COIL-MAKING FOR BEGINNERS!

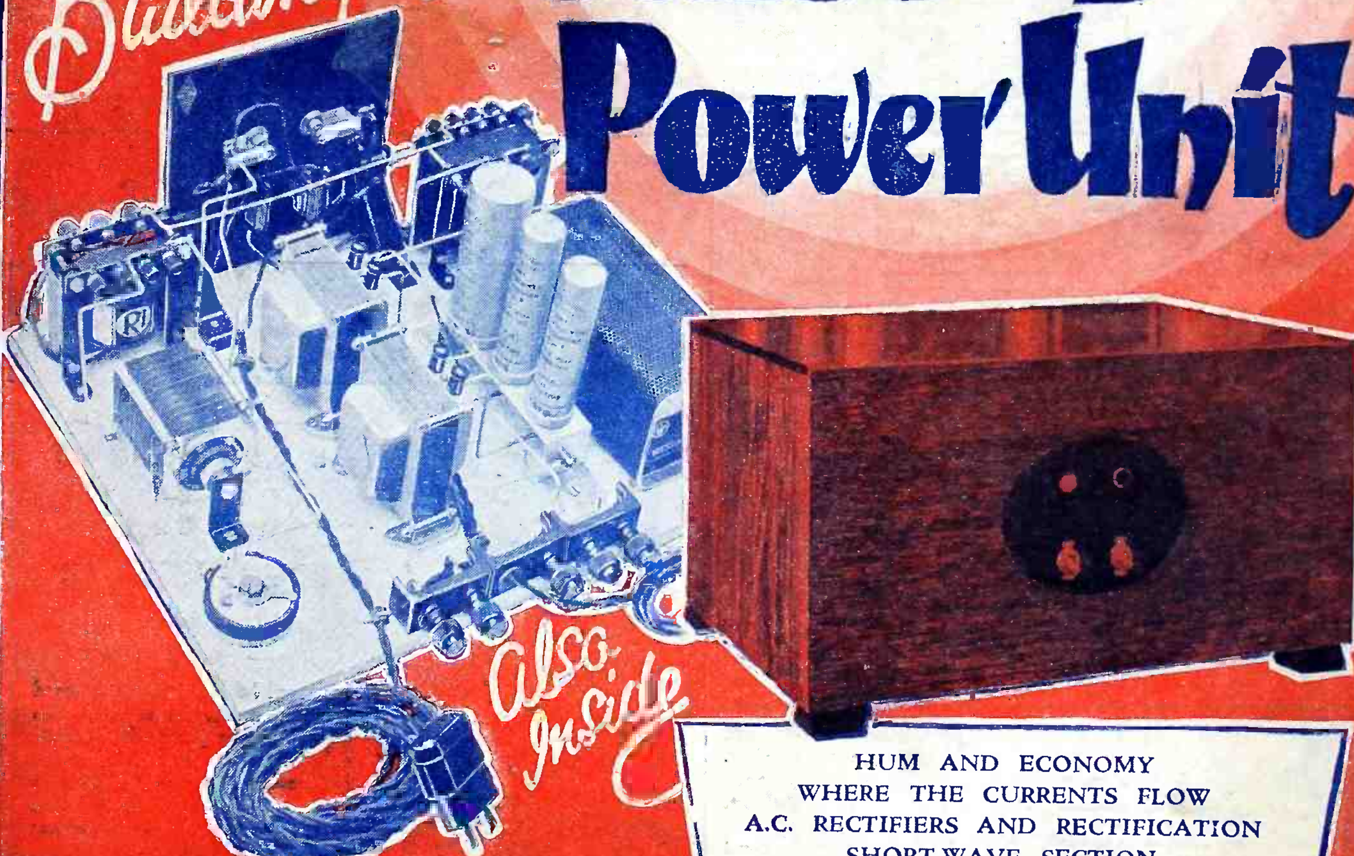
Practical Wireless

3D.

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 3.——No. 65.
DECEMBER 16th, 1933.
Registered at the G.P.O. as a Newspaper.

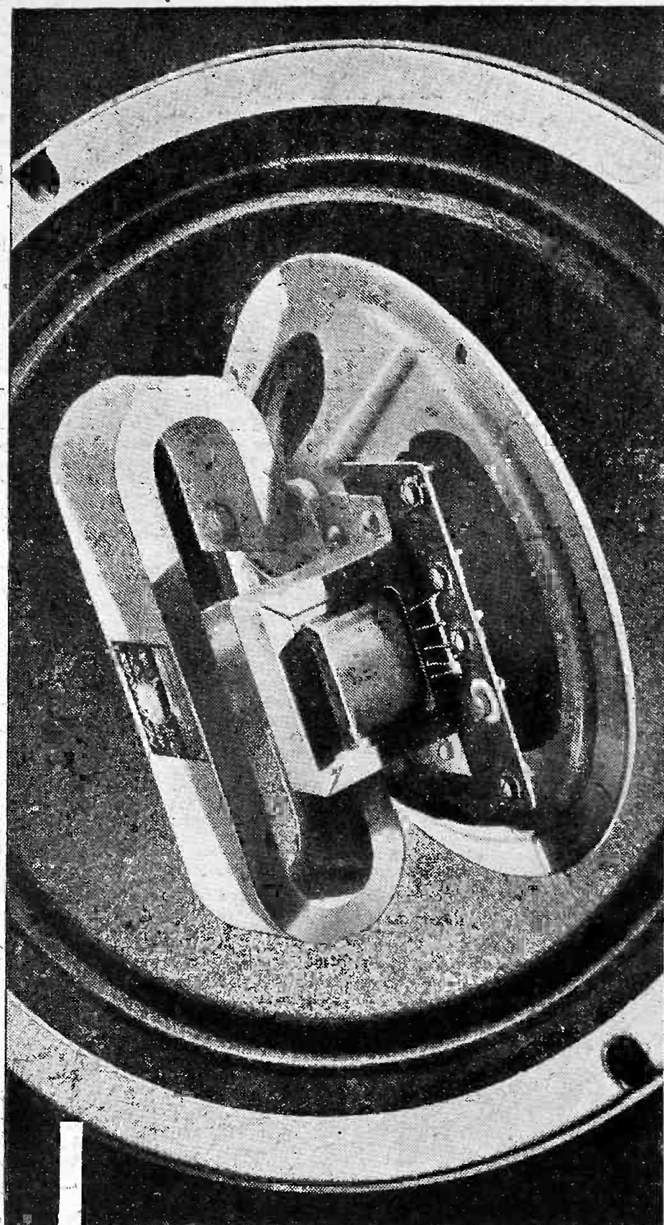
EDITED BY F. J. CAMM.

Building a Class "B" Power Unit



Also Inside

HUM AND ECONOMY
WHERE THE CURRENTS FLOW
A.C. RECTIFIERS AND RECTIFICATION
SHORT-WAVE SECTION
CONVERTING YOUR SET TO ALL MAINS



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At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World "Skyscraper" 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra Short and Short-Wave transmissions from the ends of the earth. And remember you get these stations through Double-Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.
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When you see the Great Free Chart of the All-Wave All-World "Skyscraper" 4, which tells you how to build it, and how to work it, and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!
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THE LEADING WEEKLY FOR CONSTRUCTORS!

EDITOR:
Vol. III. No. 65 || F. J. CAMM || Dec. 16th, 1933
Technical Staff:
W. J. Delaney,
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.,
Frank Preston, F.R.A., W. B. Richardson.

ROUND *the* WORLD *of* WIRELESS

Vol. II Index and Binding Case Now Ready!

HAVE your issues of PRACTICAL WIRELESS bound. Regular readers should have their copies bound in the special covers issued by the Publishers for that purpose. A 12-page index, complete with title page, and containing over 5,000 references, is issued with it and affords a means of rapidly turning up that piece of information which you know has appeared, but cannot easily locate. *This is not a loose binder*, but a correct cover in blue cloth on strong boards with silver letters. We will undertake to bind your 26 copies of Vol. II (issues dated March 25th, 1933, to September 16th, 1933) for a charge (inclusive of cover and index) of 5s. 6d. Return carriage is paid on all orders. Full particulars of this offer appeared on page 445 of our issue dated November 11th.

Young Accumulators

AS from the 16th of December, the whole of the sales of Young Accumulators in Scotland will be handled by Messrs. Day and Night Auto Serve, Ltd., 285-295, Clyde Street, Glasgow (Tel. No.: 578-9 Central Glasgow), and arrangements have been made for ample stocks of all types of batteries, including batteries for heavy commercial vehicles, and servicing facilities to be available at all times of the day and night.

"Practical Wireless" in Penang

ONE of our advertisers has just received the following letter (relating to an ad. in a recent issue) from a reader in Penang, Straits Settlements:—

"Dear Sirs,

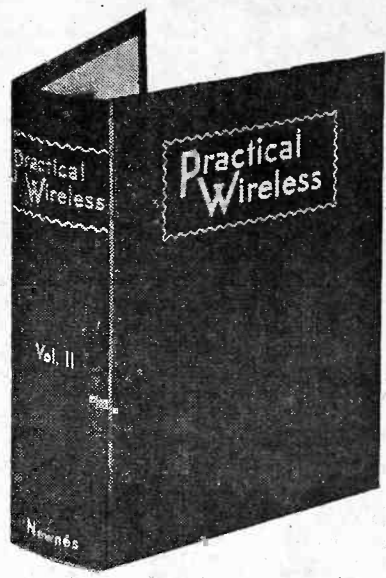
"Referring to your 'Microlode' P.M. Moving Coil Loud-speakers, will you please let me know whether you can supply type PM4A fitted in a cabinet? Please send by return full particulars and lowest cash price." The sun never sets on *us!*

Short-Wave Wireless for Aircraft

A FURTHER example of the remarkable results obtainable with well-designed short-wave wireless equipment, both for ground-and-air communications over considerable distances, and as a simple and reliable means of contact between aircraft flying in formation was the performance of the Marconi Type A.D.24D equipment installed in an aeroplane which formed one of a flight of Argentine aeroplanes recently from Buenos Aires to Rio de Janeiro.

The flight covered a distance of 2,100 kilometres, and it is reported that telegraphic contact was maintained throughout with the terminal aerodromes, although the Argentine station had only a two-valve receiver. Positions were reported every ten minutes and telephonic contact maintained with the rest of the units of the flight. Signals were always clear and powerful, and no difficulty or delay of any kind was encountered.

HAVE YOUR COPIES BOUND!



For the nominal charge of 5/6 (inclusive of binding case and 5,000 item index) we will undertake to bind the 26 issues of Vol. II. See the first paragraph on this page.

France's One Million Listeners

ACCORDING to a report issued by the Department of Overseas Trade, the market for radio in France is far from saturated, while the demand is steadily increasing. On August 31st, 1933, the number of sets declared was 1,173,817, of which 296,579 had been declared in Paris and district.

Four different fees are levied on persons owning receivers. For purely crystal sets the licence costs approximately 2s. 6d. at par, while private people having other types of sets have to pay 8s. 4d. There is also a valve tax to be paid by retail purchasers, varying between 6d. and 10d. a valve according to its selling price.

Listen to Radio Budapest

THE new 120-kilowatt Lakihegy transmitter was formally opened on Saturday, December 2nd, and now regularly broadcasts the Hungarian wireless programmes on 550.5 metres. On January 15th, 1934, no great alteration will be needed as, according to the Lucerne Plan, the channel allotted is but 1 kilocycle higher, namely 546 kilocycles (549.5 m.). The 18-kilowatt station which has been used so far will broadcast an alternative programme every evening.

The Farmyard Awakens Listeners

AS a colourable imitation of the "cock crow" which the Prague station has adopted to tempt its listeners out of bed, the Riga station has devised for the same purpose a full collection of farmyard noises. If you care to tune your sets to Riga on 525.3 metres or, better still, to Madona (452.3 m.) at 5 a.m. G.M.T., you will hear the Latvian roosters calling their owners to physical exercises. This is followed by the cackling of hens, the grunting of pigs, the mooing of cows, all of which should awaken even the Seven Sleepers of Ephesus!

Brussels on Short Waves

IN order to permit its nationals in the Belgian Congo to listen to the Brussels broadcasts, the programmes will shortly be retransmitted through one of the Ruysselede stations (near Bruges) on 29.04 metres (10,331 kc/s). In view of the difference in time, the broadcasts will be made from G.M.T. 18.00—22.00.

Extended German Programmes

FOR a period under the new régime, German broadcasting stations had somewhat curtailed their evening transmissions. Now, however, in view of increased power of stations and the greater possibility of broadcasts being picked up by Germans resident in foreign countries, late programmes are regularly given by the Frankfurt, Cologne, and Stuttgart group of studios. This principle will later be adopted by Königs-Wusterhausen, Hamburg, Munich, and Breslau.

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

Plans for the Change-over.

TO permit stations to take up their exact locations in the wave-band on January 15th, 1934, all transmitters will close down on the eve of that day at G.M.T. 23.00, and engineers will make the necessary alteration in wavelength. According to instructions each station in turn will give out its full call for a period of two minutes, and will play a specified gramophone record. The actual measuring of frequencies will be carried out by Brussels, Berlin, Helsinki, Noghinsk (Moscow), Prague, Rome, Stockholm, London, Warsaw, and Berne. Results will be communicated to individual transmitters direct, or will be broadcast through a high-power station. During the night of January 16th-17th the official Brussels listening post will again check up the transmissions on their new channels.

B.B.C.'s Twenty-third Studio

ST. GEORGE'S HALL, the former home of the Maskelyne and Devant Mysteries, has now formally come into regular use as a B.B.C. broadcasting studio; it will accommodate an audience of 450 people, and will be mainly used for vaudeville, variety, and the lighter forms of entertainment.

"The Path of Glory"

L. DU GARDE PEACH'S amusing radio comedy, which was first produced in 1931 and revived one year later, will again be broadcast in the National programme on December 15th, and from the Regional stations on the following day. It is a story of the inner history of the recent incredible hostilities between the Republic of Thalia and the Kingdom of Sardonia. Without doubt it is one of the best microphone plays offered to listeners during recent years.

Radio-Toulouse Relays Paris

IF you listen to Radio-Toulouse on any Friday evening at G.M.T. 21.30 (9.30 p.m.), you will hear from this station a relay from the famous Medrano Circus at Paris. This is a regular feature of the weekly programmes. It is a curious fact that, although taking place in the French capital, these performances are not broadcast by any Paris station.

Pity the Poor Portuguese

ACCORDING to a Lisbon paper, the 20-kilowatt station of which the formal opening was previously announced for October, cannot yet operate, as the buildings are not yet finished. Although there exists as yet no broadcasting service in Portugal, the State has been collecting the licensing tax since September, a step which is arousing considerable criticism in that country's wireless circles.

Christmas Greetings

PRIOR to His Majesty the King's Christmas message from Sandringham, greetings will be exchanged between British citizens and friends of the Empire, and good wishes will be transmitted to and

INTERESTING and TOPICAL PARAGRAPHS

from London. They will include messages from the Irish Free State, Bermuda, Canada, Australia, New Zealand, India, and South Africa. The King's address will be broadcast at 3.0 p.m. G.M.T. In view of the difference in time, it will be received at Sydney (N.S.W.) at 1.0 a.m., and at Wellington (N.Z.) at 3.0 a.m. on the morning of December 26th; in Bermuda at 11.0 a.m., Ottawa 10.0 a.m., Cape Town 5.0 p.m., and Bombay 8.30 p.m. on Christmas Day.

RAMSAY MAC. HEARS HIS MASTER'S VOICE

Mr. Ramsay MacDonald in a corner of the assembly factory during his recent visit to "His Master's Voice" factories.

The New Frankfurt-am-Main Group

IN anticipation of the re-grouping of the Frankfurt-am-Main, Stuttgart, and Cologne studios, the new Freiburg station has been added to the network already including Cassel and Treves (Trier), and now exclusively takes the Frankfurt wireless entertainments.

Broadcasts to the Fishing Fleet

ON the occasion of the recent appointment of the Governor of Flanders, as certain speeches delivered at the Ostend (Belgium) Town Hall were of vital interest to the masters and crew of the fishing fleet, the addresses were relayed to the Ostend Coastal wireless telephony station and re-broadcast on 180 metres. During the past two years most of the ships connected with the Belgium fishing industry have been equipped with wireless apparatus. This is the first occasion on which transmissions, other than weather reports, instructions, or private messages, have been broadcast through this coastal station.

Austria's Half-Million Listeners

SINCE the opening of the new Bisamberg high-power station the number of subscribers to the Austrian broadcasting service has rapidly increased. As a reward the authorities offered a gold watch to the holder of the 500,000th licence. The ceremony, including the presentation of the gift by the Minister of Commerce at Vienna, was registered on a gramophone record and later broadcast in the course of the evening programme throughout all stations in Austria.

