.0005, 8/6; Lotus Dyblock single, 0.0005, 4/9 (list 9/6); all these condensers are complete with dials, escutcheons, knobs, fully screened with trimmers, and boxed; Igranic variable, 0.0003 and 0.0005, 2/3; Hydra block condenser, 16 mfd. (2+2+8+2+1+1), 1,000 v. D.C., 7/- each; 20 mfd. (2+2+2+2+2+2+2+2+1+1+1+1), 1,500 v. D.C., with terminals, 11/6; Dubilier 4 mfd. (2+1+1), 1,000 v. D.C., 2/9; 4.5 mfd. (2.25+2.25), 3/-; fixed 4 mfd., 2/3; 2 mfd., 1/6; 1 mfd., 1/-.

SPEAKERS.—Blue Spot permanent magnet, with Universal transformer for power, pentode, super power or class B, 23/- (list 39/6); D.C. mains energised, all voltages, 16/6; Celestion Soundex P.P.M. permanent magnet, 17/6 (list 27/6); Blue Spot 100U inductor, complete with chassis, 13/6 (list 39/6); Celestion permanent magnet type P.P.M.W. universal transformer, 25/- (list 49/6).

BLUE Spot, 66K, complete in cabinet, 16/- (list 42/6); G.E.C. Stork, in magnificent cabinet, 19/6 (list £3/15); all speakers new in original cartons.

PICK-UPS.—Blue Spot, model "88," with volume control, 26/- (list 63/-); Marconi No. 19 (1934), 26/- (list 32/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor "A" 3-valve screened grid kits, with cabinet and moving coil speaker, less valves, £3/7/6; with valves, £4/10 (list £8/7/6); Ready Radio S.T.400 kits, all specified components, by Scott Taggart, £2/19/6 (list £4/17/6).

FRAME Aerials.—Lewcos dual wave 235-550 metres and 1,000-2,000 metres, 10/- each (list 37/6).

IGRANIPAK complete tuning unit, comprising (1) Completely screened coils with built-in wavechange switch; (2) Igranic 3-gang Condenser with cover; (3) Escutcheon and Disc Drive Assembly with pilot lamp attachment; (4) Mains Switch; (5) Three 5-pin Valve holders; (6) Grid Leak and Condenser; (7) Engraved Terminal Board. Complete with circuit. List price 57/6. 27/11.

MISCELLANEOUS.—Ferrocart coils, G.1, G.2, G.3, with switch, 31/9 (list 39/6); Benjamin Class "B" universal output chokes, 6/6 (list 11/-); Ready Radio Instamat Universal transformers, for matching any value to speaker, 11/6 (list 37/6); Rotorohm and Radiophone volume controls, all values, 3/- each; with switch, 3/3 (list 10/6); S.T.500 coils, 5/6 per pair; Hellesen's 8 mfd. electrolytic condensers, 2/9 each; Westinghouse metal rectifiers, H.T. 6, 7, 8, 9/3 each; Amplion loud-speaker units, 2/3; Ferranti choke, 20 henry 60 m.a., 6/9 each; Kolster Brandes gramophone motors, dual, for A.C. or clockwork, complete with turntable and all accessories, 110-250 volts, 25/- each (list 63/-); Ready Radio L.F. transformers, 5-1, 3-1, 3/3 (list 8/6); B.T.H. transformers, 3/6; Lewcos superhet 8-way bases, complete with valve holders, grid leak, fixed condenser, type "48," 2/- each.

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ALL Transformers and Chokes Guaranteed for 12 months.

ALL Goods Guaranteed and Sent Carriage Paid.

BRANCHES at 271-275, High Rd., Willesden Green, N.W.10, and at 46, Lisle St., W.C.2; please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

HIGHEST allowance made on used wireless goods in exchange for new; balance payable on easy terms. Sets and parts bought for cash (state prices required).—R. Wigfield, Furlong Road, Goldthorpe, Yorks.

EPOCH.—Annual sale of surplus loud speakers of all kinds, also sets, amplifiers, cabinets, and useful parts of every description for experimenters and wireless dealers; thousands of bargains for callers; second abridged list on application.

EPOCH.—Great bargain in 11in. super P.M. speakers, the finest moving coil in its class; these units are brand new, perfect, and guaranteed 12 months; they are slightly different from standard in design, but equally as good in performance; optional with 10-ratio or Class B transformers; worth 45/-, to clear at £1 each, carriage paid.

EPOCH RADIO, Exmouth House, Exmouth Street, E.C.1 (at junction of Rosebery Avenue and Farringdon Road).

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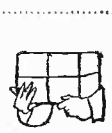
No. "N.W." 11 **10/6**

PARCELS of useful oddments for the Experimenter who wants **Coils, Magnets, Wire, Chokes, Condensers, Switches,** etc., mostly ex-W.D. parts. Worth a lot more. 10lb. **7s.,** or 7 lb. **5s.,** post free. *British Isles only.*



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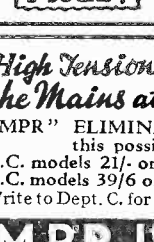

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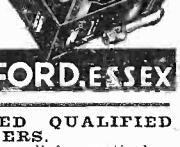

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BIRMINGHAM RADIOMART'S Manufacturers Surplus Stocks; post free over 6/-, otherwise 6d. All goods new and perfect.

RADIOMART—Utility W312B screened 2-gang bakelite condensers with disc drive and concentric Uniknob trimming, 3/6. These must be seen to be appreciated.

RADIOMART—Utility 40 mmfd. ball-bearing short-wave microvariables, 1s. 9d. Mains snap-switches, 9d.

RADIOMART—Utility ball-bearing air-spaced differentials, 0.0003 and 0.0005, list 11/6, finest made, 2/-.

RADIOMART—Utility, 1934, bakelite tuning and reaction condensers, 0.0005, 10d.; 0.0003, 8d.

RADIOMART—Radiophone straight line illuminated dials. Note complete escutcheon knob, wavelength or degree, 3.6.

RADIOMART—Illuminated Readrite visual tuning meters, 10ma. Finest made, 4/11.

RADIOMART—Ormond super low-loss variables, fitted high reduction dials, 0.00025; ideal short-wave, 2/6.

RADIOMART—Ormond air-spaced small 0.0003 log; the ideal reaction condenser, boxed, 1/6.

RADIOMART—Igranicore 1934 super, 12/6. Iron-core Dual Range short-wave inductance coils, 4/9.

RADIOMART—Igranic 400 ohm Porcelain potentiometers, 6d. Ditto short-wave H.F. Chokes, 1/-.

RADIOMART—Complete set 4. Latest Igranic short-wave inductance coils, 15-130 metres, 4/-.

RADIOMART—Igranic boxed nickelcore transformers, list 10/6. 3-1, 5-1, 3/11. Ditto parallel feed, 2/11. Formo 2mf. 400v. working with terminals, 1/8.

RADIOMART—Philco heavy duty Class "B" 1-1 driver transformers, boxed, 2/9. Valveholder baseboard, 9d.

RADIOMART—H.M.V. super 3-gang nonslip wavelength dial, trimmers; last few offered, 9/-.

RADIOMART—British Radiophone, 7/6. Wirewound logarithmic potentiometers with mains switch, 5,000, 10,000, ditto 5,000, heavy duty no switch, each type, 2/-.

RADIOMART—Super Section wound screened primary HT8 transformer with 4v. 4a. CT., 4v. 1 a., 10/6. With Westinghouse Rectifier, 18/6.

RADIOMART—Wearite 300/300 4v. 3a. CT., 4 v. 2a. CT., a quality job, 10/6. Philips, 200/200, 4v. 3a., 4v. 1a., 4/6.

RADIOMART—New purchase Met-Vick, 35/-; super transformers, 250/250. 4v. 2a., 4v. up to 5amps., fitted terminals, 9/6; 100v. or 230v., 25 cycles, 12/6.

RADIOMART—Magnum wirewound 25,000 ohm. potentiometer, ditto Colvern, 2,500—15,000, 1/9 each.

RADIOMART—Magnum radio to gram. dissolvers as used De Luxe RGD, 2/9. TCC, 0.02 mfd., 0.025 mfd., 7½d.

RADIOMART—Lotus 3½-1, push-pull intervalve manufacturing tag connections, 2/-. Ditto Plug and Jack.

RADIOMART—TCC. 0.1 x 0.1 mfd. 450v. wkg., non-inductive, ideal for curing modulation hum or H.F. decoupling, 1/-.

RADIOMART—Non-inductive tubulars, 1,500v. test 0.1mfd. and 0.01mfd., wire ended, 6d

RADIOMART—Western Electric sensitive microphone insets, 1/-. Special short-wave all-brass 0.0001, variables, 1/9.

RADIOMART—Exide 30/-, boxed Tempex Bakelite clocks, synchronous, A.C., 17/6; Ditto, 45/-, battery (runs 3 years for 1/-), 20/-, fully guaranteed.

RADIOMART—Famous Ward-Leonard and Zenith 100 watts transmitting grid leaks, 5,000, 10,000, 15,000, Bleeders, 50,000, 50ma., 4/6.

RADIOMART—TCC. 4 x 4mfd. 1,700v. working transmitting condensers, massive stand-off terminals, 25/-. Cost £9. Brand new.

RADIOMART'S March List now ready; largest and most comprehensive published; stamp essential.

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HIGH Class Radio Parts and Sets wanted for Cash, We pay up to a ¼ of the retail value for class goods (no junk).—Mildmay Radio Exchange, 24, Mildmay Grove, London, N.1. 'Phone: Clissold 5001.

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HALF PRICE. Make your set into a radio-gramophone with a Bureaugram. 7, 9, and 11 Guinea models at half price. Write for illustrated leaflet. Wilson and Gill, 139/141, Regent Street, London.

STUPENDOUS Sacrifice of Perm Mag. Moving-Coil Speaker, by famous manufacturer. 250 only, wholesaler's stocktaking realisation sale, latest modern type with transformer, tapped Class B pentode, power, super power and mains valves, fully toned realistic volume, 25/- only. 2 days' approval, reduced from 45/-. Suitable all types sets.—Hewitt Bros., Radio, Dukinfield, Ches.

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* P.W. TOOL-KIT GIFT STAMP No. 3
See page 1156

MORE ABOUT MIDGET COMPONENTS

Practical Wireless

3D.

AND PRACTICAL TELEVISION

EDITED BY F.J.CAMM

Published every Wednesday by
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Vol. 4.—No. 79.
March 24th, 1934.
Registered at the G.P.O. as a Newspaper

A SPECIAL MAINS SET for D.C. USERS

ALSO INSIDE

L.F. AMPLIFIER TROUBLES

PICK-UPS AND LOUD-SPEAKERS

TENDENCIES IN RECEIVER DESIGN

RADIOGRAM RECEIVERS

PRACTICAL TELEVISION AND SHORT-WAVE SUPPLEMENTS

BEGINNER'S SECTION, Etc., Etc.

MORE ABOUT THE LEADER—See page 12

ROUND *the* WORLD *of* WIRELESS

Index and Binding Case for Vol. 3

OUR third volume (issues dated September 23rd, 1933, to March 17th, 1934) was completed in last week's issue. Index and title page are now ready, price 4d. post free. Orders should be sent to the Publisher, George Newnes, Ltd. We shall be pleased to undertake the binding of readers' volumes in the neat blue case with silver lettering, upon the same terms as hitherto, and an announcement regarding this will be made in an early issue.

Broadcasts from Dutch East Indies

THE new N.I.R.O.M., Dutch East Indian Broadcasting Company's daily service of radio transmissions, is advertised to start on March 31st. It has been established to supply programmes to Batavia, Soerabaya, Samarang, Medan, etc., in the Netherlands East Indies. Owing to the interest taken in Holland, it is possible that a relay will be carried out through one of the short-wave Bandoeng stations and passed on to Hilversum or Kootwijk for rebroadcast on the medium- or long-wave bands.

Possible Changes in Long-wave Band

ALTHOUGH not yet definitely adopted, it is likely that the following alterations will be made in the near future to the wavelengths of transmitters in the long-wave band: Kaunas (1,948 metres); Kootwijk and Brasov (1,887 metres); Lahti (1,807 metres); Moscow (1,724 metres); Radio Paris (1,649 metres); Minsk (1,442 metres); Motala (1,389 metres); Warsaw (1,339 metres); Kharkov (1,293 metres); Kalundborg (1,250 metres); Leningrad (1,210 metres); Oslo (1,145 metres); Daventry National, Deutschlandsender and Radio Luxembourg will remain on their present frequencies. Eiffel Tower (Paris) will be withdrawn from the long-wave band to work on 206 metres at reduced power. Tests will shortly be made with the new allocations and the results further discussed at the meeting of the International Broadcasting Union at London, to be held on June 12th–20th.

League of Nations Transmitter

SO far the Prangins radio stations have only been used officially by the League of Nations for short-wave transmissions every Saturday evening. It is now proposed that broadcasts should also be carried out by this International body on wavelengths of such frequencies as to make them available to the bulk of European listeners. This would entail alterations in the plant as well as an increase in power; both matters are now under serious consideration. If the scheme is carried out, it is suggested that the station should be placed from time to time at the disposal of various European States.

Post Office Pirate Chasers

NOTTINGHAM, Mansfield, Newark, Grantham, Loughborough, and Derby are to be visited next month by a post office direction-finding van. It is to start a tour of these districts on April 2nd. Listeners who have forgotten to take out licences would do well to put themselves right with the authorities before that date. It saves trouble and possible unpleasantness!

All Radio Star Music-Hall

ON March 31st, the B.B.C. will present a variety hour in which many well-known favourites are to appear before the microphone. The bill includes Arthur Prince and his boy Jim, Gert and Daisy (Elsie and Doris Waters) who really are sisters, Rudy Starita, and the Western Brothers—not really brothers but actually first cousins.

Mühlacker's Increased Power

ALTHOUGH the Mühlacker 100-kilowatt station has been ready for some time, so far its full power has not been used. The new aerial tower, however, specially designed for this transmitter, is now finished, and with the change-over to the more modern plant the Stuttgart broadcasts will be much better heard in the British Isles. Mühlacker works on 522.9 metres, immediately below Athlone's position on the condenser dial.

New American Broadcasting System

NOTWITHSTANDING previous unsuccessful attempts to compete with the N.B.C. and C.B.S. Networks, it is reported that a group of Wall Street financiers are endeavouring to launch the Federal Broadcasting Company as an independent concern. Already fourteen transmitters in cities east of the Mississippi have been roped into this organisation, which is under the presidency of a former governor of the State of New York.

Proposed Super Station for Finland

TO replace the 40-kilowatt Lahti transmitter which relays the Helsinki programmes, the Finnish Broadcasting Company is planning the erection of a 150-kilowatt station to work on the long-wave channel. It is possible that a more favourable site than Lahti may be found for it.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

An All-Star Orchestra

A NOVEL programme will be broadcast from the National transmitters on March 26th, when Van Phillips and his All-Star Orchestra will present an hour of popular music in the modern manner. The chief feature about the orchestra is that it is an impossible combination for any leader to maintain—the salary list would be prohibitive. More than half the players have themselves appeared as soloists on the air at various times. This superb orchestra will include Leon Goossens (obce); Sidonie Goossens (harp); Hugo Rignold (violin); Anthony Pini (violoncello); Arthur Young (pianoforte); Rudy Starita (xylophone).

"Hurdy-Gurdy"

ANOTHER version of the popular series called "Hurdy-Gurdy" will be broadcast on March 26th, when songs from stage, screen, and drawing-room will be given by Elsie Eaves, John Rorke, Brian Gaye, Emlyn Burns, and the Revue Chorus and Western Studio Orchestra, conducted by Reginald Redman. This programme will also be relayed to the Empire by the B.B.C.'s short-wave Empire transmitter at Daventry.

That Holiday Feeling

THE Midland Studio Orchestra and Studio Chorus are associated in a programme entitled "That Holiday Feeling," on March 31st. Frank Cantell will conduct the orchestra in music of a festal character by Montague Phillips, Lucas, Eric Coates, John Holliday, and Lacome; the chorus, directed by Edgar Morgan, will sing eight songs which are special favourites with hikers; and Frederick Chester will entertain with original sketches.

Grand National Broadcast

THE Grand National broadcast takes place on March 23rd, and the usual pair of experts will tell listeners all about it, yard by yard, between the Grand Stand and the Canal Turn. Mr. Lyle and Mr. Hobbiss have been sharing the task of describing the race since 1930, as it was found to be impossible for the commentator at the Grand Stand to distinguish the horses nearly a mile out "in the country." Three circuits are installed between the van and the control point in the Grand Stand—one for the commentary from the Canal Turn, one for control, and one so that those on the van can hear the Grand Stand commentary and know when to fit in.

"I Pagliacci" Broadcast from Glasgow

OPERA lovers in Scotland will be interested to hear that the first act of the Royal Carl Rosa Opera Company's production of "I Pagliacci" will be relayed from the Theatre Royal, Glasgow, and broadcast on March 27th. John Wright takes the part of Canio and Mabel Baker the part of Nedda. The conductor is Eric Warr.

INTERESTING and TOPICAL PARAGRAPHS

Radio Oesterreich

LISTENERS to the Vienna radio programmes may be interested to learn that the Bisamberg high-power transmitter which is responsible for the broadcasts, has assumed the character of an armed camp. Day and night the precincts are patrolled by Austrian troops to prevent any interference with the station.

SERVICING MODERN RADIO EQUIPMENT

Radio instruments occasionally require expert servicing, and the above illustration shows an engineer making an adjustment to the amplifier of a Columbia radio-gramophone.

SOLVE THIS!

PROBLEM No. 79.

Kerrinson made up an all-mains A.C. two-stage amplifier, using choke-capacity coupling in the input arrangements, and added this to his existing broadcast (all-mains) receiver. The two ends of the amplifier input choke were joined in the anode circuit of the output valve of the broadcast receiver, yet results were very poor, signal strength being very weak and badly distorted. The receiver itself functioned perfectly, and the amplifier was thoroughly tested and every component was found to be in order and correctly wired. What was wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 79, and must be posted to reach here not later than the first post March 26th, 1934.

SOLUTION TO PROBLEM No. 78.

When Rogerson connected the impedance-matching transformer across his aerial and earth terminals he was short-circuiting the band-pass coupling condenser and thus upsetting the entire circuit. The inclusion of a small fixed condenser between aerial and the end of the impedance-matching transformer would have removed this difficulty.

The following three readers successfully solved Problem No. 77 and books have accordingly been forwarded to them:—

H. Lamb, 59, Merlin Road, Welling.
J. H. Wylde, 58, Marsden Lane, Marsden, Yorks.
G. Mosler, 83, Leadale Road, N.16.

New Aerial for Submarines

A RECENT patent describes a new aerial for the use of submerged submarines. It is in the form of a buoy which can be released from the deck and which, floating on the surface of the sea, remains connected by cable to the wireless apparatus. No actual mast is needed, the transmission being effected through framed coils enclosed in the buoy. Experiments carried out with the apparatus have given very satisfactory results.

Re-timing of Zeesen Broadcasts

FROM March 1st, 1934, alterations have been made in the broadcast time schedule of the German short-wave stations. From G.M.T. 05.35–07.00 DJB will transmit on 19.73 metres, and from 11.45–14.45, DJA on 31.38 metres. These programmes are destined to Asia and the Far East. Changes have also been made in broadcasts for North America, which now take place as under: G.M.T. 11.45–14.45 on 19.73 metres (DJB), and from 01.00–04.00 on 25.51 metres and on 49.83 metres through respectively DJD and DJC.

Put Me Through to Greenland!

GUDMUNDER HEIDELL, Greenland's Postmaster-General, recently visited London with a view to making arrangements for the establishment of a public telephony service between Great Britain and the far North.

Moscow's Flying Transmitter

TO celebrate Labour Day on May 1st, the Soviet authorities will launch their new giant eight-motor aeroplane which, capable of carrying sixty passengers in addition to the crew, is also equipped with a radio transmitter for the broadcast of official addresses whilst travelling over cities. The flying station works two giant loud-speakers which permit speech or music to be heard over an area of more than eight square miles.

Relay of Salzburg Music Festival

THE Austrian stations, and in particular the Vienna-Bisamberg high-power transmitter, will re-broadcast a number of musical performances from Salzburg during the festival to be held between July 18th–September 2nd next. The concerts will be of an outstanding character, as the orchestras will be conducted by Sir Thomas Beecham, Toscanini, Bruno Walter, Richard Strauss, Furtwangler, Mengelberg, and other equally well-known musicians. Performances of works by Mozart, Wagner, Weber, and Strauss will also be included in the relays.

Boomerang Broadcasts

A BILL is to be introduced in the American Senate to amend the existing radio law with a view to preventing the installation of studios in the United States which are linked to Mexican stations. At present transmitters over the border are fed by Texas studios and re-broadcast prohibited material into the United States.

Some Useful Hints Regarding the Method of Procedure in Locating Faults in L.F. Amplifiers

Tracking L.F. AMPLIFIER TROUBLES

FAULTS which occur in the low-frequency amplifying portion of a receiver are not usually so difficult to track down and cure as those which are present in other parts of the set. The reason is that the L.F. amplifier directly affects the sound, or lack of it, which is produced by the loud-speaker; because of this, every modification and test can directly be checked by the ear. This does no necessarily mean that L.F. trouble tracing is always a simple matter, but, provided that systematic experiments are carried out, the amateur should not experience very great difficulty, even if his supply of testing instruments is very limited.

When any particular fault is thought to be due to the L.F. stages the first thing is to check this by eliminating them and connecting either a pair of 'phones or the loud-speaker in the anode circuit of the detector valve. This can be done in two simple ways, one of which consists of replacing the coupling component (primary winding of the L.F. transformer, the resistance or L.F. choke) connected between the high-frequency choke and the H.T. supply, by the speaker or a pair of 'phones. The other method is to connect the speaker or 'phones in series with a 2 mfd. condenser between the "lower" end of the coupling component and earth. Both these systems are illustrated in Figs. 1 and 2. Of the two, the latter is generally to be preferred, because it does not disturb the normal and correct matching between the detector and its output circuit, and because it ensures that the 'phones are isolated from the H.T. supply. This isolation is of particular advantage in the case of a mains receiver and ensures against the experimenter receiving an accidental shock.

In carrying out the test in question by either of the methods described it is desirable that the L.F. valves should remain in circuit with the H.T. and L.T., and for this reason the normal loud-speaker terminals should be short-circuited. If it is found that signals can be heard correctly after making the connections described, one can be quite sure that the L.F. section is at fault; if not, the H.F. sections of the set must be tested. In regard to these tests, it should be mentioned that distortion might not be so noticeable, nor cracklings and other noises so pronounced, due to the reduction in the amount of amplification prior to the reproducing component.

Once it has been definitely concluded that the L.F. amplifier is at fault the consequent tests can be directed entirely to that side of the receiver. If there are two or more low-frequency valves, each of these should be eliminated in turn by transferring the 'phones or speaker to the anode circuits of each valve following the detector, and in this way the valve stage in which the fault occurs can rapidly be located. After that it is not a difficult matter to test its various circuits to isolate the faulty one.

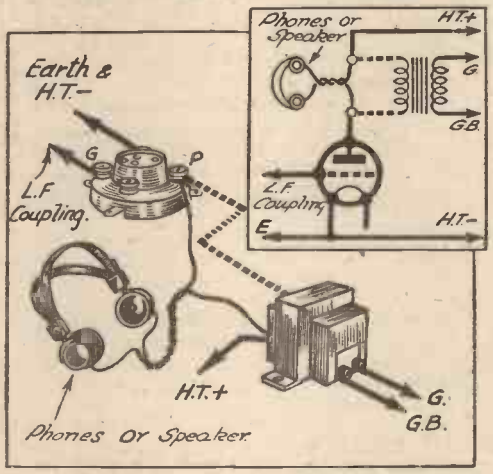

Fig. 1.—An L.F. stage can easily be cut out by connecting a pair of 'phones or a loud-speaker in the anode circuit of the preceding valve in place of the normal coupling component (L.F. transformer, etc.)

Crackling and Rushing Noises

When the fault is in the form of crackling or rushing noises it is best to make a start by testing the components in the anode circuit, whilst using the connections shown in Fig. 2, and, where the fault is in the stage immediately preceding, the speaker or 'phones. This will not quite apply, however, when there is only a single L.F. stage, or where it is the last one which is responsible for the trouble. In such instances it is best, where possible, to bridge the normal speaker terminals with an L.F. choke. Alternatively, where a moving-coil speaker is in use, the primary winding of the output transformer can be left in circuit and the secondary disconnected. While maintaining these connections the anode-circuit components should, if possible, be replaced in turn. This may not always be convenient, in which case the decoupling resistance (when used) should first of all be short-circuited; if that puts things right the resistance is obviously defective. When a decoupling resistance is not employed it is practically essential to replace the coupling component, although not necessarily by a similar one. For instance, the primary winding of a transformer might be replaced by a convenient L.F. choke, or even by a resistance of 10,000 ohms or so. The resistance will generally cause a reduction in signal strength, but if the cracklings cease it will be established that the previous component was faulty.

The H.T. Supply

Should it be found that the anode-circuit components are O.K. the next step is to check any other resistances which might be in circuit between the main H.T. supply leads and the valves under test; in most instances it will be safe to short-circuit these. There is no need to test the H.T. supply unit itself, because if that were defective the objectionable noises would have been heard when the reproducer was connected to the detector valve.

Grid Circuit

The grid circuit should be attended to next, and this often presents a more difficult problem. When resistance-capacity or choke-capacity coupling precedes the valve under test the grid leak can most easily be checked by replacement. It is not necessary to replace the component by an identical one, and any odd value can be tried for purposes of test. The coupling condenser also is best checked by replacement, although it is quite satisfactory to remove it from the set and apply the usual test with a battery and speaker. This consists of connecting a 60-volt battery to the terminals, allowing the condenser to stand for an hour or more and then touching the speaker leads against its terminals. When this is done a distinct

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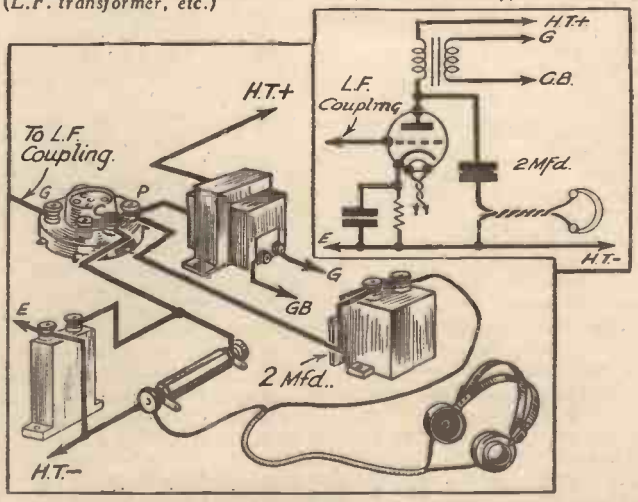

Fig. 2.—A better way of connecting the 'phones or speaker when cutting out an L.F. stage is shown above. This is particularly useful in the case of a mains set, since it isolates the 'phones from the H.T. supply.

(Continued from previous page)

" click " should be heard, so long as the condenser or speaker terminals have not, during the tests, been touched with the fingers. When a battery is used for G.B. supply, it is well to make sure that the wander plugs are fitting tightly into the sockets and that the battery is not run down. In the case of a mains set, however, where G.B. is obtained across a resistance connected in the cathode-return lead, the resistance should be tested by replacement. The condenser, wired in parallel with the bias resistance, can be checked simply by disconnecting one of its terminals; this might result in an increase of hum, but if crackling ceases the condenser is faulty.

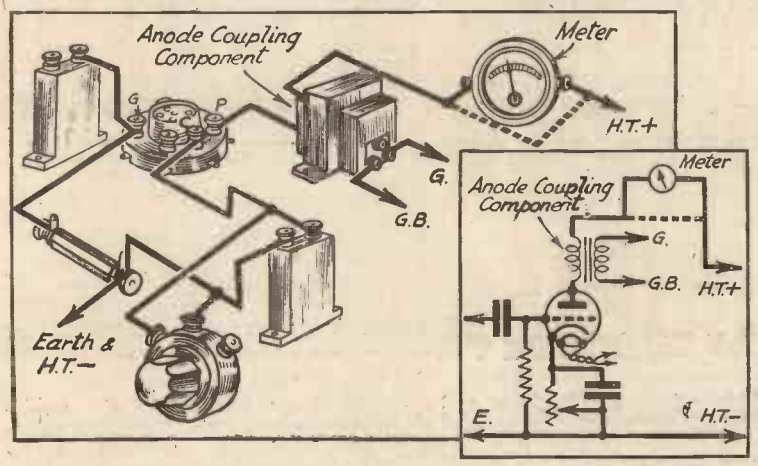

Fig. 3.—The best way to determine the correct G.B. voltage for an L.F. valve is to insert a milliammeter in the anode circuit and vary the bias until the correct anode-current reading is obtained.

Distortion

When distortion is experienced the valve which is responsible must first be located by transferring the reproducer to the anode circuits of the various valves, exactly as described above. When the responsible valve is traced the reason for distortion can be found without much trouble. With battery-operated sets, especially those which are a few years old, the most fruitful source of distortion is an overloaded valve. This can easily be checked by reducing volume either by means of the normal volume control (where fitted) or by substituting a short length of wire for the usual aerial. If a valve is overloaded the distortion will cease immediately the volume level is cut down. In order to find the valve which is responsible it might be necessary to transfer the reproducer from the anode circuit of one valve to that of another as described previously. When the valve has been located it will be necessary to replace it (if an old one or of the wrong type), increase the grid-bias voltage applied to it, increase the anode voltage, or to connect a second similar valve in parallel with it. In many cases it will be found desirable to increase both the G.B. and anode voltages so as to enable the valve to handle a greater signal input voltage. Where a pentode is the valve which is overloaded the simplest cure will generally consist of replacing the valve by a triode.

It has been stated that distortion might easily be the result of an amplifying valve being wrongly biased, and this is actually a rather important point. The approximately correct bias voltage can always be determined by measuring the voltage between the anode and filament, or cathode, of a valve by means of a high-resistance voltmeter, and then consulting the makers' tables, which give the appropriate G.B. voltages for various anode voltages. It is, unfortunately, practically impossible to measure the actual G.B. voltage between the cathode and grid with any degree of accuracy, although some idea can be gained if a high-class voltmeter is available. A simpler idea, though, is to measure the anode voltage as just described and then to insert a milliammeter in the anode circuit of the valve, as shown in Fig. 3, and to compare the figure obtained by that given by the makers for the anode voltage employed. The G.B. voltage can then be adjusted, either by altering the positions of the plugs in the battery or by varying the value of the resistance in the cathode-return lead, until the correct anode-current reading is obtained. In the case of a set operated from batteries it should be switched off between each G.B. adjustment, whilst the same thing applies to a mains set unless a continuously-variable resistance is made use of. Should it be found that alterations in bias voltage have no effect upon the anode current it will be obvious that the grid circuit is broken at some point, and, therefore, the various components, such as transformer secondary, grid leak, decoupling resistance, etc., should be tested for continuity, or checked by replacement.

L.F. Oscillation

The question of L.F. oscillation was dealt with fairly completely in a recent article entitled " Some Causes and Cures for L.F. Instability," so there is no need to do any more than touch upon it now. Oscillation is generally indicated by a continuous high-pitched whistle of constant intensity or by a general " thinness " of reproduction, or even by " cracking " on high notes. It can usually be checked by touching the anode terminal of each L.F. valve in turn until the trouble stops. A more reliable method is to insert a milliammeter in the anode circuit of each L.F. valve in turn (as in Fig. 3) and see if the reading changes when the anode terminal is touched; if it does, the valve is oscillating. The simplest cure is to reverse the connections to the secondary or primary of the preceding L.F. transformer. Another way is to connect a fixed resistance of some 250,000 ohms in parallel with the secondary winding of the transformer.

A similar kind of trouble often results from the leakage of H.F. currents from the detector into the L.F. amplifier. Such leakage is indicated when the touching of the grid terminal of the first L.F. valve produces a noise in the speaker, or a change in volume. A cure consists of using a more efficient H.F. choke, connecting a .0002 mfd. condenser between the anode of the detector and earth, or inserting a 100,000 ohm " stopper " resistance in the grid lead to the first L.F. valve. Sometimes, principally in the case of portable sets where the frame aerial wires run close to the loud-speaker, the best remedy consists of shielding the speaker leads and wiring a fixed condenser of about .002 mfd. between the anode of the last valve and earth.

Hum

Mains hum sometimes has its origin in the L.F. amplifier, and is caused by the lack of decoupling in the grid or cathode circuits. The first thing to try is replacing the condenser wired in parallel with the bias resistance by an electrolytic one of higher value. As a matter of fact, it will very often be found that hum can completely be eliminated by employing an electrolytic condenser having a value of about 20 mfd. in this position; the condenser need have a working voltage of only about 50 in most instances, and can be bought just as cheaply as a lower-capacity one of the Mansbridge type. Decoupling the grid and bias circuits is nearly always an advantage, and the extra decoupling resistance should be connected as shown in Fig. 4.

Incorrect Matching

Distortion and lack of volume are frequently due to the fact that the last valve is incorrectly matched to the speaker. This matter has often been referred to before, and it is suggested that those readers who are interested should look up the article given on page 665 of the issue of PRACTICAL WIRELESS dated Aug. 12th, 1933.

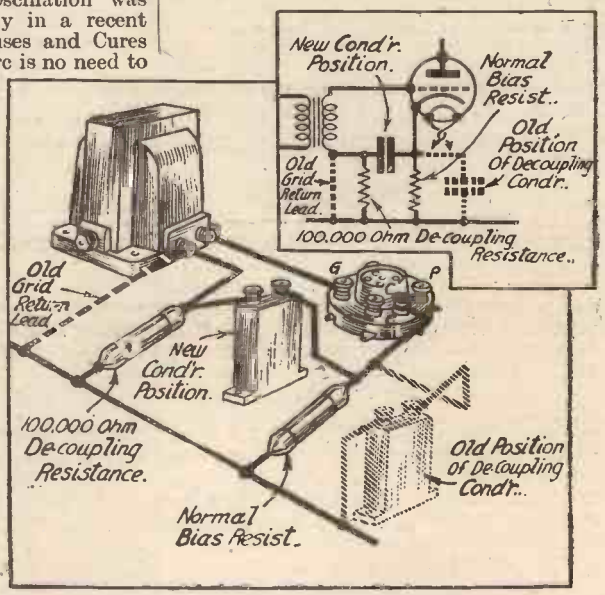

Fig. 4.—Mains hum and L.F. instability in a mains set can often be cured by fitting a grid de-coupling resistance as shown above.

PICKUPS & LOUDSPEAKERS

Some Practical Notes Regarding the Operation and Choice of these Instruments

ON the face of things it might appear that there is little or no connection between pick-ups and loud-speakers, but when the principle of operation underlying these two types of components is considered more fully it is evident that they have much in common. Both classes of instrument can be considered, technically, as machines since both convert one form of energy into another. In the case of a pick-up, mechanical energy (in the form of vibration caused by the gramophone needle passing over the surface of a record) is converted into a fluctuating electrical current. The loud-speaker, on the other hand, is fed by a fluctuating electrical current which it converts into sound.

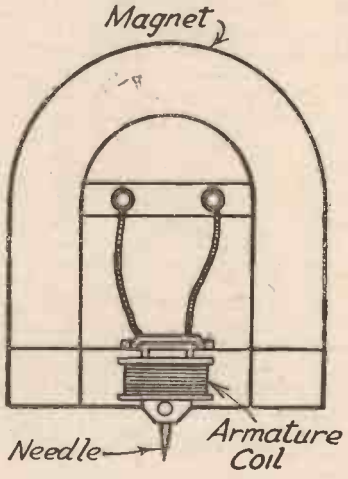

Fig. 1.—The principal parts of a pick-up are shown in this diagram.

The Operation of a Pick-up

The chief parts of a typical gramophone pick-up are shown in Fig. 1, where it can be seen that an iron armature is situated between two poles of a large permanent magnet. A needle is attached to the end of the armature, which moves inside a coil situated in the field of the magnet. Any movement of the needle is thus transmitted to the armature, and the latter is thereby made to vibrate within the field of the magnets. As a result of this, minute fluctuating currents are caused to flow through the windings of the armature coil, these currents correspondingly exactly with the vibration of the armature.

The mode of operation of the pick-up can now be compared with that of a loud-speaker. In the first place, a speaker of the simplest kind—a moving-iron instrument—will be considered, and the main component parts of this are shown in Fig. 2. Here again, it will be seen that there is an electro-magnet, near to which is situated an iron armature attached to a support by means of a short flat spring. The input to the speaker consists of a fluctuating electric current which is passed through the windings of the electro-magnet. The varying current causes the strength of the magnets to be alternately increased and decreased, with a result that their power of attraction is varied. In consequence of this the iron armature (to which the cone diaphragm is attached) is set into vibration in sympathy with the fluctuating currents passing through the windings.

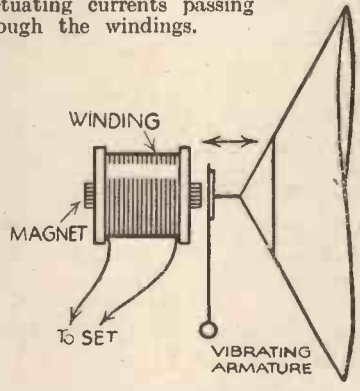

Fig. 2.—This sketch shows the working parts of a moving-iron speaker.

Moving-coil Speakers

The principle underlying the operation of moving-coil speakers is not vastly different to that already explained, although the construction of the instrument is by no means similar, as can be seen from Fig. 3. In this case an electro-magnet fits closely into the speech coil, which is attached to the speaker diaphragm. It is the speech coil which carries the fluctuating currents which constitute the output from the receiver, and the currents set up a varying magnetic field round the speech windings. The result of this is that the field links with the steady field of the electro-magnet, and thus causes the speech coil to vibrate, so setting the diaphragm into vibration.

The speaker unit actually shown in Fig. 3 is of the so-called "energized" type. In other words, a direct current has to be passed through the winding surrounding the magnet pole in order that the unit may function. This current is generally taken from the mains supply—directly in the case of D.C., and through a suitable rectifier when A.C. is employed. Another way of feeding the field is to connect it in series with the main H.T. lead to the receiver when the current consumption is sufficiently high. This point might be more clearly explained by saying that it is necessary for correct operation that a certain amount of wattage should be dissipated in the field winding. The usual D.C. resistance of the field winding is 2,500 ohms, and, therefore, if the necessary wattage is known (this is generally given by the makers) the minimum current for correct operation can be found from the formula: Power (in watts) is equal to the product of the square of the current (in amps.) multiplied by the resistance. To take an example: Suppose a certain speaker requires 6 watts for energizing the magnets, and that the windings have a resistance of 2,500 ohms. The necessary current can be found by taking the square root of the watts divided by the resistance, thus: Current, $\sqrt{6/2,500}$, or $\sqrt{.0024}$, which is approximately .05 ampere, or 50 milliamps.

It should be mentioned at this point that, although 2,500 ohms is the usual value for the field resistance, there are a number of manufacturers who can now supply field-energized speakers in a variety of resistance values. But as the wattage dissipation must be the same in every case (to ensure sufficient magnetizing force) it will be evident that if the resistance is

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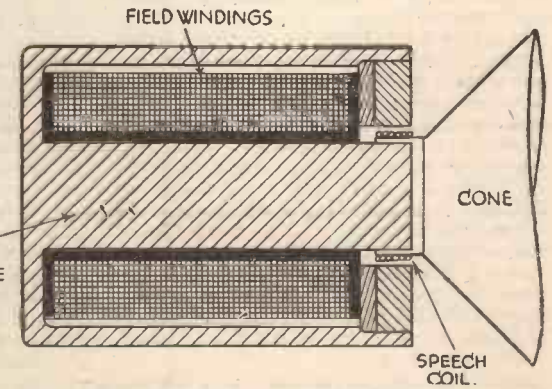
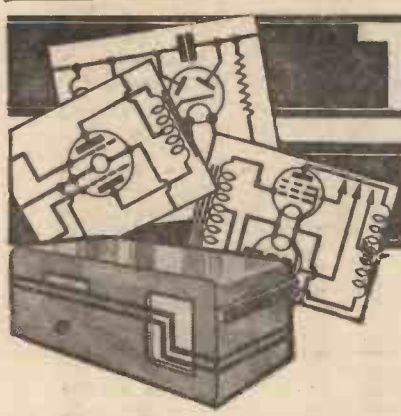


Fig. 3.—Section through an energized moving-coil speaker showing the most important parts.



TENDENCIES in MODERN RECEIVERS

Is Receiver Design Progressing Along the Right Lines?

By BERNARD DUNN

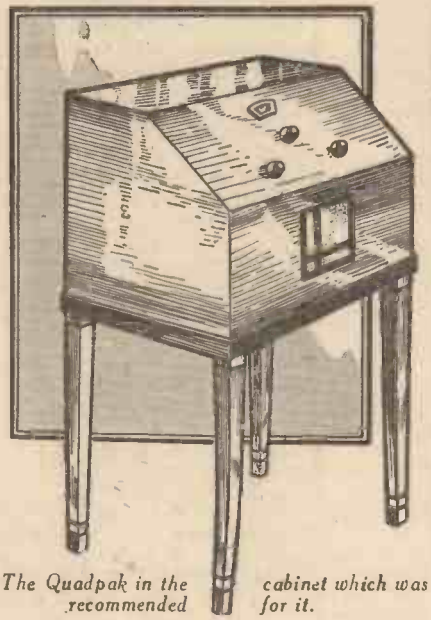
DESPITE the rapid progress which has been made in the design of wireless receivers during the last few years, one is often tempted to ask if that progress has been in the proper direction, and if some of the developments have not been retrograde. For instance, it has gradually become almost standard practice to make the loudspeaker as a portion of the complete receiver instead of having it as a separate unit as it used to be. Is this a really desirable move? From the point of view of expense it probably is; so far as appearances are concerned the change is probably desirable, but when the question is considered purely and simply in relation to optimum results and the best possible quality of reproduction the answer is different. All those experimenters who have tried the effect of altering the position of the speaker in a room know that there is almost invariably one particular situation which proves best. Besides this, it is often desirable to move the speaker about from one room to another and, because of the positions of the aerial and earth leads-in, movement of the complete receiver is precluded. Admittedly there is provision for connecting an external speaker to most receivers, but there are many to whom the cost of a second speaker is prohibitive.

In view of these facts it would certainly appear, in the case of the simpler, low-priced sets at any rate, design has not followed quite along the right lines.

Control Positions

Another very important aspect of receiver design is that governing the positions of the controls. It seems to have become standard practice to place the control knobs on a vertical panel or on the front of the receiver. Generally speaking, these positions are not good, especially when considered in conjunction with the usual position of the tuning scale. The old-fashioned arrangement whereby the control panel was sloping has many points in its favour and makes for much easier operation of controls, besides giving an ideal position for the tuning scale. An example of a modern home-constructor receiver with control panel of this kind is the "Quadpak" which was described in PRACTICAL WIRELESS" dated November 25th and December 2nd, 1933. An illustration of this receiver is given on this page, and the advantage of the sloping panel will readily be appreciated. The height of the controls, combined with their disposition, makes it just as easy to operate the set from a standing or sitting position, which is an obvious advantage.

Another arrangement of tuning controls which attained a certain measure of popularity in the past was that where the knobs were on the ends of the set, the tuning scale being on a narrow sloping panel. It seems a pity that this arrangement was discarded, for it has numerous advantages from the point of view of easy and convenient operation. As a matter of fact, the side knobs are probably more convenient, and they certainly appear more logical, than any others. The hand takes up a natural position, whilst the scale is very easily read. An illustration of a set fitted with controls of the kind just referred to is also given on this page.



The Quadpak in the cabinet which was recommended for it.

Exceptions which Prove the Rule

Before leaving the question of control-knob positions it should be mentioned that one well-known firm of receiver manufacturers, although they make their sets in the conventional upright form, have employed anatomical experts to design the controls in such a way that they can be operated without the necessity for taking up a cramped position. Another firm makes one receiver model in the form of a small book-case which stands beside a chair and has the controls mounted on top so that they come readily to hand when the operator is in a sitting position. But these are, unfortunately, exceptions which tend to prove the rule that most receivers have their controls wrongly disposed.

How Many Stations?

Another retrograde step in the general design of wireless receivers is that of attempting to make every set, even if it is of the cheapest kind, capable of receiving a multiplicity of stations. Designers and manufacturers cannot be blamed for this; it is the general listening public who have demanded that sets should be made in this way. The amazing thing is, however, that very few people who appreciate real quality reproduction would ever think of listening to any other than their local station for more than a mere fraction of the total listening time. It would surely be in the interests of music, broadcasting, and the listening public if real "local station" receivers could be made and sold. In order that a receiver should be capable of bringing in distant stations it must either have an efficient high-frequency amplifier, or excessive use must be made of the reaction control. In both cases selectivity has to be increased very nearly to the limit, with a result that there must be a cutting of the sidebands or else one must contend with a certain amount of interference between some stations. Under present conditions a receiver intended for the reception of a large number of stations must provide a frequency separation of 9 kilocycles or less. In the case of a comparatively expensive instrument it is not very difficult to maintain a constant frequency separation of, say, 9 kilocycles, but in the case of a lower-priced instrument this simply cannot be done. The design might be such that a 9-kilocycle separation will be provided at certain parts of the

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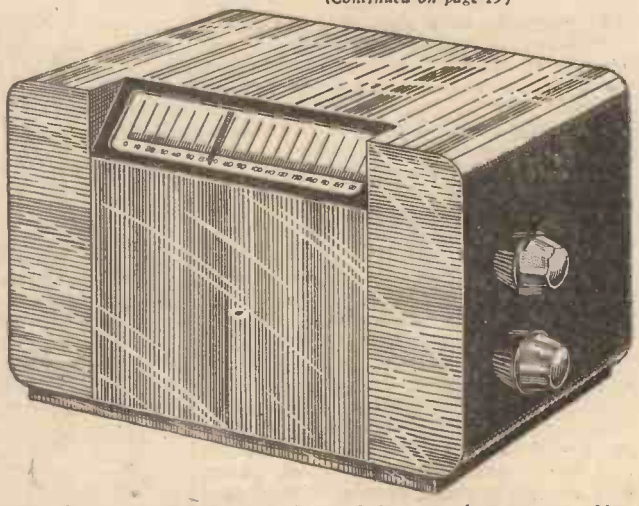


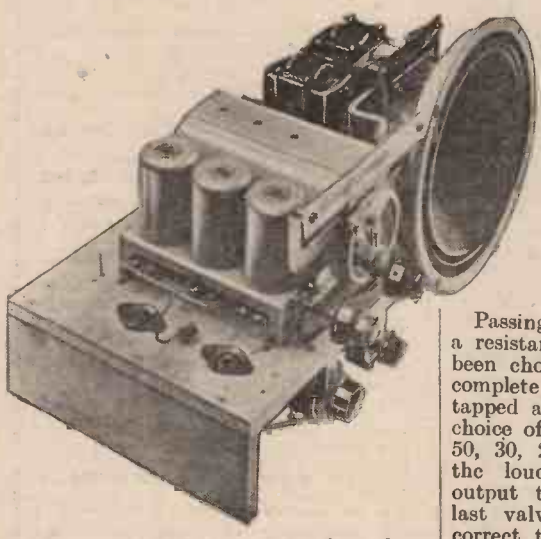
An illustration of a receiver designed for ease of operation. Note the controls arranged on the side and the full vision scale.

INTRODUCING THE D.C. PREMIER

Preliminary Details of a New Three-Valve Receiver for Complete Operation from the D.C. Mains

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc., A.M.I.E.E.

FROM time to time designs have been presented to readers dealing with receivers built entirely for operation from D.C. mains, but there has not been such a variety of choice as in the case of the battery and A.C. mains driven receivers. Bearing in mind the large percentage of D.C. mains users—a fact which I substantiated with concrete figures when describing the "D.C. Ace" a few months ago—this new set of mine is an attempt to give those users a receiver which is in every way up to date. Furthermore, conforming to the established policy of PRACTICAL WIRELESS to be ahead of all others, it is the very first design to be described in any journal using a range of D.C. mains valves only just released to the public.



A three-quarter front view of the finished set, showing the neat lay-out.

No effort has been spared to make the set worthy of this journal's high traditions, and readers can start to collect together their components straight away. They are all standard manufacturers' products of the highest grade, and yet the total cost of the completed receiver is very moderate in its class, certainly not a figure which gives a measure of its outstanding performance.