Solving a Swiss Problem

IN view of the mountainous character of the country, Switzerland requires high-power stations, and listeners are of the opinion that neither Sottens nor Beromünster on the medium waveband at their present power can give adequate service. Although rumours have been current in respect to an imminent increase in the output of these transmitters, according to a Berne daily, the matter is only under consideration, and no definite decision has yet been taken by the authorities. Much will depend on the results achieved by the Lucerne Plan. If this does not give sufficient satisfaction to Switzerland, steps to strengthen the transmissions of both Beromünster and Sottens will be taken in March, 1934.

G.M.T. For Holland

THE Dutch Government is examining the possibility of adopting Greenwich Mean Time and British Summer Time in Holland. So far, Amsterdam Time is used; it is twenty minutes in advance of our clocks. Generally speaking, the population is in favour of the change.

Edison Cables, Ltd.: Change of Address

ON December 4th, 1933, the Head Office of Edison Swan Cables, Ltd., was transferred from Queen Victoria Street to 155, Charing Cross Road, W.C.2, where all communications should be addressed. Telephone: Gerrard 8660. Business at the trade counter, 228, Upper Thames Street, will be carried on as usual.

SOLVE THIS!

Problem No. 65.

Rodgers made up a three-valve battery set employing detector and two L.F. stages, but when tested it motor-boated badly. He decided to decouple the detector stage and, on looking through his box of spare parts, found that the only resistances he had were two of 250,000 ohms each. He had plenty of 2 mfd. condensers, so he joined the two resistances in series to reduce the value to approximately 100,000 ohms and connected a fixed condenser of 2 mfds. between the earth and the junction of the transformer and resistances. This stopped the motor-boating, but he found that signals were very weak and it was impossible to obtain any reaction effects. 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, and post to reach here not later than December 18th. Mark your envelopes Problem No. 65.

SOLUTION TO PROBLEM No. 64

Owing to the fact that Smith made up the chassis from plywood, he should have covered this with metal foil, but by omitting this he failed to provide return connections for the electrolytic condensers, etc., and thus hum was caused owing to the absence of the condenser across the bias resistances. The smoothing condensers are also earthed via the chassis.

Only one reader gave a correct solution to Problem No. 63, and a book has accordingly been forwarded to him: A. Balfour, 3, Little Chapel Street, Aberdeen.

Hum and Economy

Economy in the Wrong Direction Leads to Hum Troubles. How to Effect the Best Smoothing at the Lowest Cost is Explained by W. J. DELANEY

THIS article, as its title implies, is intended for the designer or constructor of a mains-operated receiver, although if the construction is being carried out from instructions relating to a receiver designed in our laboratories, all the following points will have been carefully considered by the designer. It will be interesting for the reader, therefore, after a perusal of this article, to refer to various mains receivers which we have described, or shall describe in the future, and to see how the points embodied therein agree with the main considerations of economy and hum-free working. Alternating current, as has been explained before in these pages, consists of a supply which changes its direction at a regular frequency, usually between 25 and 100 times per second. In other words, the current from a zero line rises to a maximum in a positive direction, falls to zero and then on to a similar value in a negative direction, returning again to the zero line. The complete course just referred to is a cycle, and in the majority of A.C. mains in this country the periodicity (or frequency) is 50 cycles per second. Fig. 1 shows the sine curve which demonstrates the complete cycle, and you will find on your supply meter (if A.C.) the figure corresponding to the frequency, namely 25, 50, 100, etc., followed by a small reproduction of this curve, thus 50～.

The H.T. Supply

The high-tension supply of a receiver operated from the A.C. mains will be obtained by means of a rectifier which is fed by a transformer interposed between the mains and the said rectifier, the transformer stepping the voltage either up

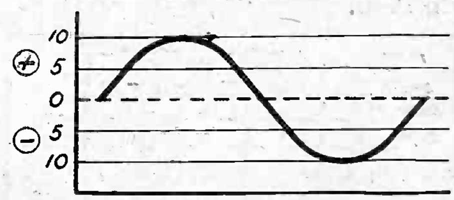


Fig. 1.—The sine curve, or symbol of alternating current. The passage of the oscillation from zero up to maximum, down to minimum and then back to zero, represents one cycle.

or down to supply the rectifier with the correct value. In the case of a half-wave rectifier (either valve or metal oxide) the secondary winding of the transformer will feed into the rectifier an A.C. supply which will be converted by the rectifier into a uni-directional, or direct current. With a full-wave rectifier each half-cycle is converted to account and passed on from the rectifying circuit. In both cases, however, although the current is uni-directional, it will bear the "pulsations" or regular rise and fall according to the frequency of the supply and the method of rectification. Thus if the supply is 50 cycles, a half-wave rectifer will pass on a direct current bearing a ripple of 50 cycles, whilst if a full-wave rectifier, the direct current will bear a ripple of 100 cycles. Our task on the H.T. side is, therefore, to retain the direct current but to suppress the ripple, and as a direct-current mains supply will also in most cases be supplied by means of a D.C. generator, there will also be the possibility of this bearing a ripple from the commutator, so that the following notes relate alike to A.C. or D.C. supplies, and Fig. 2 shows the point in the H.T. battery eliminator which is being dealt with now.

The Smoothing Circuit

It is customary to include across the points marked X what is known as a smoothing circuit, consisting of a pair of high-capacity condensers and a smoothing choke. This is shown in Fig. 3, and it will be seen that the choke is in the positive lead. A moment's consideration will show

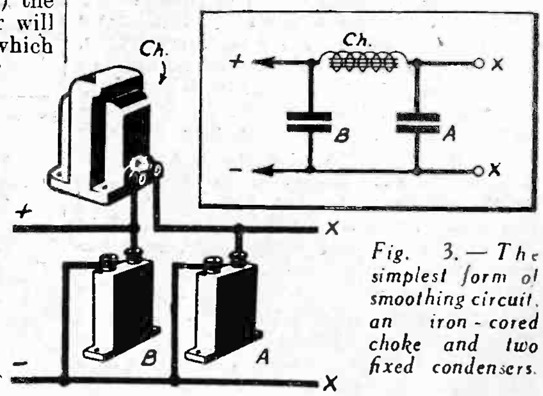


Fig. 3.—The simplest form of smoothing circuit, an iron-cored choke and two fixed condensers.

that the total anode current of the receiver passes through this choke, and in a mains receiver employing three valves this may easily total a minimum of 30 milliamps. The choke must, therefore, pass a current of this value and eradicate the ripple. The choke operates by virtue of its inductance, which means that the smaller the inductance the lower its smoothing properties and *vice versa*. In addition, it operates in conjunction with the condenser A, and this receives the impulses from the supply which are choked back by the choke, and any small ripple which is left is finally removed by the condenser B. On the face of it, therefore, to entirely remove hum all that would be required would be a large value condenser for A a very high inductance choke, and a further large-capacity condenser for B. Taking condenser A first of all, it is obvious that this is the load across the rectifying valve, and it is obviously impracticable to choose any value for this without first consulting the

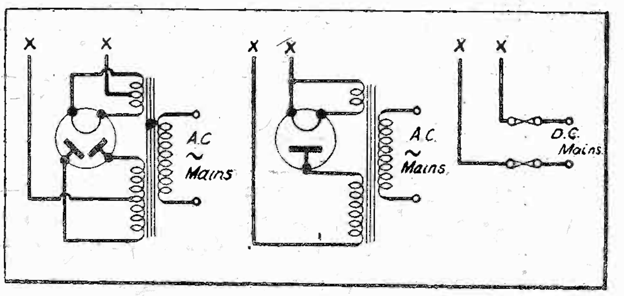
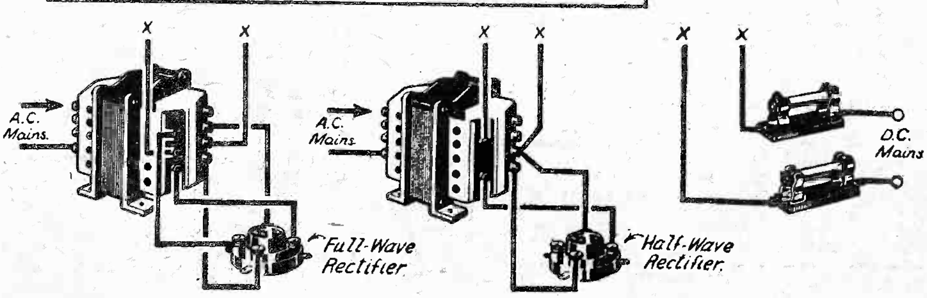


Fig. 2.—A half-wave rectifier, a full-wave rectifier, and the mains input of a D.C. supply shown diagrammatically. The points marked "X" represent positive and negative output leads which require smoothing in each case.



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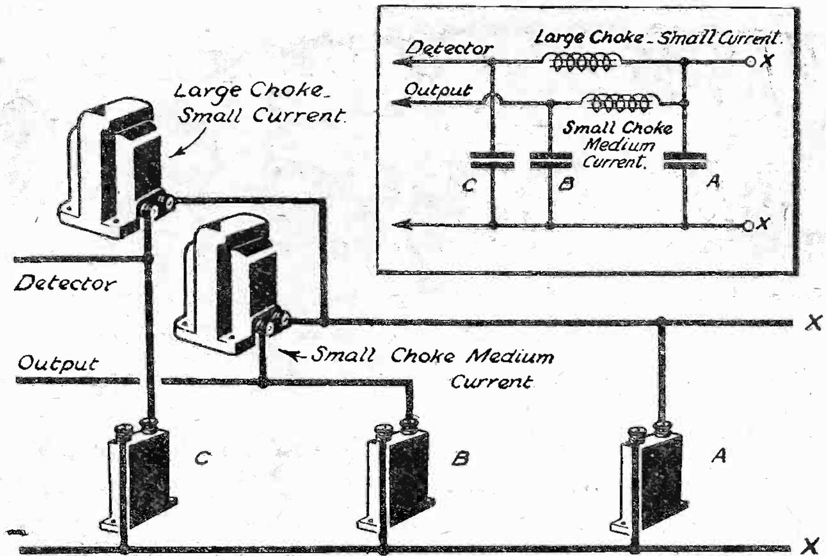


Fig. 4.—To reduce the possibility of hum, a medium-sized choke may be joined in the output or L.F. supply lead, and a further choke in the positive lead to the H.F. and detector stages.

(Continued from previous page)

valve, and a glance through any valve catalogue will quickly show that the valve makers generally recommend a value no greater than 4 mfds. for this.

The output from the rectifier is dependent upon this load, and a valve curve will show that the output increases as the value of the condenser is increased, so that we are more or less forced to adopt the valve-maker's recommendation and use a 4 mfd. condenser; or if we are certain that the valve will not be damaged, we may increase it to 6 mfds. By employing a Class B rectifier for a supply which could normally be obtained from a Class A rectifier we could adopt an 8 or 10 mfd. condenser, but this is certainly not economy. In economizing, therefore, we are bound to use a 4 mfd. condenser, and to obtain the maximum smoothing from this capacity it is obviously preferable to use one of the electrolytic condensers. This is our first point. With regard to the choke, it is essential to use a fair inductance, and as inductance depends upon turns, and the amount of wire is governed by the number of turns, it is obvious that the higher the inductance the higher the cost. Thus in economizing here we have to purchase the largest choke we can afford, although it is not essential to use a choke to smooth the entire supply, as I shall now show. I mentioned a little earlier that the total anode current passes through this choke, and that this may easily total 30 m/a or more. As inductance depends upon turns, and the greater the number of turns the higher the resistance, we are faced with the fact that there will be a drop in voltage across the choke, dependent upon its size and the current passing. If, therefore, we are using a receiver where the output valve requires 200 volts, and the rectifier only delivers a total of 200 volts, we cannot afford to waste any voltage across the choke and must reduce its size. Economy can definitely be effected here by adopting a " stage by stage " smoothing system.

The Detector

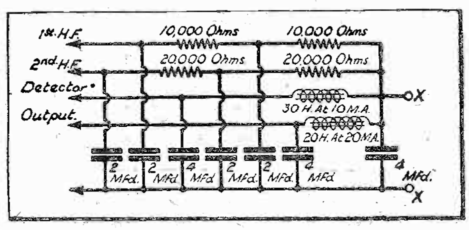
The last valve passes its signal direct to the loud-speaker, and therefore it is not so very important to ensure that every trace of ripple is removed from that valve, as there is no successive amplification. The detector, however, in addition to converting the high-frequency currents into an intelligible signal, also passes them on for further amplification, and we must endeavour to supply the detector anode with a perfectly smooth current in the interests of good rectification and to avoid any subsequent amplification of a small amount of ripple. The current in the anode circuit of a detector will not be greater than 10 m/a even with a power grid detector operating with its maximum H.T. In the majority of cases it will be of the order of 2 m/a only. Thus we can use a large resistance in its anode circuit without fear of voltage waste, and a large choke having an inductance of 300 henries, but wound to carry only a maximum current of 10 m/a will cost no more than a small, say 20 henry, choke wound to carry 50 m/a. This is the second point in our economy scheme, for we may adopt a really small choke, designed to carry only the current of the output valve, together with a large choke designed to carry the small current of the detector (and probably the H.F. valves) and join both of these to the H.T. supply direct. Fig. 4 illustrates this point. The addition of a further electrolytic condenser for C will ensure perfect smoothing. To substantiate the claim for economy I will quote from two well-known catalogues.

A 4 mfd. paper condenser costs 5/6
A 4 mfd. electrolytic condenser costs .. 4/6
A 300 henry, 10 m/a choke costs 12/6
A 40 henry, 10 m/a choke costs .. 5/-
A 40 henry, 40 m/a choke costs 12/6

It will be seen that there is undoubtedly a saving in cost in adopting the separate smoothing system, in view of the more positive guarantee of hum removal.

Resistance or Choke

For the earlier stages in a multi-valve receiver it is quite sufficient to utilize resistances in place of chokes, and by adopting two resistances instead of one of double the value for decoupling purposes, and taking fixed condensers from the ends and the centre, a very effective hum-reducing circuit is obtained at a percentage of the cost of the orthodox smoothing choke system. This arrangement, incidentally, is utilized in the receivers manufactured by one of the largest firms in the country. Fig. 5 shows an arrangement which will be found extremely cheap to construct and which will supply a receiver employing two H.F. stages, an ordinary (not power-grid) detector and an output stage, and which, in addition to being absolutely hum-free, would be absolutely stable, owing to the separate anode supplies which are used.



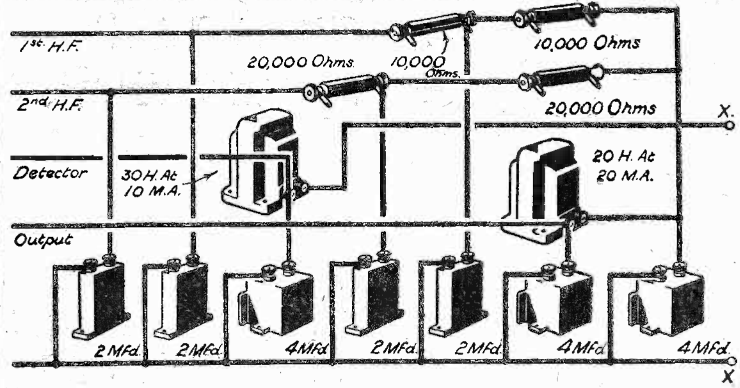


Fig. 5.—For the elimination of every trace of hum, a small choke may be joined in the output supply lead, a second choke in the detector supply lead, and resistance filters in the H.F. stages. This provides perfectly stable operation and removes all traces of hum at low cost.