The Circuit Analysed

Naturally, the reader will expect first of all to be apprised of all the D.C. Premier's salient features, and this can be done best by considering the theoretical diagram, Fig. 1. It will be noticed that every component has not been lettered. This was done to avoid confusion between single components and multiple units consisting of coils, condensers, etc. Only the single components have been lettered and these correspond with those shown in the list of components. Although, strictly speaking, every set should be dealt with by taking as the standard the power output and signal handling capabilities of the last valve, it has become usual practice to start at the aerial end first. Here we see a complete band-pass aerial input circuit using iron-cored coils of proved high grade and efficiency.

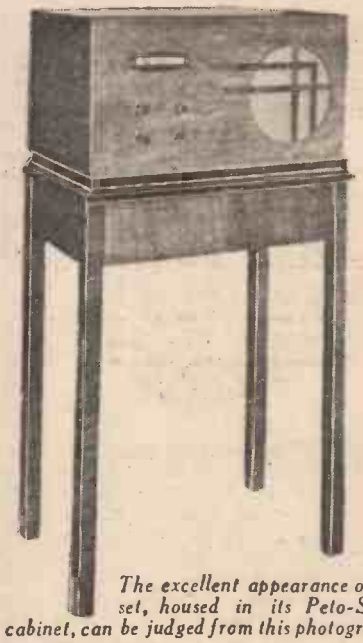
Due to modern reception conditions, it is essential to obtain both adequate sensitivity and selectivity, and the arrangement chosen has ensured this. Not only are the coils matched and gang-tuned but they are linked by a high-frequency inter-valve transformer coupling, thereby reducing the number of controls and enabling a clear, undistorted signal to be passed to the detector valve.

Power-grid detection is arranged for, the grid condenser and the reaction condenser being incorporated in the complete "Linacore" unit. Provision is also made for a pick-up to be employed, a refinement which adds considerably to the value of the set for home use.

Passing now to the low-frequency side, a resistance-fed transformer coupling has been chosen, this being built up as one complete unit. The anode resistance is tapped and, in consequence, this gives a choice of four resistance values—namely, 50, 30, 20, and 12 thousand ohms. As the loud-speaker incorporates its own output transformer the leads from the last valve can be taken direct to the correct tappings.

Since tastes in loud-speaker reproduction vary so considerably, a tone control has been fitted. This, again, is one complete unit, consisting of a fixed condenser and variable resistance (known as a "Controla-tone"), and the tone can in this way be altered at will and made to satisfy each type of transmission, whether speech, song, or music.

The biasing of each valve is effected by the standard method of inserting resistances in the cathode leads, adequate decoupling being included to ensure complete stability. In the case of the variable-mu H.F. pentode valve V_1, R_1 is a graded potentiometer to give the alteration in bias which, of course, enables the user to control the input signal to the detector valve without causing distortion.



The excellent appearance of the set, housed in its Peto-Scott cabinet, can be judged from this photograph.

The Mains Feed

The heaters of these new Mullard D.C. mains valves are designed to consume approximately 4 watts, the current in each case being exactly 0.18 ampere. This must be maintained absolutely constant and with the valve heaters in series the most satisfactory way of achieving this is to connect a "barretter" or regulator lamp in series with the heaters. The use of such a lamp, provided it is of the right type, ensures that any fluctuations in the house mains voltage over fairly wide limits cause no variation in the heater current.

Some form of smoothing is called for in this section of the circuit, however, so I decided to use the field winding of a separately energized moving-coil loud-speaker. Although it is more usual practice to use the speaker field as a smoothing choke in the anode feed circuit, by choosing a winding of the correct resistance and capable of carrying continuously the current of 180 milliamperes it was found

(Continued on next page)

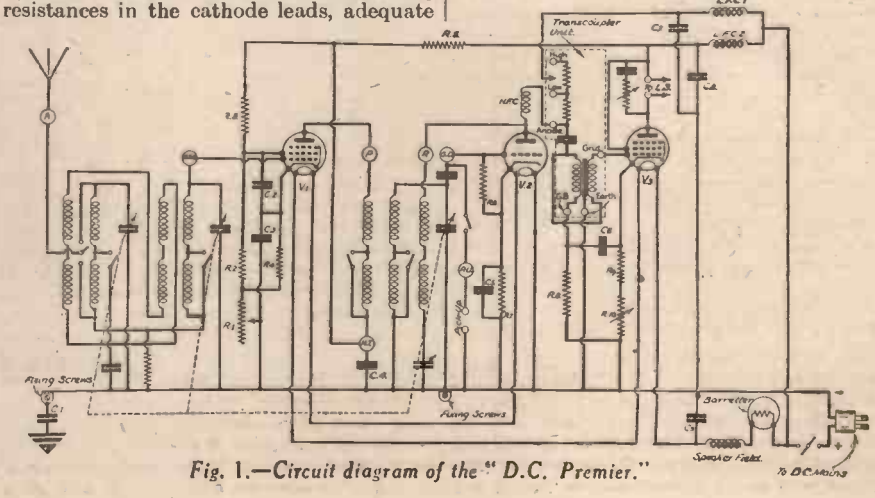
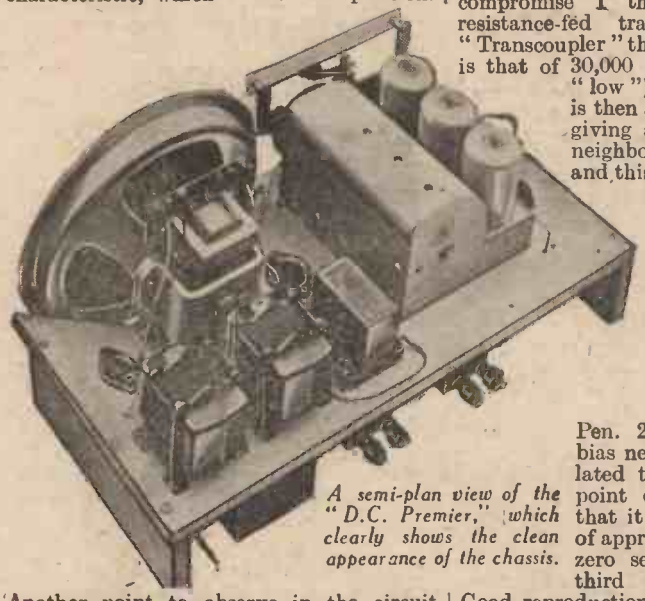


Fig. 1.—Circuit diagram of the "D.C. Premier."

(Continued from previous page)

possible to include the speaker in the position shown in Fig. 1. A Magnavox loud-speaker having a 9in. cone and a field resistance of 200 ohms is admirable for this purpose and gives really excellent reproduction. Furthermore, this scheme not only gives a measure of smoothing but reduces the heat to be dissipated in the barretter and brings the operating point of the lamp to the middle of its characteristic, which is the best position.



A semi-plan view of the "D.C. Premier," which clearly shows the clean appearance of the chassis.

Another point to observe in the circuit is that the heaters of the three valves are connected in series in such a manner that the detector heater is joined to the earth side of the mains.

The high-tension supply to the valve anodes is taken direct from the D.C. mains through two separate smoothing circuits. The choke L.F.C.$_1$ and condenser C_7 provide the feed to the detector valve, while L.F.C.$_2$ and C_8 feed the variable-mu H.F. pentode and the output pentode.

Valve Performance

The V.P.20 valve, V_1, has its resistance network so adjusted that the auxiliary screen voltage is approximately 100. This gives the "long grid-base" working (approximately 32 volts) and ensures a very smooth volume control. As the H.L.20 detector valve, V_2, is used as a power-grid detector it was felt that steady anode current would be excessive for many L.F. coupling devices, and as a satisfactory compromise I therefore employed the resistance-fed transformer. With this "Transcoupler" the best value of resistance is that of 30,000 ohms (terminal marked "low"). The anode potential is then approximately 120 volts, giving a steady current in the neighbourhood of 3.5 milliamps, and this should not be depressed below 2.2 milliamps by a signal if the accepted limit of 5 per cent. distortion is not to be exceeded. A maximum signal of 1 volt R.M.S. can be handled by the valve under these conditions.

Coming now to the pentode output valve, Pen. 20, the anode feed and bias network have been calculated to work the valve at a point on its characteristic so that it gives an A.C. output of approximately 1.5 watts, with zero second, and 5 per cent. third harmonic distortion. Good reproduction is thus assured, while the resulting volume is more than enough for all domestic purposes.

From this critical analysis of the D.C. Premier the reader will see that it is a set of outstanding capabilities. No effort has been spared to produce a receiver which will satisfy the most critical user, and from tests which have been carried out under the most adverse conditions I have come to the conclusion that the potential constructor will be justly proud of its performance and its appearance. There is not a trace of mains hum, the operation is extremely simple, reproduction is of the highest class, and every worth-while radio station is received clearly and distinctly.

Constructional Details Next Week

Next week I shall describe fully the constructional details, so in the meantime purchase all the components which are clearly specified in the accompanying list, so as to be in a position to make a start on building with the minimum of delay.

COMPONENTS REQUIRED FOR THE "D.C. PREMIER."

One "Linacore" band-pass tuner, mains model, type B.P.M. (Jackson Bros.).
One 6,000 ohm graded potentiometer Type 2 (R_1). (Watmel).
Two G.125 type resistances, 200 ohms (R_4) and 1,000 ohms (R_7) (Trevor Pepper).
Four G.250 type resistances 350 ohms (R_9), 10,000 ohms (R_5), 15,000 ohms (R_3), and 20,000 ohms (R_2) (Trevor Pepper).
One G.800 type resistance 50,000 (R_8) (Trevor Pepper).
One M.150 type resistance 250,000 ohms (R_6) (Trevor Pepper).
One "Controlatone" type B (Bulgin).
One "Transcoupler" (Bulgin).
Three 5-pin and one 7-pin skeleton chassis valveholders (W.B.).
Four type B terminals (aerial, earth and two pick-up) (Belling Lee).
Two terminal mounts (Belling Lee).
Two 0.5 mfd. condensers type 250 (C_2 and C_3) (T.C.C.).
One 1 mfd. condenser type 65 (C_4) (T.C.C.).
Two 2 mfd. condensers type 65 (C_5 and C_6) (T.C.C.).
One 12 mfd. condenser bank type R.M.12 (C_1, C_7, C_8 and C_9) (T.C.C.).
One "Magnavox" mains-excited M.C. loud-speaker 200 ohms field resistance (Benjamin).
Two low-frequency chokes type 751 (LFC$_1$) and 752 (LFC$_2$) (Heayberd).
One 400-ohm baseboard mounting potentiometer (R_{10}) (Igranic).
One H.F. choke type LMS (HFC) (Graham Farish).
One twin fuseplug, type P.25 (Bulgin).
One barretter, type 1928 (Philips).
Four brackets type EH6 (Bulgin).
Three valves, types VP.20, HL.20 and Pen.20 (Mullard).
One baseboard and cabinet (Peto-Scott).

A HOME-MADE PHOTO-ELECTRIC CELL

A LARGE number of experiments can be made by the simple photo-electric cell described in this article. Doors, etc., can be made to open by a light, or the wireless set can be operated by switching on a light. As most experimenters know, a photo-electric cell operates by a light falling on it, and this closes the circuit operating a small relay, which in turn operates another circuit which it is desired to use.

The components and articles required can be easily and cheaply obtained. They are as follows:—

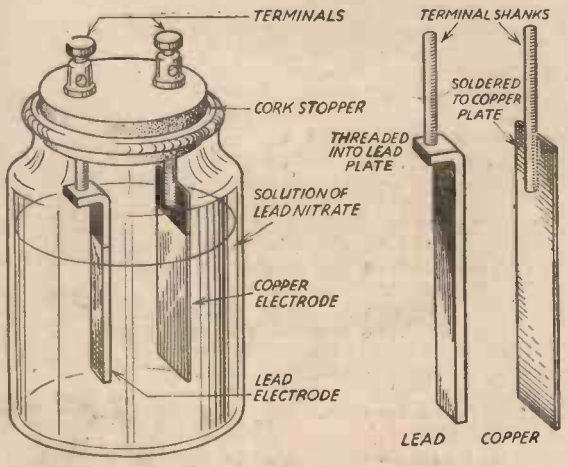
A small bottle, such as is used for preserved fruits, etc., also a cork to fit fairly tight. A piece of sheet copper 1in. by 4in. A lead strip ½in. by 4in. Two terminals, with one thread fairly long. Quarter pound of lead nitrate (to be obtained from any chemist), and also some asphaltum paint.

Details of Construction

First place the sheet copper in the flame of a Bunsen burner so that a film of cuprous oxide is obtained. This is not really required for the purpose, but must be tolerated because underneath is the cupric oxide which is what we require. When the copper is placed in the Bunsen burner a black film will cover it; this must be removed by rubbing it off with emery paper, or dissolving it in ammonia. We now have the cuprio oxide film. The back should be covered with asphaltum paint, and brass thread added by soldering it on to the copper electrode. The lead electrode is fixed by drilling a hole and fixing the terminal thread on it.

The solution of lead nitrate is made by putting 1oz. of crystals in one gill of water in correct proportion. This should be poured in the bottle three-quarters full, the two electrodes put through the cork stopper, and the cork sealed with asphaltum paint. The sketch shows the complete cell.

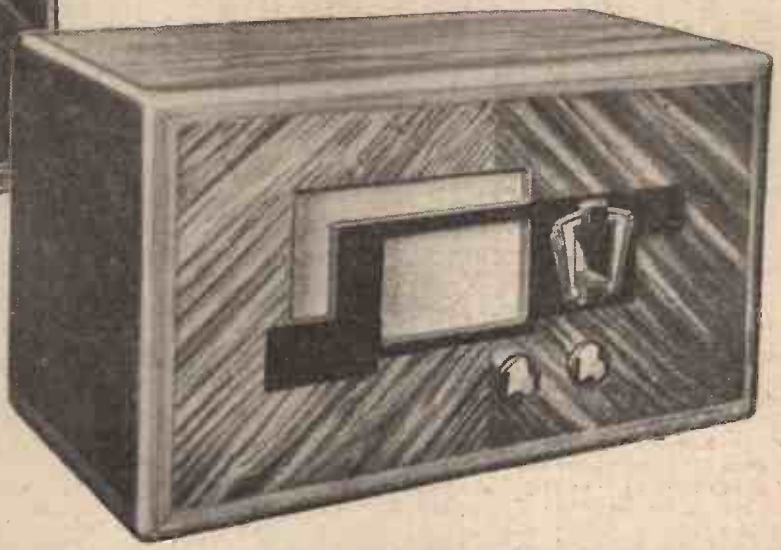
To test the cell it will be necessary to have a 70-watt lamp and a milliammeter reading to about 5 milliamperes. The lights should be turned out and the testing light brought close to the cell. At a distance of about 3ft. the meter should show about 1 milliampere.



This sketch shows the construction of the photo-electric cell described.

Two great battery SKYSCRAPERS

Now available as complete receivers FACTORY BUILT & FACTORY TESTED!



'SKYSCRAPER' ALL-WAVE-ALL-WORLD 4

Kit of parts complete with valves £5 : 12 : 6.

Kit, as above with cabinet and loudspeaker, £8 : 2 : 6.

Or complete factory assembled and factory tested receiver, with valves, loudspeaker, H.T. and L.T. batteries in cabinet, £9 : 15 : 0.

'SKYSCRAPER' 7-VALVE SUPERHET

Kit of parts complete with valves, £8 : 17 : 6.

Kit as above with cabinet and Moving Coil Speaker, £11 : 10 : 0.

Or complete factory-built and factory-tested receiver, with valves, loudspeaker, H.T. and L.T. batteries, in cabinet, £13 : 13 : 0.

For two years now the name "Skyscraper Radio" has echoed round the world wherever home-constructors meet. The mighty power, the vast range of these "Skyscraper" receivers was a new experience for everybody, and happy home-constructors boast that no commercially-built set can equal the "Skyscraper" they have built themselves.

Now at last the man who is NOT a home constructor can have his "Skyscraper Radio." So insistent has been the public demand for a ready-built "Skyscraper" that Lissen have decided to put the "Skyscraper" sets through those same factory processes which make commercial receivers so absolutely reliable. Today the All-Wave All-World "Skyscraper" 4 and the "Skyscraper" 7-valve Superhet are available as complete receivers—factory assembled and factory tested. They have retained the all-but-magic distance-getting properties of the home constructed receivers, they have not lost one iota of their power, they are sold complete with batteries, valves, accumulators, loudspeaker and cabinet—ready for all the family to use and to thrill over.

If you own a "Skyscraper" you know that you own a receiver which has been developed to the limit of range and power—you can get no better set in its class than the "Skyscraper" of your choice! Ask your dealer to show you "Skyscraper Radio," either as a kit of parts for you to build with your own hands, or as a complete receiver, factory built and factory tested.

LISSEN LIMITED, WORPLE ROAD, ISLEWORTH, MIDDLESEX.

LISSEN

All Lissen "factory-built and factory-tested" Skyscrapers carry a label to this effect.

Skyscraper Radio

RADIOGRAM RECEIVERS

Some Useful Notes in Regard to the Conversion of any Wireless Receiver to a Radiogram

THE term "radiogram" is widely used as a means of describing a wireless receiver which has provision for reproducing gramophone records. Strictly speaking, a radiogram receiver is one which is complete with a gramophone motor (spring or electric), and pick-up arm, although nearly every wireless set of modern design is a potential radiogram since it is provided with terminals to which a pick-up can conveniently be connected. Many receivers also include a switch by means of which a rapid change can be made from "radio" to "gramophone." It need scarcely be explained that in any radiogram receiver the same L.F. amplifier is used both for the ordinary wireless part of the outfit and also for amplifying the output from the pick-up, which is then passed on to the same loud-speaker.

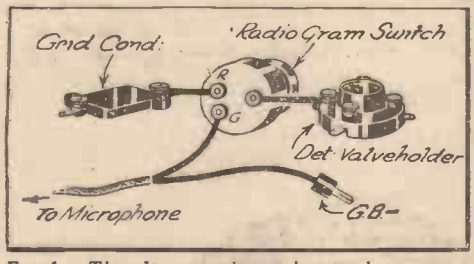


Fig. 1.—This diagram shows the simple connections of a radiogram switch to the detector circuit of a battery receiver.

Biasing the Detector

It has been stated that the L.F. amplifier functions in conjunction with the pick-up, but it might be added that in many cases, particularly with small low-power receivers, the detector valve is also made to function as an amplifier when the pick-up is in use. In such instances provision has to be made to apply a negative bias to the detector when it is being employed as an amplifier, and this can be arranged for quite simply by one of the methods shown in Figs. 1 and 2; the former refers to a battery set, and the latter to a mains one. In the case of the battery set the connection normally going from the junction of the grid condenser and leak is removed, two points of a radiogram switch being connected in its place. The third point, or terminal, of the radio-gram switch takes one pick-up lead, the other one being attached to a wander plug which fits into the grid-bias battery. When the switch is turned to the "radio" position the set functions in its normal manner as a wireless receiver, but when it is turned over to "gram" the pick-up is brought into circuit at the same time as the tuning system, aerial, and earth are put out of use. By this means there is no possibility of "break-through" from the local station when gramophone reproduction is being enjoyed.

The connections in Fig. 2 apply to a mains-operated receiver and the radiogram switch is not shown; this may be added quite easily if desired, however, simply by breaking the leads to the grid terminal of the detector valve and inserting the switch as shown in Fig. 1. In the case of a mains set it will be seen that the connection normally going from the cathode terminal on the detector valve-holder to earth is removed. Additionally, the grid leak is connected directly to the cathode terminal and a bias resistance (shunted by a 1 mfd. decoupling condenser) is included between the cathode and earth. The bias resistance is shown as being of 1,000 ohms, and although this value is suitable for most average detector valves, it might require to be modified in certain cases.

Volume Control

A volume control is always a desirable fitting in any set, either radiogram or plain wireless receiver. Most modern receivers are provided with a suitable control, but in many cases this will only be operative on "radio." If that is so a separate "gram" volume control can easily be fitted as shown in Fig. 3—in one case the connections apply when the pick-up is connected to the detector valve, and in the other they refer to a set in which the pick-up feeds directly into an L.F. valve. It will be noticed that in both cases the volume control is represented as having a value of 100,000 ohms; this is an arbitrary value, and the actual resistance will depend upon the type of pick-up employed. The most suitable value is nearly always stated on the instruction sheet issued by the makers, and varies from about 20,000 ohms to 100,000 ohms. When too high a value is used there is a danger of a certain amount of L.F. instability, this being noticed as a continuous high-pitched whistle. On the other hand, too low a value causes a loss of the higher frequencies, so that reproduction sounds rather "muffled" and unnatural.

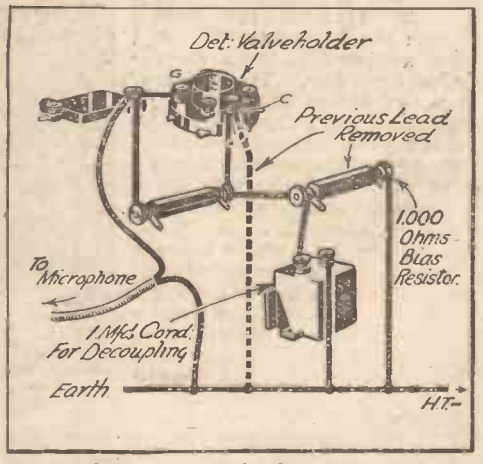


Fig. 2.—Showing the slight alterations to be made to the wiring when connecting a pick-up to the detector valve of an all-mains receiver.

The Gramophone Motor

Having made the necessary alterations to the receiver to enable it to be used for gramophone reproduction, the next matter is to choose the motor and turntable. These items are made in such a wide variety that the purchaser is often at a loss to know which model will best suit his requirements. When the set is battery-operated it is obviously necessary to use a

(Continued on page 19)

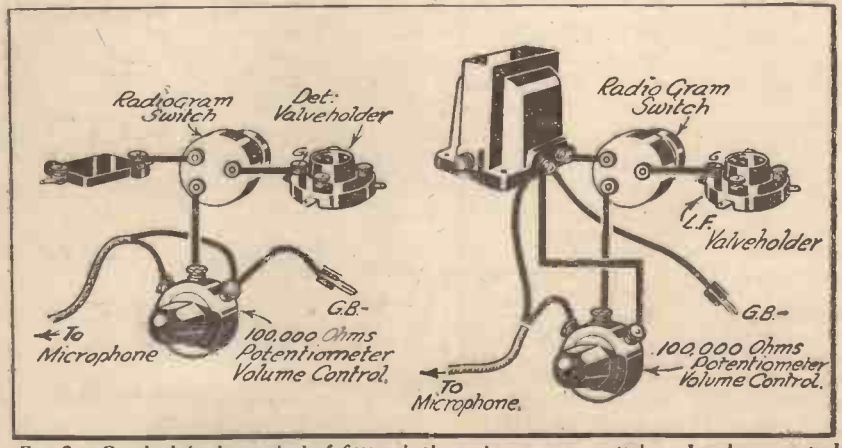
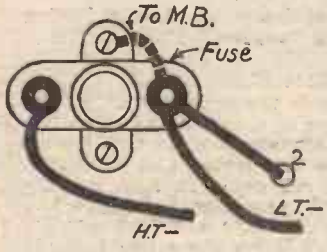


Fig. 3.—On the left the method of fitting both a change-over switch and volume control to the detector valve is shown. The method of making the same additions to an L.F. valve is shown on the right.

MORE ABOUT THE LEADER

A MIGHTY SET AT A MODEST PRICE

ALTHOUGH the Leader, which, designed around a low price and for maximum efficiency (and is in reality being made in thousands by enthusiastic constructors all over the country) is such a simple type of receiver, there are still some readers who find it difficult to construct a piece of apparatus of this nature without coming up against some point which might be termed a "snag." For instance, it was clearly stated on the Blueprint that the bracket for the reaction condenser is insulated from the metallized baseboard. In spite of this we have already seen two cases where the constructor mounted the bracket direct on the baseboard and failed to use an insulated bush for the reaction condenser. The result of this is, of course, that the H.T. supply is short-circuited. The bracket may be insulated by carefully scraping away the metallized covering of the baseboard for a space slightly larger than the foot of the bracket, or, alternatively, a piece of thick card may be placed between the bracket and baseboard. If this is done, however, there is a slight risk of the holding-down screws making contact with the metallizing, so that the former method is to be preferred. Of course, an alternative arrangement is to mount the bracket direct on the baseboard, and to fit the reaction condenser to the bracket through the medium of an ebonite insulating washer. Such washers may be obtained from any good wireless store.



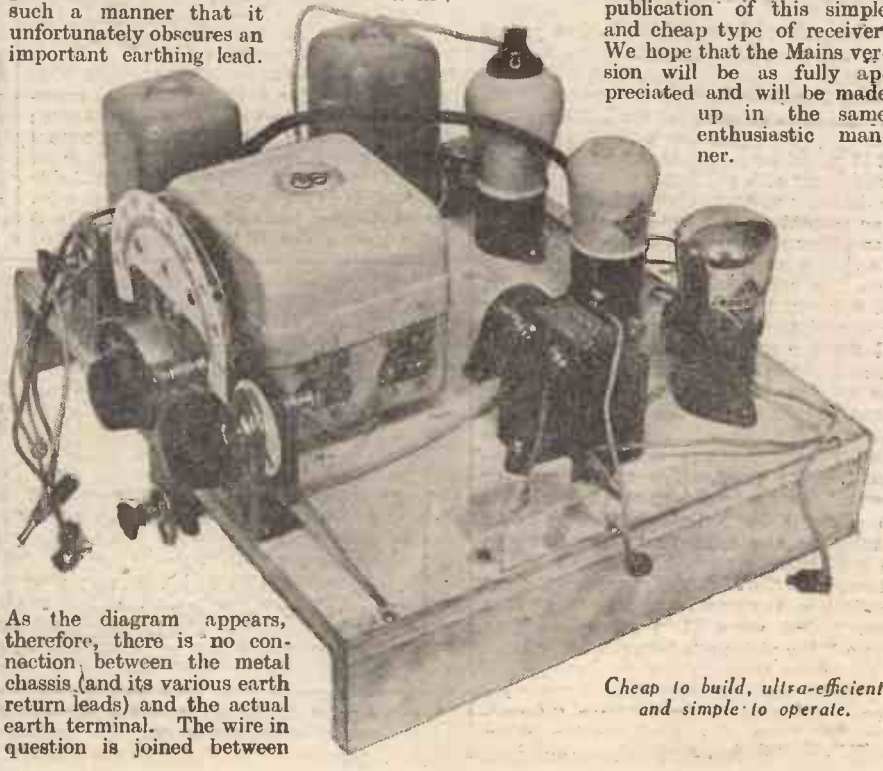
The broken line indicates the earthing wire which has to be fitted.

Selectivity

The selectivity, as has previously been pointed out, is adequate for all normal requirements. In situations where, for some particular local reason, the selectivity is not found high enough, it is possible to employ a different model of the coils which were originally employed. These coils are known as Type A, and in place of the terminal marked E on the original coils, they are fitted with a terminal numbered 8. This terminal is connected to a tapping point on the primary winding of the coils, and thus enables a more selective point to be found. It might be advisable at this point to remind readers that when purchasing the coils for this receiver it is necessary to specify Wearite Universal Coils. The new model is known as the Wearite Universal Type A Coil, and if these are obtained in error, and connected according to the wiring of the original coil the receiver will fail to work. If, owing to the particular local conditions above-mentioned the Type A coils are thought advisable, then they should be connected up as in the original model so far as terminals Nos. 1, 2, 3, 4, 5 and 6 are concerned, whilst terminal E is ignored. The earth return will be made *via* the metal surface of the baseboard. The new terminal No. 8 is used as an alternative connection for the aerial lead.

An Important Point

It has been noticed that in the Blueprint the L.T. — lead has been drawn in such a manner that it unfortunately obscures an important earthing lead.



Cheap to build, ultra-efficient; and simple to operate.

As the diagram appears, therefore, there is no connection between the metal chassis (and its various earth return leads) and the actual earth terminal. The wire in question is joined between one of the fuse terminals and is then clamped under the fuse-holder. The wire need only be about 1in. in length, and it should be simply bent round and clamped between the fuseholder and the chassis, the holding-down screw retaining it in position. The sketch on this page should make the point quite clear.

An A.C. Model

A large number of readers have asked for a model of this receiver designed for A.C. mains operation, and such a receiver is now undergoing test. The same main features of the battery receiver will be borne in mind, and the final receiver will be cheap, efficient, and absolutely up to date. The same main circuit features will also be incorporated, although certain essential modifications will have to be made in order to deal with the higher efficiency of the mains valves. We are carefully analyzing the communications which we are receiving from readers who are desirous of having A.C. and D.C. versions of the receiver, and the final model will be designed with the wishes of the majority in view.

A D.C. Model?

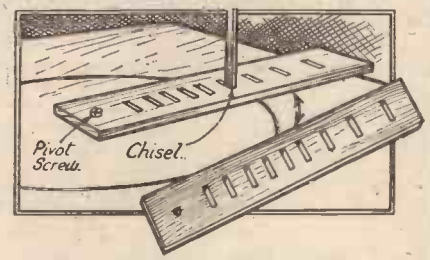
We have not, however, received many requests for a D.C. version, and we should like to assure ourselves that there is really a demand for a simple receiver of this type for use on D.C. mains. We must again record our appreciation of the manner in which this receiver has been acclaimed by the Trade and the Public, and we are very gratified to see the enthusiasm which is being evinced by constructors in the publication of this simple and cheap type of receiver. We hope that the Mains version will be as fully appreciated and will be made up in the same enthusiastic manner.

READERS' WRINKLES

THE HALF-GUINEA PAGE

Circular Hole Cutter

A NEAT and efficient cutter for any sized circular hole can be made by using a small chisel, preferably ¼in. or ½in. size.



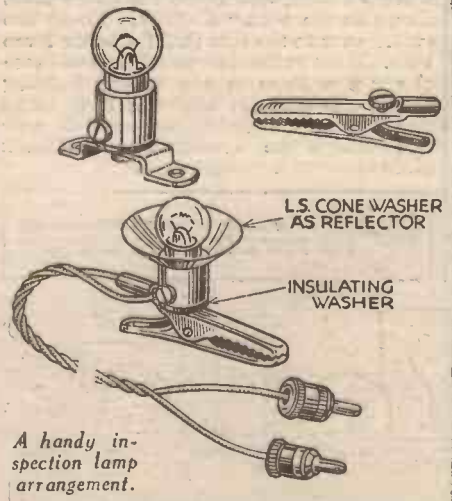
A simple method of cutting circular holes.

It is only necessary to obtain a strip of wood (hardwood is best), drill a small hole at one end and, according to the size of hole required, make slits just large enough to take the chisel.

In use it is merely necessary to drill a hole at the centre point of the required hole, pass a bolt through this and the strip of wood, and secure with lock nuts so that the strip of wood just revolves. Insert the chisel in the required slot, and by applying suitable pressure while turning the wood no trouble will be experienced in making a clean hole. Metal foil or thin sheeting used over baseboards, as well as wooden or ebonite panels, can be dealt with in this manner.—A. C. BROOKS (Aldershot).

A Handy Inspection Lamp

A USEFUL inspection lamp for use inside the set can be made from an old fuse-holder, a crocodile-clip, a few feet



A handy inspection lamp arrangement.

of thin flex, and two plugs. The base of the holder is unscrewed and the crocodile clip fixed in its place. The flex is attached, with plugs, and a flashlamp bulb inserted. The plugs may be slipped into the grid-bias battery and the lamp clipped on to the wiring or anywhere near to the job in hand. When changing batteries it can be placed near, and will greatly facilitate matters.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

If the hole in a cone-washer is enlarged it can be slipped over the bulb and will act as a shade.—J. ELVIDGE (S. Elmsall).

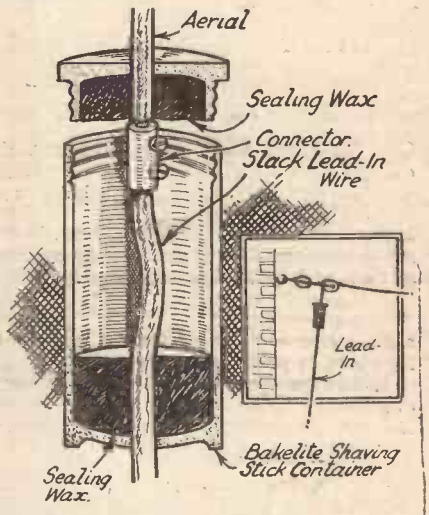
Preparing a Ground Glass Screen

TO obtain best results with the mirror-drum projector a finely ground glass screen is desirable. It is possible to obtain this from a standard photographic supply stores, but the majority of experimenters will probably find an odd piece of glass knocking about which may be cut to suitable size, and the only remaining point is how to obtain the fine ground surface. This may be very easily accomplished by the use of ordinary domestic knife-powder. To obtain best results it is preferable to employ two pieces of glass, one cut to exact size for the screen and the other slightly larger. The latter piece is placed on a perfectly flat surface, and the knife-powder is sprinkled on the glass together with a certain amount of water. Work the resultant paste slightly with the finger until spread evenly over the surface of the glass and then place the screen glass on top of the powder and with an even pressure all over, rub the glass in a circular motion. Keep the powder well wetted, adding water as it gets dry. The movement should be rotary, and even pressure is essential. After about three or four minutes the screen may be removed and washed in running water, when it will be found to possess a very even and fine grain. If not evenly ground all over, the required parts may be damped and the remainder of the paste rubbed into those parts. The paste will also be found useful for matting the surface of the ordinary Osglim lamp when this is employed for a disc receiver. The resultant even light proves of advantage in obtaining a better image. —W. D. (Hendon.)

A Novel Weatherproof Connection for Aerial

USE can be made of a disused bakelite shaving-stick holder to ensure a weatherproof connection between aerial and lead-in wire. Drill a hole of suitable diameter in both cap and body of holder; pass about 1½in. of aerial wire through the hole in cap, and bare the wire for about ⅜in. and connect to a small barrel connector. Pour melted sealing-wax or similar compound into cap; this seals and fastens aerial wire.

Through the hole in the body of the holder pass lead-in wire, bare the end, and connect to other end of barrel connector. See that sufficient slack wire is allowed to enable the shaving-stick holder to be screwed up, then pour sealing-wax into body in order to make a watertight joint where the wire passes through the hole. The holder can be then screwed tight, making a thorough weatherproof connection, which can easily be removed if required. If necessary the cavity can be filled up with vaseline.—G. H. WHITE (Catford, S.E.6).

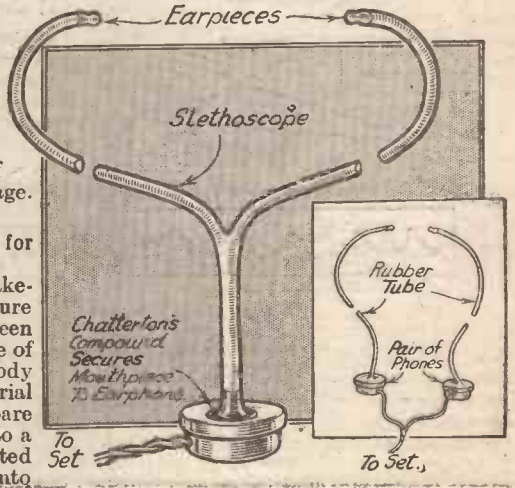


An effective weatherproof aerial connection.

A 'Phone Hint

HERE is a useful wrinkle for short-wave listeners. During a long sitting one often suffers agonies under the torture of heavy headphones. The little apparatus illustrated overcomes this. It consists mainly of a stethoscope device. The mouth of this is fixed with Chatterton's

(Continued overleaf)



A useful 'phone hint.

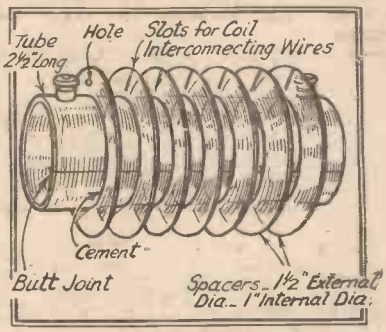
READERS' WRINKLES

(*Continued from previous page*)

compound over the hole in a 'phone earpiece. In practice the headphone is laid on a table and the stethoscope inserted in the ears. If a stethoscope is not available, a good substitute can be made from rubber tubing.—K. UMPLEBY (Normanton).

Making an Efficient H.F. Choke

EFFICIENT and very neat H.F. choke formers can easily and quickly be made with pieces of old scrap motor-car side curtains and a little celluloid cement.



Making efficient H.F. chokes.

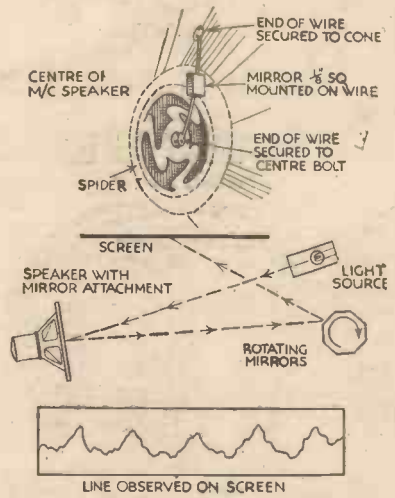
Cut out seven discs and punch out the centres with a piece of sharpened tubing, to make spacer washers. Roll a piece of celluloid 2½in. wide into a cylinder of about 1in. diameter and push it through the seven washers. Mark and cut the cylinder so that with butt edges it is sprung tightly into the washers.

Fix a terminal at each end, and smear a little celluloid cement on the washers to fix them in position.

Wind approximately 300 turns of 44-gauge enamelled wire in each space.—A. H. BARRIE (Gateshead-on-Tyne).

Home-made Oscillograph

THOSE interested will find that the oscillograph described below can be made up very cheaply. All that is needed

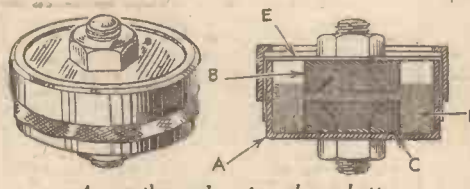


A cheap home-made oscillograph.

is a loud-speaker, a bright source of light, and a rotating eight-sided mirror. The latter may be made up from eight strips of mirror suitably mounted, and rotated by standing on a gramophone turntable. Next a very small piece of mirror, about ⅛in. square, is mounted by means of sealing wax to a pin or short piece of wire. One end of this short wire is fixed (by sealing wax) to the bolt holding the "spider" of the loud-speaker and the other end is either pushed through, or stuck to, the cone near the spider. The arrangement will be clear from the accompanying diagram.—J. R. LANSLEY (Surrey).

A Simple but Efficient Microphone Button

THE accompanying sketch gives details of an easily-made microphone. The inset A consists of the bottom half of a

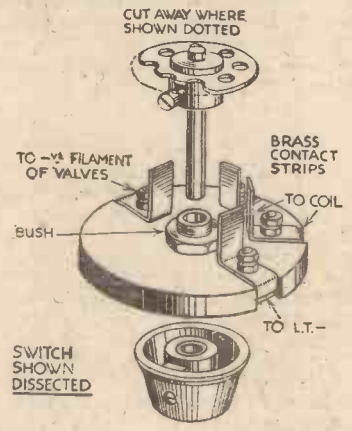


An easily-made microphone button.

small tin, this being of the sort used for samples, ointment, etc. The diaphragm E consists of a piece of thin rubber, to which is fastened a polished carbon block B, whilst another block C is secured to the base of the tin. The tin is partly filled with carbon granules D, and the lid is pressed into position as shown in the sketch. The top of the lid is cut away as shown. It may be added that the polished carbon blocks can be obtained for a few pence all ready for use at most electrical stores.—V. CAVES (Stewartby).

A Simple On/off and Wave-change Switch

FROM a stamped bush wheel, a piece of rod, a disc of ebonite 3in. diameter (an old-type tuning dial is admirable), and



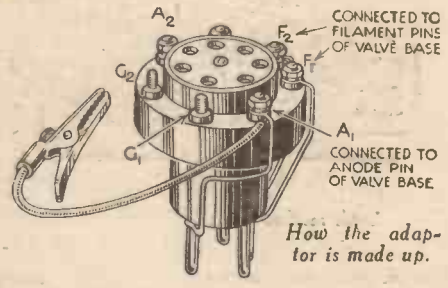
A simple "on/off" and wave-change switch.

a piece of threaded tubing, a neat wave-change switch may be made as shown in the accompanying sketch. A section is removed from the bush wheel, as shown. The ebonite disc is drilled in the centre to receive the threaded tubing, which is secured by two nuts on either side. Pieces of springy brass, 1½in. by ½in., are cut and drilled ⅛in. from one end. Four holes are then drilled in the disc 1in. from the centre (positions as in sketch), and slots are cut in the edge of the ebonite to correspond. The pieces of brass are then secured to the disc, the inner ends being bent up and the outer ends forced into the slots. The bolts are 4 B.A. The wheel is then secured to the rod, which is then pushed through the tube in the disc.—A. E. FORSTER (Dorchester).

A Class B Adaptor for the Emission Tester in the "Practical Wireless Encyclopædia"

COMPONENTS required.—1 4-pin base from old valve; 1 "Wearite" 7-pin valve holder; 1 crocodile clip.

Construction.—Drill a ⅛in. hole in the centre of the old valve base. Remove the centre screw underneath the "Wearite" 7-pin holder, which will be found to be 6 B.A. Obtain a 6 B.A. bolt long enough to pass through the drilled hole and screw into the 7-pin holder in order to securely fasten it to the top of the valve base. Connect filament pins on base to filament terminals on holder, and anode pin on base to A1 terminal on holder. Connect a crocodile clip to A1 terminal with about 3in. of single flex.



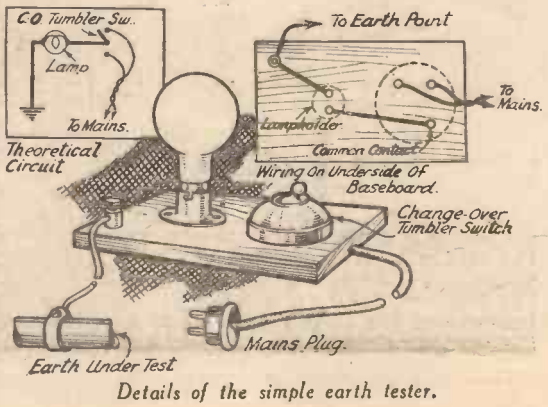
How the adaptor is made up.

In using the adaptor plug it into the emission tester and place valve to be tested in holder. As only 9 volts are used for high tension, no emission will yet be registered as the anodes of the valve are too far from the filament, but if the crocodile clip is clipped on to G1 terminal, the emission of one half of the valve will be registered. To test the other half connect the crocodile clip to G2; this utilizes the grids as anodes and a satisfactory emission test can be made.—L. C. DRISCOLL (Plaistow, E.13).

Simple Test for Radio Earth

A SIMPLE method for testing the efficiency of an earth connection is shown in the accompanying sketch. On a baseboard mount a S.P.D.T. switch and a lamp socket, and make the connections shown in the wiring diagram. Throw the switch over to the side that lights the lamp bulb. If the bulb shines as brightly as those of equal wattage in the normal lighting circuit the earth is efficient; if it burns dimly or fails to light, the earth is poor and should be overhauled.—R. SIEVE (Johannesburg).

See page 1 for instructions for securing the POCKET TOOL KIT



Details of the simple earth tester.

MIDGET COMPONENTS *for* MIN

An Interesting Review of the Midget Parts which are Ava

IT is interesting to observe the way in which wireless components have been gradually reduced in size during the past few years. It is only a short time since an efficient screened two-gang condenser could not be obtained with dimensions less than about 4½in. long by 4in. wide by some 4in. high, and yet to-day

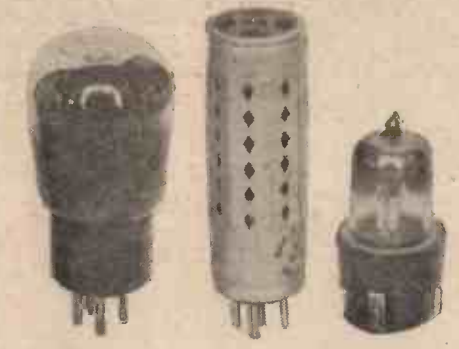


Fig. 2.—A group of valves. The size of the new midget valve on the right should be compared with those of the "ordinary" and catkin valves beside it.

there are quite a few such components on the market which will fit into a 3in. cube. In the same way, a screened coil of little over a year ago measured about 3in. diameter by 5in. high—to-day a similarly efficient coil can be bought whose dimensions are no more than 1½in. diameter by about 2½in. high. H.F. chokes of efficient type generally measured at least 1in. diameter by 3in. high, and yet a really efficient choke of screened type is now made which is little larger than a thimble. But a few years ago low-frequency transformers were judged very largely by their size, it being considered that the larger the component was, the more efficient it must be. This idea has now changed so that transformers little larger than a matchbox are not uncommon. It is not long since a 20-mfd. fixed condenser would have taken up a tremendous amount of space in a receiver, and now a 1in. diameter aluminium tube less than 1½in. long can contain a coudenser of such a capacity.

The Result of Logical Developments

And so one could go on, drawing comparisons between the components we knew a short time ago and those of to-day. There are many more examples of midget components which are now available to the home constructor, and several of these are illustrated on this page. As a matter of fact, a gradual reduction in the size of all wireless apparatus has been taking place for some time, so that the really diminutive components of to-day may be considered rather as the result of evolution than of a drastic step to economize in space. There is no doubt that many of the parts which were in common use a few years ago were unnecessarily large, and were probably made so in order to avoid the necessity for such a degree of accuracy as is nowadays expended in their production. Of course, technical developments have helped in no small measure to achieve the reduction in dimensions, an example of this being afforded by tuning coils. Air-core coils must necessarily be fairly large if they are to accommodate the required number of turns of wire. Additionally, the screen used with them must permit of a reasonable space between the windings and the metal if efficiency is to be secured, and this naturally increases the overall dimensions to an appreciable extent. Iron-core coils, on the other hand, can be made much smaller because fewer turns of wire are called for, and because the screening can be much "closer" without any resulting loss in efficiency.

New Alloy for Transformer Cores

L.F. transformers have been considerably reduced in size, not simply because space was at a premium, but because of the improvements in the metals used for their cores. Ordinary iron provides a fairly efficient core material, but it has a comparatively low "permeability" so that it must occupy a fair amount of space if it is to provide a sufficiently high inductance without the use of an excessive number of turns of wire. Ordinary iron is scarcely ever used nowadays, though, and it has been supplanted by various nickel-iron alloys having a much higher permeability. Consequently, the transformer core can be much smaller than heretofore, even though the inductance of the windings placed upon it are as high as ever. Another factor has contributed towards the reduction in transformer dimensions, however; whereas a comparatively short time ago the primary winding of the L.F. transformer was included directly in the anode circuit of a valve it is nearly always parallel-fed nowadays. Because of this, the primary is not called upon to carry any direct current, with a result that a smaller core (as well as fewer turns of wire) is sufficient to give the component the value of inductance required.

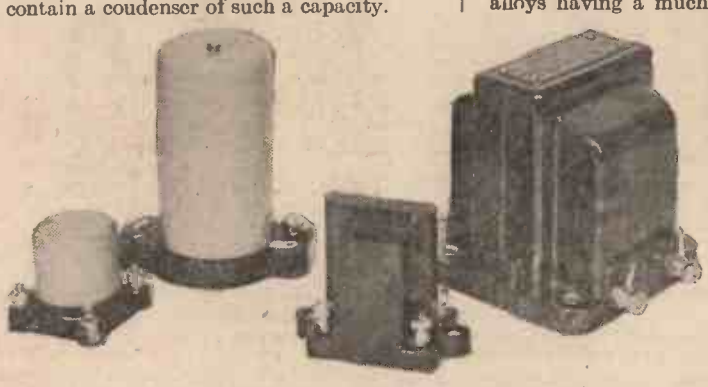


Fig. 3.—Here are two standard components—an H.F. choke and an L.F. transformer compared with similar midgets. The small choke is a Wearite and the miniature transformer a Bulgin "Senator."

Loud-Speakers

It is almost astounding to observe the tremendous reductions which have been made in the dimensions of moving-coil loud-speakers. That efficient speaker units can to-day be bought (quite cheaply at that) which have an overall diameter of no more than 5in. is a great tribute to the ingenuity of designers. Contrary to expectations these diminutive speakers are remarkably efficient, and are capable of surprisingly good reproduction if properly employed.

Fig. 5. above a type. The small condens Wilkins and Wright and E

Such components as Q.M.B. switches, volume control potentiometers, fixed condensers, and resistances can all be obtained

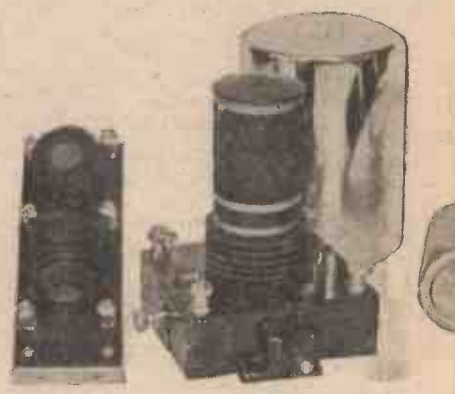


Fig. 4.—On the left is a Wearite midget iron right is a midget Telsen coil. Compare these w core coil in the centre.

in sizes which make them ideal for use in midget receivers. In most cases the reductions in size have been accomplished by good design and precision methods of manufacture. The small components are quite as efficient as their larger counterparts, and in most cases they are no more expensive, although they are made to very fine degrees of accuracy.

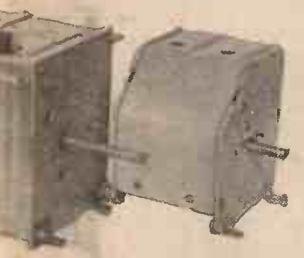
Midget Valves

So far as we are aware there are no really midget valves on the British market at the moment, [illegible]. An example of one of these valves (which is not yet released) is shown in Figs. 1 and 2, and its minuteness can be judged by comparison with the hand on the right in Fig. 1. This valve is of the usual three-electrode type,

NIATURE RECEIVERS—2

ilable to the Home Constructor

and is just as efficient as those in normal use. It requires a special holder, since the base is too small to take the usual four pins, and is a perfect example of the valve manufacturer's art.



.—All three condensers shown re of the two-gang air-dielectric ers are midgets made by Messrs. British Radiophone respectively.

The Real Portable

What does the production of all these miniature components mean to the home-constructor and set designer? It means that it is now possible to make a receiver, of even a pretentious type, which can be accomodated in a box of no greater volume then a 120-volt super-capacity high-tension battery. It also means that real portables which can easily be carried about are now a practicable proposition, and it *might* mean that in the future all our conceptions of wireless receivers will have to be modified. The production of midget components is not simply a craze. it marks a step in the evolution of radio.

Where Midget Components Can Be Obtained

Many of the midget components to which reference has been made above have not long been on the market, and many of them might be unknown to readers. A reference to some of the enterprising manufacturers who produce them will not, therefore, be out of place. The small two-gang air-spaced variable condenser shown in Figs. 1 and 5 is made by Messrs. Wilkins and Wright, but equally small and efficient condensers are also made by Messrs. British Radiophone, Ltd. (also shown in Fig. 5). Both these condensers are representative of the precision work which can now be turned out by mass-production methods.

-core coil and on the ith the screened air-

The midget loud-speaker illustrated is made by Messrs. Sonochorde Reproducers. It is of the mains energized type, having a field resistance of 2,500 ohms, but can also be obtained (in the same size) in permanent-magnet form. Other midget speakers of similar dimensions are made by Messrs. Epoch, Rola, Benjamin ("Magnavox") and others.

The particularly neat screened H.F. choke being held on the tip of the fingers in Fig. 1, and also shown in Fig. 5 is the "Wearite," List No. H.F. P.J., which costs only two shillings, despite its accurate design and excellent characteristics. Other midget chokes are made by Messrs. Bulgin, British General, Lissen, and Graham Farish.

Fig. 1.—An interesting photograph which shows a number of new midget components: their size can be judged by comparison with the hand.

Midget Tuning Coils

One can realize how extremely small a modern screened iron-core tuning coil can be by examining the Telsen component shown on the hand in Fig. 1 and, in comparison with a standard air core component, in Fig. 4. This component covers both medium and long waves when tuned by the customary .0005 mfd. variable condenser, and readily lends itself for use in a modern

Fig. 6.—Both these components are efficient volume-control potentiometers, that on the left is a British Radiophone midget, which includes a Q.M.B. switch.

midget-receiver. Another excellent, though miniature, dual-range iron-core coil is made by Messrs. Wright and Weaire (see Fig. 4). This is not screened and has the medium and long-wave sections wound on separate ebonite formers, each 1in. diameter and less than 1in. long, mounted at right-angles on a neat ebonite base.

The L.F. transformer shown in Fig. 3 is a Bulgin "Senator," and this measures approximately 1¼in. square by 1¾in. high. Other midget transformers are made by Messrs. Radio Instruments and one or two other manufacturers.

On the right of Fig. 1 can be seen a Dubilier electrolytic condenser which has a capacity of 20 mfd. and a working voltage of 12. Such a condenser is ideal for decoupling grid-bias circuits and for similar purposes. Additionally, however, similar condensers in a wide variety of capacities and working voltages are also made by Messrs. Dubilier and Messrs. Telegraph Condenser Co. Another kind of very small fixed condenser which is eminently suitable for inclusion in a midget receiver is that commonly known as the "postage stamp" type. Such small (mica dielectric) condensers are made by Messrs. T. C. C. (type "S") as well as by Messrs. Dubilier (type 665), Messrs. Ormond, Messrs. Hellesens, and others. A number of manufacturers also make a range of very convenient tubular condensers like that shown near the front on the right of Fig. 1 and also in Fig. 7. These condensers are non-inductive, and, having wire end connectors, they are easily wired up without the use of additional connecting wire.

There is little doubt that many other midget components will come on to the market in the near future and, in fact, there might already be some on the market to which reference has not been made, due to the fact that they have not yet been brought to our notice.

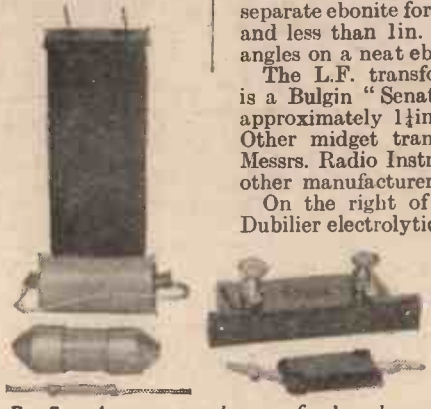
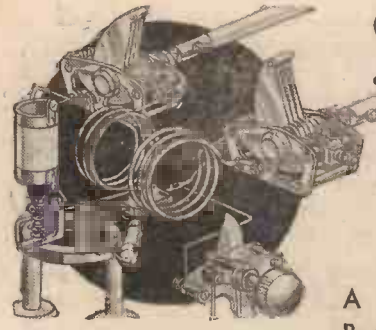


Fig. 7.—A comparison between fixed condensers of various types. Note the tubular and "postage stamp" types. A "cartridge" resistance is also compared with a new Siemens midget resistance.

Fig. 8.—Here we have a balanced-armature speaker chassis of normal type compared with a midget moving-coil unit. The latter is a "Sonochorde."



Short Wave Section

HINTS FOR SHORT-WAVE EXPERIMENTERS

A Number of Valuable Suggestions for the Beginner in Short-Wave Work are Made in this Article.

By ALF. W. MANN

THE true short-wave experimenter is never satisfied and is ever searching for a circuit or design which will outclass its predecessors. Experimenters with years of experience have long realized the advantages of personal experiments, and invariably have one receiver on the bench in order to keep up-to-date with happenings on the air, and a collection of spare components, in order to hook up and try out various receiving circuits. Whilst the experimental side appeals to the beginner, he is apt to consider himself fortunate if, in addition to a broadcast receiver, he has a short-wave adaptor. There is no reason why the beginner should not try his hand in the sphere of experimental receiver construction. After all, costly components are not required, although those used in order to carry out experimental work must be of good design and quality. The purpose of this article is to advise those who are interested how to make a start in the correct and only way, regardless of financial status.

Choosing the Circuit

Before going into detail, it would be well to correct a mistaken impression prevalent amongst beginners with reference to circuits. Do not imagine that amongst short-wave circuits there are many which are bad and one which is a good one, if only you can drop across it. Type for type, there is not one receiver circuit in common use to-day which is fundamentally unsound. The deciding factor as to the results obtained, regardless as to the circuit, is the correctness or otherwise of the methods used by yourself to carry out the practical application of theoretical principles. When the final results are unsatisfactory, do not blame the circuit or its originator, or, for that matter, the designer of the receiver you have constructed. It is far more satisfactory to look for one's own mistakes.

Having decided to experiment, the next thing to decide is the basis upon which to experiment. In order to make a decision, ask yourself this question: Which is the most important part of a radio receiver—be it broadcast, short-wave, or ultra-short-wave receiver? The answer is, of course, the detector; for does not the efficiency of every receiver depend upon the efficiency of the detector stage? For example, imagine a short-wave receiver with one or more high-magnification H.F. stages and L.F. stages of undoubted efficiency, and between them a detector stage which is a half-hearted affair, lacking in sensitivity, unstable, and prone to dead-spots in the tuning range. Such a receiver would appear to be the world's worst, and the highly-efficient stages of amplification entirely wasted.

The Detector Stage

From the previous example it will be realized that in order to build good short-wave receivers the beginner should first of all learn how to build good detector stages, and in order to obtain experience in this direction all that is required is sufficient components to enable you to build a one-valve receiver. Fig. 1 shows a circuit suitable for reception on all wave-lengths, but the values have been chosen with those below 100 metres in mind; therefore a short-wave H.F. choke is specified.

The next decision concerns the most

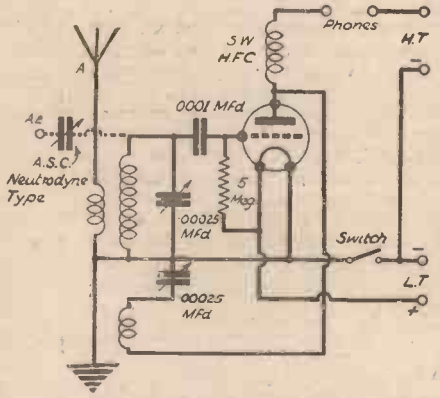


Fig. 1.—A one-valve circuit, suitable for all wave-lengths.

suitable system of construction. We may choose the baseboard or chassis method, and as we are experimenting with a view to obtaining the maximum of detector efficiency, the chassis system is undoubtedly the most satisfactory.

The beginner may not feel confident enough to undertake the construction of a suitable metal chassis. He should not worry about it, however, as one of the most popular methods in use at present is to make the chassis of wood and line the underside with tinfoil (see Fig. 2).

Constructional Details

With reference to the system outlined above, the idea is to take all connections at earth potential direct to the foil by means of small bolts which are fixed as near as possible to the point which is earthed. The infoil should be earthed by connecting a separate chassis bolt to the earth terminal of the receiver.

It will be noticed that details concerning the layout of the various components are omitted. The reason for the omission is in order that the experimenter may use his own discretion after making a careful study of various circuits and noting how, and why, they differ. Short and direct wiring, good connections, and the correct spacing of components so that there is no possibility of interaction between tuning coils, H.F. choke, and tuning condensers are of equal importance, for where there is interaction, instability and body-capacity effects will be in evidence.

The Tuning Coils

With reference to tuning coils, the type used depends upon what you have on hand. It is a good idea to make your own, if possible. If you wish to use an aperiodic aerial coupling, three windings will be necessary on one former, or three separate coils, according to the type of mounting you use. If aerial-series condenser coupling, as shown dotted, is used, only two coils—or windings—will be required.

Here is a suggestion:—

In the October 7th, 1933, issue of PRACTICAL WIRELESS the construction of an improved wavemeter complete with suitable coils was described. Study the sketch of the coils, make your own formers to the dimensions given, and arrange the contact pins so that a valve holder may be used as a coil base.

Going back to the receiver for a moment, incorporate, if possible, both systems of aerial coupling. With reference to the aperiodic coil, this may be wound around the valve-base coil mount—about four or five turns of 26 D.C.C., spaced the thickness of the wire, will do. It is best to make a former to fit the coil base and slip it in place when completed.

The tuning range of various coils will depend upon the number of turns used and the capacity of the tuning condenser; it is therefore impossible to give suitable coil data relative to tuning range. It is suggested, therefore, that, as an experiment, the following combinations should be tried:

Aperiodic, five turns in all instances.
Grid coils, twelve turns, five turns, eight turns.
Reaction, twelve turns, five turns, eight turns.

Each winding close-wound, allowing ⅛in. between grid and reaction windings.

Comparative tests, using different values of grid leaks, grid condensers, and combinations of both, are interesting and instructive, and experiments on these lines enable one to obtain maximum sensitivity. Do not overlook the possibilities of converting the one-valve receiver into a short-wave adaptor, but remember that when used in this form the 'phone terminals must be coupled together.

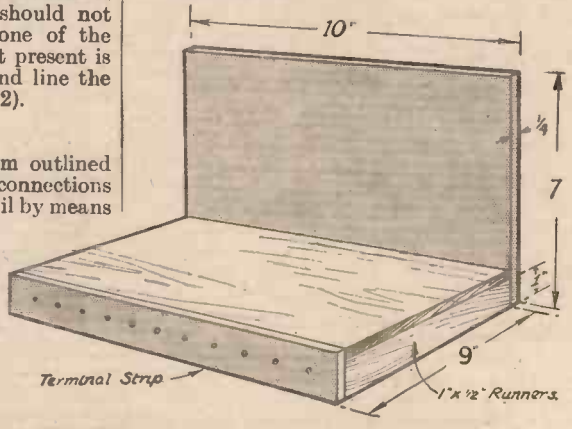


Fig. 2.—Chassis details for the all-range receiver.

TENDENCIES IN MODERN RECEIVERS

(*Continued from page 6*)

tuning scale, but the separation will probably be less at other parts. And if it is less the quality of reproduction is bound to suffer since the full range of musical frequencies cannot adequately be dealt with.

"Local-station" Sets for Quality

Another way of expressing the above remarks is that the present-day high-priced receiver cannot be complained of very much, but the cheaper sets would be far more satisfactory if they could be made to receive the local stations only and to give uniform response to a frequency range of at least 9 kilocycles—better reproduction would result if a range of 10 or 11 kilocycles was provided for. A detector-L.F. circuit with a band-pass input circuit giving a frequency response of about 11 kilocycles would provide an excellent arrangement that would take full advantage of the B.B.C.'s transmissions. The H.F. (the detector actually) side of the set would need to be comparatively insensitive so that interference would not be experienced.

Multiple Valves

Multiple valves of various kinds have come very much to the fore of late, and one is inclined to wonder if they represent real progress or otherwise. These valves, among which mention might be made of double-diode triodes, double-diode pentodes, combined driver-Class B, double pentodes, and the like, are undoubtedly of remarkable efficiency, but it would appear that they are unnecessarily complicated. It would seem that separate valves performing one each of the duties of the multiple ones would be easier and therefore cheaper to produce, they would be less confusing to the home-constructor, and less expensive in the way of replacements.

RADIOGRAM RECEIVERS.

(*Continued from page 11*)

spring motor, and this can be bought very cheaply. Do not choose *too* cheap a motor, however, since that would probably prove to be noisy and would not do justice to the excellent quality which is to be obtained from present-day records reproduced through a good amplifier and speaker.

In the case of a mains set, an electric motor is always to be preferred. In the case of A.C. the motor might well be of the synchronous type. Alternatively, however, a "universal" motor (which can be obtained from a number of manufacturers) can be used equally well on either A.C. or D.C. For the average receiver it will be found perfectly satisfactory to obtain a motor of the comparatively low-price pattern, but when a high-class "quality" set is in use a larger and more powerful motor is to be preferred, due to the fact that it has sufficient power to rotate the record at a perfectly uniform speed regardless of whether high or deep bass notes are being reproduced. This point might not be quite clear, but it may be explained that the "drag" on the record by the pick-up needle is much greater on low notes because their impression on the record is much more pronounced. Therefore, in the case of small motors, there is a possibility of the turntable speed being slightly reduced on certain passages, with a consequent introduction of distortion.

Random Jottings

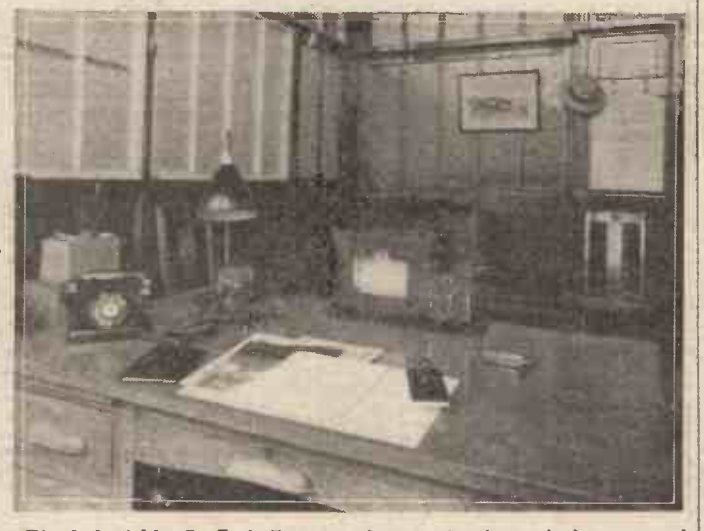
By the Editor.

The Photo-Electric Cell Again

SOME time ago I mentioned the many uses to which the photo-electric cell was now being put by various types of manufacturer. I have received a very interesting account from Messrs. Ferranti of the methods incorporated in their up-to-date factory at Hollinwood, together with the photograph which is reproduced on this page. The desk is Mr. D. Z. de Ferranti's, the Director of this firm, and on the front of the desk may be seen a clock mounted in a small cabinet which has on its left a most interesting chart. This is actuated by photo-electric cells placed at various points round the works, and the total output of articles is shown on this chart every ten minutes. Thus Mr. de Ferranti may glance at this chart from time to time during the day, and keep a constant check upon the work of the entire factory, and in the event of any slowing up, due to any particular cause, it is only a matter of a minute or so to trace the delay and to adjust matters. The entire factory is fitted throughout with the Ferranti synchronous clocks (one of which is on the desk) and thus perfect co-operation is possible at every branch of the work. When one remembers the many types of apparatus which are produced by this firm, and also that every part is manufactured in this factory, it will be seen that the efficiency of the factory must be very high indeed.

The New Poznan Station

THE new Polish station is now working with an unmodulated aerial input of 16 kw., on a wavelength of 345.6 metres. Although so far away (speaking in terms of miles) from London, the frequency of this station is 868 k/cs compared with London Regional's 877 kc/s. The separation of the two stations is, therefore, only 9 kc/s the minimum which is permitted under the Lucerne Plan. Any sign of wavelength wandering would, in view of the high power, result in a heterodyne whistle, and to prevent this the Polish authorities have had the station redesigned to incorporate Marconi principles, such as "series modulation," crystal drive, etc. The new apparatus was completely erected, connected up, and ready for operation within four hours of the delivery of the packing cases at Poznan. Apart from the high quality which is now possible from this station, the new apparatus should completely remove all risk of interference with the London programmes.



The desk of Mr. D. Z. de Ferranti, showing the chart which is actuated by photo-electric cells.

Good Work with a Converter

SOME wireless enthusiasts seem to be very lucky (or should I say skilful) in the results they obtain from simple apparatus. We hear of amateurs getting fifty stations on the loud-speaker on a two-valver and similar apparently phenomenal results, but Mr. Smith, of Ealing, has surely obtained results which will be envied by many. He uses a one-valve superhet converter made by Messrs. Eastick, coupled to a Lissen Three-valver. He has received, on the loud-speaker, 101 stations, *all of which have been verified.* The countries which he has roped in include Brazil, Canada, U.S.A., Italy, Bermuda, Belgian Congo, all the nearer European countries, and many others. The list does not include amateur and commercial code stations, nor many broadcasting stations which have not been identified. His results should spur many amateurs to see if they can beat this list with similar modest apparatus.

Institute of Wireless Technology : Change of Address

OWING to the continued increase in its scope and activities, the Institute of Wireless Technology (Incorporated), has found it necessary to move the Registered Offices to more commodious premises at 4, Vernon Place, Southampton Row, London, W.C.1. Telephone : Holborn 4879.

Corrosion by Sea and Ozone

A USEFUL innovation for engineers and manufacturers who wish to conduct practical tests on the immunity of paints, metals, and other products from deterioration due to the action of sea water, sea air, ozone, and sunlight, is the opening of a testing station for this purpose at Mersea Island. An independent means is thus provided of carrying out much more exhaustive and rigorous tests than the usual method of spraying specimens with sea water in a closed chamber. The latter method, however conscientiously employed, is inconclusive for several reasons. In the first place, the specimen is more or less at the same temperature throughout the test, a serious objection in the case, for instance, of a paint which under working conditions may cover a metal that itself expands and contracts under differing temperature conditions. Also the sprayed salt solution usually remains at constant strength, whereas under working conditions when sea splashes on to a material the sun evaporates the water, leaving dry salt which may subsequently be washed into cracks or pores in the form of a more concentrated salt solution. The possible disintegrating effects of the sun and of ozone, one of the most destructive gases associated with sea corrosion, are also not represented in artificial methods of testing.

The mud flats off the Essex coast, covered by the sea at each tide, provide an ideal site for testing all marine corrosive actions. At the Mersea Island Testing Station specimens under trial are normally placed so that at high water they are immersed in the sea for periods of between one and two hours; when the water recedes they are exposed to the sun and wind and later to the ozone released by the sun.

Are Crystal Detectors Worth While ?

I WAS surprised to read in a Sunday newspaper recently a paragraph written by the Staff Wireless Expert in which it was stated that "the crystal is still very far from being dead—and for those who wish to listen to the local stations there is nothing made to compare with the beautiful quality of the crystal and distortionless amplifier." I thought that old-fashioned idea had been wiped out quite a long time ago, for it is certainly a fallacious one. A crystal does *not* give better reproduction than a valve detector; in many cases quality is far worse, because a greater degree of L.F. amplification has to be employed.

The expert in question goes on to say that "Many listeners are under the impression that a crystal is unselective, but if the aerial, earth, and crystal are tapped down the coil—the greatest selectivity may be obtained." I do not quite know what the reader is intended to assume from this explanation, but I would say that if the aerial, earth, and crystal *were* tapped down the coil to any appreciable extent nothing would be heard at all unless the aerial were situated a comparatively few yards from the transmitting station. Moreover, it is very doubtful what the writer of the paragraph means by "the greatest selectivity." If he meant "greater" selectivity there might be some truth in the statement, but "greatest" is not a comparative adjective.

I have said that I am not in agreement with the Wireless Expert's ideas, but when he goes on to say: "I can often tune in (on the crystal set with L.F. amplifier) Midland, Scottish, and about four foreign German and French stations between the Regional and National settings, and on Sunday evenings after the B.B.C. have closed down early, as many as half a dozen foreign stations come in as the condenser dial is turned," I wonder if he has discovered some new principle or is benefiting from some kind of re-radiation. I would not suggest that he is misleading his readers, but I am quite sure that he has not given as much information as might be desirable.

Practical Television

Conducted by H. J. Barton Chapple, Wh.Sch., B.Sc., Etc.

MARCH 24th, 1934. Vol. 1. No. 12

PHASING AND FRAMING

An Explanation of Two Terms which are Frequently Misunderstood

WITH a subject of relatively recent growth like television, it is inevitable to find that the nomenclature is misunderstood, and although efforts are being made to standardize terms and expressions, the task is admittedly a difficult one due to the rapid developments which are taking place. Two terms which are frequently misunderstood, although their meaning should be obvious, are "Phasing" and "Framing." The following explanation will therefore clear any slight misunderstanding which might exist.

Optical Illusion

In the bulk of the television systems now being developed, a spot of light is caused to move rapidly in a certain predetermined path. This is called scanning or exploring, and the scanning process repeats itself a definite number of times per second to take account of any movement of the transmitted scene. The resultant effect is only an optical illusion—a case of the quickness of the spot deceiving the eye. The same thing occurs in any cinema. Apparent continuous motion takes place in the pictures thrown upon the screen, whereas actually twenty-four still pictures, each representing a *slight* change in movement, are projected in one second. The eye being relatively sluggish in its response to outside activation combines these into a harmonious whole, conveying an impression to the brain of a flickerless picture of continuous movement.

Scanning Duplication

Reverting to the television process, it is necessary to duplicate, in one form or another, the scanning action being carried out at the transmitting end, and in this way the scanning device—apertured disc, mirror drum, mirror screw, cathode ray tube, etc., —together with the modulated source of light, are intimately associated for the purpose of creating the image. It is in this duplication process that the errors occur and the image will lose all its value unless the conditions of true synchronism are fulfilled correctly. Not only must the speed of any rotating mechanism be the same at both ends but the *phase* must be the same. If only the speeds are identical then the condition satisfied is called isochronism. This is the same as two accurate clocks, one of which is in use at London and the other, say, at Calcutta. The angular movement of the clock hands are identical, but the actual time registered by each clock is of course different. To achieve true synchronism not only must the clock hands move at the same rate, but they must point to the same time.

Fig. 1.—A very early type experimental receiver showing how the current was fed into the motor and also the chain framing device.

Not Phased

With a television receiving device it is easily possible for the automatic synchronizing mechanism, which is incorporated to pull the rotating scanner into a condition of correct speed, and yet give a picture which is not a true representation of the scene at the transmitting end. Assuming that reference is being made to the thirty-line B.B.C. transmissions, the odds are thirty to one against the image being correctly *phased*, and when first shown on the screen, or viewing device, it is seen as two separate sections divided by a vertical line, an occurrence which has been illustrated several times in this journal.

It arises from the fact that at the same instant corresponding holes at both transmitting and receiving ends are not exploring the same section of the scene. If No. 1 light spot was just beginning its scan in the bottom right-hand corner of the total light area at the moment that No. 1 light spot at the receiving end was beginning to trace over the centre of the observed screen, then obviously the image would be moved bodily to the left by half an image width.

Defining the Action

To reset or rephase the image, one of the simplest methods is to alter *slightly* the speed of the motor driving the scanning device so that the image can drift slowly to left or to right, according to whether the speed is increased or decreased (this of course is for vertical scanning) and to readjust the speed to its isochronous value as soon as the image has set itself correctly within its vertical side limits. The control which affects this speed change is therefore often referred to as the "phasing" device and in a simple disc receiver is generally a variable resistance mounted on a bracket.

The idea of phasing, therefore, is to move the image *at right angles to the direction of the spot-light scan*. For horizontal scanning this means an up or down movement, while for vertical scanning the movement is to left or to right.

Out of Frame

Unfortunately, it is possible to encounter another peculiarity before it can be stated definitely that the image is in a fit condition for normal observation. Although corresponding scanning holes may be moving over their prescribed light strips in the same relative positions, it does not follow that the instantaneous position in that strip is the same at both transmitting and receiving ends. The receiving light spot may be in the centre of its light strip traverse at the same moment as the transmitting light spot is starting its own movement. This effect gives a received image split about a line at right angles to the direction of the spot movement, and the result is an image "out of frame." On rare occasions one sees the same effect on a cinema screen and the picture has to be reframed in the projector "gate." In the case of, say, a simple disc machine, if one could move the neon lamp bodily in the direction of the light spot movement all would be well. This is rather difficult, however, and fortunately by a simple device it is possible to rectify matters.

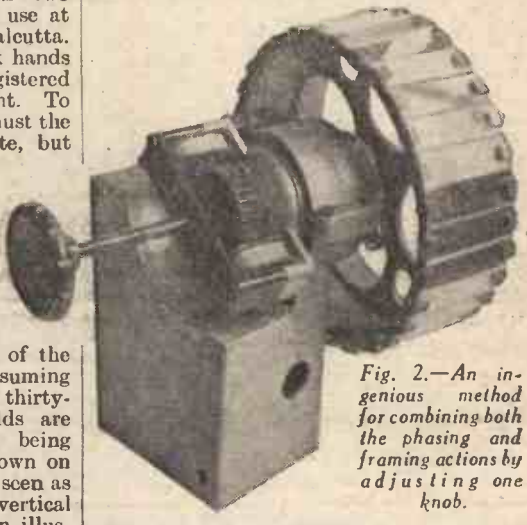


Fig. 2.—An ingenious method for combining both the phasing and framing actions by adjusting one knob.

Relative Motion

Instead of revolving the light source round the periphery of the scanning disc to find the position of correct framing, the body of the driving motor itself can be moved for, after all, it is purely a case of relative motion. The scanning device continues to revolve at its correct speed while this movement takes place, and in Fig 1 is shown the chain gearing employed for this purpose in one of the first experimental machines used by Mr. Baird. Revolving the large knob moved the bicycle chain which in turn turned the motor bodily in trunnions. In another case the scheme is simplified, for the motor itself is kept fixed and the pole pieces of the synchronizing device are "rocked" by a gearing incorporated in the field magnet framework. A central arrow knob effects this adjustment, and in consequence it is referred to as the framing control.

When reference is made to framing the image, therefore, the correct interpretation is an adjustment applied to the image

(Continued on page 26)

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

OHM'S LAW AGAIN!

What It Is and How to Use It

WHEN you turn on the tap to fill a bowl with water, the rate at which the bowl fills is dependent on two things. One is the pressure of the main, and the other is the resistance offered by the pipe. The greater the pressure, the faster will the water be forced out of the tap: likewise, the larger the pipe, the more water will it pass in a given time.

The Water Rate

Now you can readily understand that a given rate of flow of water—say, 2 gallons a minute—can be produced by various combinations of pressure and resistance. Thus if a large pipe is used, as in Fig. 1, a flow of 2 gallons per minute can be maintained with quite a low pressure, while at the same time a very narrow pipe, as in Fig. 2, will fill the bowl just as quickly, providing there is a higher pressure behind the water.

What I want to make clear is that there is a definite relationship between the pressure of the supply, the resistance of the pipe, and the rate of flow of the water.

The same sort of thing applies in the case of the flow of an electric current along a wire. Modern theory explains an electric current, either the current used for driving trams, heating and lighting, producing the spark in a motor-engine, or that which circulates in a wireless set, as the movement of *electrons* or negative particles of electricity. These infinitely small particles can be considered as flowing through the wire in much the same way as water flows through a pipe.

Now the wire naturally offers a certain opposition, or resistance, to the flow of electrons through it. The amount of resistance offered depends on the thickness of the wire and the kind of metal of which it is made, and is due to the fact that the atoms which form the substance of the metal impede the rapid movement of the electrons. Remembering the water flowing through the pipe, it will be quite clear that if the electrical resistance offered by a wire is very large, then a high pressure will be needed to pass current at a given rate. Conversely, if the resistance is small the same flow of current can be maintained with a low pressure.

Ohms, Volts, and Amps

The relationship between pressure, resistance, and current is very simple and very definite. It is called *Ohm's Law*, and was first propounded by Dr. G. S. Ohm about 1826. A knowledge of this elementary law and its practical application is of the utmost value to the beginner in radio, and will solve many of the little problems which arise in the theory and practice of wireless. Stated briefly it is this: The current in a circuit (measured in amperes) is equal to the pressure (in volts) divided by the resistance (in ohms). It is usually defined by the formula $I = \frac{E}{R}$ where I stands for the current, E for the pressure or electro-motive force, and R for the resistance.

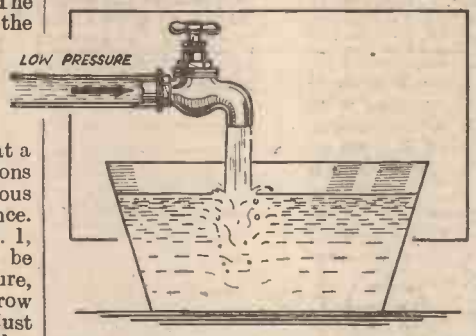


Fig. 1.—The water analogy. A certain rate of flow is produced by a large pipe and low pressure.

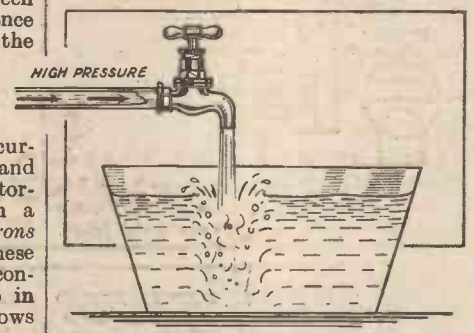


Fig. 2.—The same rate of flow produced by a small pipe but high pressure.

Let us take a very simple practical example of how Ohm's Law is used. Suppose we have a battery which is arranged to light a lamp as in Fig. 3. The battery is a 6-volt one—that is, it will exert a pressure of 6 volts—while the lamp has a resistance of 3 ohms. Suppose we wish to know the amount of current the lamp is taking—if we did not know Ohm's Law we should have to measure the current by means of a meter, but as it is we can perform a simple calculation and determine the current right away. We know that by Ohm's Law current equals voltage divided by the resistance. Thus in this case the current equals 6 volts divided by 3 ohms, which equals 2 amps. To state it in the usual way as an equation the problem appears thus:—

$I = \frac{E}{R}$; therefore $I = \frac{6}{3}$; therefore $I = 2$ amps.

Let us take a similar example, but connected with radio. Suppose we have three D.C. valves whose filaments are connected in series as in Fig. 4. Each valve has, say, a resistance of 64 ohms, while the voltage available at a—b is 48 volts. What current will be taken by the valves? Well, first of all we must add together the resistance of each valve because the current has to pass through each one in turn, thus the *total* resistance is that of all three valves added together. The total resistance, therefore, is $64 \times 3 = 192$ ohms. From Ohm's Law we know that $I = \frac{E}{R}$; therefore the current which will be taken by the valves is $\frac{48}{192} = \frac{1}{4}$ amp.

In the two examples just given we have used Ohm's Law to determine the current flowing through a piece of apparatus when we know its resistance and the voltage of the supply. Ohm's Law is also equally useful in determining resistance when voltage and current are known and for finding the voltage when current and resistance are known.

It is obvious that since the current in a circuit is equal to the voltage divided by the resistance, the resistance must be equal to the voltage divided by the current, while the voltage is equal to the current and resistance multiplied together. In other words, if $I = \frac{E}{R}$, $R = \frac{E}{I}$, and $E = IR$.

Calculating Resistances

Let us take an example where Ohm's Law is used to find the value of a resistance. Referring again to Fig. 3, suppose we know the voltage of the battery, namely 6 volts, and by connecting an ammeter in the circuit at X we discover that the current flowing is 2 amps. From Ohm's

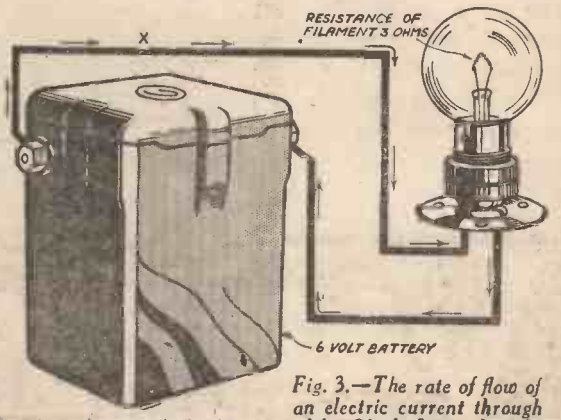


Fig. 3.—The rate of flow of an electric current through a lamp can easily be determined by Ohm's Law when the voltage and resistance are known.

Law we can immediately find the resistance of the lamp. Thus $R = \frac{E}{I} = \frac{6}{2}$ = 3 ohms.

In wireless the currents dealt with are usually *very small*. For instance, the current flowing in the plate circuit of a valve may be only a few *thousandths* of an ampere. The thousandth part of an amp is, of course, a *milliamp*. Thus when working out wireless problems by Ohm's Law one should note carefully whether the current is in amps or milliamps, otherwise the answer may be a thousand times too big or too small. Here is a typical instance. In designing a mains receiver we want to know what value a grid-bias resistance must have in order to give a bias of 12 volts to the power valve. We know from the type of valve used that a current of 30 *milliamps* will have to pass through the resistance.

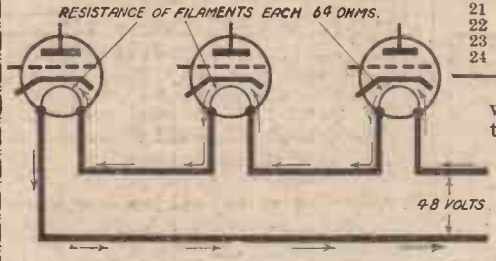


Fig. 4.—Ohm's Law enables us to find the current passing through these valves.

By Ohm's Law the resistance equals voltage divided by the current, that is, 12 divided by 30 thousandths (not 12 divided by 30) = 400 ohms. To put it in figures, $R = \frac{E}{I}$; therefore $R = \frac{12}{30/1,000} = \frac{12 \times 1,000}{30}$ (multiplying by $\frac{1,000}{30}$ is the same thing as dividing by $\frac{30}{1,000}$) = 400 ohms. (approximately).

Another very good instance of the practical use of Ohm's Law is to be found in the calculation of *voltage-dropping* resistances. A voltage-dropping resistance is one used to cut down the voltage supplied to some particular component in the receiver (usually a valve). In Fig. 5 is shown a diagrammatic representation of the detector valve of a receiver. The plate of this valve receives a pressure of 150 volts from the H.T. battery. Now, although this voltage is suitable for the other valves in the set, it is too high for the particular detector used. A 100 volts would be more suitable. In other words, we want to get rid of, or "drop," 50 volts. This is done by including a resistance R in the lead from the H.T. battery, as shown in Fig. 6. The problem is, how to find the right value for the resistance.

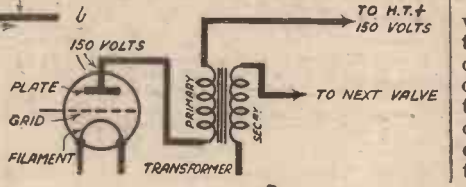
For the sake of clarity we shall ignore the fact that the primary of the L.F. transformer, through which the current also has to pass, offers some resistance. In any case, it is comparatively small and would only make a difference of a few volts. What we have to determine, therefore, is what value of resistance will drop 50 volts. From the valve-maker's pamphlet we find that the plate current of the valve, when the voltage is 100, is 2 milliamps. This current of 2 milliamps will pass through the resistance R; therefore the value of R which will cause a fall in pressure of 50 volts from one end of it to the other when a current of 2 milliamps is flowing through it, is given by :—

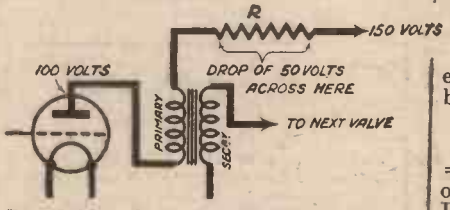
$R = \frac{E}{I} = \frac{50}{2/1,000} = \frac{50 \times 1,000}{2} =$ 25,000 ohms. Thus the resistance required is 25,000 ohms.

STANDARD WOOD SCREWS

See diagram at foot of page.

No. of Screw Gauge.	Diameter Dec.	A In. Approx. Fraction	B In.	C In.	Slot. Width.	Slot. Depth.
0	.05784	1/16	7/64	1/32	1/64	1/64
1	.07100	5/64	9/64	3/64	1/64	1/32
2	.08416	5/64	11/64	3/64	1/64	1/32
3	.09732	3/32	3/16	3/64	1/64	1/32
4	.11048	7/64	7/32	1/16	1/32	1/32
5	.12364	1/8	15/64	1/16	1/32	1/32
6	.13680	9/64	17/64	5/64	1/32	3/64
7	.14996	5/32	19/64	5/64	1/32	3/64
8	.16312	5/32	21/64	3/32	3/64	3/64
9	.17628	11/64	23/64	3/32	3/64	3/64
10	.18944	3/16	3/8	7/64	3/64	3/64
11	.20260	13/64	13/32	7/64	3/64	1/16
12	.21576	7/32	7/16	1/8	3/64	1/16
13	.22892	15/64	29/64	1/8	1/16	1/16
14	.24208	1/4	31/64	9/64	1/16	1/16
15	.25524	1/4	33/64	9/64	1/16	1/16
16	.26840	17/64	17/32	5/32	1/16	5/64
17	.28156	9/32	9/16	5/32	1/16	5/64
18	.29472	19/64	19/32	11/64	5/64	5/64
19	.30788	5/16	39/64	11/64	5/64	5/64
20	.32104	21/64	41/64	11/64	5/64	5/64
21	.33420	21/64	43/64	3/16	5/64	3/32
22	.34736	11/32	11/16	3/16	3/32	3/32
23	.36052	23/64	23/32	13/64	3/32	3/32
24	.37368	3/8	3/4	13/64	3/32	3/32





Figs. 5 & 6.—How a resistance can be used to reduce the plate voltage to a valve. Ohm's Law is used to find the value of the resistance.

The Lost Volts

Although we probably use Ohm's Law more often for finding the values of resistances than for determining voltages, instances of its application in estimating potential differences between various points in radio circuits are not hard to find. For instance, take the case where a choke is used in a mains unit for smoothing purposes, and we want to find out what loss in voltage will take place due to the resistance of the choke. The circuit is shown in Fig. 7. The voltage of the mains is 200, while the resistance of the choke is given by the makers as 480 ohms. The current passing through the choke will be the total current taken by the receiver. Suppose the receiver is a four-valver taking 60 milliamps. The drop in pressure, or, as it is termed, the *difference of potential*, between the input end and the output end of the choke will be given by : E=IR.

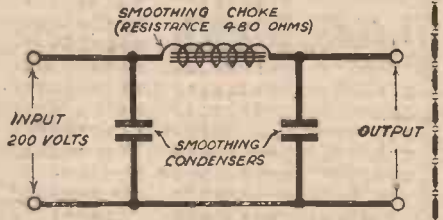
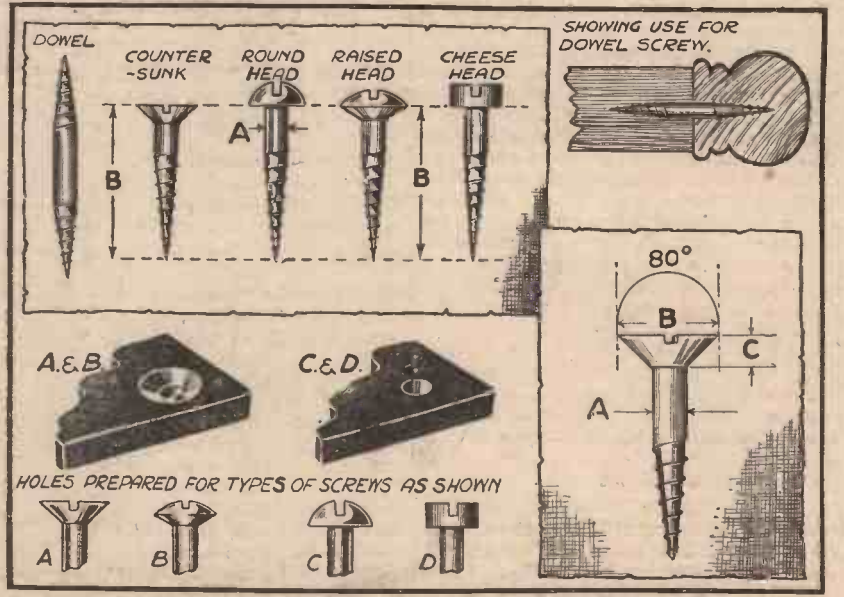


Fig. 7.—The voltage obtainable from this mains unit after the current has passed through the smoothing choke can be determined by Ohm's Law.

That is, $E = \frac{60}{1,000}$ multiplied by 480 =28.8 volts. Therefore, there is a loss of nearly 29 volts across the choke. In this case, then, the output voltage of the unit will be 200—29 volts = 171 volts.



Wood screws and their proportions. This diagram should be used in conjunction with the table at the top of the centre column.

PICK-UPS AND LOUD-SPEAKERS

(*Continued from page 5*)

reduced the current must also be increased in the proportion shown by the above equation. As a matter of fact, there is now at least one speaker whose field resistance is only 200 ohms, but this is intended for use in D.C. receivers and must be connected in the L.T. supply, where it acts as a limiting resistance, besides affording a certain amount of smoothing.

Permanent-magnet moving-coil speakers are probably more widely used than those of the energized type, since they are equally suitable for any type of receiver—either mains- or battery-operated. The P.M. speaker of to-day is nearly as sensitive as the energized type, and can be obtained in a variety of types, one of which is suitable for nearly any signal output.

Choosing the Pick-up and Speaker

Having dealt generally with the principles of speakers and pick-ups, a few hints in regard to the choice of these instruments for various requirements will not be out of place. Dealing first with pick-ups, it might be said that the only very important difference between the various types is in regard to the outputs which they give. For instance, one well-known model gives a peak voltage output of something like 4, whilst another one gives only .5 volt. Assuming that both units were equally good in regard to their response to the frequency scale it might at first sight appear that the former would be preferable, but this is not necessarily the case. If it were to be used in conjunction with a receiver having two or three L.F. stages there would be every likelihood of the valves being overloaded, so that nothing like the full output could be successfully made use of. On the other hand, if the receiver had only one L.F. or power valve to which the pick-up were connected the greater pick-up output would be desirable.

Frequency Response

Another point to watch in choosing a pick-up is the response which it gives at different parts of the harmonic scale; this can be determined by examining its "response curve." If the receiver with which it is to be used is rather lacking in bass a unit which gives emphasis to this part of the range would be best, whilst if the set already gives ample (or perhaps rather too much) bass response a pick-up which favours the upper register would prove more satisfactory.

Energized or Permanent Magnet?

In regard to the speaker, the first question to consider is whether it shall be energized or of the P.M. type. This depends largely upon whether or not a mains supply is available. If the set is intended for D.C. mains operation an energized type of speaker is nearly always to be preferred, but if A.C. mains are used an energized speaker should, generally, only be chosen when the H.T. current is sufficient to energize the field and when the voltage-drop, which is a necessary evil, can be compensated for. In other words, if the H.T. rectifier cannot supply from 50 to 150 volts more than is required by the anode of the output valve the energized speaker will be ruled out.

For a battery set it is desirable to buy the most sensitive permanent-magnet speaker that can be afforded. It is often believed that a small speaker is more sensitive than a big one, but this is by no means the case. Intending purchasers should insist upon hearing two or three different speakers on their own set, so that the most suitable one can be chosen.

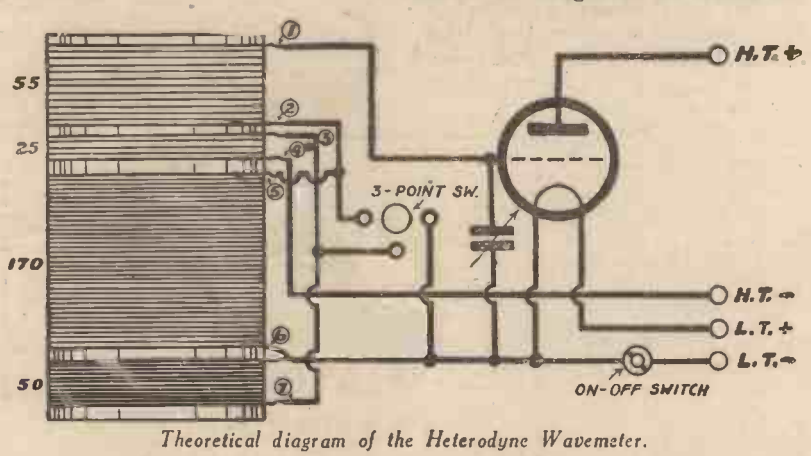
A HETERODYNE WAVEMETER

A Practical Article Giving Instructions for Making a Cheap but Efficient Instrument.

By W. B. RICHARDSON

(Concluded from page 1176, March 17th issue.)

The panel used is simply a piece of ebonite 2½in. by 4in., held upright with two small panel brackets, and having a hole near the top for the condenser spindle to pass through. The control of the condenser is by means of a really good slow-motion dial with an extension. The original component used was intended as a reaction control, and was fitted with a small reaction condenser of the solid-electric type. This, of course, was removed, and an air-dielectric tuning condenser used instead, as shown. If on ordering you explain to the makers that the condenser is not required, they will, no doubt, supply the dial and extension without this.



Theoretical diagram of the Heterodyne Wavemeter.

For the same reason that the condenser is placed some distance from the front panel, so also is the coil mounted well back. A piece of wood is fixed across the lower end of the coil with the aid of glue or one or two small brads, and then the wood is secured to the baseboard with screws. The rest of the arrangements are quite straightforward, and comprise the mounting of the two switches on the panel, the valve-holder, and the two terminal mounts with their four terminals.