Alternative Components

When we come to consider the use of alternative components in the interests of economy, we have, in addition to the resistance above mentioned, the employment of a loud-

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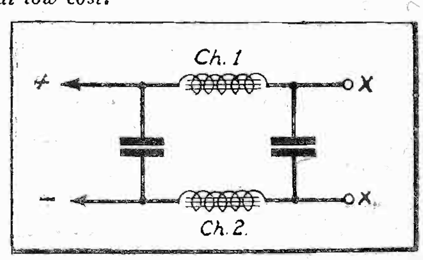


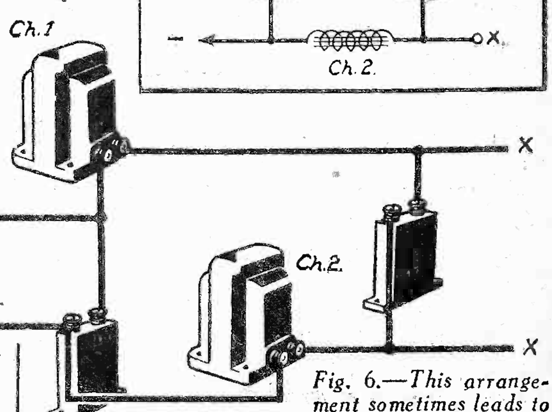
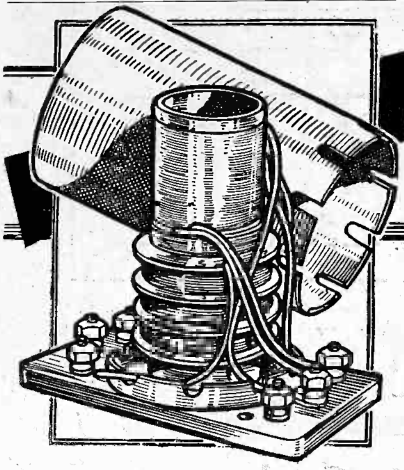


Fig. 6.—This arrangement sometimes leads to trouble, due to the interaction of the two chokes. In addition, the two inductances are in parallel.



MAKING YOUR OWN Screened Coils

In This Second Article the Author Describes the Construction of Some Other Types of Coils and Gives Various Circuits in Which They can Successfully be Employed By FRANK PRESTON

IN the last article under this heading I gave full constructional details in regard to a type of screened coil which is extremely efficient and can be employed with complete success in a variety of alternative circuits. Only a single circuit was given, however, that being for the simplest type of detector-low-frequency receiver. The tuner can be put to excellent use in a circuit of the kind illustrated in Fig. 1, which is for a three-valve set having a variable-mu H.F. amplifier, followed by a leaky-grid detector and a pentode output valve. A circuit of this kind has of necessity two tuned circuits, and thus a pair of the coils described last week are required. Two three-point wave-change switches are also called for, and it is desirable that these should be mounted as near as possible to the coils upon which they are operative. The ideal method would be to make them integral with the coils themselves in the same way as many of the coil manufacturers do, but that is rather outside the scope of the amateur whose equipment is limited. Many constructors might wish to combine the two switches so that they can be operated by means of a single knob. There are various methods by which this can be done, one of which is to mount one switch on the chassis and the second one immediately behind it on a small angle bracket, linking the two spindles with a screwed piece of ebonite tubing. Most of the other methods involve the use of a switch of complicated design, and cannot be recommended.

The circuit shown at Fig. 1 is a particularly good one and, due to the fact that both tuners are tapped on each waveband, it has an extraordinarily useful degree of selectivity. A ganged condenser is shown for tuning both coils, but it is essential that this should be of the type fitted with trimmers, whilst it is better to use one which has one of its trimmers adjusted by an external knob. This is to ensure that the two circuits shall be exactly in tune at every condenser setting, but this result will not be achieved unless great care is taken to make the coils identical. It might be added that it is by no means essential that a gang condenser should be employed, and that equally good reception will be obtained by making use of separate components.

I am not giving a complete and dimensioned wiring plan for the circuit under review (nor for any other circuit dealt with in this series of articles), but the whole arrangement is so straightforward that no reader need find any difficulty in following it. The components are not critical, and provided that they are of the values stated, they may be of any make or variety that

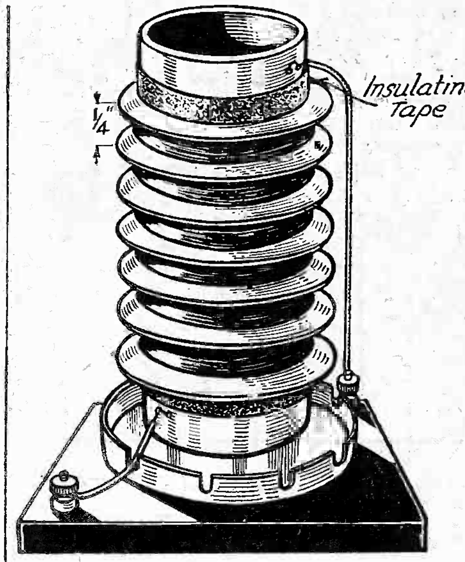


Fig. 2.—Constructional details of a very efficient H.F. choke made from the same materials as those employed for the coils.

the constructor may have on hand. It is best, incidentally, to employ screened H.F. chokes or otherwise to use two components of different types and space them as far apart as possible, without making the connections to them unduly long.

Making the H.F. Chokes

If there are no suitable H.F. chokes to be found in the junk-box, it is a perfectly simple matter to make a couple by using the same materials as those employed for the coils. Simply fit seven of the paxolin spacer washers on the former to make six winding sections and put on a continuous winding of 900 turns of 34-gauge d.c.c. or enamelled wire, placing 150 turns in each slot. The beginning and end of the winding should be anchored by precisely the same method as that employed for the coils, and then connected to a pair of terminals fitted to the ebonite base. Fig. 2 shows the arrangement of the windings, spacers, etc., and gives an idea of the appearance of the finished component.

Modifying the V.M. Circuit

The circuit given in Fig. 1 can be modified in a variety of ways to meet with individual

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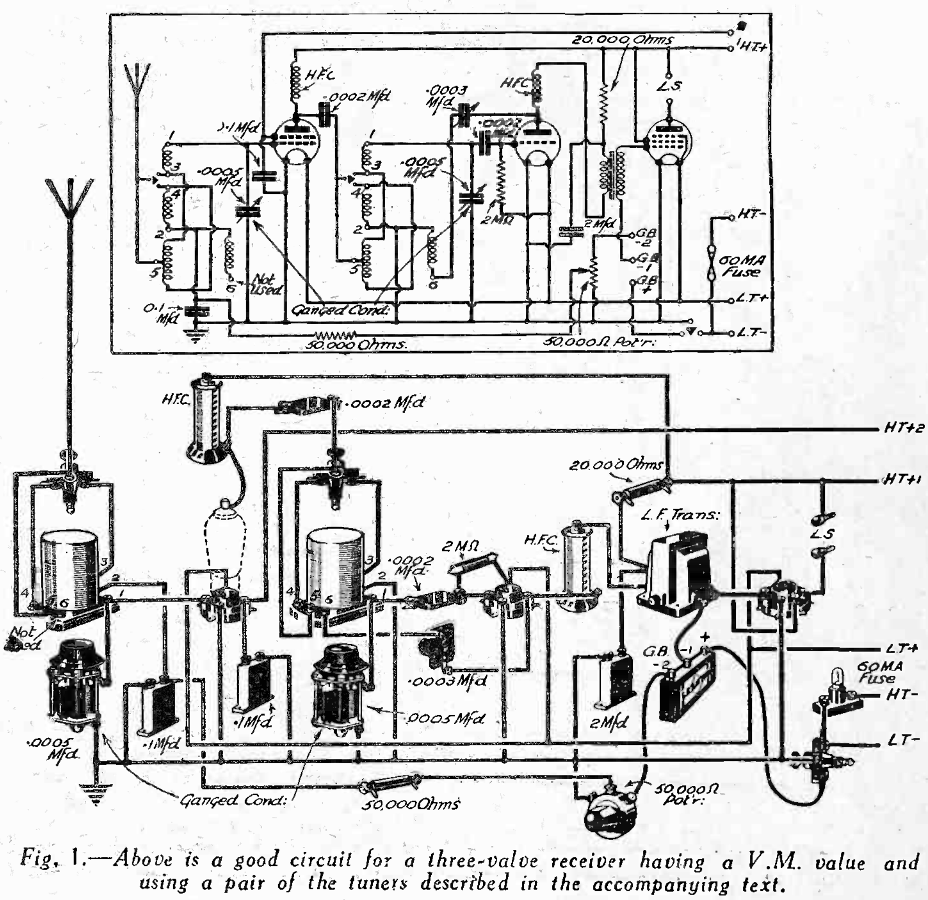

Fig. 1.—Above is a good circuit for a three-valve receiver having a V.M. value and using a pair of the tuners described in the accompanying text.

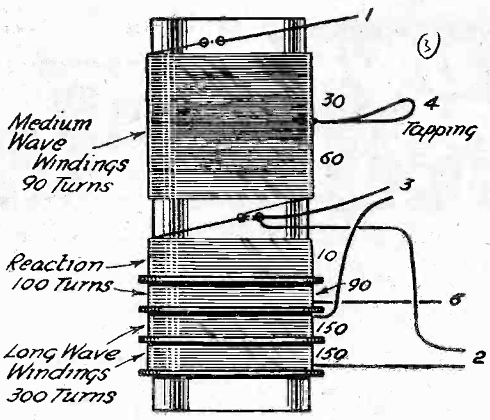

Fig. 3.—Main winding details for a coil suitable for use in a band-pass filter.

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requirements and to enable one to make use of components which are readily available. For instance, the variable-mu valve could be replaced by an ordinary screened grid one simply by omitting the .1 mfd. condenser, 50,000 ohm fixed resistance, and 50,000 ohm potentiometer used for applying the variable grid bias. Terminal 2 on the first (aerial) coil would then be connected directly to earth.

The same circuit might easily be altered to include two S.G. or V.M. stages, since the tapped coils render the arrangement inherently stable on both medium and long waves.

Another Type of Tuner

Although ideal for many circuits, the coil described last week is not quite suitable for use in a band-pass circuit, but a coil for that purpose can easily be made by using the same materials. The main constructional details are given in Fig. 3, where it will be seen that the medium-wave winding is continuous (instead of being divided into two separate halves) and is normally wired in series with the long-wave winding. A tapping is taken from the thirtieth turn and is connected to terminal 4 on the ebonite base. The reaction turns are wound as before, but are differently connected, the "beginning" end being joined to the "finishing" end of the long-wave section. Of course, a pair of coils are required for the complete band-pass tuner, and these are wired up as shown in Fig. 4. The "reaction" winding on the first coil is not essential, but it can be used when desired to give a certain increase in selectivity, by transferring the connection from the .0002 mfd. pre-set aerial condenser on to terminal 6. When the tuner precedes an S.G. or V.M. stage terminal 6 on the second coil will also be left free, but in the case of a detector-L.F. circuit terminal 6 will be joined to the reaction condenser in the usual way. A two-gang condenser is shown for tuning both sections of the band-pass filter, but again there is no objection whatever to the use of separate condensers for the two circuits. A .01 mfd. coupling condenser is specified, and this gives just about the correct "band width" of 9 kilocycles. It is important that the condenser be of the non-inductive type; it may therefore be a mica dielectric one or one of the special non-inductive kinds which have been brought on to the market during the last couple of years or so. In order that any biassing arrangements shall not be upset by the band-pass filter, the coupling condenser is by-passed by means of a 2,000 ohms non-inductive resistance.

Either of the two coils which now form the complete band-pass circuit can be employed separately with every satisfaction in a simple receiver with which extreme selectivity is not wanted on the long-wave band. The connections are shown in Fig. 5, where a single-valve receiver is represented.

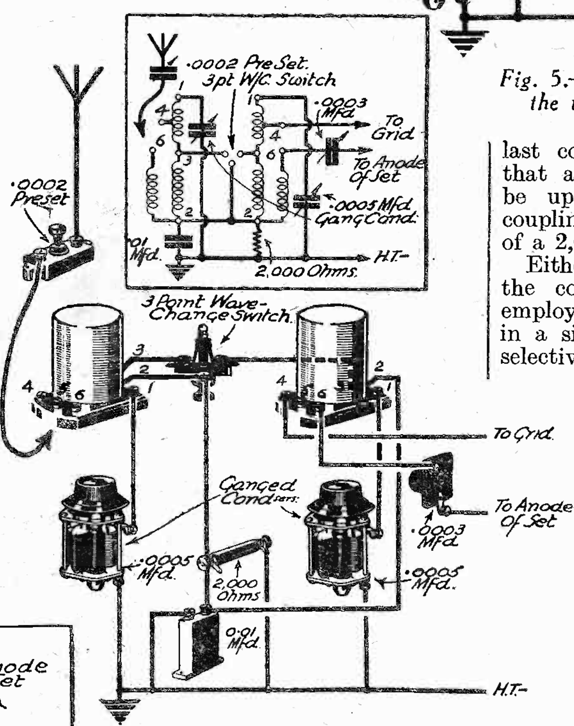

Fig. 4.—Pictorial and theoretical diagrams showing how a pair of home-made screened coils can be employed in an efficient band-pass filter circuit.

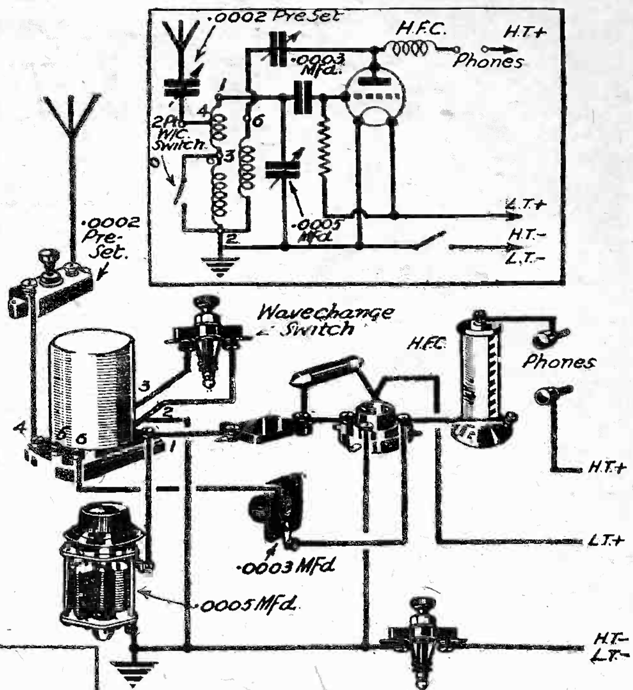

Fig. 5.—The connections for a single coil of the type described as shown above.

Preventing Medium-wave Break-through

With either of the coils described (as also with most commercial ones) there is always a possibility of medium-wave break-through being experienced when listening to long-wave signals. This condition can be corrected by making use of a special anti-break-through choke connected in series with the aerial lead-in, but that method is rather clumsy and it is much better to avoid break-through by designing a coil

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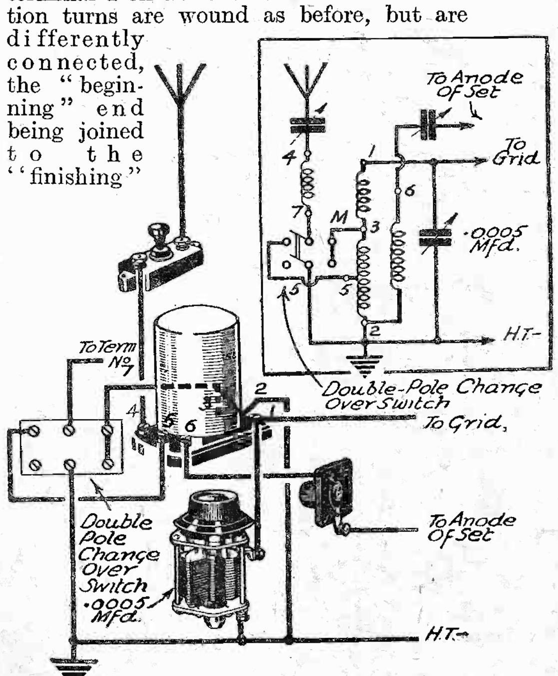


Fig. 6.—The circuit of a useful type of coil fitted with an anti-break-through winding.

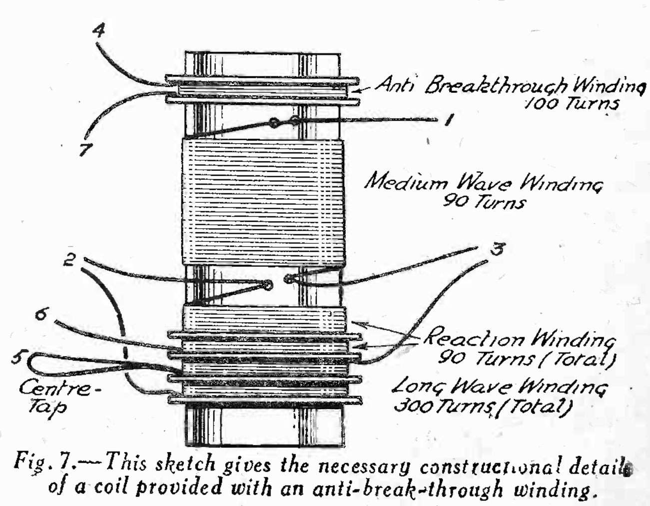
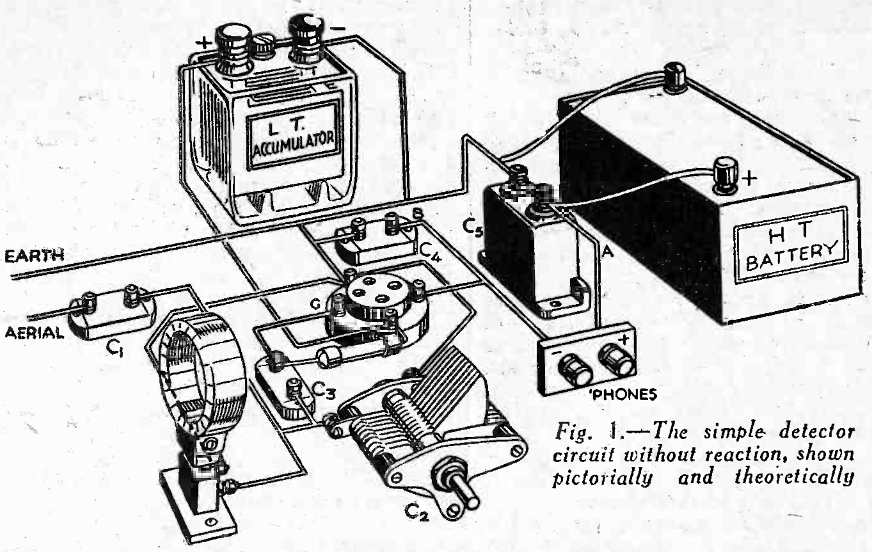


Fig. 7.—This sketch gives the necessary constructional details of a coil provided with an anti-break-through winding.

AT EARTH POTENTIAL

In This Article a Contributor Explains the Reasons for Earthing Various Parts of a Receiver



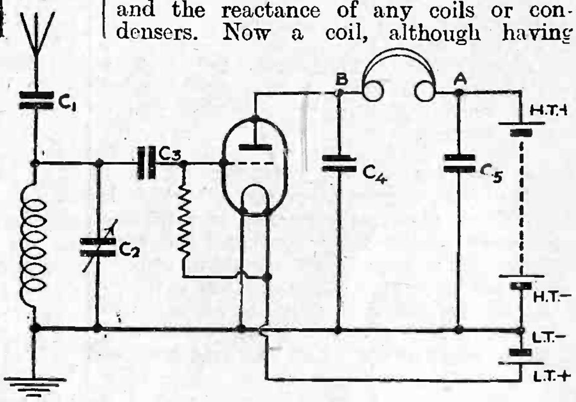
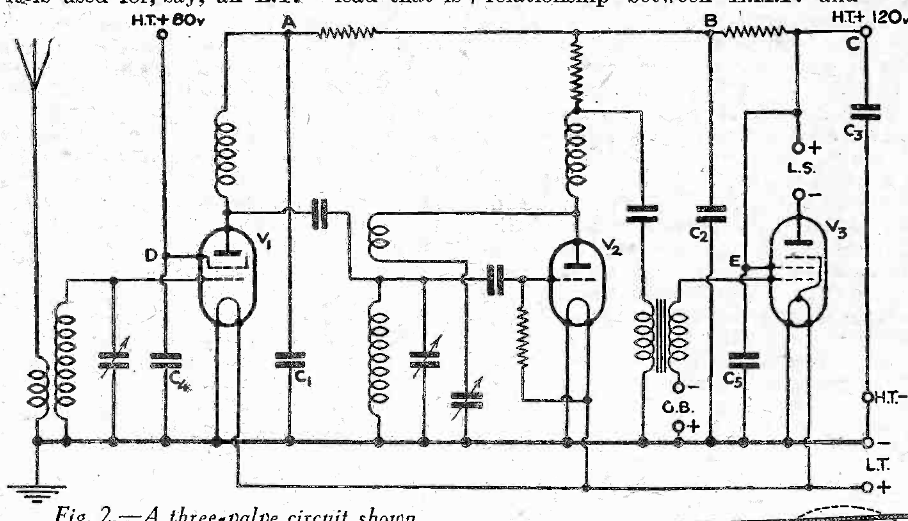


Fig. 1.—The simple detector circuit without reaction, shown pictorially and theoretically

THE phrase "at earth potential" or simply "earthed" is so very descriptive that the newest of newcomers to radio work can understand why it is used for, say, an L.T.— lead that is connected to a plate buried in the earth. It is not so obvious that the H.T.+ wire is also earthed, however; in fact, it appears to be a contradiction in terms to call a wire "earthed" when there is a battery representing a potential of 120 volts between it and earth. All the same, this wire is earthed *from the point of view of alternating currents* although at 120 volts above earth potential with respect to direct currents. To clarify this point let us consider the meaning of potential difference. The potential difference (P.D.) in volts between two points in a circuit is a measure of the electrical force which causes the current to flow round the circuit, and it can *only exist when a current is flowing*. How is it, then, that we can talk about the voltage of a battery whether it is delivering current or not? This is a different thing: the voltage of a battery measures the electro-motive-force (E.M.F.) which it is capable of exerting; when the battery is put into circuit its E.M.F. causes a current to flow which sets up a potential difference between any two points in the circuit. The relationship between E.M.F. and P.D. is that of cause and effect. The E.M.F. of a battery is constant, whatever the current drawn from it, but a P.D. depends on the strength of the current according to the familiar Ohm's Law equation:—

P.D. (volts) = current (amps.) × resistance (ohms).

This applies either to direct or alternating currents, except that in the latter case for resistance we read impedance, a quantity compounded of the resistance and the reactance of any coils or condensers. Now a coil, although having reactance to alternating currents, offers no opposition to direct current (if we neglect resistance for the purposes of argument), and therefore no D.C. potential can exist across it. Similarly, a condenser completely blocks a direct current, so again no D.C. potential can exist across it, although in both cases A.C. potential differences can be set up.



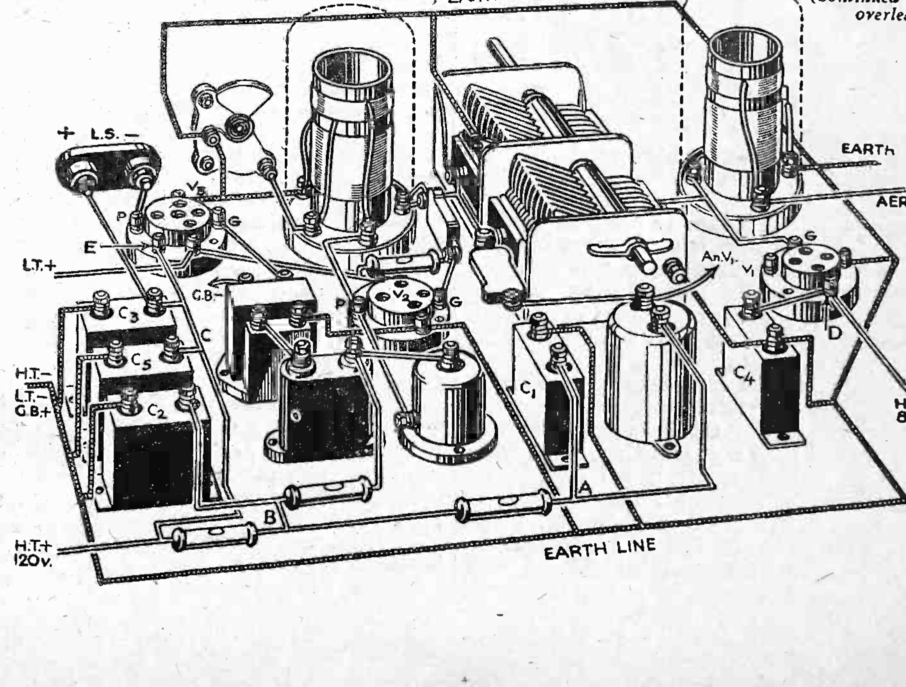


Fig. 2.—A three-valve circuit shown in theoretical and pictorial form

Simple Detector Circuit

Now let us consider the simple valve detector without reaction shown in Fig. 1. As is customary, the L.T.— wire goes to earth, and, therefore, everything connected to it is also earthed. Now what currents flow in the anode circuit? There are several; the direct current due to the H.T. battery; the low-frequency current, resulting from detection, which causes sounds to be heard in the phones; and a

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AN EARTH POTENTIAL

(*Continued from previous page*)

high (radio) frequency current left behind by the detecting action. Of these, the D.C. is a necessary evil; it must flow through the battery, and will also flow through the headphones. The L.F. current is required to flow through the headphones and nowhere else; if it flows through the battery it will set up an L.F. alternating P.D. across it owing to the battery's impedance, and in a complicated receiver this would cause instability. At the same time, the L.F. currents must flow to earth somehow, and so an alternative path to that through the battery must be provided by the condenser C_5 which, if its capacity is right, will have a negligible impedance to the L.F. currents compared with the battery, but, at the same time, will draw no current from it. The effect of C_5 on L.F. currents, therefore, is the same as if the point A had been connected straight to earth; A, in short, is at earth potential with regard to L.F. currents, in spite of the H.T. battery.

H.F. Currents

The H.F. currents, on the other hand, are not wanted in the phones, and so they must be removed by another fixed condenser, C_4, which offers them a low impedance path to earth. The point B is therefore earthed for H.F. currents, although at 120 volts D.C. potential above earth, and also above earth for L.F. currents because of the L.F. P.D. across the phones. How is it that a condenser which at the point A shunted away the low-frequency currents does not do the same at B, but discriminates between H.F. and L.F.? The answer lies in the relative capacities of the condensers. The reactance of a condenser depends on its capacity and the frequency of the current; for any given capacity the reactance increases as the frequency gets smaller. For example, a .001 mfd. condenser has a reactance of only 159 ohms at 1,000 kc/s per second, corresponding to a 300-metre transmission, but the same condenser has a reactance of 15,900 ohms for currents of 10 kc/s (10,000 cycles), the highest audible frequency required for good reproduction. Clearly, then, since the P.D. is proportional to the impedance (or reactance), if C_4 is a .001 mfd. condenser there will only be a small H.F. potential difference between the earth and the point B, which is therefore effectively at earth potential, whereas the L.F. P.D. will be high and B above earth for L.F. currents. If the capacity of C_5 is 2 mfd. its reactance at 10 kc/s is 79.5 ohms, which is much less than that of the battery, so A is earthed.

Bypass Condensers

We can now attempt to choose the bypass condensers in the more elaborate set shown in Fig. 2. To prevent H.F. currents getting into the H.T. we have to earth the points A and B, and similarly we must earth C to keep L.F. currents out of the H.T. and the circuits of the preceding valves. To remove the H.F. currents C_1 and C_2 could be fairly small, but the usual value of 1 to 2 mfds. is chosen to ensure that no L.F. gets into the H.F. stages. Obviously, C_3 will have to be at least 2 mfd. Now the screen grid of V_1 must be earthed for H.F., although at high D.C. potential, so C_4 must have a low H.F. reactance; 1 mfd. is the value usually employed, but .1 mfd. is ample on short waves. C_5, however, which earths the screen grid of the pentode, must be at least 2 mfd. because it is dealing with L.F.; C_1 and C_5 earth the points D and E.

FROM THE FLASH LAMP

SPEAKER "RATTLE" AND ITS ORIGIN

MOST of those interested in radio reception have been worried at one time or another by "*rattle*" in the speaker. Rattle was at one time regarded as a trouble to which the moving-coil speaker was particularly prone. It was very natural that almost everybody jumped to the conclusion that the "rattle" had a mechanical origin; the writer himself, back in 1928, was for a long time deceived, and searched vainly for the cause of "rattle" as being the consequence of some obscure mechanical defect, such as incorrect centring or excessive movement. Since that date the same mistake has been made by others, times out of number. Without saying that there are not forms of "rattle" that have a mechanical origin, *the* rattle now under discussion is purely electrical and due to distortion.

In dealing with the question of distortion, it is common to refer to a certain percentage, say 5 per cent. of the octave harmonic, or some other definite percentage of some other harmonic. If these harmonic contaminations were the only cause of trouble not one man in a hundred would notice it at all, because every musical note contains, as part of its structure, numerous harmonics, and the proportions in which these harmonics are present varies considerably. It is the harmonics which determine the distinctive quality of each orchestral instrument, or the tone of the human voice; for example, a characteristic of the "string quality" of the violin or 'cello is due to a preponderance of the odd-numbered harmonics over the even-numbered harmonics, and consequently a bad octave contamination will mar the beauty and perfection of the tone of these instruments. But this will only be noticed by trained musicians or others having an exceptionally keen ear. The ordinary listener is not disturbed by distortion of this character; the slight change of quality in a violin tone, suggestive of an oboe, is scarcely noticed even by a musician, actually one violin may differ appreciably from another in this respect. If there is so much octave contamination as to give a brassy character to the strings, the everyday listener may notice it, but in a mass of orchestration even that will pass unobserved.

The question then arises, what is the source of the "rattle," and what is the type of distortion to which it is due?

So long as the output from a power valve is of a single frequency, whether it be high or low, the distortion due to the curvature of the valve characteristic does, in fact, only consist of the addition of harmonics, that is to say, frequencies *related to the fundamental*, but which are alien to the broadcast. Let us, however, consider what happens when a tone of high frequency is accompanied by or superimposed on one of low frequency; then, referring to Fig. 1, for a given grid swing the superposition shows that the amplitude of the higher frequency (anode) wave varies according to whether the lower-frequency wave is in a trough or at a crest. When the low-frequency wave is at a trough as at *a*, the high-frequency anode swing is of less amplitude than when the low frequency wave is at a crest, as at *b*, owing to the curvature of the valve characteristic (this is shown clearly in the figure). When this happens we can see at once that the higher-frequency wave is being *modulated* by the lower frequency, and this modulation means that a high-frequency pure tone is accompanied by super-added side-bands. Suppose, for example, that the high-frequency tone has a periodicity of 3,200, and the low tone has a frequency of 100, then the side-bands will have frequencies of 3,100 and 3,300, which, accompanying the pure tone of 3,200, will result in a discord and beats of 100 frequency. If the conditions could be represented by just two tones, as above suggested, the result might not be serious, but in view of the fact that a full orchestra includes some seventy or more instrumentalists, and each instrument emits a whole range of harmonics, it may be readily appreciated that a low tone of considerable amplitude will give rise to such a mass of discordant side-band frequencies as to constitute the "rattle," which has been, and often is, a source of annoyance and complaint. Added to this is the fact that often there are several deep notes being sounded simultaneously, whose fundamental tones each give rise to a whole range of side-band frequencies.

The theory of "rattle" and noisy distortion given above accounts for the fact that "rattle" is nearly always worse with a power valve of low output capacity, and has little or nothing to do with the speaker. The only reason that it is more noticeable with a moving-coil speaker than one of the old balanced armature or inductor type is that the moving-coil speaker has a fuller frequency range. The writer has demonstrated over and over again that the "rattle" (on an ordinary single triode power valve) takes place when the flick of the milliammeter needle shows overload. Change the set to one having a push-pull output circuit, or a more powerful valve, and it is found that in abolishing the condition of overload the "rattle" is eliminated. Without a definite demonstration of this character it is difficult to convince those who suffer from "rattle" that it is not mechanical, and that it has nothing whatever to do with the speaker, except as evidence that the speaker has very full response curve extending over a very complete range of acoustical frequencies.

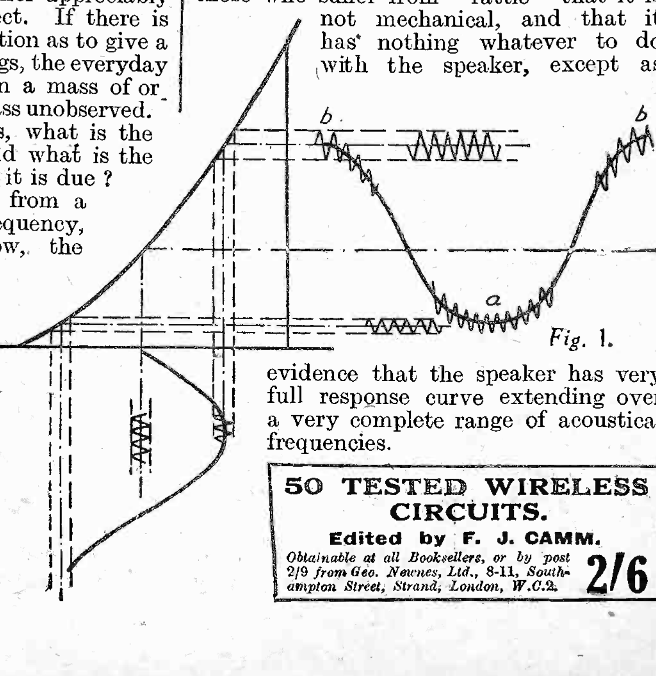

Fig. 1.