Precautions in Wiring

Although the wiring is so simple, it should not be carried out carelessly. Every wire should be as straight as possible and no fancy work indulged in, in the form of square corners or angles. Stiff wire is better than limp, as it is less likely to vary its position and so cause any slight inaccuracies in wavelength after the meter is calibrated. The same remarks apply to some extent to the wires from the set to the batteries, especially the H.T. battery. The best way is to build a cabinet to house both set and batteries and so do away with any trailing leads. It is advisable to solder all connections where possible. Where two wires from the coil are connected to the same terminal on the wave-change switch it is best to solder them together as near to the coil as practicable, and take a single stiff connecting wire from this union to the switch terminal.

Calibrating and Using the Meter

Calibration is carried out in the usual way with squared paper. Draw a line and mark it in the dial readings of the wavemeter condenser, and another at right angles to it, and mark it in wavelengths. Tune in a known station on a selective receiver, and tune the wavemeter to the same wavelength by turning its dial until it causes a howl right on top of the transmission being received. Mark the known wavelength of the station on the graph and also the dial reading of the wave meter. In each case draw a pencil line in the usual way, from the point marked, so that the two lines follow the square lines of the paper, and where they cross mark the spot with a point. Repeat this procedure with as many known stations as possible. The graph is completed by joining up each of the points thus plotted with a line. This will not be straight but slightly curved. This plotting must be carried out for both wavelengths. Either make two graphs, or plot both curves on the same graph, using, say, red ink for the medium-wave curve and blue ink for the long-wave one.

The meter is now calibrated, and to use it adopt the procedure mentioned in the first half of this article. Any set to be calibrated is set oscillating. Then rotate the knobs until the heterodyne whistle or squeal of the meter is picked up. It is already known to what wavelength one has previously set the meter, this having been done by means of the graph. Say it was 350 metres, perhaps 120 degrees on the wavemeter dial. Well, then, since the set under test is tuned to the same wavelength as the meter it must be tuned to 350 metres. The meter is then set to another wavelength and the procedure repeated.

There are one or two points to be observed in calibrating and using the meter. One is always endeavour to keep the operating conditions the same. Do not, for instance, stand the meter on a wooden table one day, and another time place it on an iron mantelshelf. Always keep the batteries at the same voltage. Here it may be mentioned that there is no need to use a higher value of H.T. than is necessary to keep the meter oscillating. Of course, it must oscillate, otherwise one won't get any note from it. If there is any difficulty in getting it to do so it means that one is not using enough H.T. or has an unsuitable valve. An earth connection to the meter can be used, and if possible the same one; otherwise if an earth is used at one time, and no earth at another, the readings will be entirely different.

When calibrating a set one may, if the meter is too near, get a double hump to the heterodyne note as one does from a powerful broadcasting station. The true wavelength is at the silent point between the humps; but if the meter is placed farther away, one will get just a single howl, which is, perhaps, more satisfactory.

Another point to look out for is harmonics. A heterodyne meter gives out, besides the fundamental, several harmonics some distance on either side of the fundamental.

COMPONENTS REQUIRED.

One .0005 mfd. low-loss log condenser.
One extended anti-capacity slow-motion reaction.
One pair of 2½in. panel brackets.
Four terminals: H.T.+, H.T.—, L.T.+, L.T.—.
Two terminal mounts.
One on-off filament switch.
One three-point wave-change switch.
One valve-holder.
Panels: one 10in. by 7in. and one 2½in. by 4in.
Baseboard, 10in. by 8in.
One coil former, 3in. by 6in.
Wire for coil, about 2oz. 24 d.s.c. and 2oz. 30 d.s.c.
One hank of connecting wire, 18 gauge.

PRACTICAL TELEVISION

(Continued from page I Television Supplement)

field which brings about a movement bodily *in the direction of the light spot scan.*

Phasing and Framing Combined

From the foregoing the reader will no doubt see that although phasing and framing the image actually represent two distinct actions, it should be possible to combine these at least in so far as a rectifying device is concerned. Provided the whole of the motor scanning device and synchronizing coils could be moved round bodily, each *complete* image area movement over the length of a light strip in the direction of scan (that is one complete frame) would also move the image area in a direction at right angles to the scan by an amount corresponding to one light strip width. Framing and phasing are, therefore, combined, and in Fig. 2 is shown an efficient scheme for this purpose.

The pair of synchronizing coils have their framework attached to, but magnetically insulated from, the motor frame. This frame is held in a large bearing and four channels are built into the cylindrical frame so that four brushes make electrical contact, one in each channel. One pair of channels and brushes act as the connections to the synchronizing coils and the other pair feed the electrical power to the motor. A rotation of the large milled knob in this way gives both phasing and framing in the mirror drum television receiver of which this unit forms an integral part.

Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

HIVAC QP.240

THE second double-pentode valve to make its appearance on the market this year is illustrated below, and is a product of The High Vacuum Valve Co., Ltd. As may be seen from the illustration, although a single glass bulb is employed, the over-all dimensions are slightly greater than the average type of valve, the greatest diameter being just over 2in., whilst the over-all height is nearly 5¼in. The two sets of electrodes are mounted side by side, and mica spacers, held in the domed top, ensure that no possible movement can take place and upset the characteristics.

The standard 7-pin base is employed, with a single pin for application of a suitable potential to both screening grids. The characteristics are as follow :—

Filament volts	2.0 max.
Filament current .4 amps total for two halves.	
Anode volts	150.0 max.
Screen volts	150.0 max.
Mutual conductance	2.3 m/v
Grid bias for max. H.T.	—18 volts
Quiescent current	.. 8 mA
Anode to anode load	16,500 ohms
Grid swing (r.m.s. per valve) ..	14 volts
Output	1,400 milliwatts

The valve was tested with a 10 to 1 transformer coupling it to a normal leaky-grid detector with both an output choke and a tapped output transformer. The actual ratio of the output device did not seem to be very critical on this particular sample, although it is advisable to work to the maker's recommendation when coupling the loud-speaker. Without an output tone control the higher frequencies were rather too brilliant for our particular own liking, but the incorporation of a .01 mfd. fixed condenser and a 10,000 ohm resistance (in series) across the two anodes enabled the reproduction to be balanced to obtain a splendid output from a good moving coil speaker. In the interests of economy it will probably be found by many users that an H.T. voltage of only 100 (with a suitable reduction of grid bias to 12 volts) will enable ample volume to be obtained with a reduction in the quiescent anode current to only 3 mA. The output even then will be found to be a full watt, which is ample for the average home under normal conditions. The price of this valve is 10s. 6d., and the small theoretical circuit at the side of the illustration shows the electrode connections.

The new Hivac Double Pentode Q.P.P. valve. The unusual size of the glass bulb may be judged by comparing it with the valve base, which, although of the 7-pin type, is of standard dimensions.

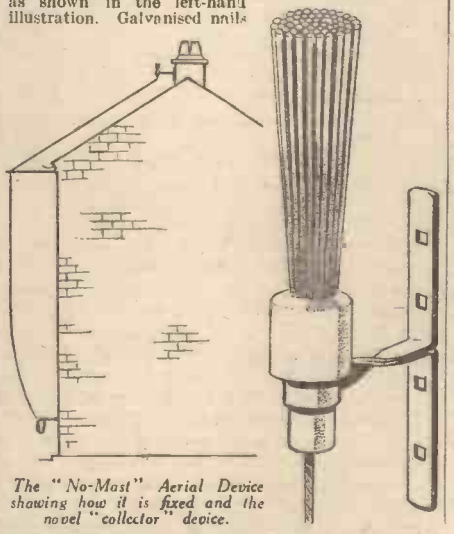
VARLEY A.V.C. UNIT

THIS is a modification of the original A.V.C. unit which was referred to on September 23rd last. In the new model four additional terminals have been fitted, and these are normally bridged by small shorting strips. The terminals are marked C, C1, E, and B+, and by suitable connection it is now possible to employ simple A.V.C., delayed A.V.C. and delayed and controlled A.V.C. The unit may thus be employed with very simple receivers employing only one H.F. stage, or with multi-valve receivers in which two or more H.F. stages are fitted. The Instructional Folder (B6) which is supplied by the makers, gives, in addition to useful data relative to the unit, several circuit arrangements which may be employed. The price of the unit is 15s. 6d.

Varley Universal A.V.C. Unit.

THE "NO-MAST" AERIAL

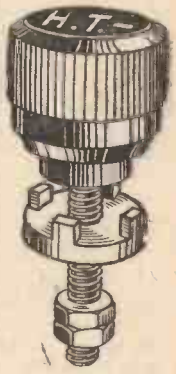
FLAT-DWELLERS and listeners in certain localities often find it difficult to erect a really efficient aerial owing to lack of garden space. Central Equipment, Ltd., of 188, London Road, Liverpool, have produced a most interesting type of aerial for this type of listener, and the illustration below shows one part of the equipment together with the method of erection. The brush-like affair is a heavy porcelain insulator 4½in. long and about 2in. in diameter, projecting from which are thirty 9in. lengths of very heavy gauge copper wire. From the other end of the insulator projects a 50ft. length of ordinary 7/22 copper wire. The complete equipment includes two galvanised metal brackets, for attachment to the chimney or high point, and a stand-off guide at the guttering, as shown in the left-hand illustration. Galvanised nails are also supplied for fixing purposes. The advantages of this type of aerial are, of course, non-directional effects and freedom from interference pick-up. In many cases the results obtained with a vertical aerial of this type will be as good as, if not superior to, those obtained with a medium height aerial carried between the house and a mast in the garden; and in areas where severe interference is experienced it may possibly be found that such troubles are reduced, if not completely removed, by this type of aerial. The price of the complete equipment is 10s. 6d.



The "No-Mast" Aerial Device shewing how it is fixed and the novel "collector" device.

BULGIN IMPROVED TERMINAL

THERE are some novel features incorporated in the Bulgin terminal which is illustrated herewith. It will be noticed that the lower portion of the terminal is of the "castle" type, and this ensures that the wire loop will not untwist when the terminal head is tightened up. In addition, the actual head of the terminal is of the type which, after rotating several times, becomes loose upon the thread without becoming detached, and is thus not likely to come adrift and be mislaid when connections are being made. The improvement in this type of head lies, however, in the fact that a special spring grip is incorporated inside so that when the head is free upon the thread a sharp pull will enable it to be completely removed where it is found necessary to do this. To replace, it is simply pressed on with a snap, and then screwed up in the ordinary manner. It thus possesses both the advantages of the non-detachable and the detachable head. It is supplied with normal engravings. The price is 3½d.



An improved terminal —a Bulgin product.

NEW FERRANTI COMPONENTS

THE new Ferranti resistances consist of a tube of refractory material upon which is deposited (at a high temperature) a special high-resistance conducting material. Metal end caps and wires are fitted to the manufacturer's type, which cost 6d. each, whilst the constructor's type cost 1s. each, and is provided with terminals. The resistances are available in the majority of standard values, and the accuracy is guaranteed to be within plus or minus 5 per cent. The design is such that self-capacity and self-inductance are negligible and the values will remain constant even when operated over a long period at the full rated load. The length of the resistance, with wires, is 6in., and the standard colour-code method of marking is employed.

The new condensers are of the dry-electrolytic type, and the 6 mfds. 500 volt peak type costs 6s., whilst the 8 mfds. 500 volt peak type costs 6s. 6d. A rectangular wax-boxed type, consisting of 8 mfds. + 8 mfds. 500 volt peak costs 7s. 9d. In addition to these there will shortly be available a number of different types ranging from .01 to 50 mfds. Further details will be given in due course.

T.M.C. HYDRA CONDENSERS

IN our report of February 24th concerning the new T.M.C. Hydra condensers, we referred to the method of enclosing the units in paper containers before including them in the metal or bakelite cases. In case any misunderstanding exists as to the precise method which was indicated, we would point out that the condenser elements are embedded in a bituminous sealing compound before being included in the paper container, the purpose of which is to give additional security against the possibility of moisture obtaining access to the essential parts of the condenser, and which also enables the manufacturers to see that the condenser element is definitely sealed.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Larger S.W. Section Wanted

SIR,—I fully endorse the views expressed by "Leon" (Meopham) in your issue of January 20th, regarding the lack of enterprise shown in the development of British short-wave receivers. As one who has recently returned from North America I agree with his remarks to the effect that the Americans seem to be the only people abreast of the times in S.W. work, and why we are content to play around with the schoolboy type of circuit is really amazing! Since I began taking your paper some three months ago purely for the "short-wave section," which I find is the best available in British radio journals, I have been hoping to see described such a circuit as your correspondent has in mind. I feel sure that a "short-wave supplement" on the lines of your recently inaugurated "television supplement" would be appreciated by a large section of your readers.—QUEST (Birmingham).

Latest Schedule of W3XAL, W3XL and PRA3

SIR,—The enclosed schedule of W3XAL, W3XL, also a few details concerning PRA3, Rio de Janeiro, Brazil, whose verification I have received in return for a o-v-2 report of November last, may be of interest to readers :—

W3XAL. Daily, except Friday, 11 a.m.–5 p.m.—17780 k/c.
W3XAL. Saturday only, 5.30 p.m.–1 a.m.—6100 k/c.
W3XL. Friday only, 11 a.m.–5 p.m.—17310 k/c.
W3XL. Friday only, 5.30 p.m.–1 a.m.—6425 k/c.
All Eastern Standard Time.
Add 5 hours for G.M.T.
Address, Station W, N.B.C., R.C.A. Buildings, 30, Rockefeller Plaza, New York, U.S.A.

8185 k/c, PRA3, A Poize Do Brasil, The Radio Club of Brasil and Companhia Radio Internacional Do Brasil, Rio de Janeiro. Call, A Poz Do Brasil (The Poise of Brazil). Verification card shows tropical scenery and call-sign PRA3. No schedule given. Verification on back. —A. W. MANN (Middlesbrough).

A Useful Anti-Corrosion Preparation

SIR,—With reference to a wrinkle on "Accumulator Terminal Corrosion" in PRACTICAL WIRELESS dated February 24th, it may interest your readers to know of a preparation called "Yoy" which I have successfully used for some time and which does not seem to be as well known as it might be. It fulfils all the purposes your correspondent mentions without the attendant disadvantages.—S. G. G. MALEY (Little Bookham).

From a 78-year-old Enthusiast

SIR,—I shall be very pleased if you will publish one or two articles in your valuable magazine on the various uses of the voltmeter, the ammeter, and milliammeter. I also think many other readers would appreciate such articles. To have good tools, and to know the *best use* to make of them, are very different propositions. It may interest you to know that I am a seventy-eight-year-old fan.—GEO. E. SKINNER (Tonbridge).

[*The uses of the various meters employed in radio work have been described in* PRACTICAL WIRELESS *from time to time. There is also a good deal of information on the subject in our new publication "Everyman's Wireless Book."*—ED.]

Kit Sets versus Commercial Receivers

SIR,—Apparently many of your readers have drawn the same conclusion as myself with regard to the cost of a kit set compared with a commercial set. I quite agree that there are many cheap sets that are little better than junk, but there are also many good sets, if one is to believe the reports you print from time to time on receivers tested.

Furthermore, I consider the internal appearance of a commercial set is neater; its components may be of the "stripped" variety, but they match each other, whereas the kit set has a patchwork appearance.

I certainly think it is time that component manufacturers catered for the thousands like myself who are not impressed by beautiful bakelite mouldings and nickel-plated terminals.—J. B. RODGERS (Bow, E.3).

CUT THIS OUT EACH WEEK.

Do you know

—THAT a modified form of high-frequency metal rectifier is now obtainable.
—THAT the new rectifier is now suitable for all wavelengths down to 150 metres.
—THAT an indirectly-heated valve cannot successfully be used as an anode-bend rectifier with automatic bias.
—THAT the reason for the above statement is that as the anode current varies, so does the bias.
—THAT certain American stations are now using a power of 500 kW for transmission.
—THAT these stations are audible in England on quite modest receivers, under favourable conditions.
—THAT a three-valve super-heterodyne receiver is now a possibility, and has, in fact, appeared on the market.
—THAT a connection to earth often improves the performance of a portable receiver.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE CROYDON RADIO SOCIETY

The diode and its descendants were discussed in a lantern lecture on Tuesday, March 6th, in St. Peter's Hall, S. Croydon. The lecturer was Mr. E. N. Shaw, of the Marconiphone Co., Ltd., and he recalled the diode of 1904 with its descendants drawn as a family tree. The triode developed easily enough with a grid between the diode's anode and cathode, and, indeed, as the years passed, grids flocked in thick and fast.

Slides showed many of the valves under discussion, those on the "Catkin" range being very clear in explaining why these valves scored regarding rigidity in electrode assembly.

Hon. Secretary: E. L. Cumbers, Maycroft, Campden Road, S. Croydon.

THE ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

A television demonstration provided an interesting and entertaining attraction at the last meeting of the Uxbridge District Branch of the Anglo-American Radio and Television Society. That men are not the only individuals interested in this science was clearly demonstrated, as many of the fair sex were present. The television set employed was of the scanning-disc type.

The Uxbridge District Branch intends to hold television demonstrations more or less regularly, and full particulars may be obtained from Mr. Leslie W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge, by enclosing a stamped addressed envelope.

A new branch of the above Society is to be formed at Heckington. Full particulars can be obtained from the Hon. Secretary, J. N. Richards, The Vicarage, Heckington, Lincs.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER CHAPTER)

The fifth meeting of the above Chapter was held at 75, Long Street, Middleton, on March 6th, at 8 p.m. After discussion it was decided that all future meetings of the Chapter should be held at the "Clarion Cafe" in the centre of Manchester. On March 10th members visited Rochdale Fire Station for an inspection, etc., of the wireless transmitting gear which is installed, and is the only one of its kind in the North of England. Arrangements are being made for members to visit "Barton Airport" in the near future. It was found, according to members' reports, that conditions during February were very bad for DX on the 25-metre band. Members are asked to listen for the following six stations and report on their reception at the next meeting—VE9JR, VUC, VK2ME, HJ1ABB, W3XAL (16.87 m.) and W8XK (25.27 m.).

Further particulars can be obtained from the Secretary, Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

SMETHWICK WIRELESS SOCIETY

Mr. F. Inchley, of the General Electric Co., Ltd., gave a lecture on the Osram gas-filled relay at the meeting of the above society, held on March 2nd at the clubroom of the New Talbot Inn. After briefly reviewing the development of the valve rectifier, he described the construction and special properties of the mercury vapour rectifier, which, with the addition of a control grid, constituted the gas-filled relay. Mr. Inchley performed an interesting series of experiments showing the various applications of the relay with and without photo-electric cells. One spectacular experiment was the conversion of D.C. to A.C., which was stepped up to operate a 4,000 volt mercury vapour tube.—Hon. Sec., Mr. E. Fisher, 33, Freeth St., Oldbury, near Birmingham.

THORNTON HEATH RADIO SOCIETY

A meeting of this society was held at St. Paul's Hall, Norfolk Road, on Tuesday, the 6th instant. Mr. Frank Whitfield presided. The evening was devoted to re-calibrating the society's oscillator, which became necessary owing to the recent change in wavelengths. Two graphs were prepared, one in kilocycles and the other in metres. The oscillator was constructed by Mr. S. J. Meares, and the receiver used was a three-valve all-mains set constructed by Mr. O. L. Crossley.

Full particulars of future meetings can be obtained from the Hon. Secretary, Mr. Jas. T. Webber, 368, Brigstock Road, Thornton Heath.

SLADE RADIO

"Westectors, etc.," was the title of a lantern lecture given by Mr. S. A. Stevens, B.Sc., of the Westinghouse Brake and Saxby Signal Co. Ltd., at a meeting held last week. He dealt with carrier waves and modulation; detection; superhets; A.V.C.; battery economy circuit; and distortion correction. A short demonstration followed of an A.C. superhet of Westinghouse design.—Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

HACKNEY RADIO AND PHYSICAL SOCIETY

At the last meeting of this Society, Mr. L. E. Cole continued his talks on "Simple Experiments" and described what band pass really meant; how very efficient band-pass coils could be made; the effect of too flat a top to the tuning graph and "double humping." Full details of the activities of the Society will gladly be sent to all local readers of PRACTICAL WIRELESS who care to write to the Secretary.—A. F. Rogerson, 19, Sewdley Street, Clapton, E.5.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

It was members' own night at the London Chapter meeting held at the R.A.C.S. Hall, Wandsworth Road, S.W.8, on Friday, 2nd March. A most interesting feature was a census taken of members' short-wave receivers. It was found that the type of receiver most generally used was the detector and 1 LF stage. Meetings of this nature give a splendid opportunity for members to exchange their views and ideas.—A. E. Bear, Sec., 10, St. Mary's Place, Rotherhithe, London, S.E.16.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

MULLARD H.F. PENTODES

CONSTRUCTORS contemplating the use of screened H.F. pentodes in their next receiver should obtain a copy of a new Mullard leaflet dealing with these valves, which was recently issued by the Mullard Wireless Service Company, 111, Charing Cross Road, London, W.C.2. The special properties of the screened pentode are fully described, and are followed by full operating data and characteristics, with curves of the two Mullard types—V.P.4 and S.P.4—and practical operating hints for using these valves in modern circuits.

SMITH'S "ANODEX" DRY BATTERIES

THE makers of the well-known "Anodex" H.T. batteries have recently issued an attractive folder giving particulars of a new range of dry cells for various purposes other than radio. Included in the list are cells for telephones, electric bells, torches, hand-lamps, cycle lamps and medical instruments. A notable feature of this new series of dry cells is the reduction of self-discharge, or "local-action," by the use of electrically welded zincs of maximum thickness, which are specially tested for purity. A copy of the folder can be obtained on application to S. Smith & Sons (Motor Accessories), Ltd., Cricklewood Works, London, N.W.2.

DARIO VALVES

TABLES of the characteristics of the complete range of Dario valves, together with a price list, are given in a folder we have received from Impex Electrical Ltd. Included in the range are 2-volt battery valves; directly—and indirectly—heated A.C. mains valves; and half and full wave rectifiers. Copies of the folder can be obtained from the above-mentioned firm at 47, Victoria Street, Westminster, London, S.W.1.

FULLER BATTERIES

FOR upwards of sixty years the name of Fuller has been associated with battery construction, coupled with the highest possible quality of materials. This reputation is fully maintained in the range of accumulators and dry batteries shown in this firm's latest price list. Accumulators suitable for multi-valve receivers, or for lighting and ignition purposes, are obtainable in glass, celluloid, or ebonite cases. There is a reduction in price of the "Triple" range of H.T. Batteries, and the standard plate type of L.T. accumulators in glass boxes. Included in the list are details of a new 4½-volt grid-bias battery, type F50, which has been produced to meet the growing demand for a battery of this capacity. Copies of this useful list can be obtained from Fuller Accumulator Company, Ltd., Woodland Works, Chadwell Heath, Essex.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications to receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us should bear the name and address of the sender.

ONE-METRE TRANSMISSION

"I have built up a one-metre receiver, but have so far been unsuccessful in receiving anything on it. I have adhered very carefully to theoretical details and am sure that the set is sound. The inductance is of copper tube, and low-loss has been the keynote of my design. Can you tell me whether there are any transmissions to be heard on the range, or am I unlucky in the design?"—B. F. G. (Bromley).

It is quite probable that your design is wrong, although you give no details. You must remember, however, that wavelengths as low as those mentioned are very strictly directional, and, furthermore, we do not know of any regular transmission on that band. Amateurs may be experimenting in this direction, and some of the big commercial companies are also carrying out experimental work, but there is no regular programme material available so far as we are aware.

TRANSFORMER DETAILS WANTED

"I am desirous of winding a filament transformer stepping down one winding, giving 3 volts at 1 amp. and another winding giving 2 volts at ½ amp. Could you please give me details as to number of turns both primary and secondary, and the gauge. Mains voltage is 230 volts 50 cycles."—F. M. (Doncaster).

We would advise a core of 6 dozen No. 5 Stalloy stampings, with a primary winding of 3,450 turns of 36 enamel-covered wire, and secondaries of 120 turns of 21 or 20-gauge and 30 turns of 24-gauge enamel-covered wire.

BLUE PRINT WANTED

"I should very much appreciate it if you could suggest a suitable circuit to build with a list of components as suggested overleaf. If you have a blue print or drawing that would suffice I should be much obliged."—R. A. J. N. (Winchmore Hill).

We regret that we have no blue prints of a circuit to utilize the parts you mention. We would suggest that you obtain a copy of "Make Your Own Wireless Set," published by this House at 6d. This book is obtainable at any bookstall, and you will find a circuit or two in there which will enable you to use up your components.

PARTS OF MIRRORVISOR.

"Regarding the Mirrorvisor, I would like to know if it is possible to obtain from you by purchase a full set of component parts, including the parts that one may make up at home. Also a full-size blue print with details, instructions for making it up, and the total cost."—S. R. H. (Nottingham).

We do not supply parts for any receivers or apparatus which is described in our pages. Readers who live out of London will probably find it most convenient to communicate with one of the advertisers in our pages who make a business of supplying complete kits of components, or alternatively may communicate direct with the makers of the individual parts. Expense is obviously saved by communicating with one firm. We regret that we have no blue print of the Mirrorvisor.

REACTION IMPROVEMENT.

"I have constructed the A.C. Fury Four Super, and apart from using a three-gang condenser, the only other difference in the published specification is that I have omitted the resistance R.10 of 500 ohms. This is my difficulty. Above the Midland Regional the set won't go into oscillation. I have tried a .0005 mfd. reaction condenser without avail. The H.F. choke is above reproach and the valve is O.K. Should I have wired the R.10 resistance in series with the reaction condenser?"—A. F. (Sheffield 8).

We certainly would advise you to put in the resistance. This is essential in the interests of stability and good smooth reaction control. If it had not been necessary we certainly should not have included it in the original design. We think you will find that when inserted as shown in the circuit, reaction will be perfectly normal over the whole range.

QUESTIONS NOT TO ASK

"You guarantee your receivers, but I have built one and do not think much of it. Will you call here or send one of your experts any evening to hear the set on my aerial, and I think you will agree it is not doing very much."

Whilst we certainly do guarantee our receivers, we think the majority of our readers will appreciate the fact that it is not possible to call upon them in order to examine the performance of a receiver. Where it fails to give satisfaction we are ready to suggest causes of trouble, etc., in the course of our Free Enquiry Bureau, and if results cannot, after two or three letters, be satisfactorily obtained we will examine the receiver in our own laboratory. As we have previously pointed out, however, this can only be done where the receiver is built exactly to specification and where correspondence has failed to enable the builder to obtain satisfactory results.

METALLIZED OR METAL?

"I have a commercial receiver which is built on a metal chassis and which is not satisfactory for me. I wish to change it to your Leader Three, but would like to use the metal chassis. Will this do in place of the metallized wooden one which you used?"—H. J. M. (Bolton, Lancs.).

There is no objection to using the metal in place of the wood, provided you make quite certain that no short circuits are introduced owing to the fact that the under side of the chassis is also of metal. In the metallized wooden chassis the under side is wood, and is thus insulated from the upper surface.

WRONG PICK-UP CONNECTIONS.

"I am using a well-known pick-up connected to a three-valve electric set. One pick-up lead is connected to the grid of the detector valve and the other lead is joined through a resistance and condenser to the cathode of the same valve. I have tried many values of resistance and condenser, and also biased the valve with a 1½-volt battery, but cannot get much tone out of the gramophone part of the set. The radio side is very good. Can you suggest anything? The volume control is on the pick-up."—P. P. (Wigan).

Your method of connecting is incorrect. The resistance and condenser (in parallel) should be joined in the cathode lead. That is, the connection at present existing between cathode and earth should be removed, and the resistance should be used to complete the connection. The pick-up is then joined on one side to the grid and on the other direct to earth, not to the cathode. If the grid leak is at present joined across the grid condenser, it should be removed and connected between the grid and the cathode. You will find these connections clearly indicated in the December 2nd number of PRACTICAL WIRELESS, page 605.

AN ARGUMENT SETTLED.

"I should like you to settle this little argument for us: I said to a friend that a speaker to be properly in working order should click when adjusted (double or single cone), and he said it is only cheap units that click, because they are not leaded, or something to that effect. I should also like you to solve this problem. Some nights my set is all right, but on others the programme fades right away until I pull out plug H.T.2 and then put it back again. The signals at once come back at proper strength. Is this a faulty detector valve?—P. H. (Manningtree).

The majority of balanced armature or ordinary cone-type loud-speakers certainly click when the adjustment is made so that the reed is attracted to the magnet. When the tension is removed the reed usually flies away when the springiness overcomes the magnetic attraction, and this gives rise to a noise usually referred to as a "plonk." There are, however, one or two units still on the market where a small rubber cushion is fitted to prevent the noise which might, on heavy volume, give rise to chatter. The trouble with your set is probably due to a defective grid circuit (not the detector) which chokes until the H.T. is removed. The grid charge then leaks away, and the replacement of the H.T. lead permits signals to be again obtained. It is probably on the L.F. side that you will have to look for the trouble.

FREE ADVICE BUREAU COUPON

This coupon is available until March 31st, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 24/3/34.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word prepaid — minimum charge 3/- per paragraph—and must reach this office not later than Tuesday for the following week's issue. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8 Southampton Street, Strand, London.

PREMIER SUPPLY STORES

offer the following Set Manufacturers' Surplus New Goods at a fraction of the original cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

PREMIER SUPPLY STORES announce the purchase of the entire stock of a world-famous Continental valve manufacturer. All the following types of standard mains valves at 4/6 each. H. HL. L. Power. Directly heated 6-watt Pentode. Directly-heated 9-watt Pentode. High magnification Screen-grid, low magnification Screen-grid. Variable-Mu Screen-grid. 250 volt 60 milliamp. full-wave rectifiers.

THE following types 5/6 each. Indirectly-heated Pentode. 350 volt 120 milliamp. full-wave Rectifier. 500 v. 120 ditto, 6/6. Dario Factory Valves 4v. filament. Set of 3, consisting of Screen-Grid, Detector and Power or Super-Power, 6/6 the lot. Power or Super-Power, 2/6.

ELIMINATOR Kits, including Transformer, choke, Westinghouse metal rectifier, Dubilier condensers, resistances and diagram, 120v. 20 m.a., 20/-; trickle charger 8/- extra; 150v. 30 milliamps., with 4v. 2-4 amps. C.T. L.T., 25/-, trickle charger 6/6 extra; 250v. 60 milliamps., with 4v., 3-5 amps. C.T. L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps. C.T. L.T., 37/6; 150 volts 50 milliamps., 27/6.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Premier chokes, 25 milliamps. 20 henries, 2/9; 40 milliamps. 25 hys., 4/-; 65 milliamps. 30 hys., 5/6; 150 milliamps. 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6.

HARLEY Pick-up, complete with arm and volume control, 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms., 3/6.

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 ma., 0-1, 0-5 amps.; all at 6/-.

SPECIAL offer of Mains Transformers, manufactured by Philips, input 100-120v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amp., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v. 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8. Transformers, 250v. 60 m.a., rectified with 4v. 3-5a. and 4v. 1a. C.T. L.T., screen primary, 15/-; with Westinghouse rectifier, 25/-.

4V. 3a. C.T., 6v. 2a. C.T., 9v. 1a., 12v. 1a., 7/6 each; 4v. 3-5a., 22v. 1a., 8/6 each; 10v. 3a., 14v. 4a., 10/- each.

PREMIER H.T.9 Transformer, 300 v. 60 m.a., with 4v. 3-5a and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. and 4v. 1a. C.T., L.T. and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER Mains Transformers, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; Westinghouse rectifier for above, giving 200v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.); with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400v. 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-.

PREMIER Auto Transformers, 100-100/200-250v., or vice versa, 100-watt, 10/-.

MULTI Radio Output Transformers, 4/6. Twin Screened Wire 3d. per yard.

CENTRALAB Potentiometers, 50,000, 250,000 half meg., any value, 2/-; 200 and 400 ohms, 1/-.

RELIABLE, Canned Coils with Circuit, accurately matched dual range, 3/- per coil. Please state whether Aerial or H.F. required. Ditto iron core, 3/6.

PREMIER L.T. Supply Units, consisting of Premier Transformer and Westinghouse rectifier, input 200-250v. A.C., output, 2v. ½amp., 11/-; 8v. ½amp., 14/6; 8v. 1 amp., 17/6; 15v., 1 amp., 19/-; 6v., 2 amp., 27/6; 30v. 1 amp., 37/6.

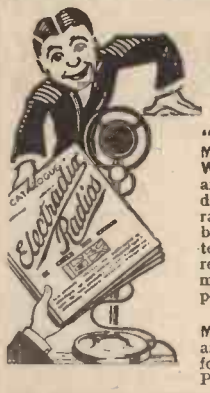
MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6; all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in cone, 18/6.

CRAMPIAN M.C. Loud-speakers, 2,500 ohm. field, 9in. cone, handles 5 watts; 21/-.

CRAMPIAN P.M. Loud-speakers, 9in. cone, handles 4 watts; 18/6.

(Continued at top of column three)

YOU CAN TAKE IT FROM ME!



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The BATTERY SUPERSEDER makes H.T. from your L.T. 2-volt battery, rectified and smoothed. Gives 3 tappings and lasts indefinitely. A boon to those who are not on the mains. **Reduced from £3/15/-. New and Guaranteed 37/6.**

No. "N.W." 11 **10/6**

SEE TEST REPORT ON PAGE 1179.

PARCELS of useful oddments for the Experimenter who wants **Coils, Magnets, Wire, Chokes, Condensers, Switches, etc., mostly ex-W.D. parts.** Worth a lot more. 10lb. 7s., or 7lb. 5s., post free. *British Isles only.*

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(Continued from foot of column one)

WESTERN ELECTRIC Condensers, 250v. working, 2 mfd., 1/-; 2 mfd. 400v., 1/6.

B.T.H. Truespeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v.; 30/-, complete. Type YH 100/250v. A.C. or D.C., 42/-

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 10,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

POLAR 3-Gang STAR, .0005, manufacturers type. Fully screened, 7/6, with trimmers, 1/6 extra.

CYLDON Capacitors (Double Trimmer), 1/-. Utility .0005 2-gang Bakelite Condensers, concentric Uniknob Trimming and Disc Drive, complete, 3/6.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job, 15/-.

AMPLION Cone Loud-speaker Units, 1/9, complete with 12in. cone and chassis, 3/11 each. Worth treble. Larger Unit with 12in. chassis, 5/9.

ORMOND Condensers, 0.0005 2-gang, semi-shielded, 2/6; brass vanes, with trimmers, 3/6.

WIRE Wound Potentiometers, 15,000 ohms, 1/6; 50,000 ohms, 2/-; 500,000 ohms, 3/6.

HOME Radio Microphone, complete, 5/-; simply plug in to pick-up terminals.

A LARGE Selection of Pedestals, table, and radio-gram cabinets, by best manufacturers, at a fraction of original cost for callers.

WESTERN ELECTRIC Mains Transformers, 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a. C.T., 4v. 1a. C.T., 19/6.

RELIABLE Intervalve Transformers 3-1 or 5-1, 2/-. Dubilier, .05 mica, 1/9.

T.C.C. Condensers, 250v. working; 2 mfd., 1/9; 1,000 ohm, 150 m.a., variable, 2/-.

T.C.C. Electrolytic Condensers, 440 volts working, 4 mf. or 8 mf., 3/-; 15 mf., 50 v. working, and 50 mf. 12v. working, 1/-; 25 mf. 25v. working, 1/3.

T.C.C. Block Condensers, 250v. working, 2 x 2 x 2 x 0.1, 2/-; 2 x 2 x 2 x 1, 2/3; the above condensers at same price by Dubilier 300v. working.

H.M.V. Block Condensers, 400v. working; 4 x 4 x 1 x 1 x 1 x 0.1 x 0.1, x 0.1 6/-; 4 x 2 x 1 x 1 x 0.5, 4/6.

DUBILIER Condensers, 2 mf. 1,200v. working, 4/-; 8 mfd. dry electrolytic, 450v. working, 3/-.

THE Following Lines 6d. each or 5/- per dozen.—Chassis valve holders, 5, 6 or 7 Pin, screened screen-grid leads, any value 1-watt wire end resistances, wire end condensers, 0.0001 to 0.1, R.I. .0005 varicaps, trimming condensers, T.C.C. 6 mfd. 50v. electrolytics.

PLEASE mention PRACTICAL WIRELESS when ordering.

PREMIER SUPPLY STORES

20-22, High Street, Clapham, S.W.4, MACaulay 2188. Close 1 o'clock Wednesdays; open to 9 o'clock Saturdays. Nearest Station, Clapham North Underground.

THE following unused set manufacturer's surplus for disposal, all goods guaranteed perfect; Magnavox 152 (9in. cone, 24/-). Magnavox 154 (7in. cone), 16/3, with 6,500 or 2,500 ohm field, power or pentode transformers. Magnavox 254 P.M., 18/6. Dubilier electrolytic condensers, 8 mfd, 500v., 50v., 50 mfd., 4 mfd., 500v., 3/9. Dubilier or Erie resistors, 1 watt type, 7d. B.T.H. pick-up tone arms, 3/-. "Clydesdale" mains units, 25ma output, D.C. type 12/6, A.C. type 25/-. All types of brand new American valves in stock, first-class makes: 201A, 226, 227, 112A, 45, 30, 280, 8/-; 224, 235, 551, 57, 58, 59, 75, 77, 78, 89, 247, P.Z., 38, 36, 44, 2A6, 2A7, 6A7, 37, 46, 32, 82, 83, 12/-; UX250, UX281, UX210, 17/6. WESTINGHOUSE rectifiers: H.T.8, 10/-, H.T.9, H.T.10, 11/-. Regentone transformers for H.T.8 or H.T.9, with 4 amp. L.T., 7/6. Hot-wire meters, 0-500ma, 5/6; Radiopaks, superhet or 2-H.F. type, 37/6; Radiophone I.F. transformers, 6/6; Marconi K.19 pick-ups, 23/6; carriage paid, cash with order or C.O.D., immediate delivery; send for list.—Ward, 2nd Floor, 45, Farringdon Street, London, E.C.4.

GRAMOPHONES. Radiograms, 64 page. How to make 'm, 3d. Motors, Arms, Pick-Ups, Speakers, Horns, Springs, Repairs, Accordions.—Regentprac, 120, Old Street, London, E.C.1.

RADIO Agencies offer Brand New Boxed Set Manufacturers Surplus. Carriage Paid. Cash with order or C.O.D. Moving Coil Speakers, in following voltages. All incorporate Humbuckers. State if for Power or Pentode. 2000, 2500, or 6500 ohms F.6s listed. 35/- at 18/-; F.7s listed 47/6 at 25/-; Permanent Magnets F.6.P.M. listed 49/6; F.7. P.M. listed £3 at 33/-; if for Class "B" add 2/- to above prices. Radio Agencies, 4/21, Upper Marylebone Street, London, W.1.

ERICSSON 3/1 L.F. Transformers. List Price, 17/6. New and guaranteed. Our price, 2/3 post free U.K.—Pioneer Radio, Coptic Street, London, W.C.1.

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SOUTHERN RADIO'S Bargains.—Set manufacturer's guaranteed surplus.

VARIABLE Condensers.—Lotus 3-gang 0.0005,12/6; Lotus 2-gang, 0.0005, 8/6; Lotus Dyblock single, 0.0005, 4/9 (list 9/6); all these condensers are complete with dials, escutcheons, knobs, fully screened with trimmers, and boxed; Igranic variable, 0.0003 and 0.0005, 2/3; Hydra block condenser, 16 mfd. (2+2+8+2+1+1), 1,000 v. D.C. 7/- each; 20 mfd. (2+2+2+2+2+2+2+1+1+1+1), 1,500 v. D.C., with terminals, 11/6; Dubilier 4 mfd. (2+1+1), 1,000 v. D.C., 2/9; 4.5 mfd. (2.25+2.25), 3/-; fixed 4 mfd., 2/3; 2 mfd., 1/6; 1 mfd., 1/-.

SPEAKERS.—Blue Spot permanent magnet, with Universal transformer for power, pentode, super power or class B, 23/- (list 39/6); D.C. mains-energised, all voltages, 16/6; Celestion Soundex P.P.M. permanent magnet, 17/6 (list 27/6); Blue Spot 100U inductor, complete with chassis, 13/6 (list 39/6); Celestion permanent magnet type P.P.M.W. universal transformer, 25/- (list 49/6).

BLUE Spot, 66K, complete in cabinet, 16/- (list 42/6); G.E.C. Stork, in magnificent cabinet, 19/6 (list £3/15); all speakers new in original cartons.

PICK-UPS.—Blue Spot, model "88," with volume control, 26/- (list 63/-); Marconi No. 19 (1934), 26/- (list 32/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor "A" 3-valve screened grid kits, with cabinet and moving coil speaker, less valves, £3/7/6; with valves, £4/10 (list £8/7/6); Ready Radio S.T.400 kits, all specified components, by Scott Taggart, £2/19/6 (list £4/17/6).

FRAME Aerials.—Lewcos dual wave 235-550 metres and 1,000-2,000 metres, 9/- each (list 27/6).

IGRANIPAK complete tuning unit, comprising (1) Completely screened coils with built-in wavechange switch; (2) Igranic 3-gang Condenser with cover; (3) Escutcheon and Disc Drive Assembly with pilot lamp attachment; (4) Mains Switch; (5) Three 5-pin Valve holders; (6) Grid Leak and Condenser; (7) Engraved Terminal Board. Complete with circuit. List price 57/6. 27/-.

MISCELLANEOUS.—Ferrocart coils, G.1, G.2, G.3, with switch, 31/9 (list 39/6); Ready Radio Instamat Universal transformers, for matching any value of speaker, 11/6 (list 37/6); Rotorohm and Radiophone volume controls, all values, 3/- each; with switch 3/3 (list 10/6); S.T.500 coils, 5/6 per pair; Hellesen's 8 mfd. electrolytic condensers, 2/9 each; Westinghouse metal rectifiers, H.T. 6, 7, 8, 9/3 each; Amplion loud-speaker units, 2/3; Ferranti choke, 20 henry 60 m a., 6/9 each; Kolster Brandes gramophone motors, dual, for A.C. or clockwork, complete with turntable and all accessories, 110-250 volts, 25/- each (list 63/-); Ready Radio L.F. transformers, 5-1, 3-1, 3/3 (list 8/6); B.T.H. transformers, 3/6; Lewcos superhet 8-way bases, complete with valve-holders, grid leak, fixed condenser, type "48," 2/- each.

SPECIAL Bargain Offer of Lewcos Spaghetti Resistances. All sizes in original sealed boxes, 4/- per dozen. Assorted. Special Price to the trade, 36/- per gross.

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MAINS Transformers and Chokes.—Please send for complete list; specials can be supplied within 3 days of order.

ALL Transformers and Chokes Guaranteed for 12 months.

ALL Goods Guaranteed and Sent Carriage Paid.

BRANCHES at 271-275, High Rd., Willesden Green, N.W.10 and at 46, Lisle St., W.C.2; please send all post orders to 323, Euston Rd., N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

WOBURN RADIO offer special purchase of T.C.C. Condensers.

T.C.C.—250v. working—0.01, 7d.; 0.1, 7d.; 1 mfd., 11d.; 2 mfd., 1/2; 1 x 1 x 1 mfd., 1/6; 1 x 1 mfd., 1/2; 0.01 x 0.01, 500v. working, 1/-; T.C.C. Electrolytics 50 mfd., 12v., 1/3 (dry); 4 mfd. and 8 mfd., 3/6 (wet); Dubilier dry electrolytics, 4 mfd. and 8 mfd., 500v., 3/6. All in metal cases. Wego condensers, 750v. test, in bakelite 1 mfd., 1/-; 2 mfd., 1/3; 4 mfd. 2/3. Ready Radio and Lotus Diffs., 0003, 00035, 00015, 1/-. 0005 reaction, 1/-.

WESTINGHOUSE Rectifiers (new): H.T. 7, 8, 9, 9/-; H.T. 10, 10/-; L.T. 5, 10/6. 10hy. 100ma. Chokes, 4/- each.

CLASS "B" Drivers and Chokes, 9/6 per pair, with suitable valve (BVA) and 7-pin holder, 19/11; Binocular Chokes, 1/3; H.F. Chokes, 1/-; Valveholders, 4/5-pin chassis type, 1/6 half doz.; 7-pin, 6d. Columbia L.F. Transformers, 3/1 ratio, 3/-. Tubular Condensers 0.01, 0.1 and 0.05, 6d. Large Stock of Erie and Dubilier Resistances. Lucerne Dual Range iron-cored coils, 3/6.

SINCLAIR P.M. Speakers with universal transformer, or Class B 7in. Cone, 12 months' guarantee, 16/6. Sinclair Matched pairs, one 9in. one 7in. P.M.'s or Energised, 35/- (carr. 1/-).

ANYTHING on H.P. above 40/-. Quotations for Kits and Components by return. Trade Enquiries invited.

WOBURN RADIO CO., 7, Woburn Buildings, W.C.1. Euston 1571. (Near King's X and Euston Stns. Back of St. Pancras Church.)

BIRMINGHAM RADOMART'S Manufacturers' Surplus Stocks. Post free over 6/-, otherwise 6d. All goods new and perfect.

RADIOMART—Utility W312B screened 2-gang bakelite condensers with disc drive and concentric Uniknob trimming, 3/6; these must be seen to be appreciated.

RADIOMART—Utility 40mmfd. ballbearing short-wave microvariables, lowloss, 1/9. Mains snap switches, 9d.

RADIOMART—Utility 1934 bakelite tuning and reaction condensers, 0.0005, 10d.; 0.0003, 8d. Ditto .0003 Diffs., 1/6.

RADIOMART—Radiophone straight line illuminated dials; Note complete escutcheon, knob, wavelength or degree, 3/6.

RADIOMART—Illuminated Readrite visual tuning meters 10ma., finest made, 5/11; as fitted Majestic.

RADIOMART—Ormond super lowloss variables, fitted high reduction dials 0.00025, ideal short-wave, 2/6.

RADIOMART—Ormond airspaced small 0.0003 log; the ideal reaction condenser, boxed, 1/6.

RADIOMART—Igranicore 1934, super, 12/6; ironcore dual-range short-wave inductance coils, 4/9.

RADIOMART—Igranic 400 ohm. porcelain potentiometers, 6d.; Igranic special short-wave H.F. chokes, 1/-.

RADIOMART—Complete set 4 latest Igranic short-wave inductance coils, 15-130 metres, 4/-.

RADIOMART—Igranic boxed nickelcore 3-1 transformers, list 10/6, 3/11; ditto, parallel feed, 2/11. Formo 2mfd. 400v. wkg., with terminals, 1/8.

RADIOMART—Philco heavy duty Class "B" 1—1 driver transformer, boxed 2/9; valveholder baseboard, 9d.

RADIOMART—H.M.V. super 3-gang nonslip wavelength dial, trimmers; last few offered, 9/-.

RADIOMART—British Radiophone, 7/6; wirewound logarithmic potentiometers with mains switch, 5,000, 10,000; ditto heavy duty no switch; each type, 2/-.

RADIOMART—Screened Dualrange ironcore coils with instructions, 2/11. 3-pole Doublethrow low-capacity switches, 6d.

RADIOMART—Super section wound screened primary H.T.8 transformer with 4v4ampsCT., 4v1aCT, 10/6; with Westinghouse rectifier, 18/6.

RADIOMART—Wearite 300-300 4v3aCT., 4v2aCT., a quality job, 10/6; Philips 200-200, 4v3a, 4v1a, 4/6.

RADIOMART—Magnum radio to gram dissolvers as used De Luxe RGD, 2/9. TCC 0.2mfd., and 0.25mfd., 7½d.

RADIOMART—Lotus 3½-1 pushpull intervalve manufacturing tag connections, 2/-; ditto plug and jack, 1/-.

RADIOMART—TCC 0.1 x 0.1mfd., 450v.wkg. noninductive, ideal for curing modulation hum or H.F. decoupling, 1/-.

RADIOMART—Non-inductive tubulars 1,500v. test 0.1mfd. and 0.01mfd. wire ended, 6d.

RADIOMART—Western Electric sensitive microphone insets, 1/-. Special short-wave all-brass 0.0001 variables, 1/9.

RADIOMART—Met-Vick 35/- super transformers 250-250, 4v2a, 4v. up to 5a, fitted terminals, 9/6 100v. or 230v., 25 cycles, 12/6.

RADIOMART—Colvern 5-watt wirewound potentiometers, 2,500, 15,000, 1/6. Packet 15 assorted 1-watt wire-ended resistances, 3/-.