A.C. RECTIFIERS & RECTIFICATION

In This Interesting Article the Author Explains the Principle of Rectification of Alternating Currents, and Gives Much Practical Information in Regard to the Choice and Use of the Various Types of Rectifiers.

By BERNARD DUNN

IN order to use the alternating current (A.C.) mains as a source of high-tension supply for charging accumulators, or for energizing the magnets of certain types of moving-coil loud-speakers, it must first be changed into direct current or D.C. That fact is perhaps very well known, but the principle of rectification and the methods employed are by no means so familiar, although they are quite interesting and well worthy of consideration.

The first question that the beginner asks is "Why is rectification necessary?" The answer is simply this. With alternating current the voltage is constantly varying between zero and maximum, whilst the polarity of the two leads changes rapidly from positive to zero and from zero to negative. A graphical representation of the output voltage from an A.C. supply is given in Fig. 1, where it can be seen that the output is represented by a uniformly wavy line. If the supply is at 50 cycles (the most usual frequency) fifty "ripples" or "waves" will occur every second. Obviously, if such a supply were connected to the high-tension terminals of a wireless set nothing would be heard from the speaker except a (rather unmusical) note. This would be produced due to the fact that the set would operate when the polarity of the supply were correct, and gradually cease to function as the polarity became reversed.

It can thus be seen that, for the supply to be of any use it must be of constant intensity and uniform polarity. To obtain such a supply from A.C. makes it necessary to employ some form of rectification, which in turn means using a rectifier, the object of which is to allow current to pass through it in one direction and not in the other. The rectifier may be of the half-wave or full-wave type, when it will produce the effect represented in Fig. 2 or Fig. 3 respectively. A half-wave rectifier simply "cuts off" one half of the wave, leaving the other; thus in one lead the potential is constantly positive or negative (according to the way the rectifier is connected) whilst the other takes the opposite polarity. In the case of full-wave rectification, however, both halves of the wave are made use of, one half becoming positive and the other negative.

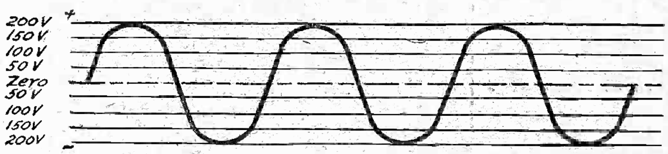

Fig. 1.—A graphical representation of the output from an A.C. supply; the voltage and polarity are constantly changing.

Fig. 2.—This graph shows the result of half-wave rectification; one half of each wave is eliminated.

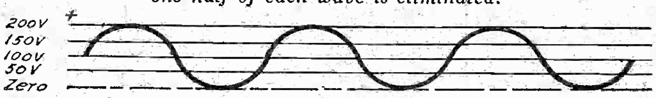

Fig. 3.—This shows the result of full-wave rectification. Both halves of the wave are made use of to produce a voltage of uniform polarity.

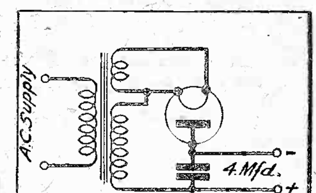
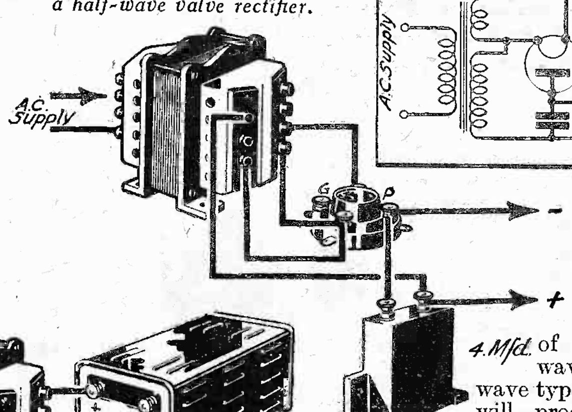

Fig. 5.—Theoretical and pictorial diagrams showing the connections for a half-wave valve rectifier.

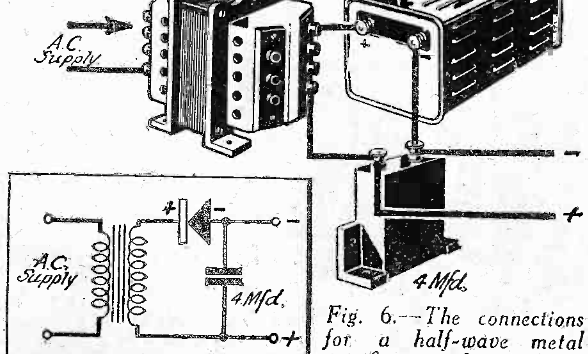

Fig. 6.—The connections for a half-wave metal rectifier are shown above.

Types of Rectifier

Rather than pursue the theoretical considerations farther it will be more interesting to get down to the practical points of rectification. You know, of course, that the process of rectification can be carried out by means of a rectifier valve, a copper-oxide (or metal) rectifier, a vibratory reed, a glow-discharge rectifier or a chemical rectifier of the nodon valve type. Perhaps, also, you have often wondered what are the relative advantages of the various systems. I do not wish to bring personal opinion to bear too much on the subject, and will, therefore, discuss briefly the pros and cons of the individual methods.

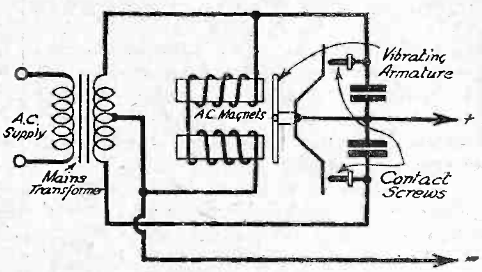

Fig. 4.—This diagram shows the chief features of a vibratory type of rectifier.

As valve and metal rectifiers are now employed almost universally for wireless purposes, we will leave them until last and make passing references to the other systems which have been fairly popular at different times, but for various reasons have fallen into comparative disuse. The vibratory-reed rectifier is fairly economical in use, and its function depends upon the correct "timing" of a vibratory contact-maker to the frequency of the supply. Once the period of vibration has been accurately adjusted the rectifier operates quite well, but the difficulty of arriving at such a state need not be dwelt upon to be well imagined. This type of rectifier is comparatively expensive in regard to prime cost, though fairly efficient in operation. It is, however, inclined to be noisy, due to the vibrating reed, whilst it is rather bulky. Fig. 4 shows the general arrangement of the vibratory rectifier, and the method of working will easily be followed by making reference to it.

The glow-discharge rectifier has never attained any measure of popularity in this country, but it has been fairly widely used in America. This rectifier is similar in appearance to a valve, but instead of having a filament the cathode is unheated, the current flowing between the electrodes by reason of the ionization of the gas in the bulb. It is an obvious advantage to have a rectifier which does not require any filament supply, but this type of component is only suitable for outputs up to

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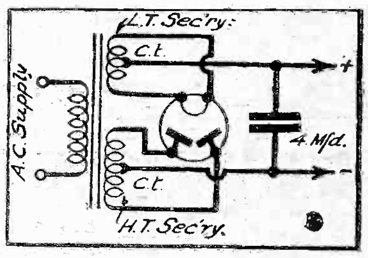

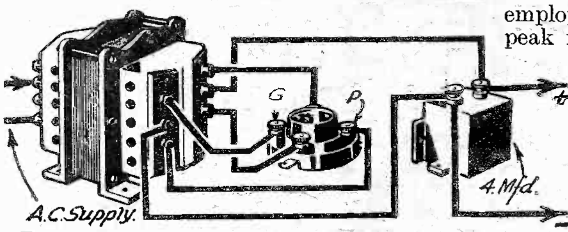

Fig. 7.—The circuit of a full-wave valve rectifier. A centre-tapped secondary is required on the transformer, and this must give the necessary rectifier voltage on each half of the centre-tapping.

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about 50 milliamps, and it is rather limited in regard to its working voltage.

Chemical rectifiers, or nodon valves, are cheap to make, and consist of a glass jar containing a solution of ammonium phosphate, in which an aluminium anode and a lead or iron cathode are placed. The nodon valve has a rather high resistance besides being "messy" to handle, and it is because of these two objections that it is scarcely ever used for any other purpose than occasionally charging small accumulators, or doing other "intermittent" work.

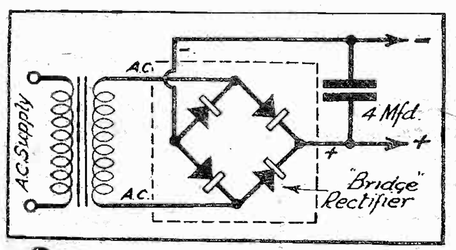
Now we come to the valve and metal rectifiers, and, since these are (justly) most popular and widely used, it will be well to consider them more fully than we have done the other types. The valve rectifier has a lower resistance than has the metal one, and is, therefore, somewhat more suitable for use in a powerful set, where the volume control is of such a type that its use results in a variation of the H.T. current. On the other hand, the metal rectifier is rather cheaper in running costs, since it does not require any filament supply and is very nearly everlasting. There is another point in favour of the valve rectifier (of the type having an indirectly-heated cathode), which is that it does not give its full output until the cathode attains its normal working temperature. And as this heats up at the same rate as do the cathodes of the receiving valves, it means that at no time is there a high-peak voltage which might have tendency to damage fixed condensers and other components. On this score the valve rectifier can be considered better for use in a powerful mains receiver where a comparatively high anode voltage is employed. Apart from the points just raised there is little to choose between the valve and metal rectifiers, and it is very largely a matter of individual taste as to which should be used. For that reason we can consider the two components jointly, especially since the circuit requirements of both are very similar.

Half- or Full-wave ?

Whether a valve or metal rectifier is to be used the first question to be settled is that of "half- or full-wave ?" Full-wave is more efficient and thus rather more economical, but the actual difference in this respect is too slight to be considered very seriously. What is more important is the fact that with full-wave the "hum frequency" (assuming that it is impossible to remove all traces of mains hum) is twice that of the supply, whilst with half-wave the hum frequency is exactly the same as that of the supply. Thus, if the speaker employed were so designed that it gave a peak response at round about 100 cycles, it would be unwise to employ full-wave rectification if the supply frequency were the usual one of 50 cycles. On the other hand, if the frequency happened to be 25 cycles, full-wave rectification might prove more satisfactory. In any case, it is scarcely possible to give a definite ruling on this question, but the experimenter will always find it interesting to observe the effect of changing over from half-wave to full-wave.

Half-wave Rectification

The connections for a half-wave valve rectifier are shown in Fig. 5, whilst those for a metal rectifier are given at Fig. 6. It will be seen that they are practically the same in both cases, a mains transformer being used to supply the requisite voltage to the rectifier. The chief difference is that the valve requires a second transformer winding to supply its filament or heater. It will be seen that, in both cases, a fixed condenser is shown as being connected in parallel with the output leads; this is important, and its capacity should not be less than 4 mfds. If the condenser were omitted, or if too low a capacity were employed, the output voltage would be less than the nominal figure quoted by the makers of the rectifier in use. Incidentally, it is sometimes possible to increase the maximum voltage slightly by using a condenser of higher capacity, or by wiring a second one in parallel with that originally fitted. Another point that should be observed is the inclusion of a fuse between the rectifier and the output leads. This acts as a safeguard in case of a short-circuit and is a real protection for the rectifier. Its current rating should be approximately twice the normal consumption of the receiver to suitably allow for the "surge" when first switching on.



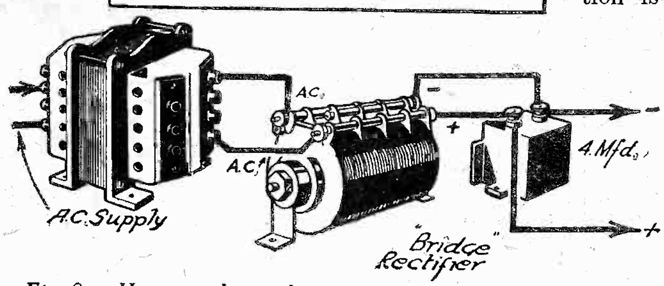


Fig. 8.—Here are shown the connections to a full-wave metal rectifier of the type using four cells to form a "bridge."

Full Wave

The method of connecting a full-wave valve rectifier is shown in Fig. 7, where it will be seen that the H.T. secondary winding requires to be a "double" one, giving the full rectifier voltage on each side of the centre tapping. On the other hand, some types of full-wave metal rectifiers require only a "single" secondary, as shown in Fig. 8. The rectifier illustrated in Fig. 8 is really a multiple one consisting of four cells connected together on the "bridge" principle, and it is not widely employed.

A far more usual system of full-wave rectification by means of a metal rectifier is that shown in Fig. 9, where the rectifier is connected on the "voltage doubler" principle. The working of this system depends upon the use of two large-capacity (generally 4 mfd.) fixed condensers wired in series across the positive and negative leads; one lead from the transformer is joined to the centre of the two condensers, and the other is connected to a centre-tapping on the rectifier. Theoretically, the voltage output from such an arrangement should be twice that of the input from the transformer secondary. In practice, however, such a state of perfection is not attained, the ratio between the output and input voltages being about 3 : 2. In choosing a mains transformer for use in a voltage-doubler circuit there is a rather important point which must be remembered; its secondary winding should be capable of delivering three times as much current as is required from the rectifier.

In all the circuits given so far it will have been noticed that a transformer has been included between the mains supply and the rectifier. This is generally essential for the purpose of obtaining the correct rectifier input voltage, but it sometimes happens

(*Continued on page 699*)

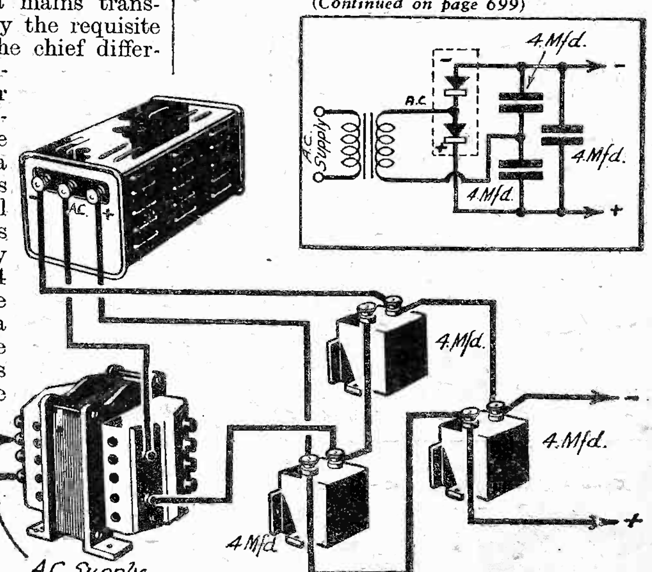


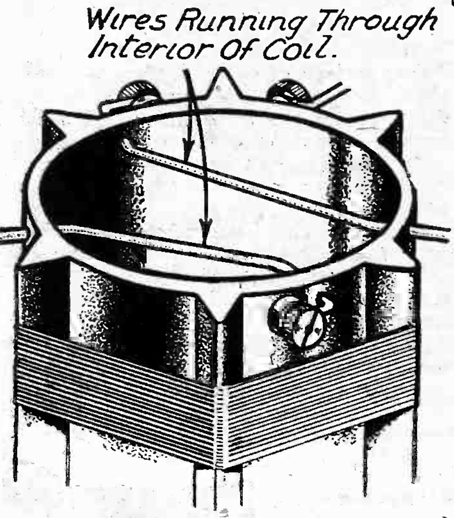
Fig. 9.—The above sketch shows the connections to a full-wave metal rectifier wired on the "voltage-doubler" principle.

READERS' WRINKLES

THE HALF-GUINEA PAGE

Shortening Leads to Tuning Coils

UPON many occasions I have wished to shorten leads to my tuning coils, and eliminate those deviating routes necessitated by the positioning of the coil terminations. Finally, I decided to drill the



Method of shortening leads to a tuning coil.

coil former in several places at the upper and lower edges; this procedure enabled me to pass any connections to the more remote coil terminals through the interior of the coil, and considerably shorten the long leads. There is absolutely no tendency whatever to produce any induction in the coil, and yet I achieved the desired results. The sketch will give the reader an idea of the advantage to be gained and the positioning of the required drillings.—WM. A. HARRISON (Aintree).

A Coil Winder With Geared Drive

THE coil winding machine shown in the sketch can be easily and cheaply made from the following materials:—

A geared drive; about 1½in. of ⅜in. T-angle iron; two pieces of ⅛in. brass 3¼in. by 2in.; a 6in. length of 3-16in. steel rod; a small collar to slip on the rod with a grub screw for locking; and two pieces of wood, one for the base 10in. by 5in. by ¾in. thick, the other piece 2in. by 2in. by

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.

1in., for holding in position the two ⅛in. metal bearers to the base.

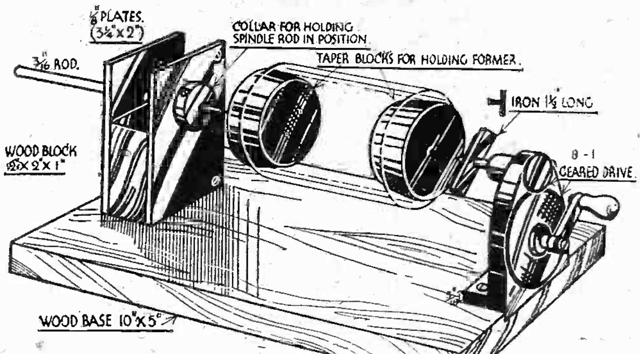
The geared drive is part of a high-speed emery wheel (ratio about 8-1), and it can be bought separately for 6d.

Having obtained the drive, take off the washer and screw out the thumb screw in the base as this is not wanted. Take the baseboard, and recess the fixing lug of the drive to a depth of 3-16in., and fix it in place with a ⅜in. wood screw. With a file, sharpen the end of the threaded spindle to a point, taking care to leave enough thread to screw on the piece of T-angle iron, which is drilled and tapped in the centre with a corresponding thread.

The bearers for the centralizing spindle rod are drilled and fixed with wood screws on either side of the wood block, after which the two 3-16in. clearance holes can be drilled in correct alignment with the driver spindle. The 3-16in. steel rod should be pointed the same as the driver spindle, put through the two bearer holes and the collar slipped on.

If a hollow former is to be wound, two small wood blocks will have to be cut to fit tightly into each end, one having a slot and the other a centre hole.

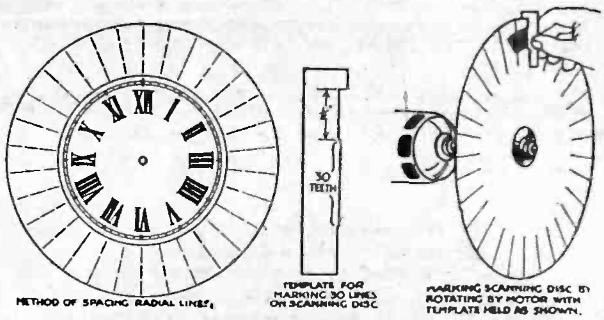
The sketch gives a good general idea of the construction.—E. SYRED (Brixton).



A simple geared coil winder.

Marking out a Scanning Disc

HERE is a method I have used for making a scanning disc with great accuracy. The radial lines were obtained by placing over my disc a clock dial, and marking off, with dots, two minute intervals. These dots were connected by a line drawn through the centre. The spacing was obtained by making a template, as shown, with teeth like a saw, and holding it against the disc while revolving on its own shaft. The holes were made with a large darning needle ground square and fitted into a wooden handle.—C. MORTON (Leicester).



A dodge for marking out a scanning disc.

A Useful Wave-change Scheme

MOST wave-changing is done nowadays by means of switches, but it is possible to adapt most circuits by means of plugs alone. This was brought to my notice when I had most of the components for a set, and had omitted to purchase any switches.

The first attempt was with the simple circuit of the Reinartz type (Fig. 1). The circuit has a common aerial reaction winding. It has a 6 to 10 turn coil closely coupled to a grid coil of 50 turns. The long waves require a coil of 250 turns, and a 60 reaction.

The complete short-wave coils connected in series complete the 60 turns required for the reaction coil, and the scheme works out as shown. 1 is short-wave aerial coil; 2 the short-wave grid coil; 3 the long-wave grid coil. Two sockets and plugs will be sufficient. When both plugs are in place No. 3 coil is shorted, and the circuit is right for the short waves, because No. 3 is the 250 coil. When plug A is in C, and D is left out, the set is right for long waves. 1 and 2 act as long-wave

(Continued on page 692)

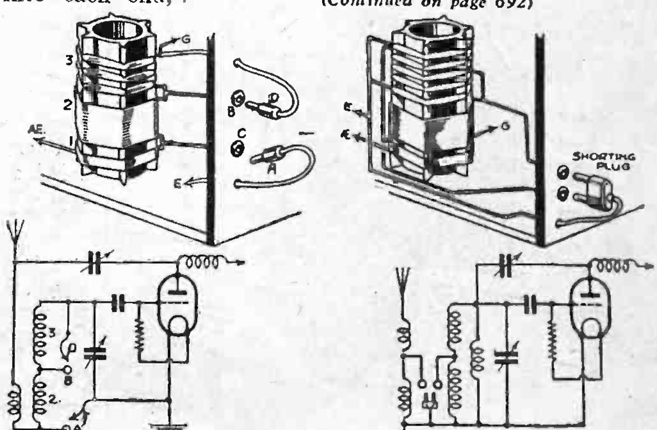


Fig. 1. *Fig. 2.*

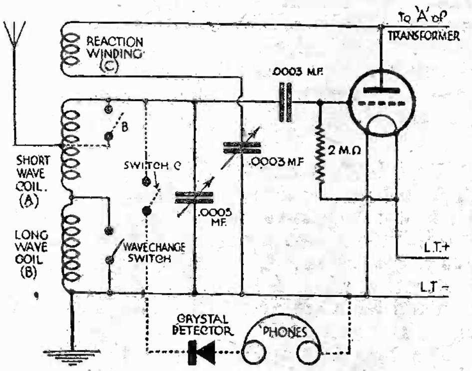
A wave-change scheme using plugs and sockets.

READERS' WRINKLES

(Continued from previous page)

aerial coil, and 3 is long-wave grid coil. On the short waves No. 1 is the aerial coil and No. 2 is the grid coil.

Fig. 2 illustrates the substitution of a 2-pin plug for a three-way switch when a dual-range coil is used. In such a case the plug is simply left out for the long waves, and placed in position for the short waves. Using a plug, the connection is positive, and should the leads get damaged they are easily repaired, whereas a switch will often give trouble.—W. H. GRAYLING (Cambridge).



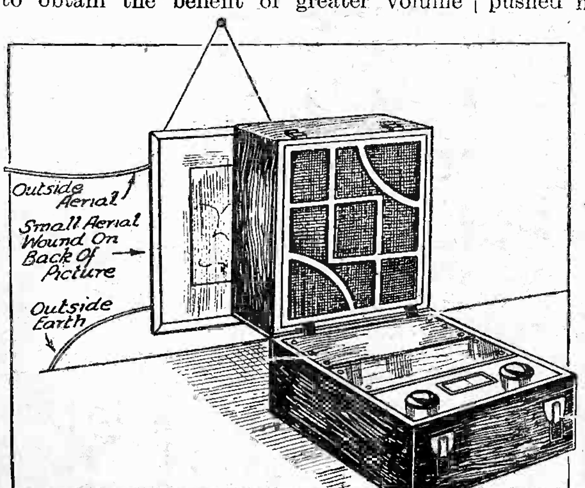
A switching arrangement for switching over to valve or crystal.

Valve or Crystal

THE arrangement shown in the accompanying diagram enables the crystal to be used instead of the valve, with a saving in battery costs. By mounting the crystal detector and switches on the panel of the valve set it is possible to change over quickly when other members of the household do not wish to hear a particular item. It will be seen that the short (medium) wave coil is tapped for the aerial connection to provide selectivity, and the lower portion of this serves as the crystal set tuning coil. When the receiver is on for medium waves, and the crystal is required to be brought into operation, the switch B is closed, and this short-circuits part of the grid tuning coil, but leaves the lower portion available for the crystal set. It can be seen from this that any set may easily be converted so long as the aerial coil is tapped for selectivity. The extra connections are shown by the dotted lines. —P. RUDD (Pinner).

Using a Portable with an Outside Aerial

THE following idea may be of some use to those who own a suitcase set and wish to obtain the benefit of greater volume afforded by an outside aerial. Some sets are provided with terminals or sockets for aerial and earth, but mine has no such provision. I therefore made a small frame by winding a dozen turns of wire around the back of a picture frame, the picture being then hung so that it was directly behind the place occupied by the radio set; the two ends of the small frame were connected to the outside aerial and earth respectively. When the set was placed in front of the picture the two aerials were coupled inductively and the signal energy transferred to the frame aerial of set.—C. E. ROSSITER (Taunton).



Using a portable set with an outside aerial.

A Simple Aerial-Earthing Switch

HERE is a simple but effective aerial-earthing device which entirely isolates the receiver when placed in the "earth" position. A piece of $\frac{3}{16}$in. ebonite about 3in. by 2½in. is drilled to take four large telephone type terminals, which are arranged as shown in Fig. 1. In each of the left-hand pair of terminals an additional hole is drilled at right angles to the existing one, as indicated in Fig. 2. Two pieces of ⅛in. brass rod, 2½in. long, are fitted with a small ebonite knob on the end of each. Two holes are drilled near one edge of the ebonite for taking screws for fixing the switch to the edge of the window frame. The leads from the aerial, earth, and receiver can be clamped under the back nuts of their respective terminals. When the receiver is to be used, the brass switch rods are both pushed horizontally through the terminals as in Fig. 1, and the terminal screws tightened up. For earthing the aerial, the bottom switch rod is simply pulled out to the right, clear of the left-hand terminal, and the top rod withdrawn, and passed vertically through both left-hand terminals, as in Fig. 3, thus completely isolating the receiver.—W. DAVEY (Wembley).

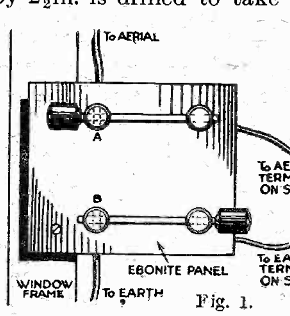


Fig. 1.

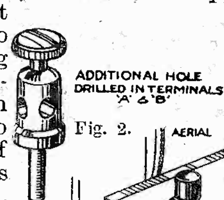


Fig. 2.

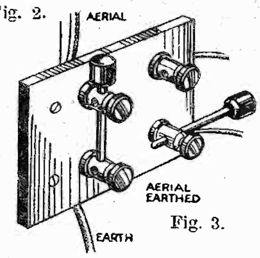
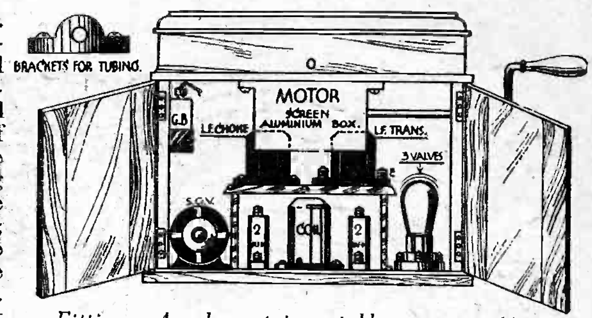


Fig. 3.

A simple aerial-earth switching arrangement.

SEND FOR YOUR TOOL KIT WITHOUT DELAY!



Fitting a 4-valve set in a table gramo. cabinet.

A 4-valve Set in a Table Gramo. Cabinet

THE accompanying illustration shows how I built a 4-valve set in a table gramophone cabinet. In the sketch the panel is removed to show how the valves and other components are arranged. The S.G.V. is on the left, and three L.F. valves on right. Owing to lack of space, I made a table of aluminium, with legs also of aluminium, which earths the transformer and chokes, mounted thereon, to the aluminium base which arrangement gave me ample room for the other components on the base without overcrowding. The motor is screened in an aluminium box, which serves a twofold purpose of screening the motor and catching the oil therefrom. When I tried the set out it began to howl (low frequency). I went over it all very carefully and finally cured the trouble in the following manner. All the wires on the cored circuit are run through glass tubing of about ⅛in. bore, which was bent to the shapes required by heating in the fire. The tubing is supported in small ebonite brackets. —W. WILSON (Greasbrough).

Slow-motion Disc Drive

THE accompanying sketches show a simple method of converting a tuning condenser to a slow-motion drive. The condenser is mounted on two brackets, the condenser dial being reversed and attached to a tin lid on the inside, as shown in Fig. 1. A cardboard disc, with the necessary gradations marked on, is glued to the tin, and a suitable aperture cut in the panel, as in Fig. 2. The spindle of the slow-motion knob, the end of which is supported in a brass angle-bracket, is provided with a piece of rubber sleeving, as shown in Fig. 3, which forms an efficient friction drive with the flange of the tin lid.—A. J. SMITH (Kenton).

NEW ELTHAM AND DISTRICT WIRELESS ASSOCIATION

An interesting lecture will be delivered to the above association on the 14th inst. by Mr. C. A. Quarrington, of the Technical Service Dept., Messrs. A. C. Cossor, Ltd. The main topic of interest and demonstration is an elaborate cathode ray display, and valves will also be dealt with.

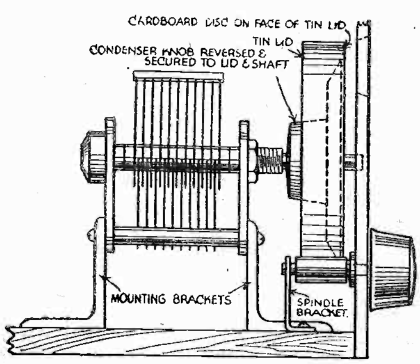


Fig. 1.

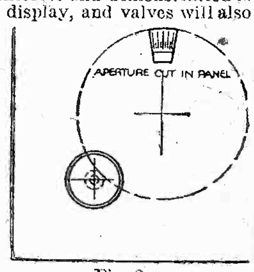


Fig. 2.

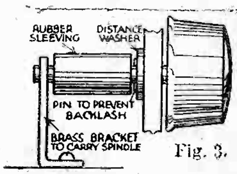
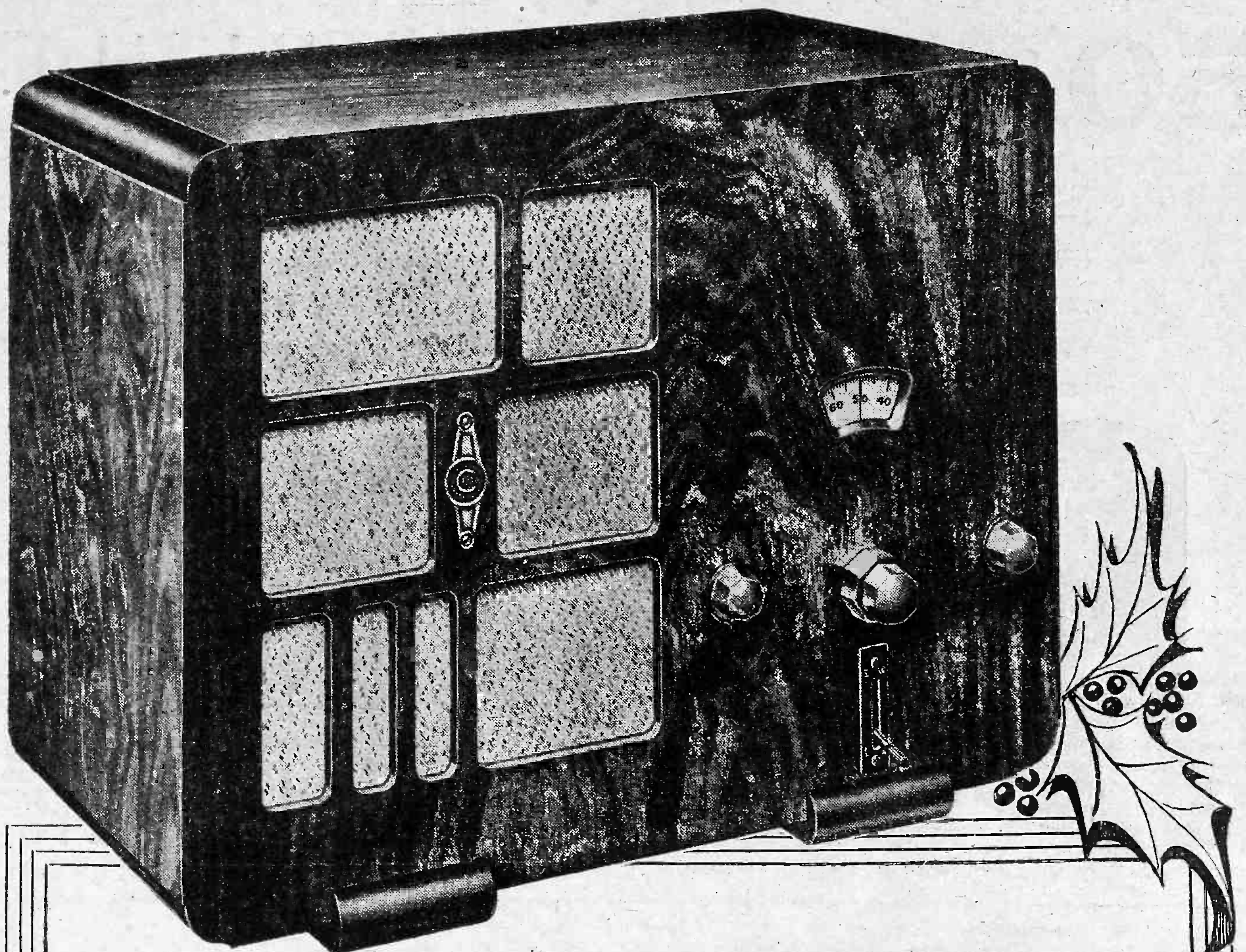


Fig. 3.