RADIOMART—Boxed Collaro £4 4s., Uniplate induction Gramunit with pick-up, autostop volume control, 59/6.

RADIOMART—Gramophone autostops (switches off when record finished), fit any motor, 1/-.

RADIOMART—Exide 30/- boxed Tempex bakelite clocks synchronous A.C., 17/6; ditto, 45/-; battery (runs 3 years for 1/-), 20/-, fully guaranteed.

RADIOMART—Famous Ward-Leonard and Zenith 100 watts transmitting grid-leaks, 5,000, 10,000, 15,000, bleeders 50,000, 50ma., 4/6.

RADIOMART—TCC 4 x 4mfd. 1,700v. working transmitting condensers massive stand-off terminals, 25/-; cost £9; brand new.

RADIOMART—Transmitters wanting 866's Mercury Rectifier 3,500v., 600ma., newly imported, 25/-; write G5NI. Most Americans stocked.

RADIOMART'S March List now ready. Largest and most comprehensive published, stamp essential.

RADIOMART—Guarantees Prompt Despatch, Perfect Goods, No Misrepresentation.—The Square Dealers, 19, John Bright Street, Birmingham.

REPAIRS—REWINDING—OVERHAULS. New cones and centres fitted any make M/c chassis, M/c's rewound. Mains transformers, etc. Receivers converted D.C. to A.C. Write Repair Dept. C. WEEDON P.L.R. Co., 80, Lonsdale Avenue, London, E.6. (Grangewood 1837.)

LOUDSPEAKERS, TRANSFORMERS, HEADPHONES, any make Re-wound, 3s. 6d. Mains Transformers, Eliminators, and Chokes quoted for—48 Hours' Service, Years Guarantee.—Breeze, Clapper House, Marden, Kent.

TELEVISION DISC KIT 50/-. Illustrated Constructors' Handbook 1/-. "P.W." Specifications Listed. Bennett Television, 50a, Station Road, Redhill.

RAD-AUTO-GRAM buy Modern Second-Hand Components for Cash.—39, Tulketh St., Southport.

ADVERTISEMENT INDEX

P.W. Gift Stamp No. 12

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* P.W. TOOL-KIT GIFT STAMP No. 4

See page 1

ALL ABOUT CAR RADIO

Practical Wireless

3D

AND PRACTICAL TELEVISION

EDITED BY F.J.CAMM

Published every Wednesday by
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Vol. 4.——No. 80.
March 31st, 1934.
Registered at the G.P.O. as a Newspaper.

CAR RADIO "IFS"!—See page 35

ROUND *the* WORLD *of* WIRELESS

Leading the Way with Our Leader

WHEN we took the bold step of announcing our new policy of designing PRACTICAL WIRELESS receivers on a competitive price basis, we anticipated that our many thousands of readers, who have loyally supported our clean-cut policy in the past, would welcome this new effort on our part; and we have been overwhelmed with letters of congratulation. It occurred to us that the time was ripe to produce a series of designs which, whilst cheap to make, were also efficient, selective, and sensitive. Hence the "Leader" Series of designs, of which the Leader Three and the A.C. Leader Three are the first. Other circuit arrangements in the Leader series will follow, and we welcome letters from our readers as to the circuit arrangements they prefer. This will enable us to gauge popular demand. As one reader aptly put it, "The Leader will start the radio game of 'Follow the Leader'!"

Telsen Changes

WE are informed that Mr. W. Henderson-Cleland, Chairman of Smiths Motor Accessories, Ltd., will be the new chairman of the Telsen Company, in succession to Mr. J. W. Murray, who remains on the board. Mr. A. W. Macnamara is leaving the company. Many new lines are to be introduced, the production of which we await with interest.

Sponsored Concerts in Italy

AS from March 26th, each Monday between G.M.T. 9 and 10 p.m., and also continuing during the months of April and May, the Italian stations will broadcast special concerts under the title: Standard Hour. As in previous years, it is stated that the expenses of these broadcasts will be defrayed by a well-known American petroleum concern.

London as Radio Telephone Centre

BY lifting the receiver of his private telephone a British subscriber can now communicate with the United States, Canada, South America, Australia, New Zealand, South Africa, and India; it is expected that Japan will be included in the network this year. Roughly, there are some thirty-four million telephone subscribers in the world, and of these some thirty-two million are within reach of any subscriber in the British Isles.

Numbered Seats for Instrumentalists

AT the Lille PTT (France) studio the floor is covered with canvas bearing numbered squares. Each musician, according to the instrument played, is allotted his exact position in respect to the microphone, after tests have been made. In this manner when the actual concert takes place the instruments are in their most favourable places. Pending the construction of the high-power station at Camphin, the present 2-kilowatt plant is to be temporarily replaced by a 15/20-kilowatt transmitter.

Spain's Collection of 100-Watters

PENDING the re-organisation of the entire system the authorities have issued licences to fifty-two small transmitters scattered over the country. As the majority of them do not exceed 125 watts in power, they are permitted to work on two channels, namely, 200 and 201.1 metres. The older and more powerful stations now operating include: Barcelona (EAJ1) 377.4 m.; Madrid (EAJ2) and Seville (EAJ5) on 410.4 m.; Valencia (EAJ3) 352.9 m.; Madrid (EAJ7) 274 m.; San Sebastian (EAJ8) 238.5 m.; and Oviedo (EAJ19) on 293.5 m. If the Regional Scheme is adopted, 20 to 30 kilowatt stations will be erected at Seville, Corunna, Valencia, Spanish Morocco, Madrid, Barcelona, and San Sebastian, with one high-power transmitter (100 kilowatts or more) to broadcast a National programme from the Spanish capital.

Swiss Stations to Increase Power

IN order to bring the Swiss transmitters on a level with neighbouring stations, work is to be started on alterations to the plant without delay. In the course of the summer it is hoped to boost the power of Beromünster and Sottens to respectively 100 and 50 kilowatts.

New Jugo-Slavian Relay

TO serve the north-western portion of the country, the Jugo-Slavian authorities will shortly erect a medium-wave broadcasting station at Maribor (in pre-war maps: *Marburg*), close to the Austrian border. It will take its programme alternately from Ljubljana and Belgrade.

Germany's High-power Regionals

AS the new Berlin and Hamburg 100-kilowatt stations have now been successfully launched on the ether, the *Reichsfunk* will increase shortly the power of all Regional transmitters to an equal output, the only exception being that of Frankfurt-on-Main, which is to remain on 17 kilowatts.

Poste Parisien's Interval Signals

OF the numerous French stations, *Poste Parisien* is the one making the most use of opening, interval, and closing signals. At G.M.T. 7.10 a.m. the studio opens with a fanfare of trumpets; at midday and at the start of the main evening programme a military march, *Entre Sambre et Meuse*, is played. At G.M.T. 18.45 and at 22.30 the last item of the programme is also followed by a fanfare and the final sounds heard are the strains of the *Marseillaise*. During the broadcasts one stroke on a gong indicates a short interval on the programme.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

Torquay Municipal Orchestra

INA SOUEZ (soprano) will be the soloist at the afternoon concert, on April 3rd, by the Torquay Municipal Orchestra, relayed from the Pavilion, Torquay. A further concert by the Torquay Municipal Orchestra will be relayed from the Spanish Barn, Torre Abbey, Torquay, on April 5th, when the soloist will be Renée Sweetland (pianoforte).

Pageant of Popular Music

GERALDO and his Orchestra will go from the Savoy Hotel to a studio at Broadcasting House on April 4th to provide for listeners to the National programme a pageant of popular music from 1918 to 1933. The vocalists are Ina Souez (soprano), John Hendrik (tenor), and the Revue Chorus.

P.O. Direction-finding Van's Tour

READERS in the areas of Nottingham, Mansfield, Newark, Grantham, Loughborough, and Derby who have overlooked the necessity of taking out a licence for their wireless apparatus should make a note of the date, April 2nd. The Post Office is then sending out a direction-finding van and it will be on service in the districts named for several weeks.

Broadcast Variety from the National

ARTHUR PRINCE and Jim make their reappearance in broadcast variety on the National wavelength on March 31st. Jim has been round the world with the well-known ventriloquist, and has made his bow to music-hall audiences in this country on thousands of occasions. Two other inseparables in the same "bill" are Elsie and Doris Waters ("Gert and Daisy"), who really are sisters. Rudy Starita will be heard in vibraphone and xylophone solos, and the Western Brothers (Kenneth and George), who are first cousins, will entertain.

The Beggar's Opera

LEICESTER has one of the most vigorous choral and dramatic societies in the Midlands. It will be on the air on April 7th in the first act of *The Beggar's Opera*, by Gay, which is being relayed from the Little Theatre, Leicester. Victor Thomas will conduct and Marion Wilson is to produce. Captain Cuthbert Reavely will play Macheath and Mona Thomas is to be the Polly Peacham.

"Noises of London"

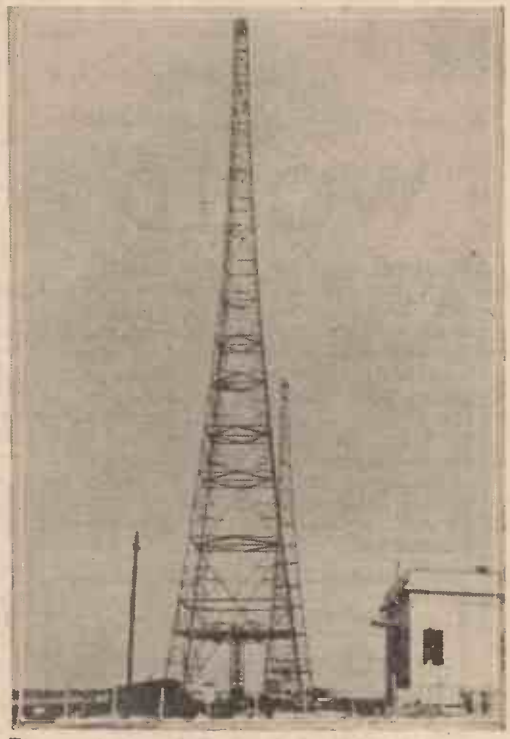
ENTERTAINMENT Hour for National listeners on April 2nd will feature Florence Desmond on her return from Hollywood. Miss Desmond is to give listeners new impressions of the "stars." Another important item in the programme will be the first performance, by Horace Kenney, of a sketch which is said to be up to the standard of his popular fireman sketch. Stanelli, the Fiddle Fanatic, will give his "Noises of London" novelty, and Eric Barker, graduating from the first of the "Tea Mixture" series, in which he was so successful a week ago, will make his first evening appearance at the microphone. The musical setting will be provided by the B.B.C. Theatre Orchestra, conducted by S. Kneale Kelley.

INTERESTING and TOPICAL PARAGRAPHS.

Hill Climb Commentary on Easter Monday

ON Easter Monday afternoon (April 2nd) Midland Regional Outside Broadcast engineers will have a busy time at Red Marley, in Worcestershire, whence a running commentary of the freak hill climb of the Birmingham Motor Cycle Club is being broadcast for the first time. This will be on the National wavelength. Major Vernon Brook is the commentator, and will speak from a hut which is being erected so as to command a good view of the crucial part of the 550yds. hill—a section of 30yds. having a gradient of one in one and a half. The climb has been an annual event since 1928; at the 1931 contest conditions were so bad that only two of the entrants got to the summit. Last year Len Heath, of Fensham, made the record climb of 25⅘ seconds. Many famous riders have already entered this year.

THE NEW RADIO-BELGRADE STATION.



The aerial masts of the new Radio-Belgrade station at Makis, about 10 kilometres from Belgrade.

Radio-Belgrade's New Station

A RECORD in the rapid moving of a complete wireless transmitting station was accomplished when the Marconi broadcasting station at Belgrade was dismantled, transported to a new site, re-erected, and tested within five days at the end of last month. The old Radio-Belgrade was situated in the centre of the city, and it was decided for technical reasons—particularly to secure a more efficient aerial system—to move the entire transmitting plant into the country. For this purpose, a site was chosen some time ago at Makis, ten kilometres from Belgrade, where the necessary buildings were erected, together with a new aerial system carried by two 100-metre insulated steel towers. By working day and night the engineers succeeded in reassembling the station by 9 p.m. on Wednesday, February 28th, when the first test transmissions were made from the new site. The transmitter which was the subject of this rapid and successful removal is a Marconi Type "Q" of nine kilowatts power. The illustration on this page shows the aerial masts of the new station.

New American Station

WNEW is the call sign of the latest transmitter to go on the air in the United States; it is situated at Carlstadt (New Jersey), with studios in Newark and New York. It operates on 240 metres (1,250 kc/s) with a power of 2½ kilowatts during the day, reduced to 1 kilowatt at night. Programmes will be broadcast from early morning until midnight.

Propaganda by Radio

ALTHOUGH in the ordinary course of events owners of wireless receivers in Germany are forbidden to place loud-speakers at windows or on balconies, or to re-broadcast to passers-by in the streets the Government permits their use in this manner for all official transmissions as on such occasions as national demonstrations, the fêting of anniversaries, and so on. This propaganda for the development of broadcasting is to be encouraged.

Eiffel Tower to go on Medium Waves

IT is now reported from Paris that, in view of the interference caused by the broadcasts from the Eiffel Tower on its present long channel, the wavelength will be changed to one in the medium band within the next three months. It is probable that a channel already granted to one of the private transmitters may be used. In the meantime the Eiffel Tower will broadcast at somewhat lower power than hitherto during the evening hours.

(*Continued on page 36*)

SOLVE THIS!

PROBLEM NO. 80

Nicholson made up the A.C.-D.C.2 recently described in these pages and used it for some months with success. He then moved to a district which was supplied by D.C. mains and decided after a short time that he could dispense with the rectifying valve. He therefore removed this valve but could obtain no signals on the receiver. Why was this? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 80, and posted to reach here not later than the first post April 2nd, 1934.

Solution to Problem No. 79

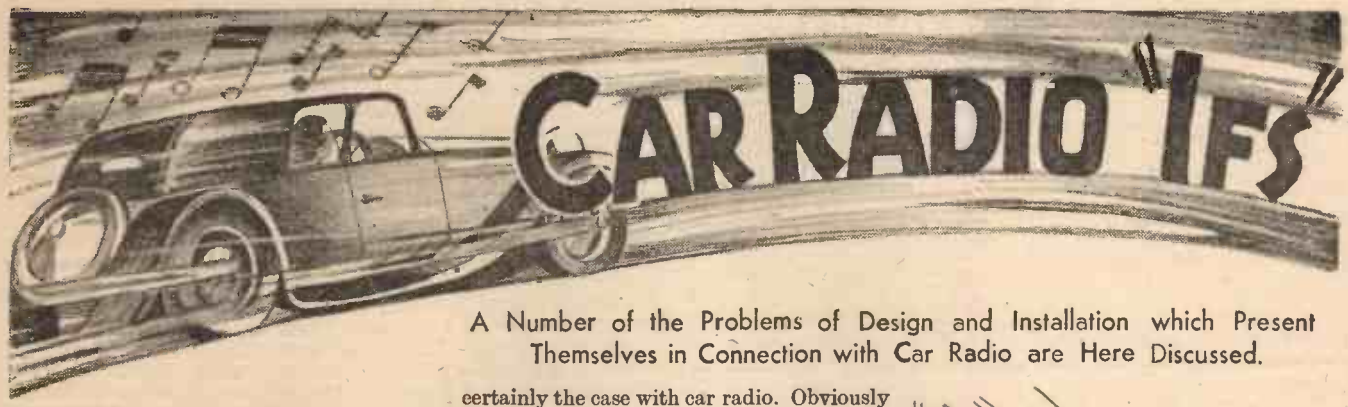
Although both amplifier and receiver are in themselves complete and in working order, it is essential, as each has its own mains portion, to link the H.T. negative connection of each together. Kerrinson failed to make this link connection, and consequently the circuit of the input valve of the amplifier was incomplete.

The following three readers successfully solved Problem No. 78 and books have accordingly been forwarded to them:—

J. B. Young-Evans, Rishworth School, nr. Halifax, Yorks.

C. R. Willis, 53, Salisbury Road, Everton, Liverpool 5

C. R. Astin, 34, Essex Street, Rugby, Warwickshire.



A Number of the Problems of Design and Installation which Present Themselves in Connection with Car Radio are Here Discussed.

AMIDST all the controversy raging around the subject of the danger or utility of permanent radio in the car stands one factor which few have grappled with, and that is: "Is it satisfactory?"

There is no simple answer of "Yes" or "No" to such a question, at the present time, so it is proposed to review the various snags and possibilities in connection with "Car Radio."

As to its utility there can be no question. One has only to travel through charming country to the accompaniment of sweet music to appreciate its value. Danger—it simply does not exist.

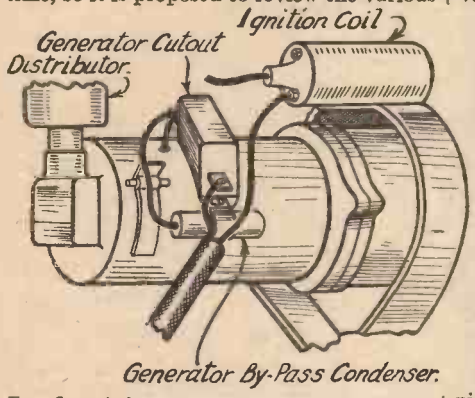


Fig. 2.—A by-pass condenser is here shown connected across the accumulator-charging dynamo. There is only a single lead to the condenser, but the other connection is made through the metal framework of the dynamo.

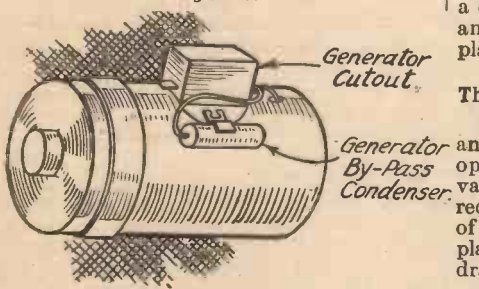


Fig. 3.—Showing the connections of a by-pass condenser used in conjunction with a generator. The condenser case is "earthed" to the frame of the generator.

Where the Difficulties Occur

Snags—well, one hardly knows where to begin. At first sight it appears to be mostly a question of suppression of interference from the ignition system and the fitting of a suitable aerial. First and casual glances are very often misleading, and this is certainly the case with car radio. Obviously the most suitable cars for radio are those with plenty of spare room for the receiver, H.T. and L.T. supplies. The author has in mind such a car in which a thousand-miles' tour was accomplished with the radio equipment working all the time. The actual receiver, a superhet, was perhaps the most efficient in its class; mains type "Catkin" valves were employed with Westector detection, and A.V.C. was incorporated. The H.T. was obtained from the car battery through a converter (both a rotary and a vibratory type were tried). It was found that suppressors fitted in the leads to the plugs accounted for loss of engine power until the correct valves were employed. Special screened plugs with screened leads proved more satisfactory. A short trial run disclosed many faults in the electrical system on the car—faults which in the normal course of running would not have "shown up" for eighteen months or so, such as "arcing" at the carbon brushes of the generator.

The long run was started and the real troubles began. Eddy currents produced by vibrating side panels and rattling bonnet pieces were almost impossible to cure. The lid of the metal container to the receiver happened to be of a different metal to that of its associated box, and this caused differences of potential with resultant crackles, and curing it was hardly a wayside job. At a certain speed static interference occurred and appeared to come from the clutch plates acting as a Wimshurst machine.

The Power Supply

Arrived at Birmingham and the starter refused to operate. Five mains-type valves and a converter do require amps. and the use of the radio at stopping places had entailed a fair drain on the battery.

"Birmingham" was delighted with the radio performance and quality. (Foreigners in daylight and 1½ watts through a moving-coil mains energized speaker.) But—and it is a real big "but"—they would not countenance the alteration to a single nut or bolt on their cars, and one can hardly blame them. What is most important is the fact that only a very small margin of overload is allowed on electrical equipment under the makers' guarantee, so our car battery supply was ruled right out of the question.

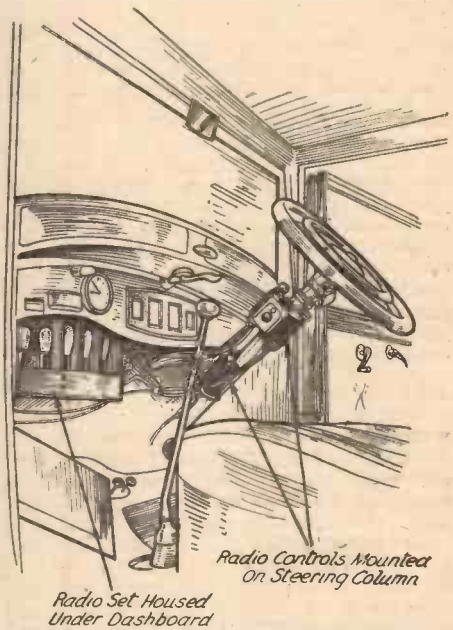


Fig. 1.—This pictorial illustration shows the arrangement of a receiver and its controls in a typical car. Note the mounting of the principal controls on the steering column.

This is the car manufacturers' attitude. Only a certain small proportion of manufacturers' cars will be required with car radio fitted, therefore the maker cannot

(Continued on next page)

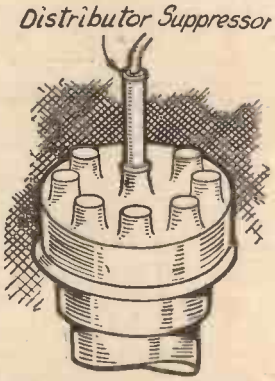


Fig. 4.—A "suppressor," also in the form of a fixed resistance, is fitted to the main supply lead to the ignition distributor. This system applies particularly to cars which employ coil ignition, and the "suppressor" illustrated would not be required where a magneto was used.

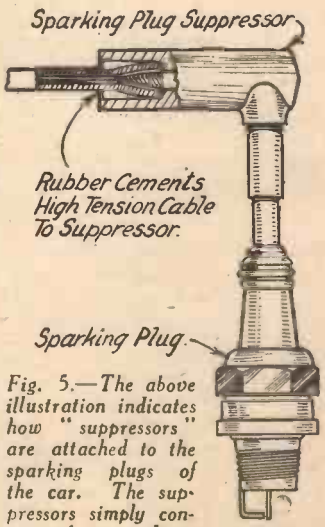


Fig. 5.—The above illustration indicates how "suppressors" are attached to the sparking plugs of the car. The suppressors simply consist of non-inductive resistances of about 50,000 ohms each.

(Continued from previous page)

afford to have his entire production turned out with larger batteries and bigger generators. (The idea of fitting a few of the special valves are produced we must "wait and see."

Three-hundred-thousand cars in America are fitted with radio, but valves there are always ahead of ours, and it is a notorious fact that the Americans will put up with more than we will in the way of "quality" reproduction.

The object of this article is not to dampen the ardour of those pioneers who love to surmount difficulties, but rather to indicate the nature of the problem and give ample warning to those who intend to fit or have fitted radio to their car. There are now a few firms who specialize in this class of work, and it really is the job for specialists, and to any but the most enthusiastic I would recommend that they wait until suitable components are made available.

PRACTICAL WIRELESS will give you the first tip when the way has been cleared for a satisfactory solution of this most unusual set of problems.

It is true that many components are now obtainable which, apart from their compact build, are also ideally suited for car radio owing to the fact that they are effectively screened. There still remains the problem of the circuit, however, and, although the superhet is an admirable arrangement to employ, automatic volume control is one of the features which absolutely must be incorporated. Without this arrangement, iron bridges under which you pass will completely wash out signals.

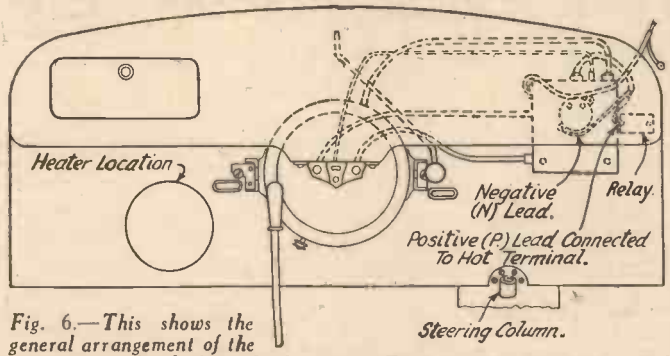


Fig. 6.—This shows the general arrangement of the receiver on the dashboard of a car. The principal connections and controls are illustrated, and the neatness of the scheme is apparent.

stock with radio equipment is anathema to car manufacturers in these days of mass uniform production.) The only solution on this point is that the electrical firms shall provide equipment with larger outputs at the same price as heretofore. Obviously, they will only do this if they can derive some benefit by so doing, and thus it becomes necessary for the car electrical firms to market car radio in order that they shall reap the harvest sown with their oversize batteries, etc.

Why Mains Valves?

You might raise the objection, "Why mains type valves?" "Why a converter?" Well, until battery "Catkins" with similar characteristics to the mains types are produced, car-radio will be a question of "ifs" and "buts."

To those who have Rolls Royces and other powerful cars these words will have no meaning, vibrations will be a strange word to them, and as for "juice," well, what's an amp. or two to Mr. Rolls. Our lessons are rather for the guidance of the million whose cars are small in stature. To them we say, "Yes, car-radio is a wonderful advance, but until such time as

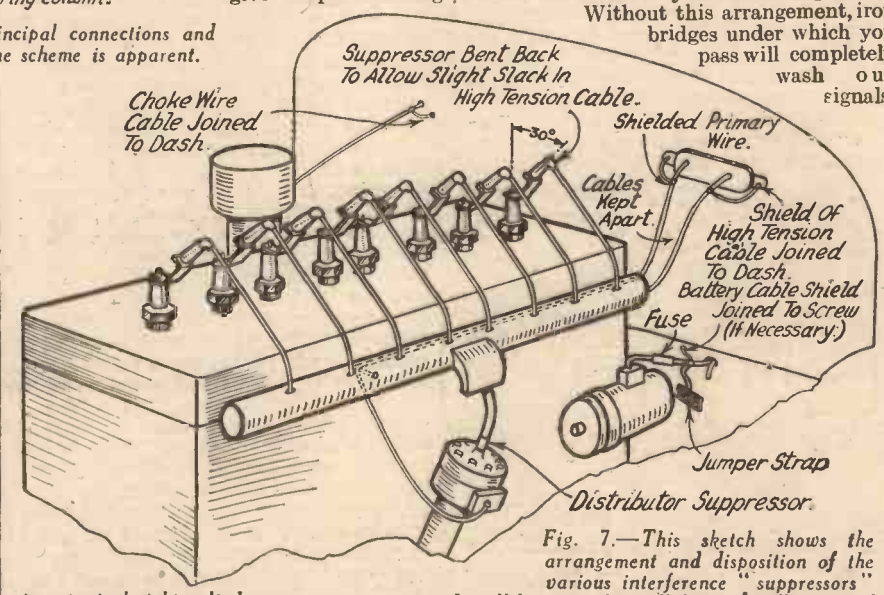


Fig. 7.—This sketch shows the arrangement and disposition of the various interference "suppressors" in a typical eight-cylinder motor-car engine. It will be seen that all loose metallic control wires, etc., are properly "earthed" by being connected to the metallic chassis of the car. Any loose "un-earthed" metal parts are liable to cause various forms of background noises due to vibration, and this is why such care has to be taken to maintain good connection to the chassis, which acts as a capacity earth.

Wide Frequency-band Television

IT is reported that during the next year a wide frequency-band television system (as distinct from the present narrow frequency-band system) will be given a thorough test on ultra-short wavelengths. It appears, indeed, that this year is to be a television year, wherein all of the existing and proposed systems will be "on trial."

Television Scanning Devices

In reply to several correspondents the letter references on Fig. 1. page I of "Practical Television," Vol. 1, No. 3, are as follows: P O N, muscles of eyeball; A, cornea, which closes the front of the anterior chamber B, which is filled with aqueous humour, and the back wall of which is formed by the curtain of the iris D. In the middle of the back wall is the opening of the pupil C, through which is seen the lens E. Behind the lens is the posterior chamber L, filled with vitreous humour. Entering the eye from behind is the optic nerve which is distributed to the retina K. The posterior wall of the eye shows from within outwards the image-forming retina, the dark choroid with blood vessels I, and the firm protective sclerotic H.

ROUND THE WORLD OF WIRELESS

(Continued from page 34)

Resistance Power-ratings

A note is necessary in regard to the power-rating of the resistances recommended in the article on page I of "Practical Television," Vol. 1, No. 9. It must be remembered that most of the resistances have to carry a fairly heavy current and they must be capable of doing this without undue heating. In every case the minimum rating (in watts) can be determined from the formula: Power=Current^2 times Resistance, where the current is in amperes and the resistance in ohms. An example will make the method of calculation more easily understood. Suppose a 10,000-ohm resistance is inserted in the anode circuit of a valve which passes 30 milliamps; the power "absorbed" by the resistance will be 30/1,000 squared times 10,000, or 9 watts. In such a case a 10-watt component would conveniently be chosen. When the resistance is connected between the positive and negative terminals of the H.T. supply, the current passed by it must first be found by dividing the voltage by the resistance in ohms. For example, suppose a 10,000-ohm resistance is connected across a 250-volt supply, the current will be 250 divided by 10,000, or 1/40 amp.—in other words, 25 milliamps.

In this article it has not been possible to deal with the switching required for every form of output circuit, nor to consider machines of the mirror-drum type which employ a Kerr or Grid Cell, but it is hoped that sufficient has been said to indicate where the minor pitfalls lie and to make clear the principles involved.

Result of Geneva Conference

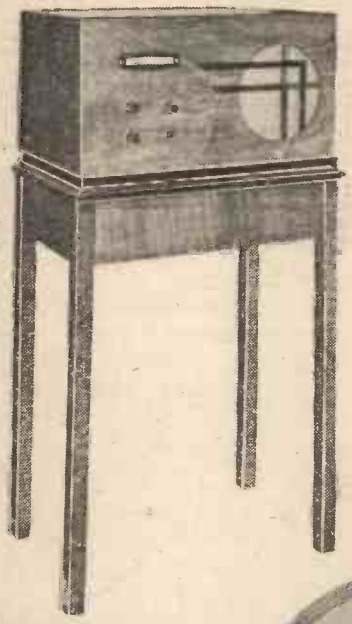
FOLLOWING discussions in regard to the long-wave band, it would appear that a re-allocation of channels has been suggested; it takes into consideration stations belonging to all European States, irrespective of the fact whether they agreed or refused to adopt the Lucerne Plan. Although tests may be carried out at an early date it is hardly likely that the new scheme will be adopted before the summer months. There will be a further conference held in London on June 12th to 20th to study the results of the experiments carried out.

SPECIAL SET FOR D.C. USERS

CONSTRUCTING THE D.C. PREMIER

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc., A.M.I.E.E.

Practical Notes Concerning the Assembly and Wiring of the Receiver.

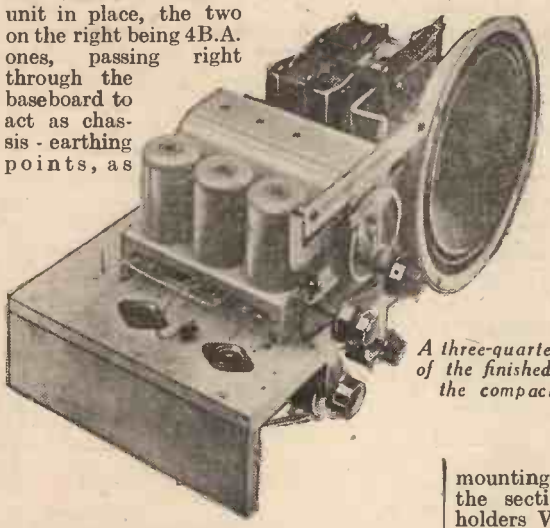


ALL the components required for the D.C. Premier are listed elsewhere, and assuming that they have all been obtained attention is turned first to the baseboard. Its size is 20in. by 10in. by ⅝in., and two side battens 10in. by 3in. by ⅝in. and 8½in. by 3in. by ⅝in. are screwed firmly to the two short sides to raise it 3in. from table level, the shorter batten being on the right when facing the front.

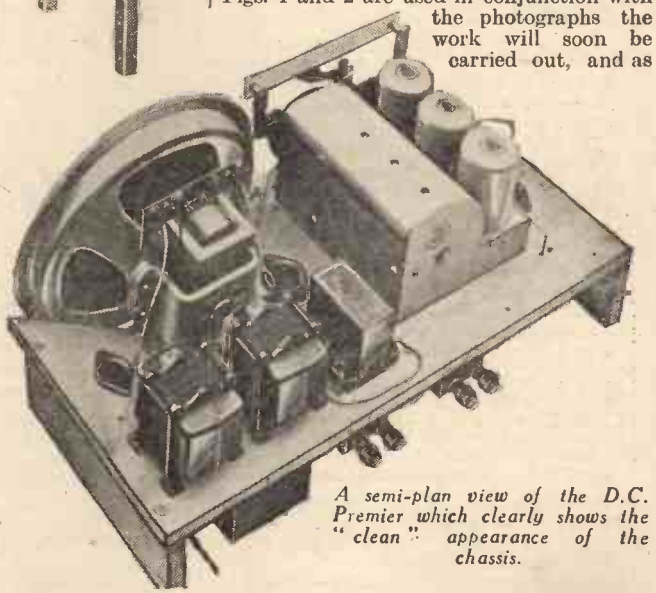
As will be seen from Figs. 1 and 2, a truncated V-shaped section is cut out of the baseboard on the right to accommodate the loud-speaker, so that the cone flange is flush with the front baseboard edge. The depth of the "cut" is 3in., and the sides are parallel to the loud-speaker cone.

Above Baseboard

Next mark off the positions of the four valve-holders, using the scaled illustration Fig. 1 (shown overleaf) to assist you. V_1 and V_2 are 1¾in. inside the baseboard edge, V_3 and V_4 being 8¾in. and 1¾in. respectively from the other baseboard edge. In the case of V_1, V_2 and V_4 1in. holes will suffice, but V_3 requires a 1¼in. hole. Now we come to the Linacore tuning unit. Care must be taken in positioning this, but as the makers supply a dimensioned stiff paper template there is no difficulty. Facing the baseboard front, the left-hand edge of the unit is 3½in. from the end of the baseboard. Four screws hold the unit in place, the two on the right being 4B.A. ones, passing right through the baseboard to act as chassis-earthing points, as will be seen from Fig. 2. The remaining above-baseboard components can then be mounted.



A three-quarter front view of the finished set showing the compact lay-out.



A semi-plan view of the D.C. Premier which clearly shows the "clean" appearance of the chassis.

Under Baseboard

To conveniently fix in place the remainder of the components below the baseboard, it is advisable to make temporary wooden supports or legs and screw them to the batten sides. Let them project 8in. vertically above the top surface of the baseboard and be attached as near the four corners as possible. Turn the baseboard over and the chassis will now be raised above table-level without any damage occurring to the components previously screwed in place.

Study Fig. 2 very carefully before mounting each individual item, especially the section on the right where valve-holders V_1 and V_2 appear. All the condensers have feet for screwing down in place, except the two tubular ones C_2 and C_3. These are held against the baseboard with a short crosspiece of ebonite, a single central screw providing quite a rigid and secure grip.

Every resistance is connected up in the run of the wiring, so they should be laid on one side for the time being. Both the volume control and tone control are held on right-angled brackets. The centres of the control spindles are 1⅞in. from the *top* of the baseboard edge (see Fig. 3), while they are positioned directly below the centres of the Linacore controls to preserve symmetry in the finished set. Do not attempt to mount the loud-speaker in place—this item can best be left until the wiring is almost completed, so avoiding possible damage.

Next drill the sixteen holes in the baseboard for the wiring to pass through. These are numbered in Figs. 1 and 2, and it is very essential to see that the drill does not in any way foul a component and thus damage it.

Wiring

Wiring up the set is really quite a straightforward task if undertaken with reasonable care. The bulk of it is carried out below the baseboard, and as the resistances are supported by the wiring reasonably stiff wire is recommended. No. 16 or 18 gauge Glazite is my preference, and all the joints are soldered, a practice which I was glad to see met the needs of the majority of PRACTICAL WIRELESS readers, as indicated in the census taken recently. As the resistances are colour-coded, make quite sure that you incorporate the correct ones in their individual positions, referring to the colour-code chart in each case for a check.

Any bare wire ends of these resistances should be sheathed with sistoflex to prevent short circuits. If the wiring diagrams of Figs. 1 and 2 are used in conjunction with the photographs the work will soon be carried out, and as each wire is complete it is a good plan to cross-hatch it on the diagram to serve as a check. Terminate the flex lead passing to the anode terminal of the variable-mu valve in a Belling-Lee anode connector, for this is a "live" point and a bare end may cause serious damage if left free while making adjustments.

The Loud-speaker

The loud-speaker can now be attached to the baseboard in its correct position by two small right-angled brackets held against a pair of field-magnet bolts—see Fig. 1. Be sure that the base of the speaker flange is just flush with the bottom of the battens—see Fig. 3—for since the height of the cabinet inside is 10in. it will just fit when in this position.

Complete the wiring by adding the leads

(Continued on next page)

(Continued from previous page)

passing to the speaker field and multi-ratio transformer. The field-coil terminals are denoted by light-blue discs, other connections being made to the terminals with black and red discs respectively, to obtain a load of 8,000 ohms. This will ensure operation under the best conditions. These leads, together with those passing to the low-frequency chokes, and also the H.T. lead to the transcoupler unit, are carried out in flex.

The four flex leads to the speaker should be made three or four inches longer than actually required, the reason for this being made clear later. Note that the positive flex lead from the mains is cleated neatly to the baseboard in its passage to the Q.M.B. switch which forms part of the Linacore assembly, the return lead from the switch terminating at the junction point between the barretter and the pair of low-frequency chokes.

A little time should now be spent in testing each soldered joint and in straightening each connecting wire. With sets deriving their power from D.C. mains it is so easy to induce an unpleasant hum if the wiring is at all slipshod. Therefore, see that high-frequency and low-frequency wires are as remote as possible and make sure that each resistance is clear of any neighbouring component.

Housing the Set

The dimensions for marking out the cabinet front to take the four controls are given in Fig. 3, and these must carefully be measured off. If in any doubt, use the drilling template furnished by the makers of the Linacore unit to prick off the centres for the top upper controls. The two additional ones below these can then very easily be measured up.

Drill the four holes to clear the control spindles and then mark out the rectangular aperture for the escutcheon plate, using the template once again for this purpose. Fix the escutcheon plate. For convenience in wiring the speaker was held to the baseboard by two small brackets, but I mentioned that the four connecting leads should be left longer than actually required. This was to allow the speaker flange to be screwed to the cabinet front, which acts as the baffle.

Slide the set partly out from the cabinet back, remove the screws holding the bracket to the baseboard and push the loud-speaker forward so that it is flush with the cabinet front. Now mark off the positions of the four screws which will hold the cone in place against the baffle. Do not screw the speaker flange to the baffle yet, but withdraw the set completely, screw the brackets once more to the baseboard to replace the speaker in its "wiring" position and prepare to give the D.C. Premier an aerial test. One or two slight adjustments are sure to be required, and these will be dealt with next week.

COMPONENTS REQUIRED FOR THE "D.C. PREMIER."

- One "Linacore" band-pass tuner, mains model, type B.P.M. (Jackson Bros.).
- One 6,000 ohm graded potentiometer Type 2 (R_1). (Watmel).
- Two G.125 type resistances, 200 ohm (R_4) and 1,000 ohms (R_7) (Trevor Pepper).
- Four G.250 type resistances 350 ohms (R_9), 10,000 ohms (R_5), 15,000 ohms (R_3), and 20,000 ohms (R_2) (Trevor Pepper).
- One G.800 type resistance 50,000 ohms (R_8) (Trevor Pepper).
- One M.150 type resistance 250,000 ohms (R_6) (Trevor Pepper).
- One "Controlatone" type B (Bulgin).
- One "Transcouplet" (Bulgin).
- Three 5-pin and one 7-pin skeleton chassis valveholders (W.B.).
- Four type B terminals (aerial, earth and two pick-up) (Belling Lee).
- Two terminal mounts (Belling Lee).
- Two 0.5 mfd. condensers type 250 (C_2 and C_3) (T.C.C.).
- One 1 mfd. condenser type 65 (C_4) (T.C.C.).
- Two 2 mfd. condensers type 65 (C_5 and C_6) (T.C.C.).
- One 12 mfd. condenser bank type R.M.12 (C_1, C_7, C_8 and C_9) (T.C.C.).
- One "Magnavox" mains-excited M.C. loud-speaker 200 ohms field resistance (Benjamin).
- Two low-frequency chokes type 751 (LFC_1) and 752 (LFC_2) (Heayberd).
- One 400-ohm baseboard mounting potentiometer (R_{10}) (Igranic).
- One H.F. choke type LMS (HFC) (Graham Farish).
- One twin fuseplug, type P.25 (Bulgin).
- One barretter, type 1928 (Phillips).
- Four brackets type EH6 (Bulgin).
- Three valves, type VP.20, HL.20 and Pen. 20 (Mullard).
- One baseboard and cabinet (Peto-Scott).

Fig. 1.—Wiring diagram of the D.C. Premier upper surface.

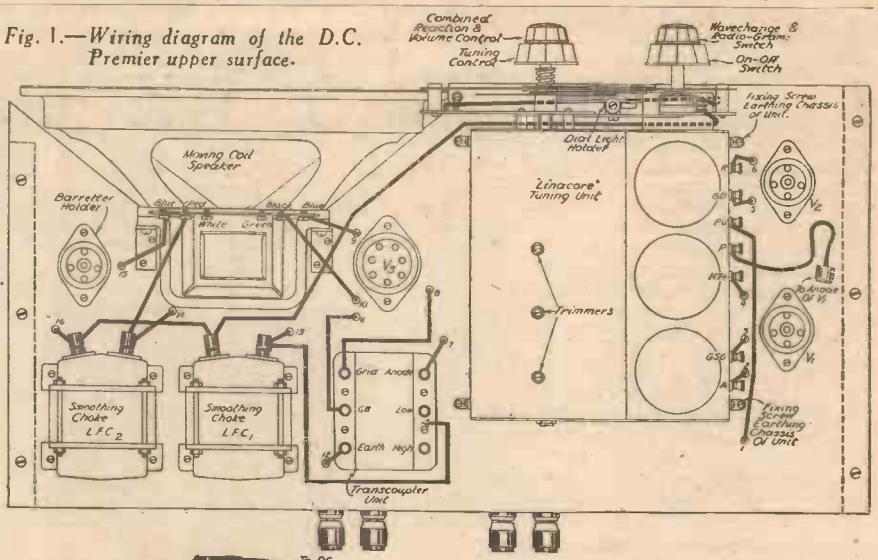


Fig. 2.—Sub-baseboard wiring of the D.C. Premier.

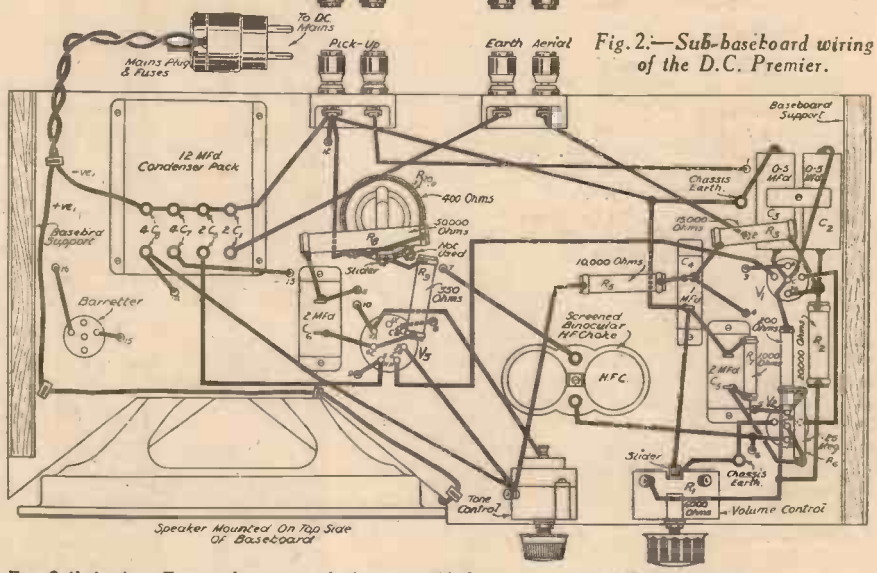
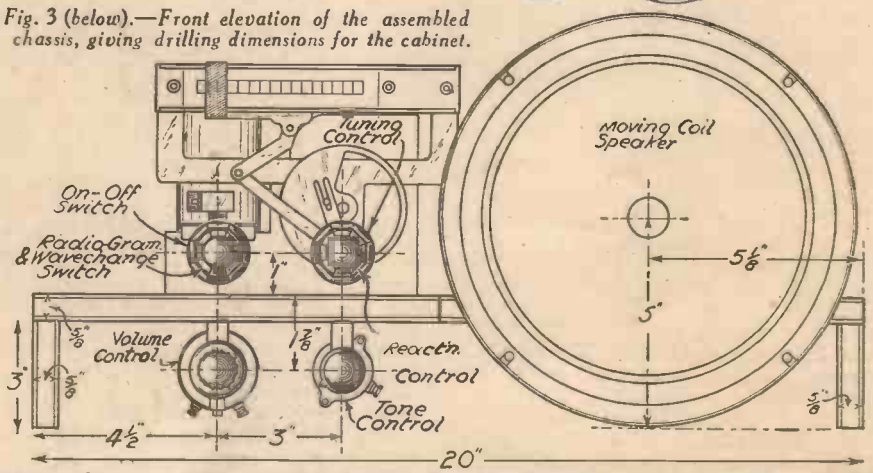
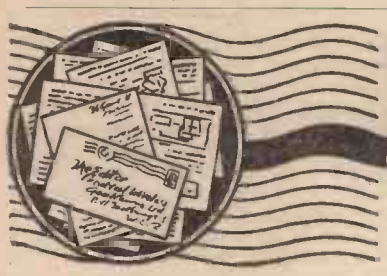


Fig. 3 (below).—Front elevation of the assembled chassis, giving drilling dimensions for the cabinet.



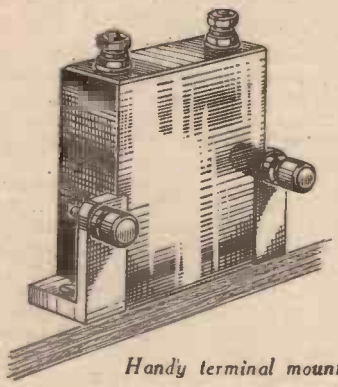


READERS' WRINKLES

THE HALF-GUINEA PAGE

Convenient Terminal Mounts

HIGH-CAPACITY fixed condensers of the 1 and 2 mfd. type with extra long lips for screwing to baseboard can conveniently be used as terminal mounts as shown. This idea, in the majority of cases, enables the use of very short wiring and effects a saving of space. In screen-grid sets the 1 mfd. condenser in the S.G. stage may be used for aerial and earth, whilst in the output stage the 2 mfd. filter condenser may be used for speaker terminals. This



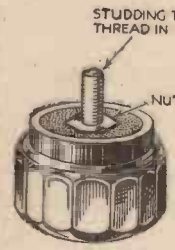
Handy terminal mounts

idea, besides making for neatness, also reduces the expense of "etceteras."—T. G. BARKER (Seaford).

Easily-made Bakelite Knobs

PROCURE a suitable bakelite screw cap as found nowadays on many bottles and jars. Remove all traces of grease or foreign matter from the threads of the cap. Then carefully fill the interior of the cap with plastic wood, making sure it is pressed into the threads of the cap.

Assemble a nut and bolt of suitable size for the component for which the knob is required. Press this carefully into the plastic wood and make sure the nut is central and that the plastic wood is packed tightly around it.



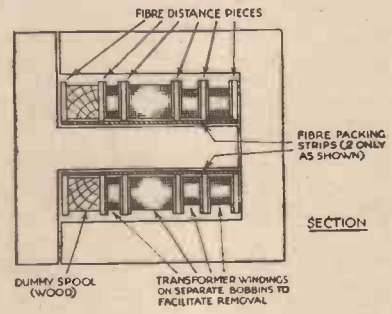
Improvised bakelite knobs.