A neat slow-motion disc-drive arrangement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Converting Your Set to All-Mains

With Particular Reference to the Types of Valves to be Used

By C. H. KEELING

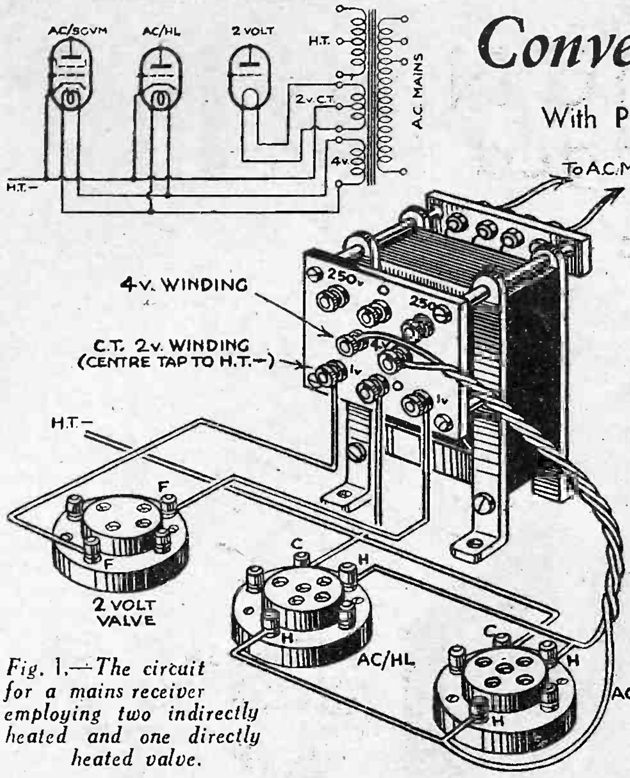

Fig. 1.—The circuit for a mains receiver employing two indirectly heated and one directly heated valve.

WHERE an H.T. eliminator is used in conjunction with a receiver of the battery type, one is often asked: "Can I, with slight modification, change my set for use with all-mains valves?" Providing that the eliminator has a sufficiency of milliampere output, the change can be effected with little outlay and the minimum of trouble.

Assuming the mains are A.C., and that the set is home constructed with its parts fairly accessible, we can proceed to get together the necessary components.

We probably have to deal with a popular three-valver, comprising one stage of H.F., detector, and L.F. amplifier. It will be essential carefully to select A.C. equivalents, bearing in mind that the amplification with mains valves is considerably more than that obtainable with the battery types.

As we already have the unit for the H.T., we have only to procure a transformer for supplying the "raw" A.C. at 4 volts to the heaters of the valves. Of course, 5-pin valve-holders will have to be substituted, but this may not be necessary in the output stage if we intend to use our existing output valve with "raw" A.C. on its filament. If the latter is a 4-volt valve the matter is simplified; if either 2-volt or 6-volt a special transformer will be required, and details for winding one will be given in a later article.

The diagram, Fig. 1, shows the wiring to the 5-pin valve-holders, and assumes that the old type 2-volt valve is going to be used in the output stage.

Fig. 2 indicates the connections when using a battery type 4-volt valve as L.F. amplifier; in this instance an ordinary commercial type transformer can be utilized, such as the Heayberd No. 723, price 12s. 6d.

One has to bear in mind the fact that when using an eliminator H.T. volts are very precious, the usual unit only supplies something like 120/50 volts. This has a bearing on the type of bias we should employ. If we attempt to apply automatic bias we shall lose our valuable volts; for example, if an A.C. valve requires 10 volts for cathode bias, our H.T. will be reduced accordingly. It is therefore recommended that when making the suggested conversion, battery bias should be retained. In this case the cathodes will be joined together and connected to earth or H.T. negative.

If our conversion calls for a vari-mu S.G. valve in the H.F. and the eliminator can supply only 20 milliamps, we may use an A.C./S.G.V.M. in the first position, an A.C.2/HL as detector, and a PM4 as output valve.

The centre tap on the mains transformer should be taken to earth, or a suitable variable resistance can be connected across the winding with the earth connection brought to the slider of the resistance.

As a result of the extra punch the set will now give us, it may be necessary to introduce more effective screening into the H.F. section between the S.G. valve and the detector stage; if our coils are already screened this will probably not be required.

Although straight wiring is shown in our diagrams for the sake of simplicity, it is best if the heater wires are twisted together in order to minimize hum.

The various types of transformers required to meet the different types of output valves will be dealt with in another article, when constructional details will be given.

If the eliminator is one of those rarities which supply milliamps in abundance, an indirectly heated A.C. mains type output valve may be used; it then becomes essential to use a mains heater transformer giving sufficient L.T. amps. The wiring diagram is shown in Fig. 3.

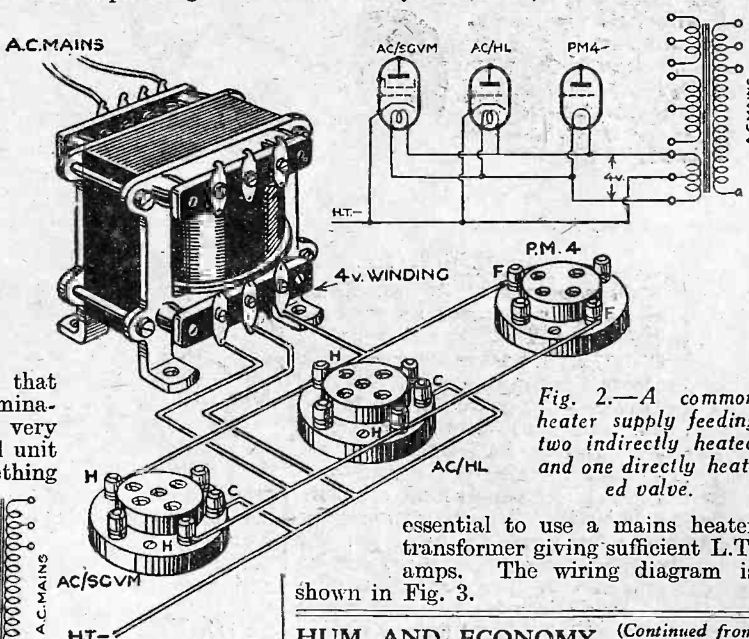

Fig. 2.—A common heater supply feeding two indirectly heated and one directly heated valve.

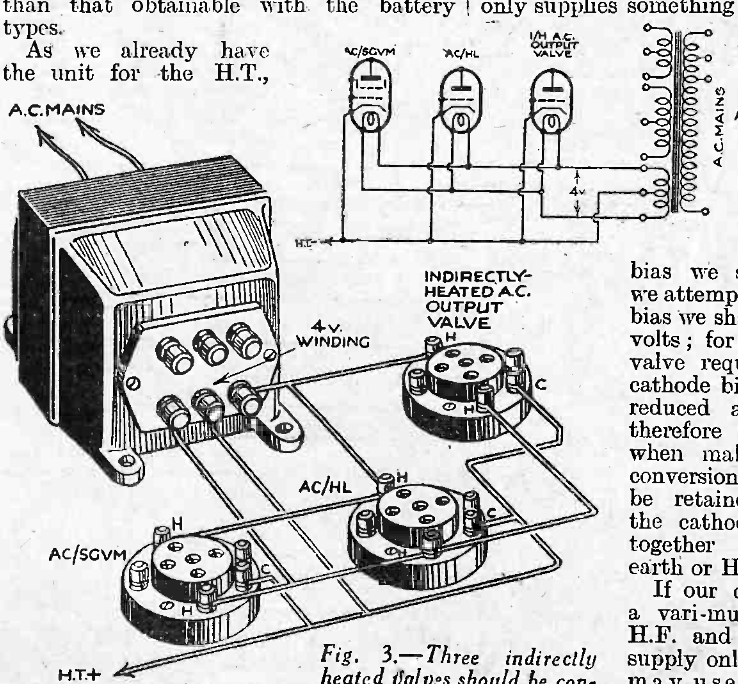

Fig. 3.—Three indirectly heated valves should be connected as shown in this illustration.

HUM AND ECONOMY

(Continued from page 682)

speaker field as a smoothing choke. This can be employed in place of the choke in the positive lead, and although an inductance of the order of 60 henries is generally obtained, there is a corresponding large voltage drop, resulting in approximately 100 volts or so being lost in this part of the circuit, although the wattage must be obtained from some source to energize the speaker. It is not wasted, therefore. Alternatively, the speaker field may be used as a biasing resistance for the L.F. valves, although with this method particularly, there is possibility of hum due to interaction. It is in every case advisable to use a speaker which has what is known as a "hum-bucking" coil fitted, to ensure that the ripple is not picked up by the speech coil and thus added to the music or speech. As a final warning in the matter of economy, do not attempt to use two cheap, medium-inductance chokes, inserted in both positive and negative leads from the rectifier.

Building a Class "B" Power Unit

A Practical Article Describing the Construction and Operation of a High-class Combined H.T. Eliminator and Accumulator Charger

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

WITHIN the last few months the Class "B" method of low-frequency amplification has been introduced to give battery users an economical method of achieving the equivalent of a mains-driven set volume. It has already been pointed out to readers that with a Class "B" output stage the current drawn from the H.T. supply varies, within very wide limits, according to the type of signal being received. The peak values of the anode current may be as much as ten times the "standing" current, and in consequence such a radio receiver, if fed from an ordinary H.T. eliminator, could not be expected to be stable.

It is necessary therefore to adopt a special design for an eliminator unit of this character, and the criterion is one which has what is called technically a "close regulation." This is the same as saying that even if the current demanded varies between wide limits, the voltage variation confines itself to narrow limits—something of the order of 10 volts or so between the usual maximum and minimum values of the Class "B" output valve anode current. There is more than one way of carrying this to a successful conclusion, and in the unit I am about to describe a metal rectifier is used of the half-wave type with very generous smoothing arrangements.

To make the power supply more complete in itself it is obvious that the accumulator which normally must be employed for delivering the total valve filament current merits consideration. If on the high-tension side we are replacing dry batteries which inevitably must run down at some time, and so reduce the power and possibly cause distortion, why not maintain the accumulator in a fully-charged and first-class condition at the same time. The dual scheme has been incorporated in the unit which is seen in the accompanying illustrations.

Theoretical Considerations

A reference to Fig. 1, will enable the reader to see just how this is done. First of all we have a mains transformer T_1 having an output of 150 volts feeding into a H.T. 13 metal rectifier H.R. Two H.T. tappings are provided with a separate smoothing choke (LF_1 and LF_2) and a separate smoothing condenser (C_2 and C_3) in each lead. One of these must feed the Class "B" output valve alone, while the remaining one serves all the other anode supplies in the radio receiver with which it is used in conjunction. This is an important point, and since no decoupling arrangement is included in the eliminator every user of this unit must make sure that the decoupling is taken care of in the set.

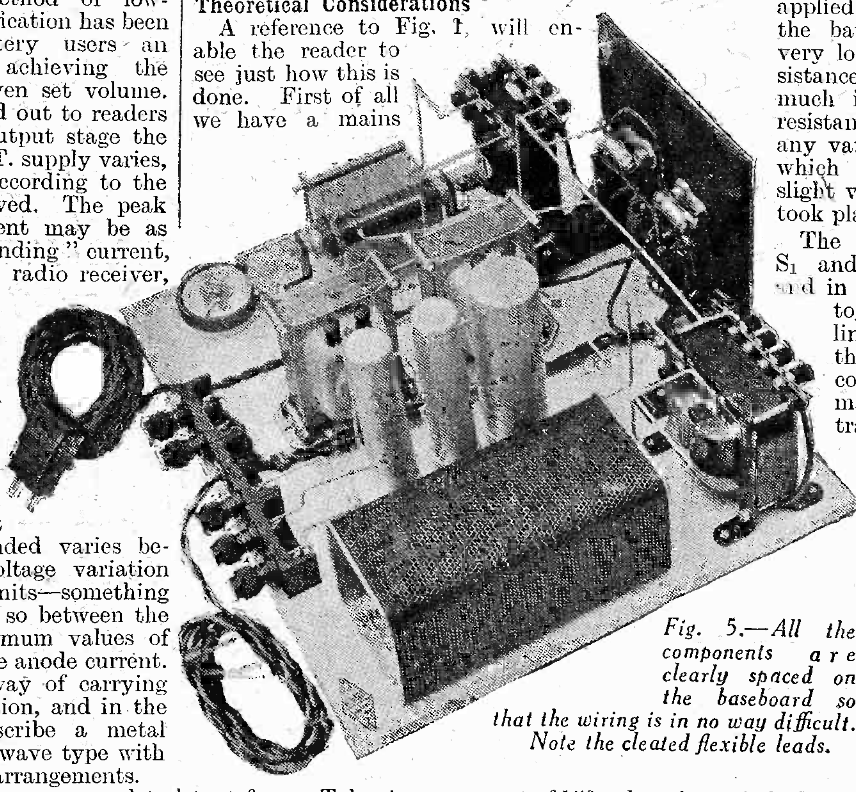

Fig. 5.—All the components are clearly spaced on the baseboard so that the wiring is in no way difficult. Note the cleated flexible leads.

Visible Indication

The second mains transformer T_2 with the tapped secondary connects to low-tension dry rectifier L.R. The resistance R in the D.C. output side of the rectifier is essential for it enables a control of the charging current to be made. When charging a battery, the current flowing depends upon the battery resistance and the difference between the applied and battery voltages. Since the battery resistance is always very low, the addition of the resistance R, which has a value much in excess of the battery resistance, will almost eliminate any variations in charging current which would otherwise arise if slight variations in applied voltage took place.

The two change-over switches, S_1 and S_2, are shown together, and in practice they are operated together. With the circuit linked up as shown, and the three switch arms making contact on the left, the A.C. mains are switched to the transformer T_2 and the accumulator is placed on charge. The small lamp across the rectifier output will glow, and gives a visible red indication that charging is taking place.

With the three switch contacts over to the right, the transformer T_1 is brought into circuit and T_2 cut out. The high-tension supply is therefore made available while the accumulator is switched over to the L.T. terminals which are joined to the set, and so feeds the valve filaments. There is another lamp across this pair of terminals which gives a white glow to show that the unit is alive.

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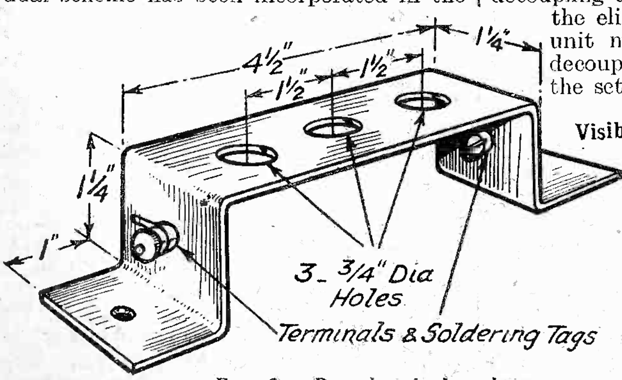


Fig. 3.—Details of the aluminium support for the three electrolytic condensers.