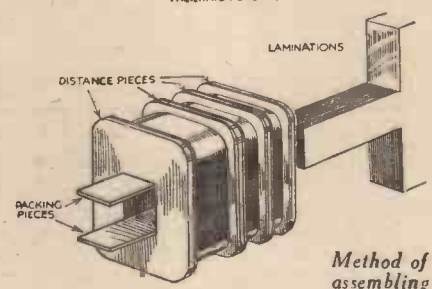
Place the knob in a warm, airy place for 12 hours; then carefully remove the bolt. The knob should be left for another 12 hours when the plastic wood will be set quite hard and a useful knob will result.—R. J. ALLEN (Leigh-on-Sea).

Assembling Transformer Windings on Individual Spools

HAVING assembled several mains transformers for various types of sets, I have found that the best method for the amateur coil constructor is to wind each individual winding upon a separate spool. Usually I cut my spools and end cheeks from fibre about 1/32in. to 1/16in. thick. These spools are not so rigid when assembled as the "layer" type of winding and to overcome this difficulty I adopted the following procedure.

The spool cores are cut so that they will cater for the insertion of loose fibre strip





Method of assembling transformer windings on individual spools.

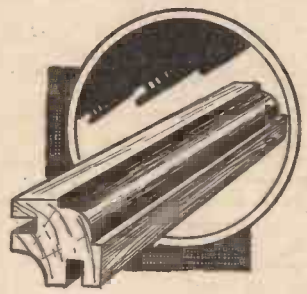
packings at right angles to the laminations, and also loose fibre packing cheeks are cut to insert between the spools as required. By the use of these packings (inserted before the laminations), I found that the completed assembly attained a rigidity comparable with the "layer" wound type of transformer, and it possessed certain advantages. The bobbins may be centralized or readjusted to any desired position, and any particular winding may easily be removed to be replaced or repaired. The use of the dummy spool (made of wood) will conveniently fill any space required to add an extra winding at some future date and ensures the "winding space" being completely filled, thus reducing any possible hum due to loose windings or laminations.—WILLIAM A. HARRISON (Aintree).

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

Cabinet Making Simplified

THOSE readers who make their own wireless cabinets will find that this task can be considerably simplified by using the corner moulding shown in the sketch. The two grooves shown enable the sides to easily slide into place, the moulding forming a pillar at each corner and providing strength to the cabinet, as



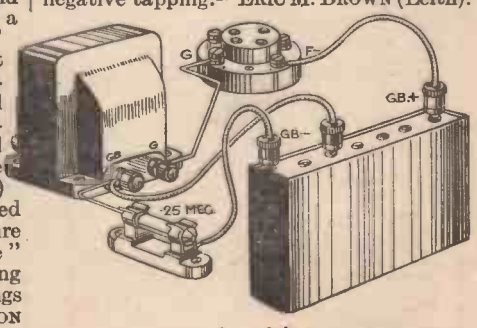
The shape and grooves of the corner moulding are clearly seen here.

well as covering any bad joints which otherwise might be seen. This moulding can be purchased in a variety of designs; thus the constructor is not restricted to one particular type of wireless cabinet.—C. F. (S.W.9).

A G.B. Safety Tip

THE accompanying sketch shows an excellent "safety" dodge which safeguards the output valve of a battery receiver when grid-bias adjustments are being made. By connecting a .25 megohm grid leak as shown, the G.B. plug can be moved without having to switch off the set.

It will be seen that in the event of the G.B. negative tapping coming out of its socket or being pulled out for re-adjustment the valve will receive a large negative bias from the other connection through the resistance. When the two connections are made to the battery it will be seen that the resistance is connected across a portion of the battery; this will cause a current to flow through the resistance, but it will be so small that it will not damage the battery. When two power valves, or a power valve and pentode, are used in the same set a by-pass resistance might be connected, as shown, in parallel with each negative tapping.—ERIC M. BROWN (Leith).



A grid-bias safety dodge.

READERS' WRINKLES

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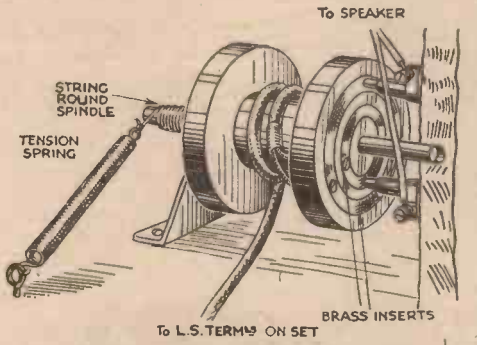
Automatic Flex Winder

THE device illustrated automatically winds up the loud-speaker leads. The parts required are as follows: One 3in. length of wooden rod; two spring



An automatic winding device for L.S. leads.

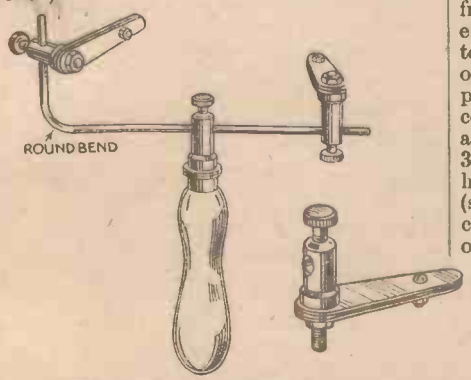
contact plungers from electric-lamp holder; piece of sheet brass; wooden or ebonite bobbin; tension spring; and wooden rod for spindle.

From the sheet brass are cut two concentric rings, which are screwed on to the bobbin. The latter must be large enough to accommodate the required amount of flex. From each of the brass rings a connection is made to the L.S. flex. The bobbin is locked to its spindle, this being mounted on two brackets fixed to the inside of the L.S. cabinet. The spring plungers are next mounted so as to make good contact with the two brass rings as they revolve. Connections are taken from the plungers to the loud-speaker.

One end of the spring is fixed to the cabinet, while the other is attached to a piece of string which passes several times round the spindle and is then fixed to it. On pulling the flex (which goes to L.S. terminals on set) the string winds round the spindle, thus extending the spring; on letting go of the flex the tension of the spring is sufficient to wind up the flex.—J. L. MANNINGTON (Eastbourne).

Handy Soldering Tweezers

A PAIR of soldering tweezers are a useful addition to the constructor's kit. This handy tool can easily be made with four strips of brass, spaced slightly with small washers, as in sketch. The other parts required are three large 'phone terminals, a turned wooden handle, and a thick piece of wire. All these parts when assembled as shown make a handy tool with universal action.—ALFRED READ (Dagenham).



Easily-made soldering tweezers.

A One-valve Portable Set

THE accompanying sketches show a one-valve portable set made for use in a room where a loud-speaker is not allowed, and where there would be great difficulty in arranging an outside aerial. The set works well from an inside aerial of a wire net description, and earth wire to a pipe. To avoid trouble in charging the accumulator, a dry battery of the kind sold for bicycle lamps is used for L.T. and four 9 volt grid-bias batteries provide the H.T. current. Brass strips are fixed to the wood framing so as to make contact with the strips on the L.T. battery, so that a new battery can easily be slipped into its compartment. The four grid bias batteries are connected + of one to — of the next by pieces of wire and wander plugs.

Fig. 1 shows the batteries divided by a

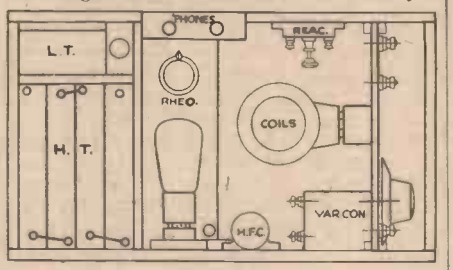


Fig. 1.

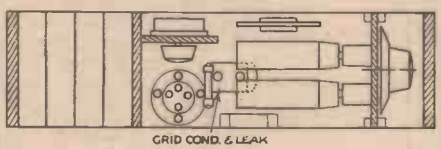


Fig. 2.

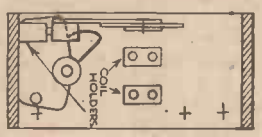


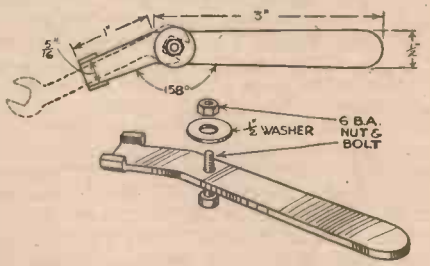
Fig. 3.

Fig. 4.

The lay-out and details of a one-valve portable set.

thin wood partition from the rest of the set. In the next compartment is the valve grid condenser and leak, and H.F. choke, and above the valve is seen a rheostat (or a push-pull switch with a resistance to reduce the 3 volts of the dry battery to 2 volts). This is fixed on a small ebonite panel in the position shown on Fig. 2. On the front edge of the main outside framing an ebonite strip is let in, and the 'phone terminals are fixed on this. To the right of Fig. 1 is seen the edge of an ebonite panel on which are fixed the variable condenser, two coil holders, and two aerial and one earth terminal, as shown in Figs. 3 and 4. A basket coil is plugged into a holder fixed on the bottom of the framing (see Figs. 2 and 3). One aerial terminal is connected to the aerial (basket) coil, the other to the grid coil direct, the idea being that the first would give greater selectivity if the latter did not separate the stations. However, Regional and National stations are heard clear of each other on either terminal. The dial is seen edgeways in Fig. 1, but as shown in Fig. 4 there is a brass pointer, and the reading on the dial in relation to this is easily visible in use.

A Formodenser attached to the top framing (Fig. 1) acts as a reaction condenser, which is wired in the usual way with the H.F. choke to get capacity reaction. The wiring is not shown, as the circuit follows the usual lines for a one-valve set with capacity reaction. The whole is made to fit an attache case, and the appearance when the lid is open is as it appears in Fig. 1.—C. D. ROCHESTER (Kettering).



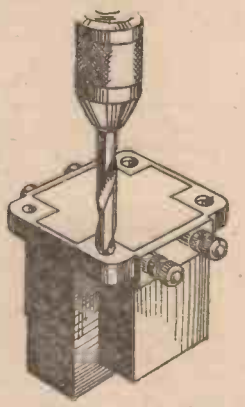
A handy extension handle for small spanners.

Extension Handle for Spanners

THE extension handle shown in the accompanying illustration is designed to fit the spanners in the PRACTICAL WIRELESS Tool Kit, but it also can be applied to any spanner by altering the dimensions to suit. It will be found very useful when tightening nuts, etc., where space is limited. The handle consists of a stout piece of brass or other suitable metal cut to the sizes given and shaped as shown in sketch. The two lugs marked A are bent at right angles and serve to hold the spanner firm while the bolt is to clamp the spanner down tightly. The spanner can quickly be changed by a turn of the nut.—F. H. HOUGHTON (Walworth).

Countersinking Fixing Holes in Components

A DODGE I have found beneficial, when assembling components, is to countersink the screw holes of wireless components on the underside. The reason for this is that wood screws, when driven into wooden baseboards (usually of ¾in. plywood), cause wood surplus from the hole being made to climb the thread of the screw and form a "lump" under the part being fastened down, thus preventing it from fitting flush and often breaking the bakelite screw lugs off. By countersinking the holes underneath, as depicted in the sketch, they accommodate this waste, and a twist drill larger than the holes themselves will do the necessary countersinking.—R. JOHNSON (Rotherham).



Countersinking fixing holes in components.

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Illustration shows the handsome cabinet of the All-Electric Model 635, a receiver of truly magnificent performance.

A battery-operated model is also available, the abridged specification being as follows:—

5 Valve Battery Superhet. Model 634

Class B Output, Moving Coil Loud Speaker, Illuminated Single Dial tuning calibrated in wavelengths; tone control, Walnut finished cabinet with space for batteries. Pick-up plug and socket. Price, less batteries and accumulator - - - - - - - - - - - - - **£13.10.0**

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SOME EARLY TUNING COILS AND COMPONENTS

A Brief Retrospect Covering Some of the Coil Arrangements Which Have Been Used in the Past.

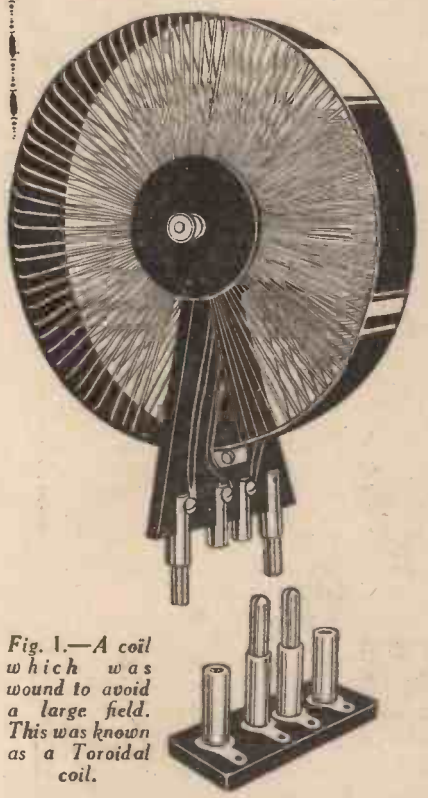

Fig. 1.—A coil which was wound to avoid a large field. This was known as a Toroidal coil.

IN view of the recent review of Midget components, it is interesting, for comparative purposes, to examine some of the tuning schemes which have been utilized during the past few years, and to see how these compare with the arrangements which are now employed for tuning receivers of various types. One of the greatest troubles which arises from the use of highly-efficient coils is interaction due to the extensive field which such a coil possesses. To reduce the extent of the field screening is now employed, together with small diameter formers. In Fig. 1 is shown a coil which at one time had several uses. It is known as a Toroidal coil, because the windings are arranged in the form of a toroid. This is, in effect, a solenoid coil, having adjacent turns slightly spaced, and then the two ends are bent round until they practically meet. In this particular model, the turns of wire are held firmly on a rigid former, and pin connections are employed. It does not seem to have met with the popularity which it deserved.

Another attempt at removing the external field difficulty was seen in the astatic method of winding as exemplified in Fig. 2. Here the windings are carried on a former with a wave-change switch mounted on the centre of the coil. The complete unit is rather on the large side, and it was not very easy to mount, although it was intended for panel-mounting so that the switch could easily be operated.

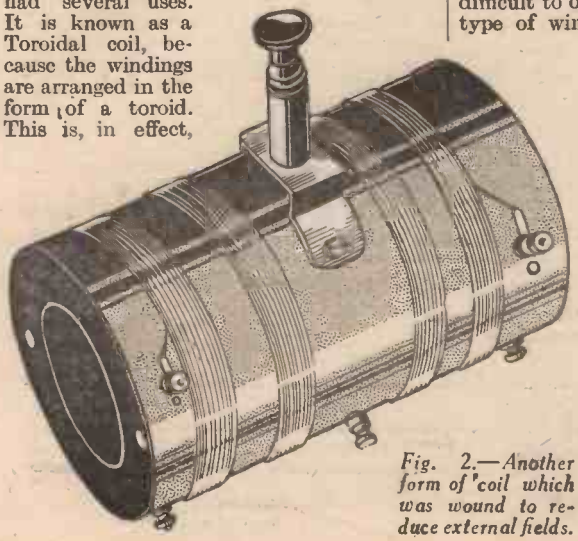

Fig. 2.—Another form of coil which was wound to reduce external fields.

Old Tuning Arrangement

In Fig. 3 is an ambitious coil which had a good deal of popularity. The coil was wound on low-loss tubing, with a reaction winding carried on a rotating former arranged in the centre of the tube. This was controlled by the central knob. At the left was a small variable condenser which was connected in the aerial lead and served to control selectivity, whilst at the other end was a rotary tapping switch which enabled various ranges to be covered with a standard .0005 mfd. tuning condenser.

Litz Coils.

It will be noticed that the present-day iron-cored tuning coils all employ Litz wire for the medium wave-band. This has been used before for the medium-band tuning coils, but in most cases it was found difficult to obtain the full advantage of this type of winding. Fig. 4 shows a simple plug-in coil which had such a winding, and, to protect it from damage and to enable it to remain calibrated, a bakelite case was fitted round it. Of the two-pin type, this particular coil was also provided with three tapping points brought out to terminals mounted on the upper edge of the case. These tapping points were arranged in the centre of the winding, and between the centre and the earthed end of the coil, and the coil was known as an "X" coil. It gave very good selectivity and good signal strength.

Tuning Condensers

Fig. 5 shows a type of condenser which was at one time employed for tuning a broadcast coil, and which was made up in the form now better known as a preset condenser. A lower metal plate formed one electrode, and a sheet of mica separated this from an upper plate of springy material. The control knob pressed upon the upper plate, and by varying its position in comparison with the lower plate effected a variation in capacity which was indicated by the pointer and engraved scale. At the time that this condenser was introduced it formed a great space-saver as compared with the variable condensers then existing. Fig. 6 shows how the variables of the time were made up. Ebonite end plates at least a quarter of an inch thick were threaded to take standard 2 BA rod, and spacing washers a quarter of an inch thick were placed between each plate. The actual condenser which is illustrated is a forerunner of the ganged condenser, and was a novelty in that both sets of fixed plates were electrically connected, whilst the rotors, or moving plates, were insulated by a small section of ebonite rod in the centre of the spindle. Its principal use was for receivers employing two tuned-anode stages.

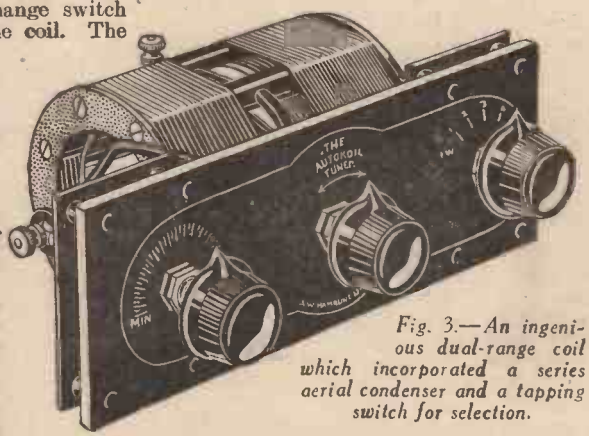

Fig. 3.—An ingenious dual-range coil which incorporated a series aerial condenser and a tapping switch for selection.

(Continued on page 44)

Fig. 4.—A neat Litz-wound plug-in coil.

OPERATING YOUR BATTERY SET FROM THE MAINS

Practical Details of Eliminators Supplying Both H.T. and L.T. from A.C. or D.C. Mains are Given

By FRANK PRESTON

A LARGE number of the queries received by the PRACTICAL WIRELESS Free Advice Bureau are from readers who wish to operate their battery receivers from the mains. The inquiries generally read something like this: "I have a three-valve battery-operated receiver, which I wish to modify so that it can be driven from the mains supply, which is 230 volts, 50 cycles A.C. Please tell me what alterations should be made and what new components I shall require." On the face of things such a query seems to be a fairly simple one, but actually that is not the case. To modify the set and convert it into an all-mains version employing indirectly-heated valves would be a difficult task in most instances, and one calling for a considerable amount of skill and knowledge of wireless practice. In fact, such an alteration would, in nearly every case, make it essential entirely to re-design the receiver from beginning to end. The principal reason for this is that indirectly-heated valves (either A.C., D.C., or universal) are considerably more efficient than their battery-operated counterparts. Consequently they require to be used in somewhat different circuit arrangements, and have to be supplied with entirely different anode and grid voltages. Additionally, the general lay-out of an all-mains set must often be unlike that of a normal battery receiver because of the different components which must be employed, and because precautions have to be taken against mains hum, etc. There is yet another point that should not be overlooked, which is that the condensers and other components used in a battery set (in which the highest voltage in circuit seldom exceeds 150), would probably be quite unsuitable for use in a mains set where voltages up to 250 are quite common. If these components were used there would always be a danger of their breaking down and so causing serious damage.

It will be quite clear from the above remarks that, whenever it is desired to re-model a battery set in order to make it of the so-called all-mains type, it is considerably better to dismantle it, and then rebuild to a new design taken from PRACTICAL WIRELESS or other reliable source. This will probably make it necessary to dispense with some of the components, but it is the only satisfactory solution.

Another entirely different way of obtaining all the power for a battery set from the mains is to leave the set itself unaltered, and to employ an eliminator of the kind provided with a trickle charger. By following this idea a considerable saving can be effected, there will be no need to buy new valves or replace other components, and practically the same reliability of operation can be secured as with the specially-designed mains receiver. Eliminators of suitable type can be bought in either D.C. or A.C. form, but the average amateur will probably prefer to make his own, especially since this can be done quite easily.

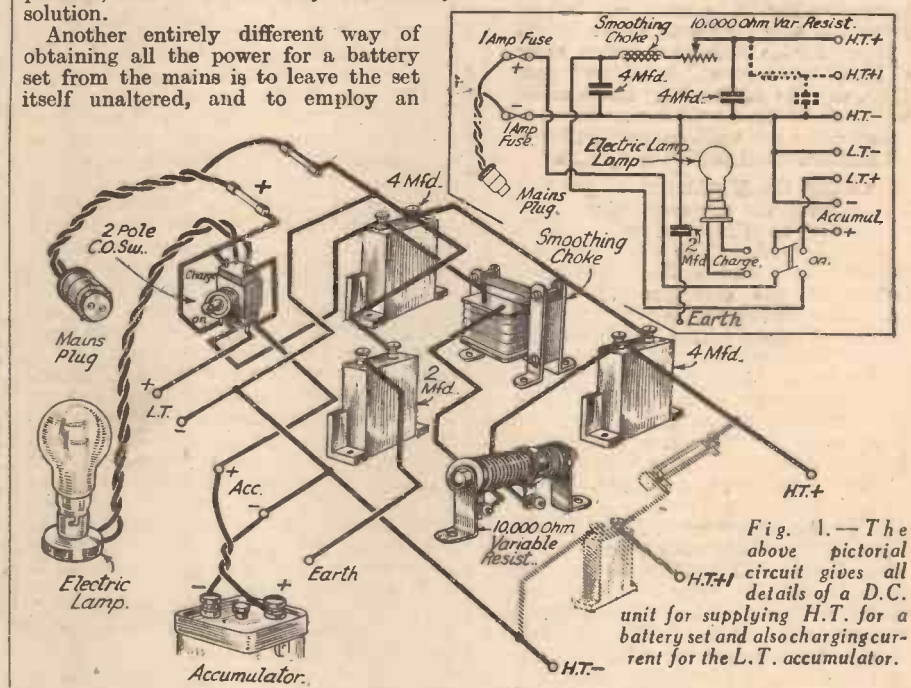

Fig. 1.—The above pictorial circuit gives all details of a D.C. unit for supplying H.T. for a battery set and also charging current for the L.T. accumulator.

Making a D.C. Unit

The D.C. eliminator is the simplest, and this will be dealt with first. A circuit diagram for a suitable unit is given in Fig. 1, from which it can be seen that very few components are required. As shown, the eliminator is designed to give only a single positive H.T. tapping, but there is no difficulty at all in arranging for other low-voltage tappings by connecting resistances and condensers as shown by broken lines. The most important point about the circuit arrangement illustrated is that a double-pole double-throw Q.M.B. switch is so connected that when it is in one position the mains voltage is passed directly to the smoothing choke and from there to the receiver, whilst when it is in the other position the H.T. supply is disconnected, and the mains are connected to the accumulator through an ordinary electric lamp. The idea of the lamp is merely to restrict the accumulator charging current when the receiver is out of use. If a 60-watt lamp were employed the charging current would be about ½amp. in the case of a 230-volt supply, and this is generally a convenient rate. It will be understood from Fig. 1 that there is no reason why the lamp should be a part of the eliminator unit; in fact, it will always be more convenient to place the lamp

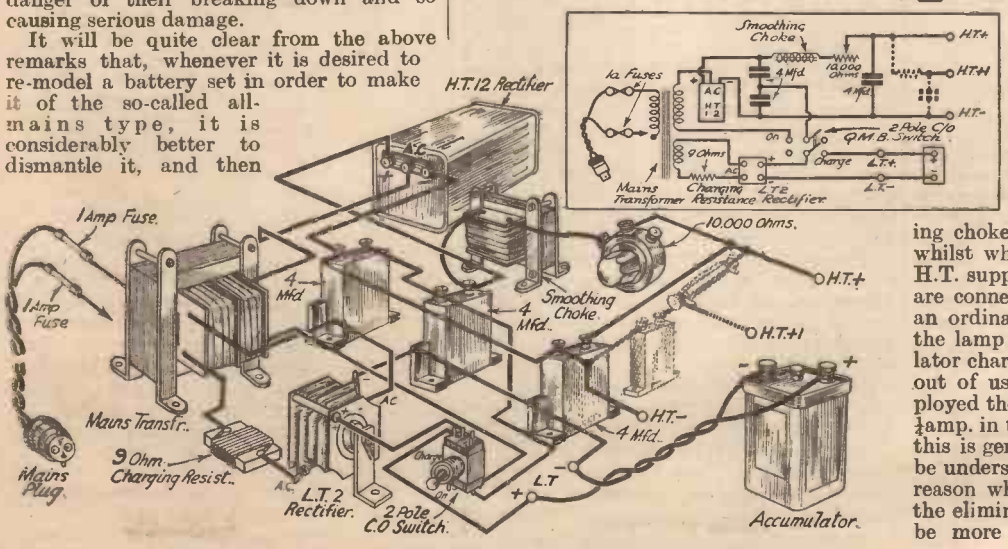

Fig. 2.—The combined H.T. unit and trickle charger shown above is for A.C. operation.

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somewhere where use can be made of the light which it gives when the accumulator is on charge.

Making the Smoothing Choke

Very little explanation is called for in respect of the construction of an eliminator like the one illustrated, and no great care is called for in arranging the components. The smoothing choke may be any good commercial component having an inductance of 20 henrys or more at the H.T. current normally passed by the set, or it can be made quite easily in the manner described in PRACTICAL WIRELESS, dated Dec. 23rd, 1933, using six dozen pairs of No. 4A stalloy stampings for the core, and approximately 8 ounces of 36 s.w.g. enamelled wire for the winding.

The variable resistance shown as being of 10,000 ohms should be of the "power" type, capable of handling up to about 10 watts, whilst the smoothing condensers and that used in the earth connection should be rated at not less than 400 volts peak working.

Connecting the Eliminator

The method of connecting up the eliminator to the receiver is perfectly straightforward. The four terminals, marked H.T. and L.T. should be connected to the corresponding terminals on the receiver, and the accumulator should be joined to the terminals marked "Acc.", taking care that correct polarity is observed. Since an earth connection is provided on the eliminator the earth lead normally connected to the set should be transferred to the new terminal; this will prevent the possibility of short circuits, due to the positive mains lead being earth-connected.

After the above connections have been made, the set will be switched on by putting the Q.M.B. switch into the "On" position. When the switch is turned over to "Charge" the set will be switched off and the accumulator will automatically be put on charge. Particulars in regard to the charging rate and length of charge were given in PRACTICAL WIRELESS dated September 30th, 1933, on page 103, so there is no need to repeat them here.

There is just one other point which calls for attention in regard to the circuit shown in Fig. 1, which is that it is assumed that H.T. negative and L.T. negative are joined together in the set; if, however, H.T. negative is joined to L.T. positive a slight alteration will be called for.

An A.C. Eliminator

When the mains supply is A.C. the circuit arrangement of a combined H.T. eliminator and trickle charger is slightly more complicated, and a circuit similar to that shown in Fig. 2 will be required. In this case a mains transformer is used to supply a metal rectifier connected on the voltage-doubler principle for H.T. purposes, and also to feed another (bridge-connected) rectifier which serves for charging purposes. The choice of the mains transformer and H.T. rectifier depends entirely upon the H.T. output required, but in most cases a maximum output of 150 volts at about 30 milliamps. will be ample. For this amount of power the rectifier might conveniently be a Westinghouse style H.T. 12, when the transformer should be able to feed 110 volts at 75 milliamps. to it. For accumulator charging the L.T. rectifier might conveniently be a Westinghouse style L.T.2, in which case an input voltage of 9 at .3 amp. will be suitable. It will be seen that a series resistance is included in the accumulator charging circuit, and the value marked applies to 2-volt accumulators. If a 4-volt or 6-volt accumulator were to be charged the resistance should be reduced to approximately 6 and 2.5 ohms respectively in order to maintain the charging current at about .3 amp. A convenient tapped resistance could easily be made, if desired, to enable 2, 4 or 6-volt accumulators to be charged with equal facility. The resistance should consist of approximately 1½yd. of 32-gauge Eureka resistance wire wound on a glass or porcelain tube. Tappings should be taken after winding about 12in. and 30in. A similar resistance, without tappings, can be used when a 2-volt accumulator only is to be charged.

The Mains Transformer

The transformer will require to have a primary wound to suit the mains voltage, and two secondaries, one giving an output of 110 volts, 75 milliamps., and the other 9 volts at .3 amp. A ready-made component can be bought, if desired, or a suitable instrument may be made, as described on page 847 of PRACTICAL WIRELESS dated January 20th, 1934. The core will consist of six dozen pairs of No. 4 stalloy stampings; the winding spool should be divided into three sections, of which the centre and one end one should be about ¾in. wide, the other end one being about ½in. wide; the primary should consist of 2,000 turns of 36 s.w.g. enamelled wire tapped at 1,600, 1,760 and 1,920 turns for 200, 220, 240 and 250 volts respectively, and placed in the centre section; the H.T. secondary will consist of 880 turns of 32 s.w.g. enamelled wire placed in the wider end section, and the L.T. secondary will consist of 72 turns of 22 s.w.g. double-cotton covered wire in the remaining section. The smoothing choke can be made exactly as described in respect of the D.C. unit.

The method of connecting the A.C. eliminator to the set is practically the same as that for the D.C. unit, and can easily be followed by referring to Fig. 2. It will be seen, however, that the normal earth connection is not altered in this case, and that it does not matter whether or not the H.T. negative terminal of the set is joined to L.T. negative or L.T. positive. A Q.M.B. switch is again used for changing over from "On" to "Charge" exactly as before.

Voltage Adjustments

In the case of both eliminators described it is best to adjust the value of the 10,000-ohm power resistance to a point at which no more than 150 volts is obtained between the H.T. positive and negative terminals. The best way to make this adjustment is first of all to set the resistance to its maximum position, switch on the set and join a voltmeter (preferably a high-resistance one) between the H.T. terminals. The resistance can then be adjusted until the correct reading is obtained.

When alternative H.T. tappings are required they can be obtained as described above, and as shown in Figs. 1 and 2 in broken lines. The only point which is likely to introduce any difficulty is the method of finding the appropriate value for the voltage-dropping resistance(s). This can be determined, as explained many times before in these pages, by using Ohm's Law and assuming a maximum voltage of 150. Thus, if a 90-volt tapping were wanted to supply a current of 7½ milliamps. the value of resistance would be found by dividing 60 (the voltage to be dropped) by 7½, and multiplying by 1,000.

SOME EARLY TUNING COILS AND COMPONENTS

(Continued from page 42)

It is interesting to note that there is no commercial ganged condenser now on the market which possesses the feature of a separate moving section, and this is probably accounted for by the fact that it is

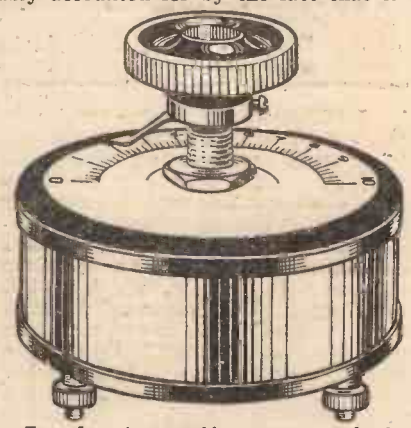

Fig. 5.—A variable condenser of the compression type.

now considered the proper practice to earth all moving vane, as these are directly in contact with the control knob, and this method of connection then removes the possibility of troublesome hand-capacity effects. There have been many occasions when such a condenser would have proved useful, and this particular model is still in existence in my workshop for occasional use and has been found very useful in more than one experimental receiver.

It is not proposed to deal with complete

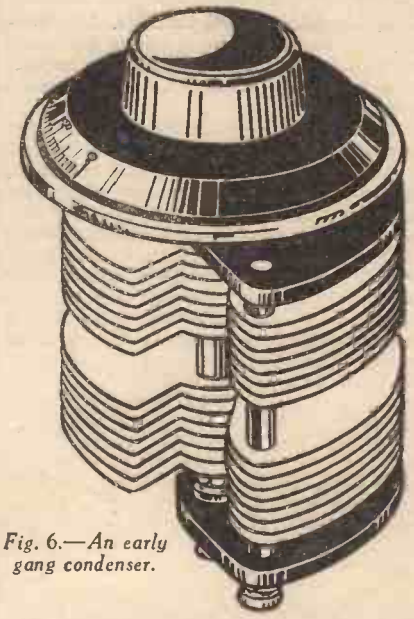

Fig. 6.—An early gang condenser.

self-contained tuners, which were at one time proposed. So far as we can trace, these never appeared in a really commercial form, although from America some novel models once appeared in a London store. These consisted of two types, one an insulated former carrying the tuning coil (which, as is common in American practice, covered only the medium-wave band), and inside the former the tuning condenser was accommodated. In the other model, the condenser was a solid affair and the tuning coil was supported on the end plate of the condenser.

INTRODUCING THE A.C. LEADER

Preliminary Details of the A.C. Mains Version of the Popular Leader Three-Valve Receiver.

This is the Battery "Leader" which has proved so popular.

AS was stated in last week's issue, we have received a very large number of requests for a version of the Leader receiver which could be operated from the A.C. mains. We have very carefully examined all these requests, and we have found that the majority of our readers prefer a simple type of three-valver, not employing a pentode valve. This, of course, agrees with the opinions which we found were expressed when the original Leader was designed, the majority of listeners finding that the cost of the receiver is really the principal consideration. Consequently, the analysis of requests has resulted in overwhelming majority for the simple type of circuit such as was employed in the original battery model. For the benefit of those who desire to know precisely why this component was used, or why that circuit arrangement was adopted, we propose this week to describe the circuit and lay-out arrangements only, and to leave the actual constructional details until next week.

The Circuit

The theoretical circuit of the A.C. Leader is shown at the foot of this page, and it will be noticed that it is almost a replica of the original battery receiver, with only those modifications which are rendered necessary by the use of the indirectly-heated A.C. valves. These valves, of course, require an anode voltage in the neighbourhood of 200, and this means that the mains side of the apparatus must be designed to deliver this voltage. It has been found in the past that the cost of the mains equipment forms a very large portion of the total cost of a receiver and, as we have been emphasizing during the past few weeks, we are most anxious to design receivers which will successfully compete with the commercially-built receiver. The original battery Leader was constructed for sixty shillings, and we are pleased to be able to inform our readers that this A.C. version will not cost more than eight pounds. The principal part of the mains equipment is, of course, the mains transformer, as this has to deliver not only the high-tension voltage but also the supply for the heaters of the valves. We could not at first find a transformer which, whilst possessing those characteristics which were found desirable in the finished receiver, could be obtained at a price which would be proportionate to that of the complete receiver. However, Messrs. Heayberd stepped into the breach and have specially produced to our design a mains transformer which, whilst not a standard article, delivers adequate supplies for the receiver. The cost of this article is only 16s., and ample supplies are available.

NOTABLE "LEADER" FEATURES

THE LATEST COILS FOR THE NEW "LUCERNE" WAVE-LENGTHS
AN EFFICIENT SCREEN-GRID STAGE FOR DISTANT RECEPTION
TUNED-TRANSFORMER H.F. COUPLING FOR MAXI-MUM SELECTIVITY
SELECTIVITY *IN EXCELSIS*
ONE AND-A QUARTER WATTS OUTPUT
METALLIZED CHASSIS CONSTRUCTION
REMARKABLY EASY TO BUILD
EQUALLY GOOD ON "RADIO" OR "GRAMOPHONE"
COSTS ONLY EIGHT POUNDS FOR THE PARTS
THE MOST POPULAR CIRCUIT ARRANGEMENT
GANGED TUNING CONTROL FOR EASE OF OPERATION
THE IDEAL SET FOR EVERY CONSTRUCTOR
ABSENCE OF MAINS HUM
NEGLIGIBLE CURRENT CONSUMPTION

The Rectifier

In the interests of low initial cost we have decided to employ a valve rectifier. It is admitted that there is always the possibility of such a rectifier having to be replaced at some future date, whereas the metal rectifier will last indefinitely, but the metal rectifier would cost more, and requires, in addition, extra smoothing condensers. The choice was, therefore, limited to the valve rectifier. A special moderately-priced block type of condenser is employed on the smoothing side, and this part of the circuit is completed by a very good choke (a Wearite product) possessing high inductance, low resistance, and costing only 9s. For smoothing the bias supplies to the output valve and the detector—when the latter is employed for gramophone-record reproduction, electrolytic condensers are employed. These provide ample smoothing and eliminate practically all traces of mains hum. They have the extremely high capacity of 20 mfds., combined with a working voltage of 12 (there is thus an adequate factor of safety since they are only called upon to deal with voltages of 7 and 2 respectively), though costing only 2s. 6d. each.

Four T.M.C. tubular condensers are employed, and these are all tested at 1,000 volts D.C., again providing a wide margin of safety under all conditions. The condensers are small in size, convenient to use, and, despite their excellent characteristics, are remarkably low-priced.

The "key" components, such as the coils, gang condenser, L.F. transformer, which were used in the battery model, have been retained in order to ensure the same high degree of efficiency shown by the battery version. As a matter of fact, however, the A.C. model is even more efficient because of the better characteristics of the indirectly-heated valves. The range of reception is appreciably extended, and the undistorted signal output is 1,250 milliwatts, as compared with 150 milliwatts for the battery set.

Such notable features as selectivity, ease of control, simple component lay-out and short, direct wiring which were prominent

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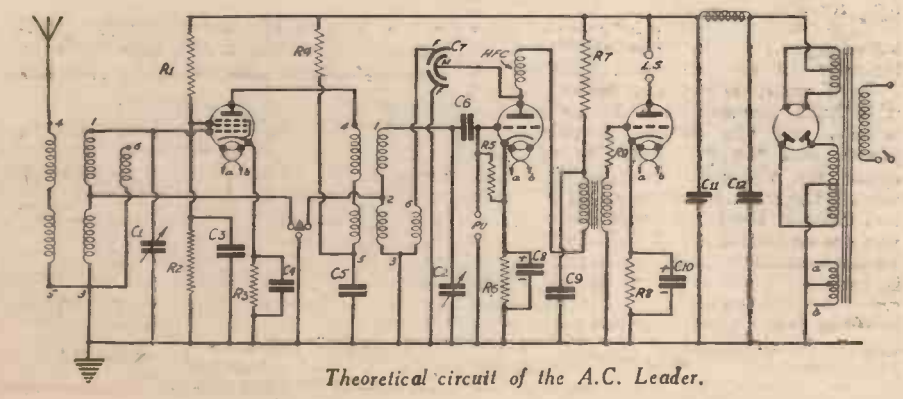
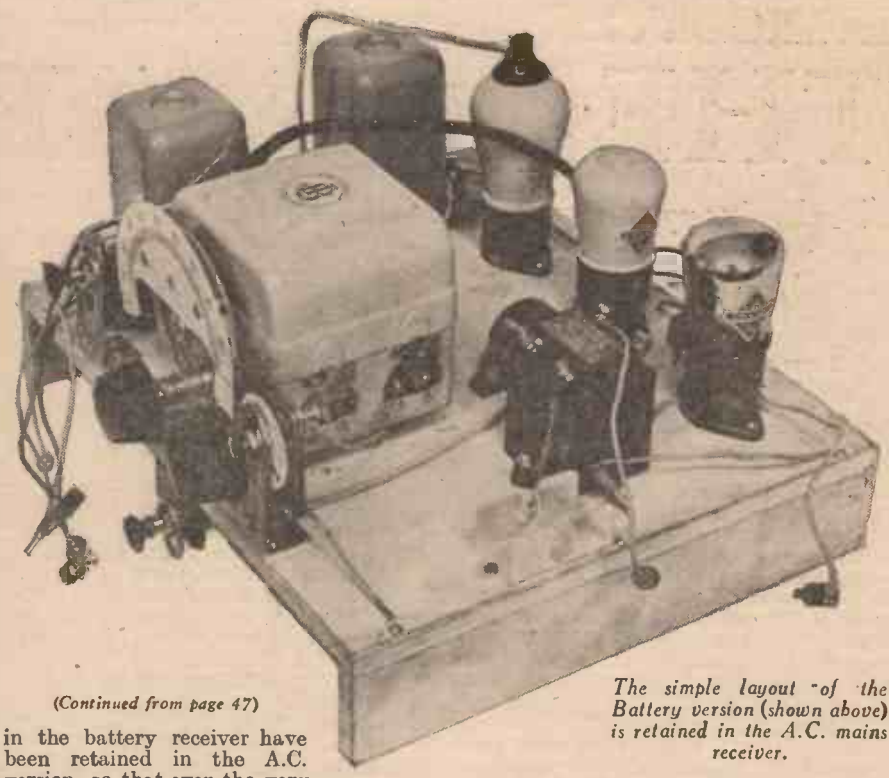


Theoretical circuit of the A.C. Leader.

LIST OF COMPONENTS FOR A.C. LEADER.

One Jackson Bros. Double-gang Condenser .0005 "Nugang" Type A (C1 and C2).
Two Wearite "Universal" Screened Coils.
One Graham Farish .00015 mfd. Differential Reaction Condenser (C7).
One Bulgin Junior On-off Switch, type S.38.
One Varley "Niclet" 5—1 L.F. Transformer.
One Graham Farish "Snap" H.F. Choke.
One Heayberd "Leader" Mains Transformer.
One Wearite Smoothing Choke Type H.T.25.
Three 2in. Component Brackets British Radiogram.
Two Clix Terminal Socket Strips (one marked Aerial and Earth, and one marked L.S. and P.U.).
Six Solid Clix Plugs for use with terminal strips.
One Claude Lyons "B.A.T." Type 728-L.T. Switch.
Four W-B chassis mounting 5-pin valve-holders.
One Claude Lyons "B.A.T." 100,000-Ohm Resistor, Type R.1 (R9).
One Claude Lyons "B.A.T." 50,000-Ohm Resistor, Type R.1 (R7).
One Claude Lyons "B.A.T." 40,000-Ohm Resistor, Type R.1 (R2).
One Claude Lyons "B.A.T." 30,000-Ohm Resistor, Type R.1 (R1).
One Claude Lyons "B.A.T." 5,000-Ohm Resistor, Type R.1 (R4).
One Claude Lyons "B.A.T." 1,000-Ohm Resistor, Type R.1 (R6).
One Claude Lyons "B.A.T." 350-Ohm Resistor, Type R.34 (R8).
One Claude Lyons "B.A.T." 250-Ohm Resistor, Type R.1 (R3).
One Claude Lyons "B.A.T." 1 megohm Resistor, Type R.1. (R5).
Two Dubilier 20 mfd. Electrolytic Condensers, Type 401 (C8 and C10).
One T.M.C. 4+4mfd. fixed Condenser, Type 40 (C11 and C12).
One T.M.C. 2 mfd. fixed Condenser, Type 40 (C9).
One T.M.C. .0001 mfd. tubular fixed Condenser (C6).
Two T.M.C. .1 mfd. tubular fixed Condensers (C4 and C3).
One T.M.C. 1mfd. tubular fixed Condenser (C5).
One Peto-Scott Metallized Chassis, 16in. x 10in. with 3½in. runners.
One Cossor MS/PEN Valve.
One Cossor 41.MH Valve.
One Cossor 41.MP Valve.
One Cossor 506.BU Rectifier.
Wire, screws, flex, etc.



The simple layout of the Battery version (shown above) is retained in the A.C. mains receiver.

(Continued from page 47)

in the battery receiver have been retained in the A.C. version, so that even the very beginner may undertake the construction of this modern and high-class mains receiver with the same confidence that he would build the most elementary kind of set. It will be observed from the list of parts that a metallized chassis has been again employed, as in the case of all recent PRACTICAL WIRELESS receivers, and this is particularly useful in providing efficient screening and also in simplifying numerous earth-return connections. The chassis is supplied ready drilled and the components may be mounted upon it at once without any tedious woodworking operations being called for.

SHALL I BUILD MY OWN RECEIVER?

By GRID LEAK

I ONCE heard one of my friends, nicknamed the "Hunchback of Superheterodyne," because, it was stated, he had become a human distortion from ceaseless work, dumb as to radio, blind to the outside world, hard-hearted and cynical from disappointments, but with the patience of a veteran fisherman. All this because he had cut himself away from his many intimate friends in order to make a study, in an amateurish way, of wireless. It mattered not what new circuit was published, he must by habit rig up the set to find out for himself what could be got out of it. After this sort of thing had been going on for quite a considerable period he accidentally stumbled, by chance, on doing something which in theory was all wrong, but in practice it was very much all right. To-day, he is a man of considerable wealth and certainly no resemblance of what his friends at one time called him.

Now why I mention this little episode, which came to my personal notice, is to answer a question which is often put to me, "Which is the best thing to do, buy a ready-made wireless receiver or construct one at home?"

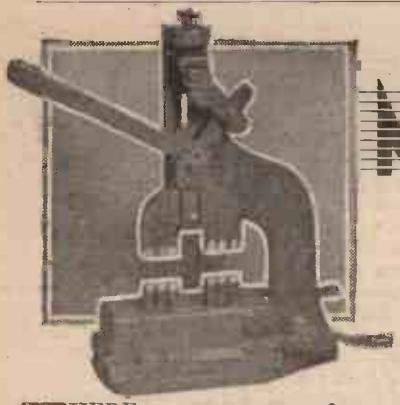
It is one that cannot be answered, except in a general sort of way, because no two persons are temperamentally alike. Some have not the time or patience to use a drill, or struggle with a screw-driver, preferring in a lazy kind of way to pull out a switch and listen to what good things are poured into the ether; while another is eager to know how this tapping of the ether is accomplished. Most men keep the inquisitiveness of childhood, no matter how old they may become, and it is curious to notice that father gets most enjoyment out of the new clockwork toy, which he has bought for his young hopeful, until he has satisfied himself of its intricacies. It is a searching and hunting for knowledge which is the driving force. Knowledge is power and is but another way of saying, experience is the ladder to success. Unfortunately, many complain that it takes too long to obtain experience. The objection is wrong where radio is concerned, for books covering the experiences of others are before you for reading, and although the lessons of theory make it possible for you to absorb knowledge, it cannot be substituted satisfactorily for practice itself. We owe a debt of gratitude to those radio pioneers who have bequeathed a legacy for the present and the future. Knowledge is power, and the practical side of radio opens up vistas of imagination which compel the mind to theorize. If you neglect learning the mere simplicities of radio you are neglecting actual gold for nothing. Radio presents many mysteries; the reason is, perhaps, it is as yet quite young. There are many things which cannot be explained in other sciences, so it cannot surprise us that in a world where we will never know the how and why of most things mysteries abound in the complicated science of radio. We have played with electricity for a century and a half, and yet do not know what it is.

It is a mistaken idea to think that you must be an electrical wizard in order to build a radio set. As a matter of fact, you do not need to have any technical knowledge whatever of the principles of radio in order to build even one of the most complicated valve sets. The diagrams of new circuits published in PRACTICAL WIRELESS from time to time may at first appear very complicated to you, but they are not nearly so hard to understand as they at first appear. The designer's method of issuing blue prints and lay-outs of the circuit makes it almost impossible for an error to be made by the constructor, for they can be followed by the dullest schoolboy with the utmost simplicity. It not only shows you the best method of wiring, but it also shows you a lay-out for assembling the components on the panel and baseboard.

Long-distance Wireless Reception

WHAT is considered to be a record in long-distance wireless reception was accomplished, so we learn, by an amateur wireless operator in Amsterdam. He reports that shortly after midnight (G.M.T.) on February 13th, he picked up a message from an Imperial Airways liner. The message, which was a routine one, giving the position of the liner, was on a wavelength of about 46 metres. The distance of the liner from Amsterdam at the time was 7,000 miles.

For the Technical Experimenter.



MAGNETISING THE MAGNET

BY:- DR. F.W. LANCHESTER

In This Article the Author Explains the Principles Involved and Describes the Various Systems in Use Commercially

THERE are many types of permanent magnet used in present-day moving-coil speakers, and there are several alternative methods of magnetization, some of which are applicable only to particular types, whilst other methods are of more general application.

Before discussing these in detail a few words need to be said on the subject of the fundamental nature of the problem. In Fig. 1 is shown the hysteresis loop (half only) of a high-grade cobalt magnet steel. This loop shows the variation in flux density in a closed circuit of the steel in question when the magnetizing force is undergoing a periodic change from H = +1300 to —1300 (only plotted to —250). The part of this hysteresis loop that is of interest to the designer of a moving-coil speaker is that figured B_{rem} (remanence) to C.F. (coercive force) in the "north-west" quadrant, but the part of the loop which is of particular interest from the point of view of magnetization is that from the peak "P" to the point "B_{rem}." The object when magnetizing is to bring the magnetic condition to the point P, in order that when the magnetizing force is withdrawn the condition may be that implicated by the graph B_{rem} C.F. To effect this it is necessary to subject the magnetic circuit to a magnetizing force under conditions where it can carry a flux (for the steel in question) equal "B" 17,000. Bearing in mind that we are dealing with *ampere-turns* and not *gauss* (for which the symbol H stands, or according to the latest international nomenclature "œrsteds") and knowing that two ampere turns per inch is approximately one gauss, a good rule for magnetization is to provide 3,000 ampere turns per inch of magnet (=1,200 per c.m.) for a high-grade cobalt steel. For tungsten and low-grade magnet alloy-steels the magnetizing force required is not very different. In any case an addition is necessary to cover the demands of the external field.

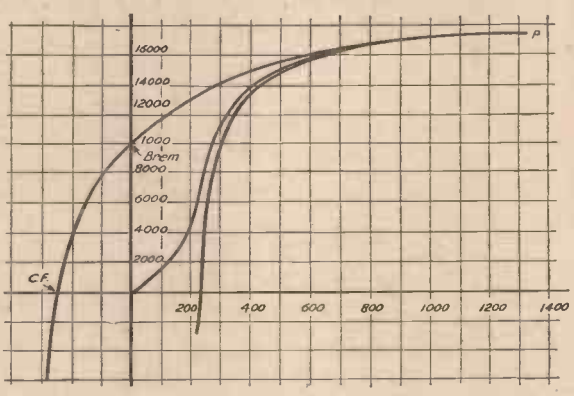


Fig. 1.—The hysteresis loop of a high-grade cobalt magnet steel.

Various Methods Available

The methods of magnetizing available and actually in use are the following:—

(A) The use of a powerful electro-magnet, external to the magnet to be magnetized, and including the latter in its magnetic circuit (Fig. 2).

(B) A winding inserted in the magnet assembly itself which may be withdrawn (unwound) subsequently, Fig. 3.

(C) The equivalent, in which, instead of a winding, the circuit is constructed or built up of one or more copper conductors represented diagrammatically in Fig. 4.

(D) Similar to (C) in which mercury connections are used.

(E) By inserting the whole magnet assembly in a field winding with iron yoke components to complete the circuit, Fig. 5. This method is only applicable when the permanent magnet forms a part only of the magnetic circuit, and in which the remainder of the circuit is carried by soft iron or mild steel.

(F) A variant of the foregoing to suit a magnet of the two-claw type, Fig. 6.

Taking these methods in order:—

Method A. This method is suitable for magnetizing small magnets generally, and provided the electro-magnet has sufficient ampere turns and that the core is of sufficient area, it may be applied to speaker magnets in certain cases, but it is rarely that the field can be fully saturated by this means.

Method B. The magnetizing coil is most conveniently inserted when building up the magnet assembly. The winding may consist of some twenty or more turns having a resistance = .015 Ω and may either be in the form of a copper strip or flexible cable or, say, two strands of 16-gauge double-cotton-covered wire. This is wound on a paper sleeve or spool which facilitates the final removal of the winding. The current is conveniently taken from a storage battery at about 12 volts. The size or capacity of battery required, in order to keep the internal resistance sufficiently low (about

(Above). The corner of a workshop where magnetizing transformers are used with magnet jigs.

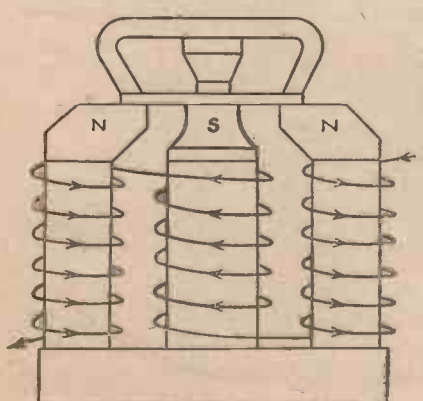


Fig. 2 (left).—Showing one method of magnetizing by means of a powerful electro-magnet.

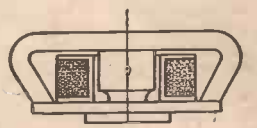


Fig. 3 (top right).—Magnetizing the magnet by means of a winding placed on it.

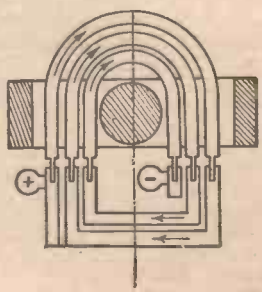


Fig. 4 (bottom right).—A magnetizing system consisting of a number of copper conductors.

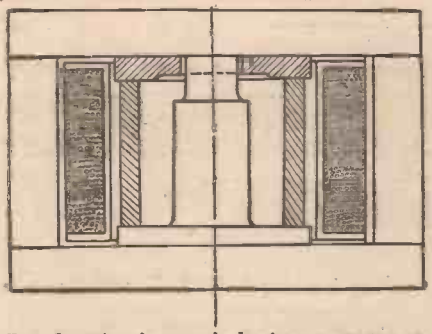


Fig. 5.—Another method of magnetizing, in which the complete magnet assembly is placed within a field winding with iron yoke.

.005 Ω) is some 300 ampere hours. It is good practice to insert a suitable fuse in the circuit so that the operator only has to close the switch, the breaking of the circuit after a short time being determined by the blowing of the fuse. The fuse may consist of a piece of 20-gauge copper wire. Fig. 7 shows a four-claw magnet with the winding in situ. An iron armature is applied to the magnet pole gap to close the circuit during magnetization.

Method C. This method is, electrically speaking, equivalent to a winding consisting in a single turn, or a few turns only. The conductor takes the form of a "croquet hoop" of stout copper or a number of such. If a single conductor is used it is necessary to provide for very heavy current, some 10,000 to 20,000 or more amps being necessary according to the size of the magnet, *i.e.*, length of magnetic circuit. This heavy current can be provided either by a special D.C. dynamo or by a step-down transformer in which the core is saturated from a primary winding of many turns. On either making or breaking the primary circuit the field functions by its inductive reaction on the secondary; this latter may consist of only one or two turns of copper, producing a short-lived current of the necessary strength.

In a modification of this system (Fig. 4) instead of single loops an assembly of copper conductors of hoop form are used, the prongs of which register with fixed connecting conductors.

Method D. This method is similar to C, except that mercury cups are used into which the prongs of the copper conductors dip. This method, though used until recently by certain of the leading firms, suffers from the disadvantage that the conductivity of mercury is very low, being about 1/100th of that of copper. Beyond this a certain amount of mercury is lost at every operation, and has to be replaced. This method of magnetizing may be taken as obsolescent.

Method E is generally used when the magnet assembly is of the pot type in which the permanent magnet takes the form of a hollow cylindrical casting, and in which the centre pole is of soft iron. When the current is passed the permanent magnet is magnetized, and at the same time the centre pole is saturated in the magnetic field *in the same direction*. This pole, however, consists of soft iron, and cannot hold its field. Immediately the circuit is broken, the field in the centre pole is reversed by the permanent magnet, and so the gap field is established. It is the necessity of reversing the field in the pole member that renders this method inapplicable when the whole circuit is of magnet steel.

Method F. In principle this is the same as (E), adapted to magnets of the two-claw type. Two magnetizing windings are employed, and a double-return circuit is made by a yoke built up of blocks of soft iron in the manner shown in the Fig. 6. Here again, part of the circuit, namely that in the pole-plate, is induced in the not-wanted direction when magnetizing, but the pole plate being of soft iron, the field is reversed by the permanent magnet the moment the magnetizing current is broken.

Method B, above described, is the most conveniently adopted by the amateur who wishes to magnetize his own assembly or remagnetize an assembly which he has imprudently taken down. It is not necessary to unwind or remove the winding after magnetization. It may be left in place so that it will be available at any time for remagnetizing, or for boosting the field from a battery in order to increase sensitivity. The quantity of copper so "buried" in the winding is not great and the cost is not prohibitive.

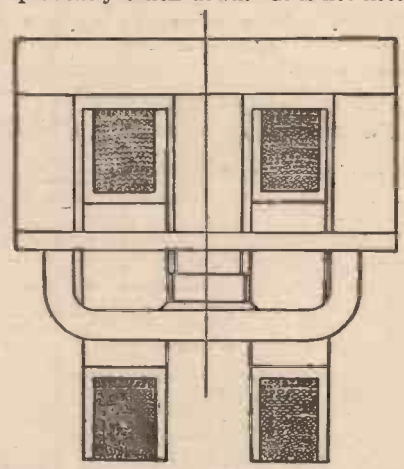
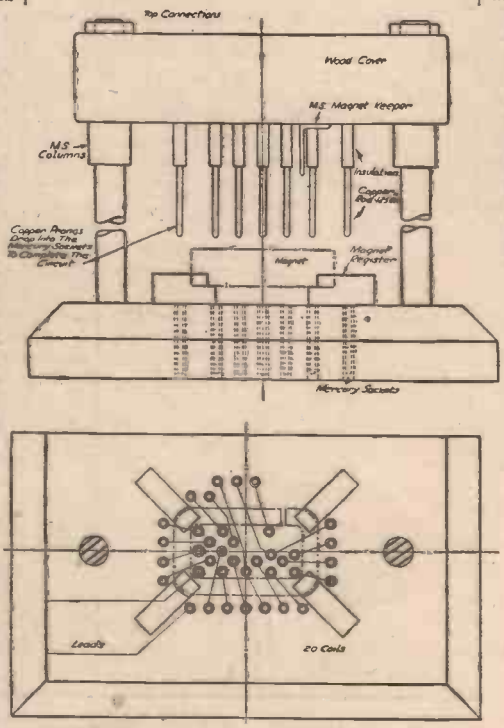


Fig. 6.—Illustrating a method similar to that of Fig. 5, but suitable for a magnet of the two-claw type.



Figs. 7 and 8.—Details of a commercial form of magnetizer; this is described in the text.

It has already been stated that the D.C. necessary for carrying out Method B is best derived from a battery carrying about 12 volts. The reason for this is if a high voltage is used the conductor has too great a number of turns for convenience. A lower voltage may be used if a suitable cable is available.

For method C, it is possible to use a generator capable of giving the necessary heavy current if cost of equipment is no great handicap; the alternative, as already stated, is to use a transformer to "step-down" from mains voltage to that required. It has to be remembered that the energy to be thrown into the magnet in order to saturate is approximately 0.1 joule per c.c. of magnet steel, which means for an average size speaker magnet about 20 or 30 joules are required. This is the net energy to be thrown into the magnet steel; many times this is necessary to bring about saturation in practice. It is this that determines the dimensions or capacity of the transformer necessary. Method A, E, and F are not restricted to the number of turns, and consequently mains current may be used; in the case of an A.C. supply the current may be derived from a rectifier.

Details of Magnetizing Equipment

As illustrating the methods described, a few examples may be given of magnetizing equipment as used by some of the leading firms.

The system employing a transformer would appear to be that in most general use. When reference is made to a *transformer*, it usually calls to mind the use of an alternating current, but the transformer as used for magnetizing purposes is, in its function, more resemblant of an induction coil in which the primary and secondary windings are so proportioned as to step-down the voltage instead of stepping it up. Such a transformer is adapted for use in connection with a D.C. supply; in its manner of use there are two possible alternatives, namely, to utilize the secondary current either on primary "make" or on primary "break," these two methods correspond to what have been termed the "make" spark and the "break" spark of a Ruhmkorff coil.

(To be continued)

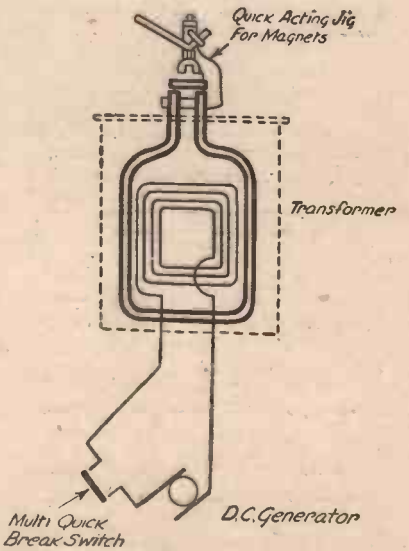


Fig. 9.—Another commercial form of magnetizer, the advantages of which are described.

PERFECT QUALITY

Why Broadcast Reproduction can Never be as Good as the Original Performance.

By E. WATTS

AMONGST wireless enthusiasts one can often hear the boast that "My reproduction is perfect." Whilst it is admittedly the aim of all listeners to endeavour, by careful receiver design and choice of accessories, to obtain reproduction which is of high quality, it would appear to be impossible to pick up a broadcast transmission and reproduce it with all the characteristics of the original performance. Before explaining why this is so it is necessary to examine the small diagram of Fig. 1. This is not a complete frequency chart of all the musical instruments, but is a diagram showing what actual musical frequencies exist above 2,000 cycles and below 50 cycles. The reason for taking these limits will be given shortly. It has previously been explained (see page 385, PRACTICAL WIRELESS, June 3rd, 1933) that all musical instruments owe their characteristic tone (or timbre) to the harmonics which accompany the pure or fundamental note. In order, therefore, to retain the characteristics of any one individual instrument we must include the full range of harmonics. In Fig. 1 the harmonics are shown as extending, in some cases, up to 30,000 cycles. Theoretically, therefore, the broadcast receiver should reproduce at equal volume all frequencies from 20 to 30,000 cycles. We already know how difficult it is to design such a receiver, but fortunately there is no necessity to go so far as will now be shown.

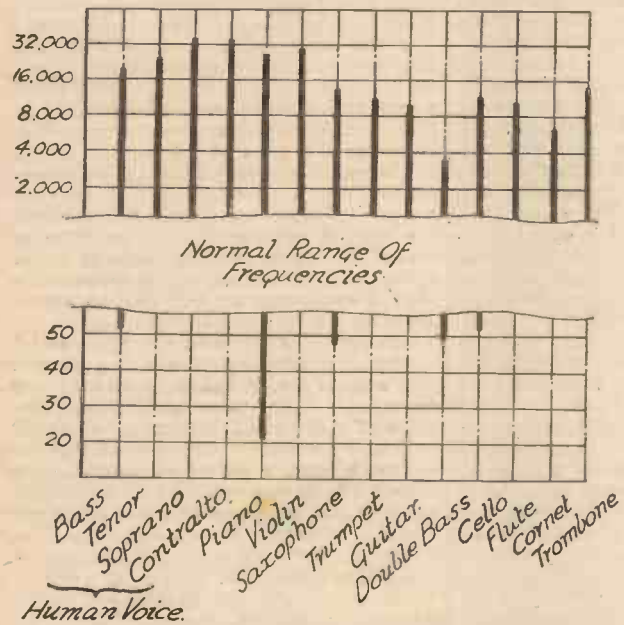


Fig. 1.—The range below 50 cycles and above 2,000 cycles which is covered by the human voice and the majority of popular instruments.

The B.B.C. Frequency Range

The various European broadcasting stations are allotted certain wavelengths upon which to work, and these are so arranged that there is a certain separation between each station. The theory governing this choice of wavelengths, or frequencies, is that the carrier-wave of the transmitter, which is given in any table of stations under the term kilocycles, is modulated by the music it is transmitting, and these modulations extend for a certain distance on either side of the actual frequency or wavelength. Thus, if a station has a wavelength of 300 metres, which is 1,000 kilocycles, in order to obtain full musical quality it is necessary for the receiver to be tuned so that it offers equal amplification to a band of frequencies of 1,000 minus a certain amount, up to 1,000 plus a certain equal amount. Fig. 2 shows what is meant, and this small diagram will be recognized by most readers as the ideal curve of what is known as a band-pass tuner. However, the point at the moment is how far above and below the actual station frequency the broadcast receiver must tune to embrace the full musical frequencies.

The spacing between stations which is adopted in Europe is 10 kilocycles, that is 10,000 cycles, and this means that in order to prevent the reception (together) of the upper and lower limits of any two adjacent stations the broadcast receiver must be designed to accept only just over 9,000 cycles, or 9 kilocycles. Unfortunately, however, there are some parts of the present medium waveband where less than this spacing is necessary, owing to the fact that two stations are broadcasting with a smaller separation than 10 k/cs., and this overlap gives rise to a whistle, which in some cases may be heard to carry the speech or music, badly distorted, of course, of each station. Therefore if we do not wish to hear this noise, which is termed a "heterodyne whistle," we must design our receivers to cut off at a point just about 9 k/cs. A band-pass tuner will enable us to do this, of course. If we take this figure as a standard, therefore, the response of our receiver will cover a band of 9,000 cycles, which, from Fig. 1, shows us that we lose some of the harmonics which have been shown to be so important.

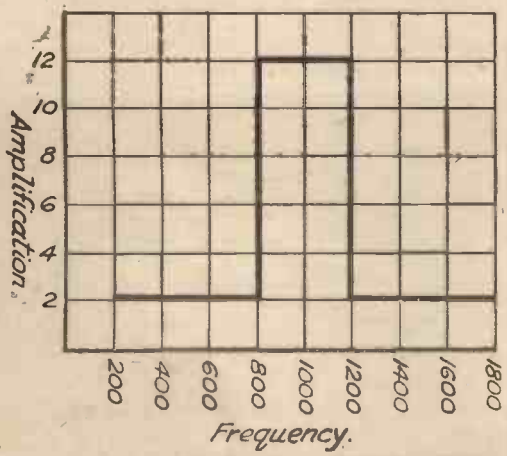


Fig. 2.—This diagram illustrates the ideal which should be aimed at in designing the frequency response of a broadcast receiver.

Theory and Practice

If we examine the catalogues of loudspeaker manufacturers we shall probably be surprised to see that various makers guarantee their products to have a level response from 50 to 5,000 cycles, so that theoretically we may still further limit the response of our receivers, with consequent avoidance of heterodyne whistles and other similar noises, but obviously with a further loss of harmonics. Again, the B.B.C. tell us that land-line transmissions are now so arranged that they are able to carry from 50 to 6,000 cycles on a line originally designed for 200 to 3,000 cycles, and therefore these transmissions will be deficient of frequencies necessary for *real* quality.

It will be noticed from the diagram that the human voices will be those which suffer most by this harmonic cut-off, and this, of course, accounts for the rather unnaturalness of such transmissions. In fact it will probably be found, if you listen carefully, that no two sets give the same character to the spoken voice; and this is due principally to the over-all frequency response.

CUT THIS OUT EACH WEEK.

Do you know

—THAT the tuned-anode method of coupling gives a higher degree of amplification than any other method of H.F. coupling.
—THAT due to the above fact the tuned-anode system is more prone to instability.
—THAT there is a possibility of an 11-pin valve appearing on the market in the near future.
—THAT cheap flex should not be used for wiring the heaters of multi-valve mains receivers.
—THAT adequate ventilation should be permitted in mains receivers, especially where super-power valves are employed.
—THAT care must be exercised when connecting the metalised coating of some types of valve to earth owing to the risk of short-circuiting grid bias resistances.
—THAT the total grid-circuit resistance must be watched when designing a power amplifier employing super-power mains valves.

NOTICE.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Random Jottings

By the Editor.

Valve Manufacturers Please Note

I HAVE previously commented upon occasional queries which come our way and help to relieve any possible monotony. A post-card was recently received by our Free Advice Bureau which read as follows: "I had occasion recently to break open a pentode valve for examination. Deposited on the auxiliary grid were thirty-three small moth eggs—presumably they got there during manufacture. Please tell me if this is usual, and if the makers would replace it. Yours (signed)." Whilst we are well able to appreciate a good joke, and although our legs are becoming very elastic, we do think that this is taking things a little too far. Seriously, though, if the correspondent in question had realized that in the "gettering" process all valves are passed through a high-frequency "furnace" in which their electrodes are made red-hot if would have been obvious that either the supposed moth eggs would have been burnt to ashes, or otherwise would have been hatched out. In any case, they would not have remained as eggs. We are therefore afraid that the manufacturers could hardly be expected to replace the valve, although students of natural history might be persuaded to pay handsomely for the disembowelled valve and the remarkable "eggs" found in it.

We certainly do not think that the finding of potential moths in valves is by any means common, for such a discovery has never before been brought to our attention.

Exide Cells on Safari

ANOTHER example of the way in which British goods are penetrating into strange places is afforded by the Gatti Expedition, led by Commander Attilio Gatti, which left London on December 29th for Central Africa with the object of bringing back specimens of such rare animals as the okapi, the zebra, the antelope, and the giant forest hog. The expedition has taken, as part of its necessary equipment, a battery of Exide cells for work in conjunction with a portable Lister lighting set. Exide batteries are also fitted to a specially equipped Vauxhall car and two Bedford trucks. Mombasa is the disembarkation point, and at Nairobi, where, incidentally, the Exide Distributors, Messrs. Battery & Electrical Equipment Co., Ltd., will be called upon for filling and charging the batteries, the expedition goes on safari, and for night work a number of Drydex torches have been taken.

A New Burne-Jones Multi-contact Switch

I ALWAYS enjoy a chat with Mr. Burne-Jones, one of the pioneers of the Component Industry, who has on more than one occasion come to the rescue with an ingenious component to relieve the troubles of the home constructor. It is generally agreed that even to-day the greatest sources of trouble in a wireless set are in the valve-holders, potentiometers, and *switches*. Please accent that last item, Mr. Printer!

In the course of our last conversation, Mr. Burne-Jones enchanted me by producing from his pocket the first sample of a new multi-contact multi-purpose switch of ingenious and robust construction, which he will shortly place on the market.

The rotating member of this is a slackening rod, and distance brushes space the two-point cams which make and break contact. The sprung portion of the contact is of phosphor bronze, and the contacts themselves are of gold-silver, thus ensuring that there will be no voltage-drop across the contacts.

The switch is of the Q.M.B. type, and I am looking forward to receiving a production sample for inclusion in one of our receivers. The rotating member also operates in one of its positions a snap on-off switch, and a Maltese-cross stop mechanism ensures a positive click and stop. I have encountered every sort of switch trouble, but I cannot imagine where this one could possibly go wrong. Mr. Jones tells me that it will be marketed at a competitive price which is not yet fixed.

New Spanish Air-Line

THE opening of the new Spanish air-line from Seville to the Canary Islands has again demonstrated the value (for long-distance air routes) of the Marconi combined medium- and short-wave aircraft equipment, as used in the Imperial Airways' "Atalanta" class aeroplanes on the African and Indian routes. On the Spanish air-line the aircraft follow the West African coast for about 1,100 kilometres flying distance, from Tangier to Cabo Juby (via Rabat, Casa Blanca, Mogador, Agadir, and Cansaba), and across to Las Palmas via Fuerte Ventura. Throughout the flight they are in touch with the aerodromes at Madrid and Las Palmas by short-wave wireless (50 metres), and with the local coastal and aerodrome stations on the route by medium-wave wireless (900 metres). In addition to normal air and ground communication, the wireless operators have also been able to report direct to Madrid on the short waves.

An artist's impression of the new Cossor Valve Works at Highbury.

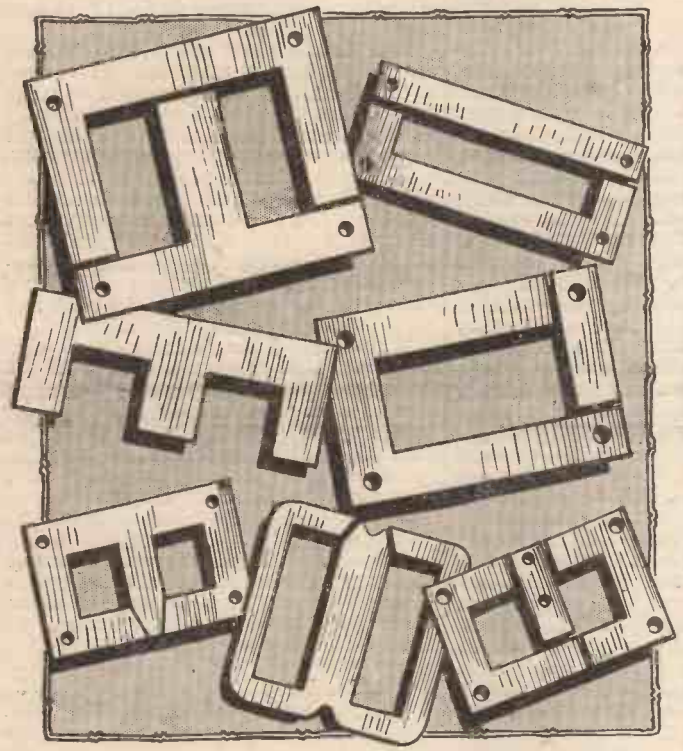
THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

ABOUT MAINS TRANSFORMERS

Practical Points on Their Design and Uses, with Special Reference to Valve and Metal Rectifiers.

TRANSFORMERS are probably the most useful and adaptable accessories used for wireless work, being employed in radio frequency (H.F.), audible frequency (L.F.), and A.C. power mains circuits: A transformer forms a convenient means of stepping up or stepping down the A.C. component as required, and giving an output completely insulated, and separate, from the input supplied to it. In its simplest form, *i.e.*, for H.F. work, a transformer merely consists of two coils inductively coupled, which function by virtue of the fact that as current flows through one coil (which we term the primary) a magnetic field is set up, in which we place the second coil (termed the secondary) into which voltages are induced, in relation to that which is flowing through the primary winding.



The above drawing shows a variety of types of transformer stampings.

Winding Ratios

By making the secondary coil larger in proportion to the primary winding, we get a larger E.M.F. output than we put into the primary, and this is termed step up: and by making the secondary coil smaller in relation to the primary, we get a correspondingly smaller output from the secondary (step down). The property of stepping up is made use of in the L.F. portion of our wireless set, and here we include iron in the magnetic field of our coils. This useful state of affairs is not applicable to direct current, as transformers will only function on an A.C. supply; it is only the alternating component—in the case of the L.F. transformer, the speech current—that is transformed. The direct current from the H.T. battery flowing through the primary will not be induced into the secondary coil. It is true to say that without transformers, A.C. mains wireless working would not have reached its present state of development, as the A.C. voltage from the mains can be transformed up and down as required. It is possible by the simple act of feeding our mains voltage (of, perhaps, 200 volts) into the primary coil, to arrange for an output of any number of volts from the secondary coil. If necessary, this can be as much as 1,000 volts, as to step 200 volts up to 1,000 volts merely requires the secondary coil to have five times as many turns of wire as the primary winding. A still further advantage is that we can couple to this same primary more secondary coils; one for 4 volts if we want it, and so on, until all the available space on the iron core is used up.

The iron used in a transformer for this purpose is sold quite cheaply by many firms, in the form of stampings of convenient sizes and shapes for radio work. The iron used is of special high quality, each lamination being insulated on one side. The most commonly used are known as L and T pieces, shown in the accompanying illustration, and when assembling the core the L and T pieces should be threaded through the coils, alternately, first one pair from one side, and then one pair from the other; the L pieces round the bobbins being, as it were, the thickness pieces of the T pieces, which have their tails-pieces through the coils. The laminations must then be clamped at the edges very tightly, as any loose iron will vibrate, and cause a bad hum from the transformer.

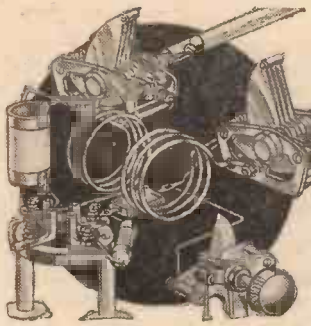
Valve and Metal Rectifiers

Considering the great uses of mains transformers, it is perhaps rather surprising that there are not more wireless firms, as distinct from purely electrical firms, marketing them. It is, of course, very difficult to decide exactly what everybody will want to use; for instance, is a metal rectifier or full-wave valve to be used to provide H.T. power? for the answer to this question alone decides whether two secondary windings of (say) 300 volts each, or one of 230 volts is required to give us the same value of H.T. voltage. There are, however, many electrical firms, such as Heayberd and Co., Parmeco, Rich and Bundy, and Davenset, who are exclusively employed in the manufacture of transformers, and many of these firms will build special transformers for any particular purpose, at little extra cost. When considering what particular mains transformer is required, consideration must first be given to the method of rectification we intend to use for our H.T. supply, the two ways usually adopted are metal and valve. A year or two ago metal rectifiers were so very dear in price as to be almost prohibitive, and valves were usually used, but at the present time metal rectifiers are a very serious rival to the valve. Returning to our position then: For anything up to 200 volts H.T., we can decide to use a metal rectifier which is costing us about 6s. more (the difference between 18s. 6d. and 12s. 6d.). Our transformer will not need to be as large in size, owing to the fact that we can now dispense with two coils, which we would require if we had decided to use a valve. Another important point in favour of the metal rectifier system is the ability to use what is known as the voltage doubler circuit. Briefly, this consists of the two half-wave rectifiers being wired in series, instead of in parallel, and this system enables us to save further space on the transformer, as the H.T. winding will not need to supply so many volts as the other method requires. To explain this point further, take the case of the H.T.11 ; we only need to supply an A.C. input from the transformer of 300 volts to obtain a D.C. voltage of 500 at 120 milliamps.

Topical Technicalities.

THE BRIDGE CIRCUIT.

The term "bridge" circuit is generally applied to all forms of circuit wherein certain arms provide a balance with opposite arms. Perhaps this is better explained by taking the standard Wheatstone Bridge circuit which is adopted for measuring the values of resistances. Four arms are arranged exactly as in the case of the four sides of a square, and diametrically opposite corners are connected together. These two connections may be known as the input and output circuits, or as the power and null circuits. If known values of resistance, for instance, are connected in three of the arms, and an unknown resistance joined in the fourth arm, it is possible, by suitable adjustment of the known resistances, to obtain the exact value of the unknown resistance. This is generally found by means of a galvanometer in the output circuit. To test capacities a known value may be balanced against the unknown value, and, generally speaking, a source of A.C. is applied across the input circuit whilst telephones are included across the output circuit. The exact capacity is indicated when the sound in the 'phones passes to the null point. There are many other uses for the bridge circuit, such as inductance measurements, etc.



Short Wave Section

IDENTIFYING THE AMATEURS

This Article is Packed with Useful Information for Those Who Listen to the Many Interesting Amateur Transmitters.

By E. THURWAY.

AS will be noticed from the "Replies to Broadcast Queries," published regularly in PRACTICAL WIRELESS, most short-wave fans, during their searches for distant transmissions, invariably pick up telephony broadcasts made by experimental amateurs. These are not necessarily confined to stations in the United Kingdom, but frequently include calls made from such European countries as France, Holland, Denmark, Belgium, Spain, Germany, and so on. It should be borne in mind when seeking the identification of such signals that the *only* clue which is of value is that given by the call sign—a piece of information repeatedly put out by the transmitter, and one of which careful note should be made without delay.

Most short-wave listeners know, for instance, that the letters G and F prefix call signs emanating from Great Britain and France, but, unfortunately, it has not been found possible to give to every country letters of the alphabet corresponding with the initials of its name. As an example, mention need only be made of, say, Belgium and Holland, which use respectively ON and PA. The letters chosen, however, are included in the group which has been allotted to the individual State, namely, for stations of every description. It is, therefore, useful when listening to have a list of the international prefixes in front of you.

Whilst on this subject you should note that in view of their increasing number of radio transmissions, from January 1st, 1934, certain countries have seen their range of call signs extended. It bears comparison with the growth of motor vehicles in this country where, from two letters and three numbers, in order to cope with increase, we have added a third initial letter, and thus considerably widened the scope of the possible combinations.

Identifying the Country of Origin

In amateur radio call signs, the initial letter or letters may be followed by a number and two or three more letters. In some instances the first number may indicate a district; we see examples of this principle adopted in the United States, Australia, Canada, etc., also in Spain and other Continental States. Many European experimental transmitters, to ensure accuracy when giving out their call signs, replace the letters by proper names. For instance, you may hear, say, a Frenchman repeat two or three times: *Ici Eff-huit, Canada, Londres, Belgique.* This may puzzle you at the outset, but you should translate it easily as F8CLB.

There has been a certain amount of clearing up in France, Belgium, and other countries during the past few months, and many of the call signs have been altered. There still exist a number of unregistered or pirate transmitters, and as they are not anxious to give their addresses but merely give out arbitrarily chosen calls, it is nearly always impossible to identify them. Most of the French calls to-day start with F3 or F8, but from Tunis and Algeria you may still pick up unofficial transmissions with FM4 and FM8, the registered stations having been given, respectively, F4, and in Morocco F8M. Belgian experimenters now use ON4, followed by two letters.

In Spain, where the lists have been completely revised, the initials EAR, followed by one to three figures, have been changed to EA, with a figure and two letters. The first figure now indicates the zone in which the station is situated. The districts are now classified as follows: EA1 (Asturias, Galicia, Castilla-Leon); EA2 (Aragon, Guipuzcoa, Vizcaya, Navarra, Alava); EA3 (Cataluna); EA4 (Estramadura, Castilla la Nueva); EA5 (Murcia, Valencia, Alicante, etc.); EA6 (Balearic Isles); EA7 (Andalusia); EA8 (Canary Isles); EA9 (Spanish Morocco and North Africa).

There is No Language Difficulty

Although there now exist amateur experimental transmitters in most countries, it will be found that the question of language is not one to cause much difficulty; it is a curious point that English is largely used, mainly for the reason that most fans adopt the professional jargon of international abbreviations. In reply to an inquiry you will hear a Spaniard or a Pole, a Dutchman or a Dane, state that his QRA (name and address) is so and so. Also, they may tell you that they are suffering from QRN (atmospherics), or QRM, that one of them is being jammed, and other interesting details. In many instances the English used may be broken, but it is always possible to pick up the bits, and there appears to be no necessity to know foreign languages to understand a conversation between two foreign amateur stations.

Possibly, when listening in this manner, you may have been informed that one of the operators is hearing the other in this way: Your signals are QSA4. This indicates the degree of readability or clarity at which the communication is being picked up. There is a regular scale adopted for this purpose, varying from QSA1, hardly perceptible, unreadable, to QSA5, very good signals, perfectly clear. Another system used is the R1 to R9, which goes into greater detail in somewhat more gradual stages.

"Changing Over"

Finally, that word "over," which from the letters I receive so frequently puzzles listeners. At the end of a communication the word signifies that the operator has switched over from transmission to reception and awaits a reply. Many amateurs follow this up with a spoken *dah-di-dah*, which, representing the letter K (–.–) also means "go ahead" as an invitation to transmit.

For the guidance of listeners, a short list is given hereunder of the initial letters assigned to amateurs of the countries most heard at present; those marked with an asterisk possess a number indicating the district:—

CT (Portugal); CV (Romania); D (Germany); EA* (Spain); EI (Irish Free State); ES (Esthonia); F* (France); G (Great Britain); GI (Northern Ireland); HA* (Hungary); HB (Switzerland); I (Italy); LA* (Norway); LX (Luxembourg); OE* (Austria); OH* (Finland); OK* (Czecho-Slovakia); ON (Belgium); OZ* (Denmark); PAO (Netherlands); RY (Lithuania); SM* (Sweden); SP (Poland); TF (Iceland); U* (U.S.S.R.); VE* (Canada); VK* (Australia); VU (British India); W* (United States); YL (Latvia); YM (Danzig); YT-YU (Yugo-Slavia).

Note that the above only refer to amateur stations, and do not necessarily represent the initial letters of commercial or other transmitters in view of the greater range in the alphabet allotted to the different countries.

Even when dealing with morse signals—if the listener can translate them—it is a simple matter to tell as soon as you have established the call sign whether the transmitter is an amateur experimenter, a commercial or other land station, a ship or a 'plane, as the combination of letters and figures will supply this information.

When the letter combinations were allotted to the various countries under the International Radiotelegraphy Conventions, definite rules were laid down in regard to the type of call sign to be allocated to each kind of wireless station. Fixed land transmitters use three letters; ships have four, and aircraft, in every case, five letters; but the classification does not include broadcasting stations on long, medium, or short waves. They do not always comply to these rules, but are allotted calls by their respective countries. Commercial short-wave transmitters may add a numeral to their three-letter combination.

Confirming Reception

Finally, a few words regarding confirmation of reception. Most amateurs are pleased to hear from listeners who have picked up their transmissions, and if a letter or card be sent to them, furnishing useful information in respect to the signals picked up, a reply may be expected. In the case of experimental broadcasting stations, it is wise when writing to enclose an international postal reply coupon, obtainable at any post office in the United Kingdom; this will defray postage for the answer. If, by chance, you should hear commercial or private communications of any description—it is sometimes possible to capture transatlantic, ship or other messages—do not seek to get them confirmed. They are not intended for public reception, and although nobody can prevent your listening to them, you are not allowed to violate their secrecy. A clause to this effect will be found in paragraph 5, under conditions of issue, on the back of your receiving licence.

D.X. listening has grown apace during the last year or so and several clubs have been formed to encourage amateurs to pick up distant transmissions.

Practical Television
Conducted by H. J. Barton Chapple, Wh.Sch., B.Sc., Etc.
MARCH 31st, 1934. Vol. 1. No. 13

SOUND PLUS VISION

Some Hints on Connecting Two Sets to One Aerial, and on Eliminating Interference.

By W. J. DELANEY.

FOR the full enjoyment of the television transmission it is essential to employ two separate wireless receivers, one tuned to the vision transmission and connected to the vision apparatus, and the other connected to a loudspeaker and tuned to the sound transmission. At the present time vision is transmitted on the

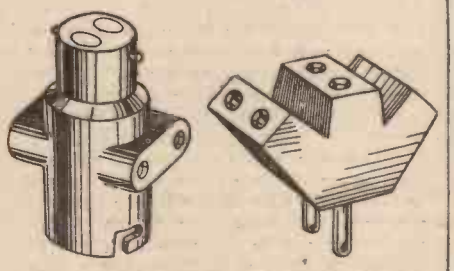
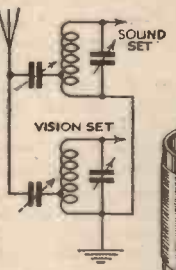


Fig. 1.—Two types of multi-socket adaptor for use in power sockets, or ordinary lamp holders.

wavelength of the London National transmitter and the sound from the Midland Regional transmitter. It might, therefore, seem quite a simple matter to use two sets tuned to these points in conjunction with a normal aerial and earth. It so happens, however, that there are one or two snags which might crop up, and the following notes detail some which have been met with in various cases, and the methods which were adopted to overcome them.

Sound from a Portable

Obviously, to those who live in a suitable locality, all troubles of receiving the dual transmissions will be removed if a portable receiver is employed for the reception of sound. This will, by its nature, be a compact receiver and may accordingly be placed close to the vision apparatus to heighten the illusion of the "living" picture. There are, however, many places in England where a portable will not afford sufficient signal strength from the Midland station to make the reception audible above the sound of the television apparatus, and recourse must be had to a different type of receiver.



Alternatively, the vision apparatus will, in most cases, be mains operated, and it may be thought undesirable by the majority of listeners to have to be bothered with batteries. We will assume at this point that the receiver for the vision reception is mains operated. This means that a connecting lead will have to be provided for the receiver, and, as the television apparatus also necessitates the application of mains power, some convenient point is also required for that. Multi-contact plugs are, fortunately, now obtainable from most electrical supply stores, or even from the popular sixpenny stores, and one of these plugs may be inserted in a suitable power point so as to accommodate both the receiver and the television apparatus plugs. Where a lamp-socket is employed for the normal supply of mains potentials to the receiver a similar multi-contact plug may be obtained. The two types of plug are illustrated in Fig. 1.

Voltage for the Extra Receiver

When the sound receiver is to be operated from the mains also, the supply may be tapped through the medium of the plugs just referred to, three separate leads being available with both models. At this point it must be pointed out that the total load of the apparatus must be borne in mind so as not to put too great a load on the particular wiring which is employed. Thus, if the ordinary lighting circuit is being used (and this is generally of the 5-amp. type), the total load of vision receiver, plus sound receiver plus television apparatus, must not exceed that figure. It is advisable, therefore, where convenient, to employ the 10 or 15-amp. power circuit for the operation of the three parts of the apparatus.

Aerial and Earth Supplies

The most difficult part about the installation of the two receivers is the attachment of aerial and earth leads. It is obviously impracticable and unnecessary to erect a second aerial in the garden just for the second transmission. Not only would two aerials be unsightly, but they would probably give rise to unwanted capacity

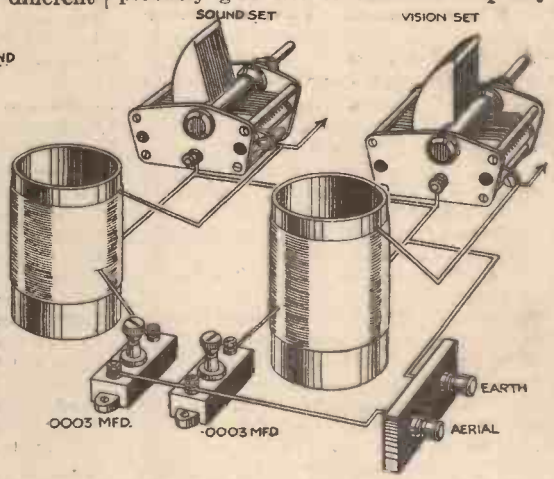


Fig. 2.—Two fixed (or pre-set) condensers, used to feed the sound and the vision receiver where ordinary tapped coils are employed.

effects as they were tuned and probably be more nuisance than they were worth. Fortunately, there are much simpler methods available, although much depends upon the types of receivers which are employed. With most listeners it will no doubt be found that the receiver which is used for normal broadcast reception is coupled to the television apparatus when suitable transmissions are available, and a smaller (probably roughly-erected) receiver is kept for the sound transmission. If the aerial circuit of each receiver is of the simple tapped aerial coil type, fed through a small fixed condenser, then the two aerial terminals may be joined together, and the aerial lead taken to either one. The earth in this case may also be taken to either earth terminal, and the two earth terminals joined together. This arrangement is shown in Fig. 2 and it will be found that either set may be adjusted to the required wavelength, and adjustment of the other will not alter the setting first made. This is probably the simplest and most effective way of carrying out the combined reception. Where apparatus is not yet installed or the listener desires to experiment, there are several other schemes available, each of which has its particular merit.

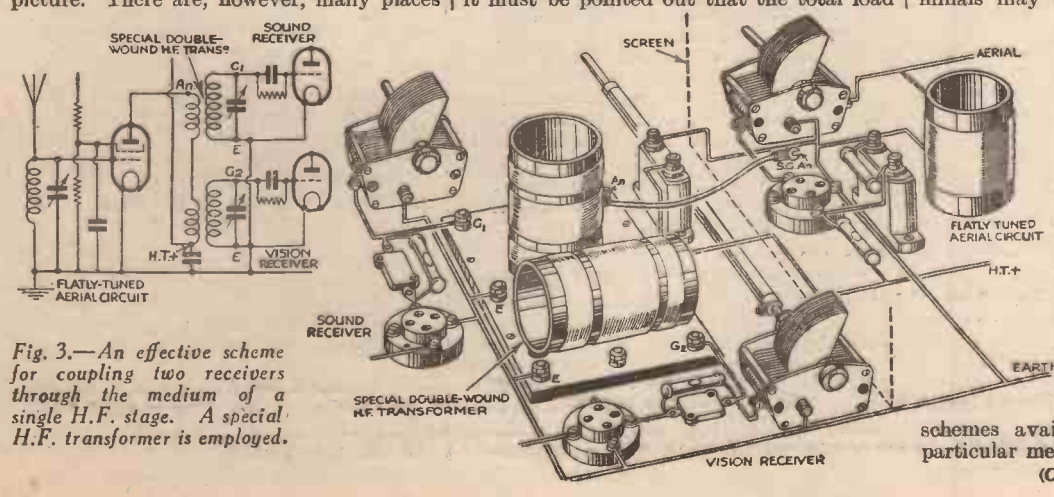


Fig. 3.—An effective scheme for coupling two receivers through the medium of a single H.F. stage. A special H.F. transformer is employed.

(Continued on next page)

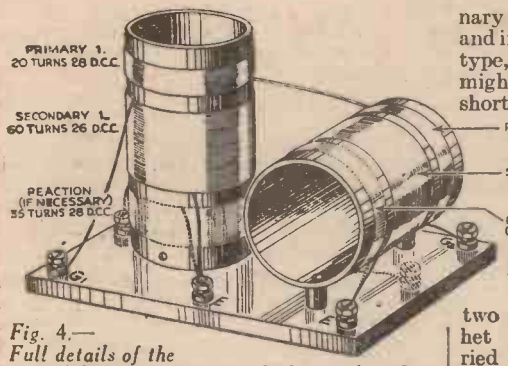


Fig. 4.—Full details of the special H.F. transformer which is referred to in this article.

PRACTICAL TELEVISION

(*Continued from page 1 Television Supplement*)

Alternative Schemes

A flatly-tuned aerial circuit tuner may be coupled to an H.F. valve, and the anode circuit of this may be fitted with a special double-wound transformer, as shown in Fig. 3. This will be found a very good scheme for listeners who are situated at a long distance from the two stations, or who desire to economize in equipment. A simple detector stage may follow this H.F. valve, which thus serves both receivers and removes the necessity for one complete H.F. stage. The H.F. transformer may be home-made, and may consist of secondaries of 60 turns of 26 D.C.C. with the primaries wound at the ends of the former as shown. Full details are shown in Figs. 4 and 5. I have not found it necessary to employ dual-range coils with this arrangement, although reaction may be applied to both coils, if desired, as indicated. Other arrangements may be tried by the listener according to the type of set in use, and the only point which must be emphasized is in regard to commercial receivers which employ band-pass tuning. In some of these receivers ordinary bottom-capacity coupling is used, and if the second receiver is of the simple type, employing a tapped aerial coil, it might, in some cases, be possible to short-circuit the band-pass coupling condenser, which will, of course, upset the ganging of the receiver and perhaps prevent the reception of the required station.

Motor Interference.

In my own case, coupling of the two receivers (one commercial superhet and one home-made) was carried out through the medium of the small fixed condensers, and pre-sets were employed in order to obtain a balance which had the minimum effect on both sets. The calibration of the superhet was not affected in the slightest and the commercial band-pass pack in the other receiver also remained set throughout the entire tuning range. It was found, however, that the motor in the television apparatus radiated quite a lot of interference. In point of fact, the motor is capable of two forms of noise—radiated and mains-fed. The latter was not very troublesome, but, where it is found that this is the worse, two special H.F. chokes in the mains lead *to the motor* will prevent the noise being received on the set. Radiated interference is a little more difficult to remove, but after some experiment I was able, in my particular case, to completely remove all trace by the following means. The normal broadcast receiver (which is employed for the vision reception) was fed from a special anti-interference aerial system, consisting of the impedance matching transformer described on page 1125 of PRACTICAL WIRELESS dated March 10th. This transformer was mounted at the rear of the radio-gram cabinet, and the metal screen "earthed." The sound receiver, a small commercial superhet, was connected to the aerial terminal on the vision receiver by means of metal-screened flex, the same material also being employed for connecting the earth terminals of the two receivers. The metal braiding was connected to the earth terminal on the impedance matching-transformer, and this practically removed all interference. Two 2 mfd. fixed condensers connected across the brushes of the television motor, and the junction earthed in the usual manner, and an earth connection to the metal case of the motor completely removed the remaining traces, and the motor may now be run with complete silence on each receiver and a perfectly clean screen for the televised subjects.

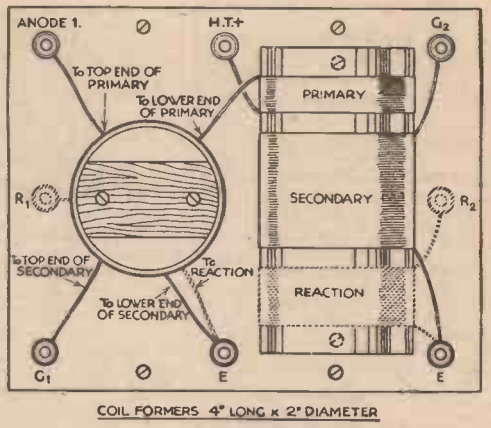


Fig. 5.—Wiring diagram of the H.F. transformer.

It should be remembered that motor interference gives rise to black or white dots on the screen.

Experiment showed that individual cases required special treatment, and it would be interesting, therefore, if readers would send an account of their experiences in regard to the dual reception and the removal of the different forms of interference which may be experienced, as this data will no doubt be of use to others.

THE FURY FOUR SUPER—

An Appreciation

By GRID LEAK

IF you have never attempted to build a set, start at once to build the "Fury Four Super" which can be put together in a couple of evenings with ease. The set in question occupied exactly 3½ hours from the commencement of assembling to the moment of actual operation. There are so many circuits which have been published during the past few months that the mind of the novice must be in a state of dismay when it comes to a question of choosing a suitable set to build. I am too old a hand to be hoodwinked with the glowing literature with which they are introduced and foisted on a believing public. A couple of years ago the craze was for reproduction, then followed the necessity for selectivity. Having attained the latter, it has been found that defects appeared in the low-frequency side of the receivers. The reason for this I do not intend to discuss here; it is nevertheless a fact, and it has occasioned the necessity for further research in the audio-frequency amplifiers.

Distance

What appeals to me in the "Fury Super," is that the designer had recognized this failure of being able to get selectivity and perfect tonal reproduction without some kind of compensating device, so he struck a centre course which permitted of his combining both without any inherent defects being observable. I have built and designed hundreds of radio receivers and passed through the experiences which many of my readers are experiencing to-day, particularly that of seeing how many stations a receiver will be capable of receiving, and the distance-getting capabilities. No matter what I have to say on the wisdom of owning such a receiver, it would never have any effect upon you once you get the urge for distance getting. Later on there comes a time when a receiver is required that will provide a reasonable number of stations of a true entertainment value, and which can be listened to with that peaceful background which is so necessary for perfect reproduction.

Over 100 Stations!

The "Fury Super," I am told, has tuned in over 100 stations in the Windsor district; well, I have not done so well as that because I have searched for stations to which I could listen and enjoy. During one evening I thoroughly enjoyed extracts from programmes of twenty British and Continental stations with perfect loud-speaker reception, and it is for this reason that I suggest you should choose that circuit.

By all means build your own receiver taking care to choose only the best components. Make up your mind which you will use, and don't be beguiled into substituting something else by the radio store-keeper because he has not got in stock that which you require.

Home Construction Will Always Be

It is estimated that at least 50 per cent. of the radio receiving sets in use in the British Isles are home-built sets, and I venture to make the statement that the owners of most of these sets were more gratified by becoming the possessors of these instruments of their own creation, than they were by the substantial saving in the cost which they effected by constructing their own sets. There are hundreds of thousands more people who would build themselves radio sets if they did not feel that they lack the technical knowledge and mechanical ability to make their venture a success. Dispel this fear, and accept my advice to try your hand at this most interesting pastime; you will be astounded at the ease with which you can accomplish the work, and the joy which comes of tapping the ether with a receiver of your own making.

NEXT WEEK—

Full Constructional Details of the A.C. Leader!

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

In furtherance of their policy to let the public know that television is an entertainment, the Uxbridge District Branch have given television demonstrations upon March 5th, 6th, 7th, 12th, 13th and 14th. All the demonstrations have been highly successful and considerable interest has been aroused. The last demonstration was given at the conclusion of the weekly meeting of the Uxbridge District Branch. All members of the A.-A.R. and T.S. and of other societies and the general public are welcome at these demonstrations. The branch hopes to give a television demonstration at the conclusion of most of its meetings. Full particulars may be obtained from Mr. Leslie W. Orton, 11, Hawthorn Drive, Willowbank, by enclosing a stamped, addressed envelope.

THORNTON HEATH RADIO SOCIETY

A meeting of this Society was held at St. Paul's Hall, Norfolk Road, on Tuesday the 13th instant. Mr. S. J. Meares presided. A discussion took place between two of the members, Mr. Clark and Mr. Hoare, on the respective merits of all-mains and battery receivers, Mr. Clark supporting the all-mains and Mr. Hoare the battery type.

Mr. Clark contended that although the initial outlay was greater, the cost of running an all-mains set was so small that it paid for itself in a short time. He reckoned that in his own case the cost worked out at about 1½d. per week. Mr. Hoare agreed with this and admitted that his battery set cost about 9d. per week to run, but he maintained that the reproduction was far superior to that given by all mains and that this in itself was worth the extra cost and trouble. Hon. Sec., Mr. Jas. T. Webber, 368, Brigstock Road, Thornton Heath.

THE NEW ZEALAND DX CLUB

Owing to the fact that short-wave bulletins are not given the publicity that they ought to receive, we are bringing forward a small bulletin that will appeal to all short-wave fans. Will interested readers please send us all items of news, reports, etc., and we will do the rest. The whole scheme is outlined in a leaflet published by the N.Z. DX Club, copies of which can be obtained by applying to Mr. S. Cullen, 33, Dilston Grove, London, S.E.16 and enclosing a 1½d. stamp.

UNIVERSAL RADIO DX CLUB

The official organ of the Universal Radio DX Club has come to hand and it contains a comprehensive list of stations taking DX programmes. A novel contest in which all members of the U. DX C. may participate is described. This club also offers its members free advertising space in its paper. Full particulars may be obtained from Mr. Charles C. Norton, 2559, Polk Street, San Francisco, California, U.S.A.

THE CROYDON RADIO SOCIETY

"The heater was the problem," said Mr. A. R. Twist, M.I.E.E., when lecturing on high voltage valves in St. Peter's Hall on Tuesday, March 13th. He described the design of filaments which could be subjected to the mains' full voltage, whether A.C. or D.C. Here, of course, such items as mains transformers and break-down resistances could be eliminated, and so high-voltage valves were particularly useful as mains rectifiers and supplying voltage for high resistance field windings in loud-speakers. Current consumption was of the order of 5 watts per valve, so even a seven-valve set would consume considerably less than one electric light lamp. Hon. Secretary: E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

THE CHATBURN AND DISTRICT RADIO SOCIETY

A very interesting and enjoyable evening was spent by members of the above society on Friday the 16th inst., when Mr. Preston, of Messrs. Whiteley Electrical Radio Co., gave a lecture on loud-speakers. Tracing the development of loud-speakers from the horn and cone types, Mr. Preston explained the principles of a moving-coil speaker, and illustrated these principles by a number of very interesting experiments. The lecturer then gave details of the new "Microlode" impedance matching transformer and explained how matching between output valve and speaker was obtained.—J. Holden (Hon. Sec.), Downham Road, Chatburn, Lancs.

INTERNATIONAL SHORT WAVE CLUB (LONDON)

At the meeting of the London Chapter held on Friday, 16th March, at the R.A.C.S. Hall, Wandsworth Road, S.W.8, Mr. P. J. L. Macfarlane, G5MK, the Chapter Technical Adviser, gave a most interesting talk on transmitters used by amateurs. He gave details of the various stages which form the equipment of an average amateur station. With the aid of the blackboard he was able to illustrate his talk with drawings of circuits which could be used. All readers of PRACTICAL WIRELESS are welcomed at these meetings.—A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

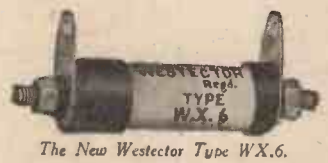
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

WESTECTOR, TYPE WX.6

THE accompanying illustration is of the newly-introduced special high-frequency Westector. It has been already stated that the original type of Westector, which was familiarly referred to as the "Cold Valve" was of such a character that it could not be employed efficiently on wavelengths down to 150 metres or so. It was, therefore, only used extensively in superheterodyne receivers as a second-detector, where, of course, it operated at approximately 2,000 metres. Experiments have been continued by the Westinghouse Brake and Saxby Signal Company,



The New Westector Type WX.6.

and a type of Westector has now been perfected which will permit of its employment for high-quality detection at radio frequencies without the excessive damping and consequent loss of selectivity which existed with the former type. The new model is no larger than the previous types, but is distinguished by the colouring and the letter X included in the type number. It may be used for half-wave rectification, automatic volume control purposes, battery economizing circuits, first detector in superheterodynes, etc. The Westector will handle a maximum input voltage of 36, and the maximum current output is in the neighbourhood of .1 mA. The price is 7s. 6d.

GOLTONE STATOFORMERS

WE recently published an article on anti-interference aerial systems, in which certain constructional details were given concerning the impedance-matching transformers. We have received details from Messrs. Ward and Goldstone, Ltd., of Frederick Road (Pendleton), Manchester, concerning the special statoformers which they manufacture and which are employed in a similar manner to those described in the article in question. The aerial transformer is housed in a cup-shaped metal case which prevents rain, etc., from coming into contact with the windings, and a substantial fitment is provided on the top for attachment to the aerial wire, three grub screws serving to make the whole firm. A similar attachment is provided on the underside to accommodate the leading-in wire, and a projecting lead is provided for connection to the metal screening of the down-lead. The Receiver Statoformer is contained in a metal case in the same manner as the standard Goltone coils, and the ebonite base of this device is furnished with six terminals. The Aerial Statoformer costs 4s. 6d., and the Receiver Statoformer costs 5s. Special shielded metal screened down-lead, of the non-spaced type, costs 4s. 3d. for a 50ft. coil and 8s. for a 100ft. coil.

The new Hivac S.G. valve.

HIVAC S.G. 220

A FURTHER addition to the range of Hivac valves takes the form of a screen-grid valve, and has the glass bulb moulded in the new style as may be seen from the accompanying illustration. The main characteristics of this valve are:—

Filament volts	2.0 max.
Filament current	.2 amps.
Anode volts	150.0 max.
Screen volts	80.0 max.
Mutual conductance	1.5 mA/V
Amplification factor	500
Impedance	330,000 ohms.

The price of this valve is 10s. 6d.

MULLARD BATTERY H.F. PENTODES

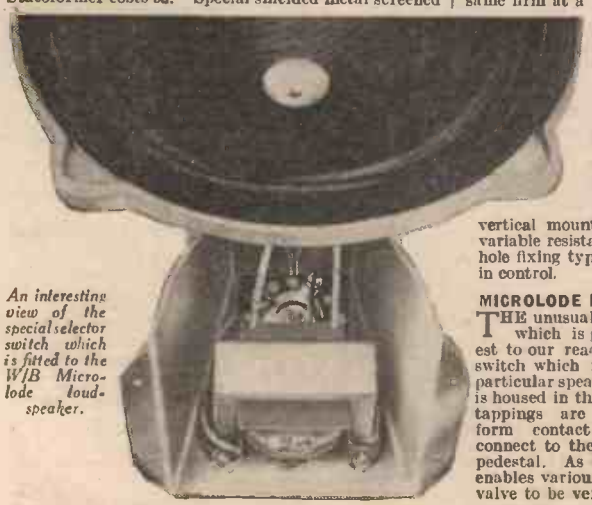
THE Mullard Company inform us that they are releasing their two battery H.F. pentodes, types V.P.2 and S.P.2 to the public shortly. No definite release date has as yet been fixed, but they should be generally available by the time this issue appears on the bookstalls.

PETO-SCOTT TELEVISION MOTOR

THE illustration shows a neat little motor designed for either a television disc or a mirror-drum. This is of the universal type, fitted with a substantial field-magnet system. The armature spindle is continued at each end so that a synchronizing movement may be mounted, if desired. The motor is rated to deliver the correct revolutions, and suitable resistances for use with mains from 200 to 240 volts are also obtainable from the same firm. The brushes are of the carbon type, and the caps which are fitted over the brush sockets are of insulated material so that adjustment of the brush friction may be carried out without fear of shocks. Oil retaining glands are fitted to each of the bearings and are protected with screw plugs. This is a very good example of a low-priced motor, the cost being only 30s. A kit of parts for synchronizing gear suitable for the motor is also obtainable from the same firm at a cost of 37s. 6d.

A very good low-priced motor, especially designed for Television purposes.

For control of speed it is customary to connect a fixed resistance (provided with tapping points to suit different mains voltages) between the mains and the motor, and to insert a small value variable resistance between this resistance and the motor. Two such resistances are illustrated on this page and are manufactured by the same firm. The tapped resistance is provided for vertical mounting and keeps very cool, whilst the variable resistance is a substantial unit of the one-hole fixing type, and gives a very smooth variation in control.



An interesting view of the special selector switch which is fitted to the W/B Microlode loud-speaker.

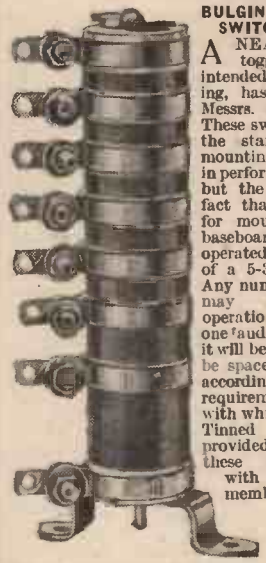
MICROLODE P.M.4.A.

THE unusual view of the Microlode loud-speaker which is given here will no doubt be of interest to our readers, as it shows the rotary selector switch which is such an important feature of this particular speaker. It will be seen that the transformer is housed in the neat pedestal foot, and the various tappings are brought out to the studs which form contact with the rotating arms which connect to the indicating levers on the rear of the pedestal. As we have previously pointed out, this enables various ratios to be obtained and enables a valve to be very accurately matched.

NEW THEORETICAL SYMBOLS

WE have had a number of inquiries from readers who are anxious to know the theoretical symbols which are adopted for the new types of valve which have been introduced during the past few months. The accompanying illustrations show the symbols which have been adopted for the heptode (or pentagrid), the double pentode and the Class B plus driver.

Theoretical symbols for the new valves which have been introduced recently.

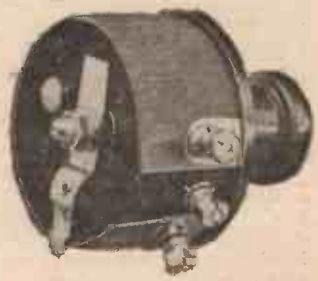


The neat resistance which Messrs. Peto-Scott supply for use with the Television motor shown below.

BULGIN TWO-WAY TOGGLE SWITCH

A NEAT type of two-way toggle switch, which is intended for baseboard-mounting, has been received from Messrs. A. F. Bulgin and Co. These switches are similar to the standard type of panel mounting toggle action switch in performance and application, but the difference lies in the fact that they are intended for mounting direct on the baseboard, and they are operated through the medium of a 5-32in. diameter shaft. Any number of these switches may be assembled for operation simultaneously by one and the same shaft, and it will be obvious that they may be spaced out on a baseboard according to the particular requirements of the circuit with which they are employed. Tinned soldering tags are provided for connection, and these tags are integral with the internal contact members, thus providing satisfactory contact without losses. The on-off switch is rated at 3 amps. up to 250 volts, and the 2-way is rated at 2 amps. up to 250 volts or 3 amps. up to 125 volts. The two-way switch may be used for the alternative control of isolated and separate circuits or as an S.P.C.O. type, by linking the two contacts at either end and treating these joined parts as the arm of a normal S.P.D.T. switch.

Both switches have grub screws fitted in the moving member for clamping to the shaft, and 5-32in. brass rod for use with the switches is supplied by Messrs. Bulgin in 6, 9 and 12in. lengths. Small coupling pieces are also obtainable at 3d. each, and a panel bush for accurately aligning the rod for control purposes may be obtained for 2d. The rod costs 2d., 2½d., and 3d. for the 6, 9 and 12in. lengths respectively, and the switches cost 1s. 9d. for the single pole on-off and 2s. for the two-way type.



For fine control of motor speed this Peto-Scott resistance should be employed.

HOW TO CHOOSE AND USE THE BEST VALVES

PART III

This Week Some Useful Information is Given Regarding the Choice of the L.F. Amplifying Valves

WHEN it comes to considering valves for the low-frequency side of the receiver, we find the range of choice is very large. As in previous instalments of this series, we shall not deal with this matter so much from the standpoint of comparing valves of different makes in the same general class, but mainly from the point of view of the different main types which are available in every standard make.

First of all, low-frequency valves may be divided into two main classes—early-stage amplifying valves and output valves, sometimes called power amplifiers, power valves, or loud-speaker valves. These two classes, which are in their turn further sub-divided, perform totally different functions. Early-stage valves are required merely to give voltage amplification, that is to say, to build up a sufficiently large voltage swing for exciting the grid of the output valve. The output or last-stage valve, on the other hand, is not primarily required for voltage amplification, its main duty being to deliver a substantial amount of audio-frequency power for operating the loud-speaker.

Older Type Receivers

In the average present-day receiver, the voltage output from the detector valve is usually sufficient to load the output valve fully, and no other low-frequency amplifier is required unless, indeed, a very large output valve, requiring a large grid swing, is employed. On the other hand, we must take into consideration the existence of a number of older type receivers in which the nett gain per stage is not so great as in modern sets, so that one or more low-frequency stages in addition to the output valve are necessary. Then separate gramophone amplifiers and equipments used for public address work all need first-stage low-frequency valves.

The problem of the early-stage low-frequency valve, however, can be dismissed very easily by saying that, for most normal sets, any valve rated for grid-leak detection will make a satisfactory L.F. amplifier. The reason is that it is now standard practice to fit gramophone pick-up terminals to the receiver, and the connections are so arranged that when the gramophone is in use the detector valve acts as first low-frequency amplifier. Detector valves have therefore been so designed that they work satisfactorily for either purpose. It is true, however, that the actual valve type must be chosen with due regard for the type of coupling to be employed between it and the next valve. For transformer or R.C. coupling with an anode resistance up to 100,000 ohms a "general purpose" type of valve, such as one of the "H.L." class, should be employed. If, however, R.C. coupling with a high anode resistance up to 250,000 or 500,000 ohms) is employed, then a valve of the "H" or "R.C." class should be selected.

Operating Conditions

If the input voltage to the low-frequency amplifier is very big, as in the case of a very sensitive pick-up, a valve of lower amplification factor may be desirable. Most makers offer a battery valve with an ampedance from 9,000 to 12,000 ohms and an amplification factor of about sixteen, which is very suitable for this position or as second stage amplifier after a valve of the "H.L." type.

A valve in this class is also very suitable for a special application in low-frequency amplification, namely as a "driver" valve in conjunction with a Class "B" output stage.

Concerning the operating conditions of early-stage low-frequency valves, whether they are of the general-purpose "H.L." type, the special high-gain, high-impedance type for R.C. stages, or the somewhat larger valves for use in the last stage before the output valve, the first thing to remember is that they give the best results when operated at or near their maximum rated anode voltage, which in the case of a battery valve is 150 volts, and for A.C. mains valves 200 volts. The higher the anode voltage, the longer the available grid base, and therefore the larger the signal which they can handle without distortion.

A Question of Bias

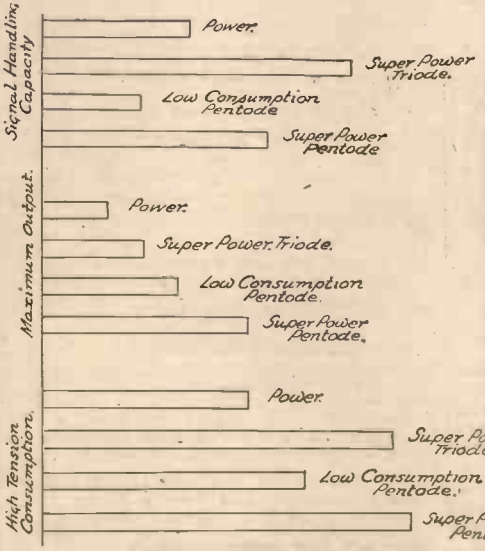
It is essential that all valves used as amplifiers, and particularly low-frequency valves, shall be given the correct negative bias voltage on the grid. It is not necessary here to give a long explanation of the reason for biasing a valve, as the majority of listeners are fully aware of the facts. If the bias is too large or too small, there is a grave risk that the valve will act as a rectifier rather than as a distortionless amplifier, and reproduction will be spoiled. Incidentally, correct grid-bias limits the value of the high-tension current, and thus preserves the life of the high-tension battery.

The correct bias voltage can most easily be determined by making reference to the makers' instruction sheet.

The Output Valve

The available range of valves for the output stage is large, various types being described as "power" valves; "super-power" valves, pentodes, Class B valves, and so forth, and to the novice it seems difficult to know what to choose. The points which have to be taken into consideration are: first, what output or volume is required from the set; second, what signal strength is provided by the earlier stages; and, third, what high-tension supply is available. Let us see how all these factors affect the choice.

Consider first the question of volume required. If the listener is content with small or moderate volume, he can, in all probability, obtain all he wants with a small power valve of the type having an impedance of about 4,000 ohms and an amplification factor of 15 or a little less. Such a valve has, therefore, a fairly high amplification factor for a three-electrode output valve, and is designed primarily to give the very utmost output which a triode can be expected to give from comparatively weak input signals. A small power output valve of this type can be designed to take a very small high-tension current, and this, combined with its large sensitivity, makes it particularly suitable for use in portable sets where battery power is restricted and the input signal is small, owing to the use of a tiny frame aerial. For ordinary household sets, however, this small power valve has the disadvantage that, if a large signal is applied, as, for instance, when an orchestra works up to a fortissimo climax, the valve may overload and cause distortion. Where really good quality is desired, therefore, even if great volume is not demanded, it is better to employ a valve of the "super-power" class.



A comparison chart of output valves according to signal handling capacity, output, and H.F. consumption.

Super-power Valves

The characteristics of a super-power valve are still lower impedance, say about 2,000 ohms, combined with an amplification factor considerably lower than that of a power valve. This means, in effect, that the simple substitution of a super-power valve for a power valve will not necessarily mean more power. Actually, if the remainder of the set is unchanged, less volume will be obtained, because a super power valve is not so sensitive as a power valve. But the super-power valve will handle, without distortion, much stronger signals than a power valve, and for a given input will give better quality, although somewhat smaller output.

So far, we have considered only the requirements of small volume. If, however, big volume is required, a super-power valve is certainly indicated—that is, provided the early stages of the set are capable of providing sufficient

(Continued on page 60)

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

One Valve and Crystal!

SIR,—Anent your excellent idea of a "Leader" series of sets at a low cost, which I am sure will meet with great success, I should like to see a set described of the one *valve* H.F. type (valve specified) with crystal detector. This, I understand, would receive several stations in addition to the local on 'phones. I presume it would include instructions for home-made coils. I am assuming it would be better than a one-valver only.—T. B. ANDERSON (Belfast).

[*This idea is retrogressive. You would get better results from a single valve set without the addition of a crystal.*—ED.]

The Leader Three Solves the Price Problem

SIR,—It may interest you to know that although I gave up wireless as a hobby about eighteen months ago, I have continued to take PRACTICAL WIRELESS in order to keep up with developments in radio. Just recently, however, I decided to build a small receiver, and I searched everywhere for a set that gave the stations I wanted to hear under the new Lucerne wavelengths at a price that would suit my pocket, until I saw the Leader III, described in your columns. The price leaves enough over for me to construct a S.W. receiver as well, using some of my old components. Many thanks to PRACTICAL WIRELESS for solving my problem for me.—B. H. B. (London, N.W.).

Better Than the Rest

SIR,—I should like to express my appreciation of your publication, by saying that although I have been associated with radio for the past twelve years, I have never yet opened my weekly PRACTICAL WIRELESS without gaining knowledge. Good luck to your paper; it's better than the rest!—W. C. HOWELL (Acton).

A Well-satisfied Canadian Reader

SIR,—My tool-kit and Encyclopædia have just arrived, and I am very pleased with them.

The tool-kit is very well made, and I did not expect to get anything nearly so well finished. I shall find it a great help.

I am also very pleased with the "Encyclopædia of Popular Mechanics." It is beautifully bound, and is full of really useful tips. The book is nearly twice as large as I thought it would be. I have already found the chapter on motor-cars and motor-cycles most useful. PRACTICAL WIRELESS is the best wireless paper.—C. BROOKE (Montreal, Canada).

Skeleton Components

SIR,—*Re* the recent discussions on Soldering or Terminals and the demand for cheaper components. I recently purchased an "all-mains" kit from one of your advertisers, the circuit being band-pass tuning with v.-mu det. pentode and rectifier. The components were all by the best makers, but they were of the "Skeleton" type with soldered connections, and when completed the set looked and performed as well as the best manufactured set, and the price was only £8 15s., including valves. This is surely the strongest argument one could use in favour of soldered connections, and I should like to see you lead once again by starting a campaign for skeleton components.—G ROOME (Southfields).

HOW TO CHOOSE AND USE THE BEST VALVES

(Continued from page 59)

signal voltage to load the super-power valve. Usually, a set having one or more high-frequency stages and a good transformer-coupled detector can load a super-power valve. In the case of a set having no H.F. stage, it may be necessary to interpose another low-frequency stage before the super-power valve in order to get big volume. As an alternative, a pentode or five electrode output valve may be employed immediately following the detector.

Advantages of the Pentode

The advantage of the pentode is that it combines a big output with a high effective amplification—in other words, it is a very sensitive valve, and gives full output for a smaller grid-input voltage than any form of triode output valve. Battery pentodes fall into two distinct groups, the low-consumption class, which takes a very small high-tension current—about 4 to 5 milliamps at 100 volts or about twice that amount at 150 volts; and the super-power pentode which has an anode-current consumption comparable with that of a super-power triode. The low-consumption pentode, while very sensitive, has small signal handling capacity. It is, therefore, suitable for use in a portable set, or in a domestic set where medium volume is required and economy in high tension is a consideration, and where, at the same time, the listener is not very critical on the score of quality.

The Super-power Pentode

Where big volume is required the super-power pentode is strongly recommended because, while retaining the high sensitivity of all pentode valves, it has a larger signal handling capacity than the smaller pentodes, is not so liable to distort, and gives a very large output for a comparatively small input.

Now let us see where the nature of the high-tension supply comes into the picture. It is here; small power valves and low consumption pentodes are designed for a high-tension consumption in the neighbourhood of 6 milliamps or less. If the high-tension supply is a small dry battery, it can supply a valve of this type. Valves of the super type, whether triodes or pentodes, take a much larger H.T. current, up to 12 or even 18 milliamps. Such a drain is quite beyond the economic discharge rate of a small battery, and demands the use of either a triple-capacity H.T. battery or a mains unit—preferably the latter.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

FERRANTI RECEIVERS

Full particulars of a complete range of Ferranti superhet receivers and radiograms are given in an attractive brochure just issued by Ferranti Ltd. Two new battery receivers are described, the Lancastria Battery Consolette, a five-valve superhet priced at 14 guineas, and the Lancastria Portable Consolette, a six-valve model priced at 15 guineas. Other fine ranges of consolette models listed are the Arcadia and Gloria series. Some exceptionally fine radiograms are shown embodying all the latest improvements, including the well-known Lancastria Radiogram, priced at 26 guineas, and the Arcadia, a high-grade instrument to suit the most discerning listener. It is priced at 35 guineas. Ferranti products are known the world over for the excellence and reliability of their product, and interested readers are advised to write for a copy of this brochure (We. 537) to Ferranti Ltd., Hollinwood, Lancashire.

T.C.C. CONDENSERS

The familiar green case of a T.C.C. condenser symbolizes over twenty-seven years of specialization and research work in condenser-making. The materials used in the construction of T.C.C. condensers are carefully selected after exacting tests, and a full range of these components, together with prices, is shown in a handy booklet we have received from The Telegraph Condenser Co., Wales Farm Road, North Acton, W.3. Included in the range are the new aqueous type electrolytic condenser in an inverted aluminium container and of varying capacities, mica condensers, paper condensers, and subdivided block condensers. That useful component the T.C.C. Disturbance Suppressor is also listed. Copies of the booklet can be obtained from the address given above.

PIX PRODUCTS

"Pix," that useful little component which gives selectivity to a set, is a small cylindrical component which is inserted in the aerial lead for improving selectivity and cutting out unwanted stations. To insert the "Pix" it is only necessary to undo the lead-in wire from the aerial terminal and connect same to one end of the "Pix," and then join the other end to the aerial terminal. Another useful component is the "Modula," a simple remote control device which is simply fitted on the arm of a chair, a table, or in any other convenient position by means of an armchair strap, or press-stud fitment. A turn of the knob and the programme can be faded out or the volume increased at will. Copies of leaflets describing either of these components can be obtained from The British Pix Co., Ltd., 118, Southwark Street, London, S.E. 1.

EELEX SHORT-WAVE CONVERTERS

An efficient S.W. superhet type of converter to work with superhet receiver has been introduced by J. J. Eastick and Sons, who have produced a range of compact converters of single and two-valve types, the two-valve models having an extra stage of amplification. The converters are suitable for all types of broadcast receivers which are designed for reception above 1,000 metres. The wavelength range of the converter with the standard coil supplied is 15-60 metres, although this range can be increased to 120 metres by means of an additional coil. Copies of a booklet containing full particulars can be obtained from the above-mentioned firm at 118, Bunhill Row, London, E.C.1.

REPLIES TO BROADCAST QUERIES.

EDITOR'S NOTE: Queries must limit their queries to three per letter.

S. HOPPER (Brighton): (1) W3QZ, H. D. Eisenhauer, 124, Jackson Avenue, University Park, Hyattsville (Md.); (2) W1CHI, W. F. Holman, 34, Williams Street, Arlington, (Mass.); (3) W2EDW, R. Mautner, 2,244, New Haven Avenue, Far Rockaway, L.I., New York; regret, cannot give power. NOSTUH (Boston): *JUA*, Tokio (Japan), 51.99 m. Regret, cannot trace call-sign JUE. DJG Nauen (Germany), 65.43 m.; OZT, Danish call but regret, cannot trace; FZM, Bamako (French Sudan), 19.50 m.; DIR, Königs Wusterhausen (Germany), 30.422 m.; LQB, Monte Grande (Buenos Aires), given as 19.10 m. E. F. STAINES (Mitcham): DJB and DJA, Zeesen (Germany) work on 19.73 and 31.38 metres respectively; yes, the latter station was transmitting a programme to Asia between G.M.T. 11.45—14.45. NOSTUH (Boston): (2) FTZ, St. Assise, Paris; wavelength given as 38.04 m.; possibly testing on another channel; XGJ, Hanchow (China), 70 m.; RKLT, Nikitova (U.S.S.R.), given as 66.23 and 51.46 m. L. J. STEVENS (Bedminster): We can trace the following: YR5AA, send report, under cover, to: Lt. C. Bratescu, Str. Dr. Ciru Illescu 6, Bucarest 6, Romania; W1CTO, E. S. Burns, 81, Colman Street, New London (Conn.); W1FOV, E. F. Robinson, 32, Walnut Street, Narragansett, R.I.; YU7UU, send report, under cover, to: S. Liebermann, Meduluceva 9, Zagreb, Jugo-Slavia; W6FKC, S. Perkins, 1610, S. Orange Grove Avenue, Los Angeles (Cal.). H. J. (Galloway): CT1IB, Mario Reynaldo de Barros Ferreira, 5, Largo das Latinhas, Braga, Portugal; HAF1G, Julius Feher, Erzsebet Korut 16, Budapest 7, Hungary; W8BTI, C. W. Luhn, 4,909, Arnold Street, Cincinnati, Ohio. SARUM: G2AT, J. W. Marlow, "Hadleighdene," Fitzwilliam Street, Mablethorpe, Lincolnshire.

T. E. KILL (Edgware); J. F. W. (Hendon): Police transmission; cannot give details. DE EX (Cleveleys, Lancs.): W3BUX, E. Foster Hammonds, Montgomery Avenue, Rosemont (Pa.); W3DQ, W. S. Wilson, 405, Delaware Avenue, Wilmington, Detroit (Mich.); W3IS, J. T. McLamore, 31, Park Place, Audubon, New Jersey. For addresses or re-forwarding QSL cards, we advise you to write: W9FO, 608, South Dearborn, Chicago (Ill.). E. COOMBES (Walthamstow): "Break through" of transmission by local amateur G6JI; would advise you to write to him: J. W. Ismay, 6, Douglas Avenue, Walthamstow, E.17. C. J. C, LAWDAY (Shepton Mallet): The B.B.C. new temporary interval signal (a gramophone record of the chimes of Bow Bells). R. BULLER (Old Kent Road): G2XS, H. W. Sadler, "Redways," Wootton Road, Gaywood, King's Lynn, Norfolk; G2LV, V. Leach, "White House," Hucclecote, Gloucester; G5SY, W. B. Sydenham, B.Sc., "Sherrington," Cleveland Road, Torquay, S. Devon; W8XK, Westinghouse Electric and Manufacturing Co., East Pittsburgh (Pa.). Write: HJ3ABF, Manuel Jose Uribe & Cia, Box 317, Bogota, Colombia. DE-EX (Cleveleys): Regret, cannot trace, W2WHY, but if W2WH, William G. Herbert, 2,407 7th Avenue, New York City. ECKOFAN (Edinburgh): Regret, but it is impossible to trace amateur transmission without call sign. B. MCCAULEY (Co. Donegal): For particulars regarding amateur transmitters we advise: "The Radio Amateur Call Book Magazine," obtainable from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Ilford, Essex; for particulars regarding ships, the List of Ship Stations, published by the Bureau de L'Union Internationale des Télécommunications, Berne, Switzerland. What you heard was possibly a series of "V's" which is the call sent out by one transmitter when calling another. F. HOLDEN-RUSHWORTH (Hammersmith): A complete list of National prefixes, also Commercial stations, can be obtained only from the Bureau de L'Union Internationale des Télécommunications, Berne, Switzerland. R. BRIGGS (Clacton-on-Sea): W8RG, H. L. Bear, Curtisville (Pa.); W1VR, T. R. Pennypacker, 19, Brentwood Avenue, Newton Centre (Mass.); Cannot trace call sign W6VR; G5QY, A. C. D. Hornsby, 7, Lansdowne Terrace, Gosforth, Newcastle-on-Tyne. C. BROWN (Hendon): Regret, cannot give details; apparently police transmission.

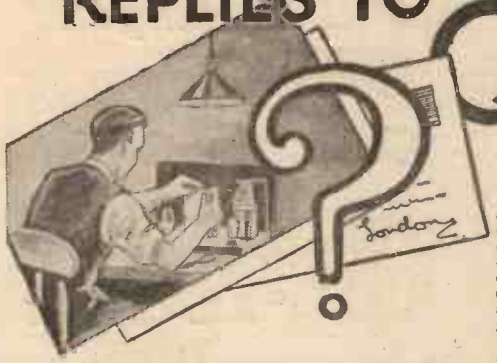
C. SOWERBY JNR. (South Shields): G6HV, D. Large, 25, Park Parade, Roker, Sunderland. G. E. BROWN (Gillingham): F8PI, P. Samuel, 1, Rue Gilbert, Epinal (Vosges), France; F3DC, R. Derosier, 24, Avenue de Ceinture, Cretail (Seine), France; G5HB, H. Biltcliffe, 74, Beldon Lane, Great Horton, Bradford. A. B. (Kingston, Portsmouth): possibly an amateur transmission (75—75.8 m.) but regret, details are too vague to trace.

OSRAM VALVE GUIDE.

A handy and well produced catalogue just at hand from the General Electric Co. Ltd., is the Osram valve guide for 1934. This deals with the full range of Osram valves giving the characteristics and technical details of the valve range in handy form. The book comprises four sections, section 1 dealing with 2-volt battery valves, section 2 with A.C. mains valves, section 3 with rectifiers for mains sets, and section 4 with D.C. valves. There is a handy table of European wavelengths at the end of the book. Copies are free to the readers of this paper.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff



The coupon on this page must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications of commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us should bear the name and address of the sender.

ONE-VALVE BURNT OUT

"I have a three-valve set which I've had for two years without any trouble. I changed a 1 mfd. condenser on the H.F. side with a 1 mfd. on the L.F. side. On tuning the set I could not get a sound, and I therefore tested the valves and found that the S.G. valve had blown. The detector and power were all right. I had no fuse in the set but cannot understand why only one valve had gone. Can you explain this."—J. T. (London, N.1.).

You might have shorted the H.T. across the S.G. valve filament connections whilst changing the condenser round, and if this was rated, say, at .1, whilst the other valves are rated at .2, then the lower resistance of the H.F. valve would have caused it to blow as soon as the H.T. was connected across it, but as the short-circuit was only momentary, the other two valves did not blow. On the other hand, the valve filament may have become nearly worn out, and during the change-over you may have knocked it and caused a break in that manner. However, the accident proves the advantage of fitting a fuse to every battery receiver.

H.F. VALVE DEFECTIVE?

"I have a three-valve portable which uses a screen-grid as a detector, an L.F., and a power valve. No signals come through unless you put an aerial on the plate of the S.G. valve. If you could give me any idea what is wrong I should be much obliged."—N. F. (Edinburgh).

Connecting an aerial to the anode of the S.G. valve means that the whole of the tuning arrangements are cut out of circuit, and, therefore, we fail to see how the receiver can tune. However, as you only say signals can be received, but do not state that they are tunable, we would imagine that the H.F. valve (which acts as a detector in this circuit) is faulty, and there is no passage of current from the grid side of the valve. You say you have checked the frame and condensers, etc., so we would advise you to try a new valve. As the receiver is a commercial one, we would not advise you to tamper with it, but if a new valve does not effect a cure, you should send the set back to the makers for test.

INSUFFICIENT DETAILS

"I have just completed an ordinary straight three, det., L.F., and power. It is an exact copy of another set in every detail. One set works all right, but this one does not tune-in correctly. I can only get the London Regional on 50 and the National on 30. I have tried different coils, condensers, etc., and there is the same thing always. In fact, I have tried a different set of components and also rearranged them. I would be obliged to have your opinion."—W. S. (Lambeth, S.E.).

You say you can accurately tune the two London stations, and, therefore, it appears that the tuning circuits are in order, and also that the circuit arrangements must be more or less correct. You do not give any details regarding signal strength, quality, etc., and, therefore, we cannot offer any information other than that failure to get other stations is due to the fact that your aerial system is not sufficiently good, or that wrong voltages are being applied to the valves and they are thus not working at the maximum sensitivity. If you can offer some further information we may be able to help you.

LUCERNE COILS WANTED

"Since the alteration in wavelengths I find that I cannot get certain stations. Previously I got a number at good strength, but those I do get now are not good. Would new coils make any difference, say, the new Lucerne coils, and would the numbers on the terminals tally with those on the existing coils."—F. E. (Horwich).

We presume that you find that the rearrangement of wavelengths has resulted in certain stations being found at such a position on your tuning dials that other more powerful stations have swamped them out. Alternatively, you may have found that certain stations which you wish to hear are now on such a wavelength that your existing coils do not tune either high or low enough to receive them. You should, therefore, fit the coils which have been designed to cover the new ranges. The coil numbers will not necessarily be the same, but the makers of the coils supply a leaflet of instructions which give all connections and you should not find it difficult to wire the coils into your present set.

MOVING COIL OR CLASS B

"I have a three-valve set with balanced armature speaker, and I am thinking of getting a new moving-coil speaker or Class B. I wonder if you would kindly advise me what to get, and the best makes so that I can get the best results from my set."—D. H. (Stretford).

We presume that your desire is simply to improve volume with good quality. A moving-coil speaker, if it is sensitive, will probably give slightly more apparent volume, and will certainly give better quality than the existing speaker. The only problem will be how to feed a sufficiently strong signal to it to enable it to give of its best. A Class B amplifier will give more signal strength than the present arrangement, although if you simply fit such an amplifier, and retain the present speaker, you will not be doing justice to the Class B arrangement. We think, therefore, that your best plan would be to obtain one of the new Class B speaker-amplifiers, which consist of a Class B unit and a moving-coil speaker combined. When this is added to your set and the correct voltages are applied, you will get both the increased volume and the better quality.

IMPROVING SELECTIVITY AND SENSITIVITY

"I wish to get more stations, and to be able to separate them easier on my present detector and 2 L.F. set. Could you give me any details to enable me to do this?"—A. S. (Ilkeston).

We replied to your letter through the post, using your own stamped addressed envelope, but this was returned by the postal authorities marked "Insufficient Address." We would advise you to make up the S.G. Unit which was described in PRACTICAL WIRELESS No. 62 and 63, page 599. This will result in an improvement in both selectivity and sensitivity and should meet your requirements.

MAKING IT ALL-ELECTRIC

"I have a 1928 S.G. Three, at present running from a D.C. eliminator (home-made) and accumulator. I want to know if I could make this all-electric without doing away with any of the present parts excepting the accumulator."—E. B. (Southwark Park Road).

To fit D.C. valves to your receiver you would not only have to alter the filament wiring, but would probably also find that the majority of the condensers would not be of sufficiently high rating to withstand the extra voltage which could be applied to the D.C. type of valve. Your eliminator would not deliver sufficient voltage to operate the valves at their best, as they will conveniently take 200 volts at the anode. Therefore, your best idea if you wish to avoid the accumulator charging difficulty, is to make up a trickle charger.

QUESTIONS NOT TO ASK

"I have built the Auto B Three, but now wish to make this into a self-contained portable receiver. I should be glad, therefore, if you would give me details for the frame aerial windings for this particular set."

We have had a number of queries on these lines, and if only readers would think for a minute or so they would realise that it is not advisable to make a frame aerial receiver which employs no H.F. stage. Owing to the lack of high-frequency amplification results would be disappointing, apart from the fact that the frame aerial takes the place of the tuning coil. Thus, reaction arrangements, as well as other circuit details have to be modified, and it may, therefore, be taken as a general rule that a self-contained frame aerial receiver is not advisable unless H.F. stages are included.

FREE ADVICE BUREAU COUPON

This coupon is available until April 7th, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 31/3/34.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word prepaid — minimum charge 3/- per paragraph—and must reach this office not later than Tuesday for the following week's issue. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8 Southampton Street, Strand, London.

PREMIER SUPPLY STORES

offer the following Set Manufacturers' Surplus New Goods at a fraction of the original cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

PREMIER SUPPLY STORES announce the purchase of the entire stock of a world-famous Continental valve manufacturer. All the following types of standard mains valves at 4/6 each. H. HL. L. Power. Directly heated 6-watt Pentode. Directly-heated 9-watt Pentode. High magnification Screen-grid, low magnification Screen-grid. Variable-Mu Screen-grid. 250 volt 60 milliamp. full-wave rectifiers.

THE following types 5/6 each. Indirectly-heated Pentode. 350 volt 120 milliamp. full-wave Rectifier. 500 v. 120 ditto, 6/6. Dario Factory Valves 4v, filament. Set of 3, consisting of Screen-Grid, Detector and Power or Super-Power, 6/6 the lot. Power or Super-Power, 2/6.

ELIMINATOR Kits, including Transformer, choke, Westinghouse metal rectifier, Dubilier condensers, resistances and diagram, 120v. 20 m.a., 20/-; trickle charger 8/- extra; 150v. 30 milliamps., with 4v. 2-4 amps. C.T. L.T., 25/-, trickle charger 6/6 extra; 250v. 60 milliamps., with 4v., 3-5 amps. C.T. L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps. C.T. L.T., 37/6; 150 volts 50 milliamps., 27/6.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Premier chokes, 25 milliamps. 20 henries, 2/9; 40 milliamps. 25 hys., 4/-; 65 milliamps. 30 hys., 5/6; 150 milliamps. 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6.

HARLEY Pick-up, complete with arm and volume control, 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms., 3/6.

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 ma., 0-1, 0-5 amps.; all at 6/-.

SPECIAL offer of Mains Transformers, manufactured by Philips, input 100-120v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amp., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v. 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8. Transformers, 250v. 60 m.a., rectified with 4v. 3-5a. and 4v. 1a. C.T. L.T., screen primary, 15/-; with Westinghouse rectifier, 25/-.

4V. 3a. C.T., 6v. 2a. C.T., 9v. 1a., 12v. 1a., 7/6 each; 4v. 3-5a., 22v. 1a., 8/6 each; 10v. 3a., 14v. 4a., 10/- each.

PREMIER H.T.9 Transformer, 300 v. 60 m.a., with 4v. 3-5a and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. and 4v. 1a. C.T., L.T. and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER Mains Transformers, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; Westinghouse rectifier for above, giving 200v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.); with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400v. 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-.

PREMIER Auto Transformers, 100-100/200-250v., or vice versa, 100-watt, 10/-.

MULTI Radio Output Transformers, 4/6. Twin Screened Wire 3d. per yard.

CENTRALAB Potentiometers, 50,000, 250,000 half meg., any value, 2/-; 200 and 400 ohms, 1/-.

RELIABLE, Canned Coils with Circuit, accurately matched dual range, 3/- per coil. Please state whether Aerial or H.F. required. Ditto iron core, 3/6.

PREMIER L.T. Supply Units, consisting of Premier Transformer and Westinghouse rectifier, input 200-250v. A.C., output, 2v. ½amp., 11/-; 8v. ½amp., 14/6; 8v. 1 amp., 17/6; 15v., 1 amp., 19/-; 6v., 2 amp., 27/6; 30v. 1 amp., 37/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6; all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in cone, 18/6.

GRAMPIAN M.C. Loud-speakers, 2,500 ohm. field, 9in. cone, handles 5 watts; 21/-.

GRAMPIAN P.M. Loud-speakers, 9in. cone, handles 4 watts; 18/6.

(Continued at top of column three)

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1 Wearite Type H.T. 25 Smoothing Choke	0	9	0

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(Continued from foot of column one)

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SPECIAL Offer of Wire Wound Resistances, 4 watts: any value up to 10,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

POLAR 3-Gang STAR, .0005, manufacturers type. Fully screened, 7/6, with trimmers, 1/6 extra.

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T.C.C. Electrolytic Condensers, 440 volts working, 4 mf. or 8 mf., 3/-; 15 mf., 50 v. working, and 50 mf. 12v. working, 1/-; 25 mf. 25v. working, 1/3.

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PLEASE mention PRACTICAL WIRELESS when ordering.

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SPEAKERS.—Blue Spot permanent magnet, with Universal transformer for power, pentode, super power, or Class B, 23/- (list 39/6); D.C. mains energised, all voltages, 16/6; Celestion Soundex P.P.M. permanent magnet, 17/6 (list 27/6); Blue Spot 100U inductor, complete with chassis, 13/6 (list 39/6); Celestion permanent magnet type P.P.M.W. universal transformer, 25/- (list 49/6).

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ALL Transformers and Chokes Guaranteed for 12 Months.

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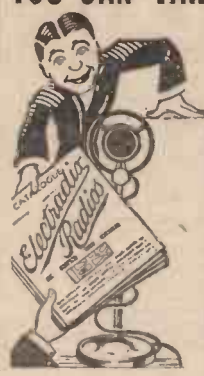

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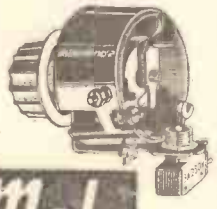

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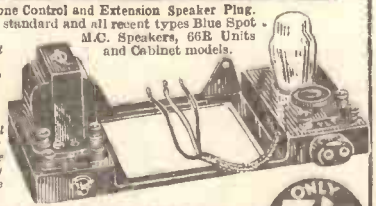

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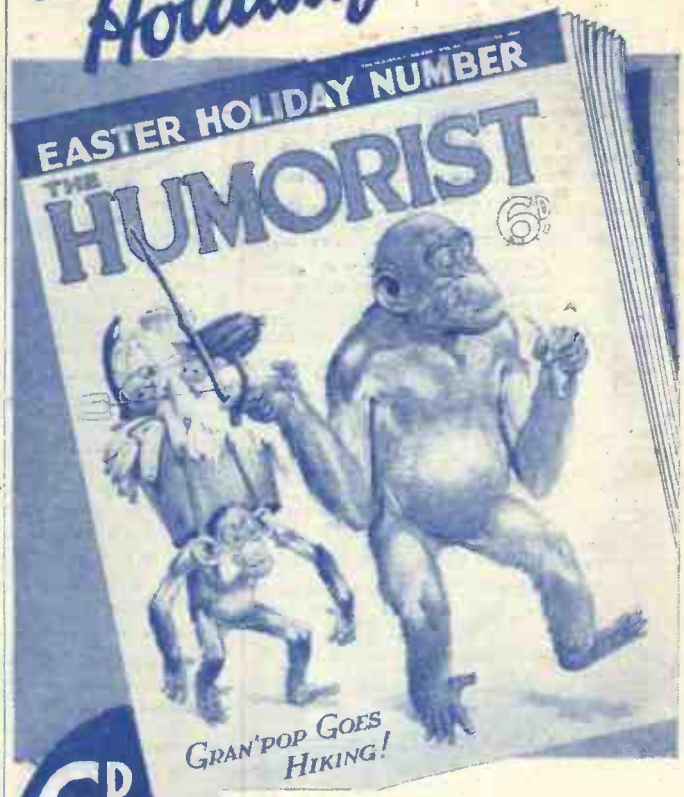

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