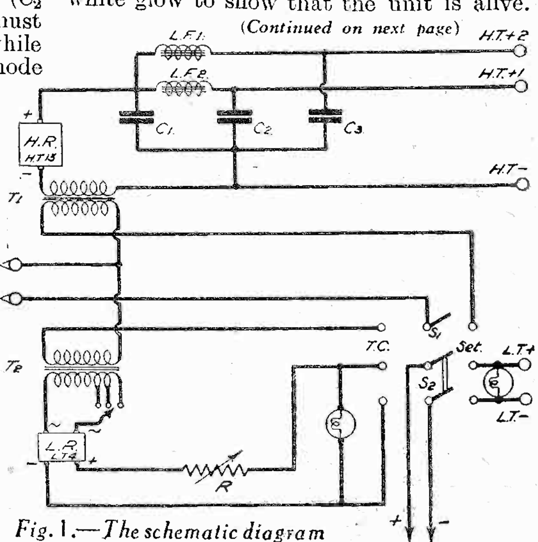


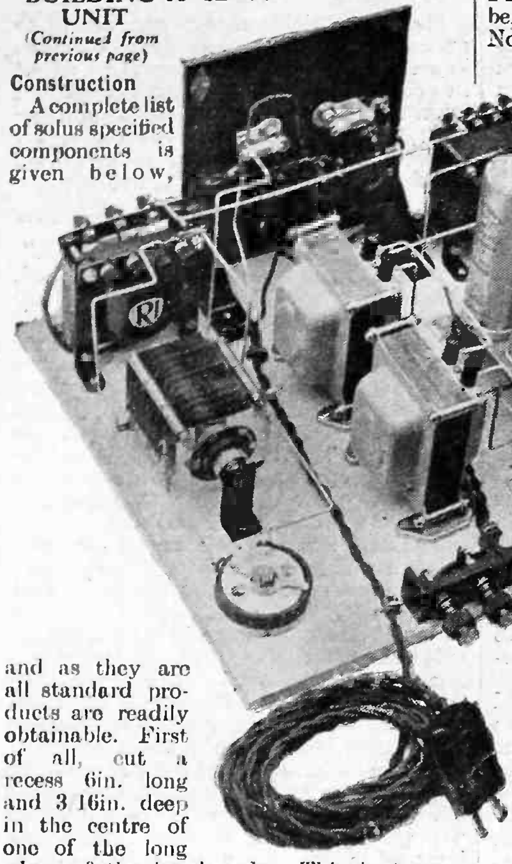
Fig. 1.—The schematic diagram adopted for the combined power unit and trickle charger.

BUILDING A CLASS "B" POWER UNIT

(Continued from previous page)

Construction

A complete list of solus specified components is given below, and as they are all standard products are readily obtainable. First of all, cut a recess 6in. long and 3/16in. deep in the centre of one of the long edges of the baseboard. This is to accommodate the panel so that its front face is flush with the baseboard edge, and in this way will fit better into the cabinet.



Now drill the panel according to the dimensions given in Fig. 2, and attach the two switches and two signal lamp fittings as shown. Be sure to intimate to the makers that one of these fittings must have a white lens (this is the one on the left facing the panel front) and in addition both switches must be supplied with panel indicating plates marked TC/Set (see illustration on page 696). When this is completed and the brackets added, lay the panel on one side for a time and make up an aluminium bracket to act as a fixture for the three dry electrolytic condensers. Full details of this are given in Fig. 3, it being constructed from 1/16in. thick metal. Note the inclusion of two small terminals and soldering tags on each short vertical side for connecting purposes.

Layout and Wiring

With the aid of Fig. 4 and the accompanying photographic illustrations (Figs. 5 and 6), the constructor can now assemble all his components in their correct positions on the baseboard. This is quite a simple matter as there are not many components. See that the electrolytic condensers are rigidly screwed to the aluminium mount and each component firmly screwed to the Metaplex baseboard.

Now proceed to carry out as much of the baseboard wiring as is possible, using Glazite connecting wire and making neat right-angled bends with sound electrical joints. Figs. 4, 5 and 6 will help you here, and each wire should be checked carefully. Be sure and connect the L.T.4 rectifier round the right way, the four terminal tags being stamped with their indicating mark.

Attention can now be given to the switch and lamp connections on the panel before it is attached to the baseboard. These leads are shown very clearly in the wiring diagram of Fig. 4. By using the "Pull back" wire the linking up of the switches and lamp-holders becomes a very simple process. Remember that with both the switches up the unit is in the trickle charge (TC) condition, and with both switches down (Set) power is given to the set.

The pair of red and black flexible leads passing to spade tags for joining to the accumulator should be connected while the

(Continued on next page)

Fig. 6.—The panel wiring is clearly seen in this illustration and also the aluminium bracket holding the three electrolytic condensers.

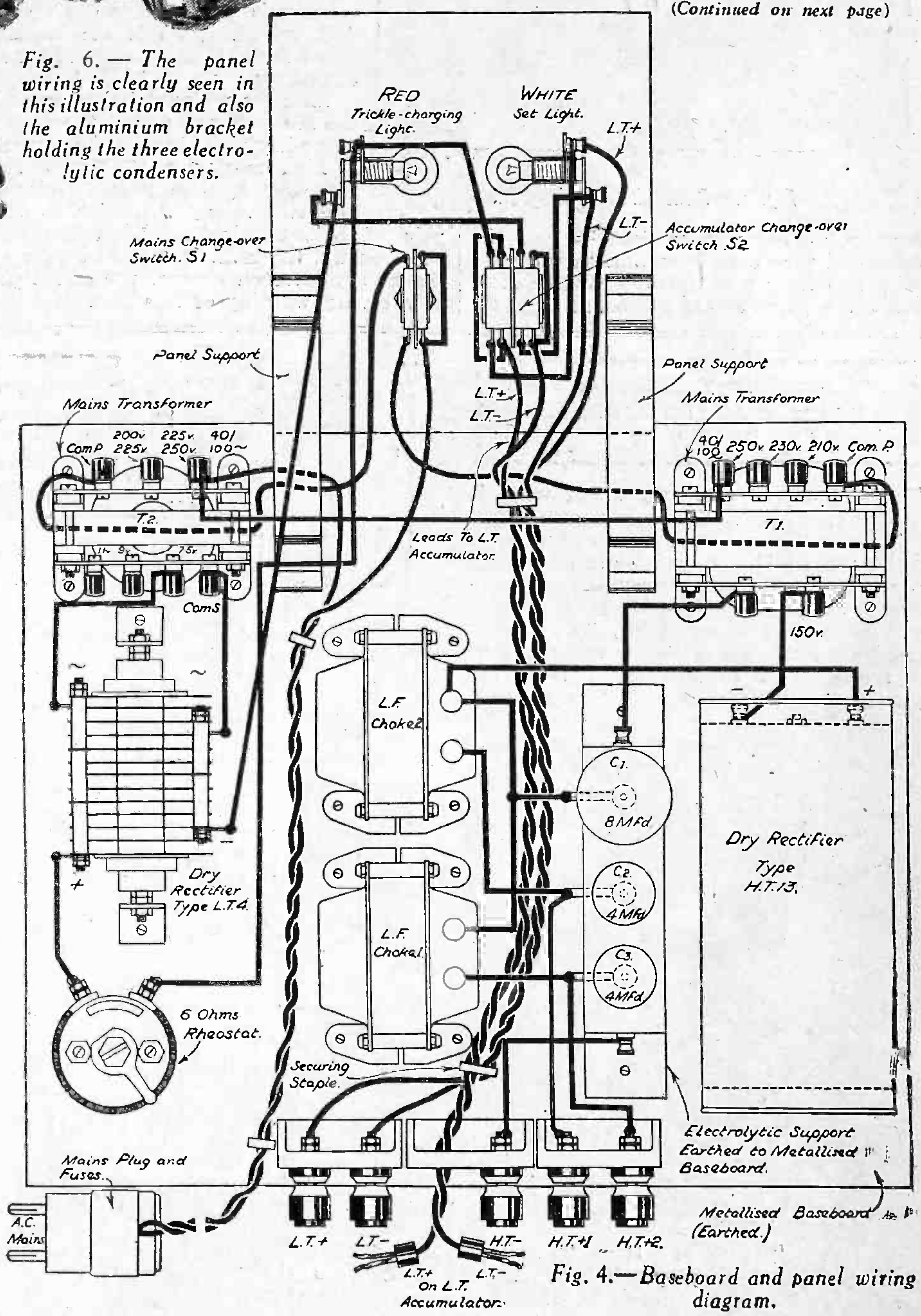


Fig. 4.—Baseboard and panel wiring diagram.

Components Required for the Class "B" Power Unit.

- 3 *High voltage dry electrolytic condensers: 2—4 mfd. (C_2 and C_3), and 1—8 mfd. (C_1). (Dubilier.)*
- 2 *Mains transformers for L.T.4 and H.T.13 rectifiers (T_1 and T_2). (Radio Instruments.)*
- 2 *Metal Rectifiers—H.T.13 (H.R.) and L.T.4 (L.R.). (Westinghouse.)*
- 2 *Constant inductance chokes, type H.T.12 (L.F.1 and L.F.2). (Wearite.)*
- 2 *Change-over toggle switches—single-pole type S81 (S1) and double-pole type S89 (S2). (Bulgin.)*
- 5 *Type B terminals: H.T.+2, H.T.+1, H.T.—, L.T.+ and L.T.—. (Belling and Lee.)*
- 3 *Terminal blocks. (Belling and Lee).*
- 2 *Spade tags L.T.+ and L.T.—. (Belling and Lee.)*
- 2 *Miniature signal lamp fittings, type D.19, with two-volt low-consumption bulbs. (Bulgin.)*
- 1 *0/6 ohm baseboard variable resistance (R). (Igranic.)*
- 1 *Fuseplug, type P.25. (Bulgin.)*
- 1 *Metaplex baseboard 14" × 12" × ⅜". (Peto-Scott.)*
- 1 *Ebonite panel 6" × 7" × 3/16". (Peto-Scott.)*
- 1 *Oak table cabinet with oval vignetted front. (Peto-Scott.)*
- 1 *pair panel brackets. (Peto-Scott.)*

BUILDING A CLASS "B" POWER UNIT

(Continued from previous page)

panel is "free," and also the flex leads to the L.T.+ and L.T.— terminals, together with the mains lead and links between the switch S_1 and the pair of mains transformers. These wire lengths can be measured very readily so that they can be joined to their respective terminals. Now screw the panel to the baseboard edge, fix the brackets and complete the small amount of wiring. Note that the ends of the mains lead terminate in a twin fuse-plug, this affording a measure of protection should a short circuit arise. Tuck away neatly any spare flexible leads, and also cleat them to the baseboard with one or two insulated staples, as indicated.

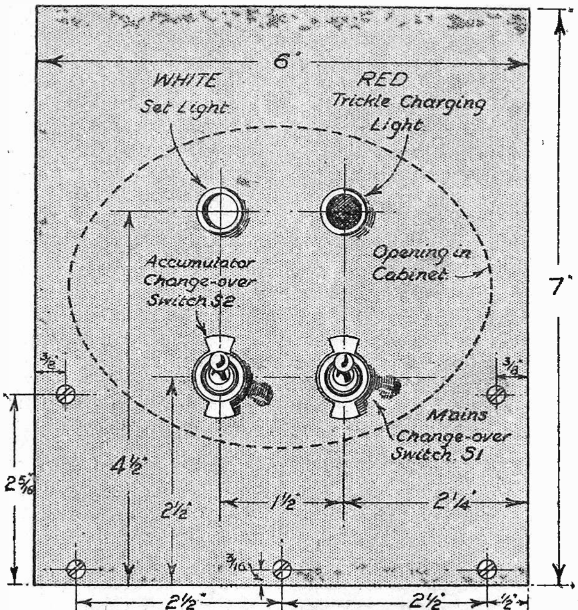


Fig. 2.—Panel drilling diagram.

Testing and Using

The unit is now ready for testing before housing it in its cabinet. Join the mains plug to a convenient electric socket, and the pair of spade tags to the two-volt accumulator. Before switching on the mains, adjust the baseboard resistance R so that the total resistance is 1.75 ohms. This is very easily done by estimating the position of the movable arm, bearing in mind that the total resistance is 6 ohms. Just under a third of the total resistance strip gives the value required, and in addition make quite sure that the mains transformer feeding the L.T.4 rectifier is joined to the 7.5 volt A.C. output. This is the correct value for charging a two-volt accumulator.

With the mains switched on and the *two* switches down, the white lens will glow to indicate that there is high tension available at the three appropriate unit terminals, and two volts low tension at the pair of L.T. terminals. With the two switches up, the H.T. is switched off and the accumulator on charge, the red light now giving warning of this fact.

Rated Output

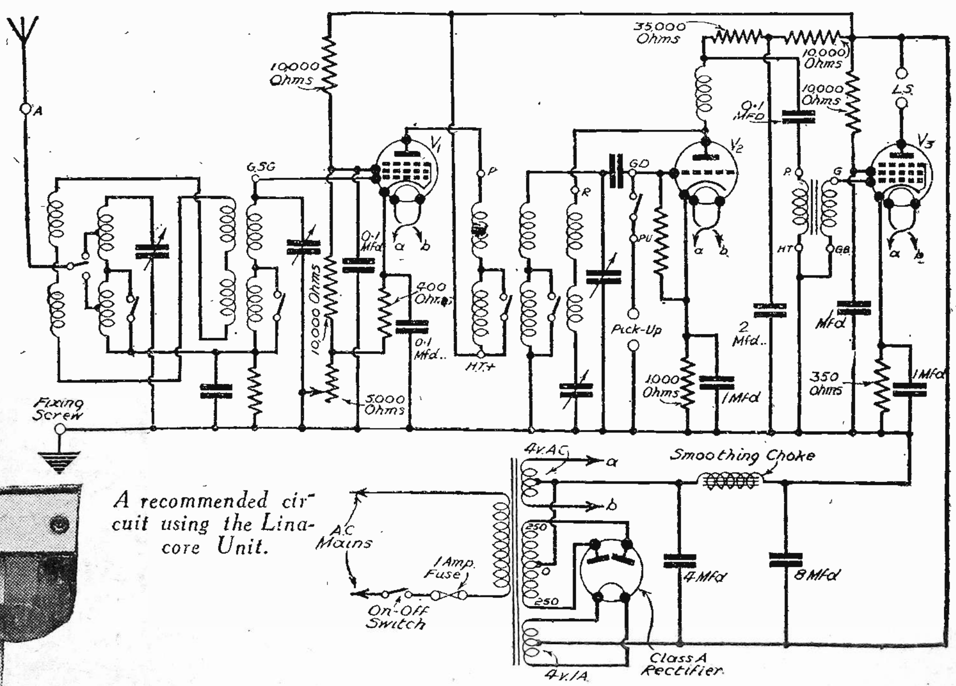
Since the trickle charge current is one ampere it is a very easy matter to calculate how long the accumulator must be charged in order to replace the energy extracted when the set is in use. For example, if the total filament current of the set is 0.8 ampere (this can be readily totalled from the data on the individual valve cartons) then the time of charging is just $\frac{0.8}{1.0}$, that is, four-fifths of the set's "working time."

As far as the high tension is concerned, the rated output *after* smoothing is 25 milliamps at 150 volts, while the maximum current is 40 milliamps. This is ample for any normal Class "B" receiver, a fact which I have proved very conclusively under rigid test conditions. Furthermore, there is not the slightest trace of mains hum, this being due to the very generous design of the smoothing equipment, while the presence of the 8 mfd. condenser C_1 materially improves the voltage regulation.

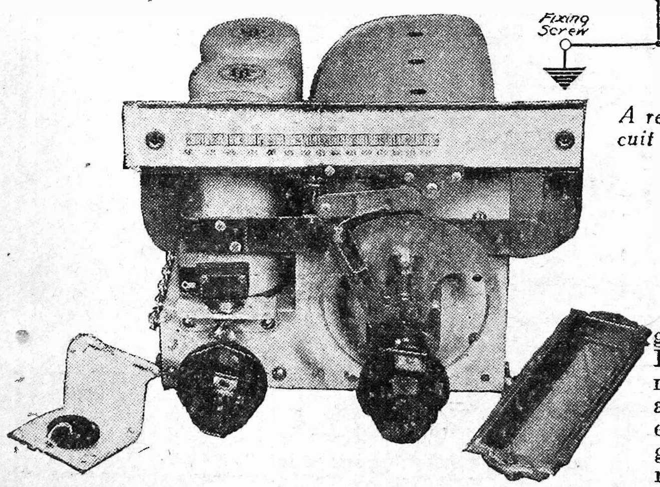
The unit can now be housed in its own cabinet, which has a particularly neat and unobtrusive appearance, as will be seen on page 696. In use, just connect the H.T. and L.T. leads from the radio set to the unit and switch on as previously instructed. The warning lights will remind you that the unit has to be switched off from the mains when not in use for power or charging, and, in addition, disconnect one of the spade tags from the accumulator when no charging is being done and the mains are switched off, otherwise one or other of the lights will glow. This is because I have not included a switch in the pair of L.T. accumulator leads, an unnecessary complication.

AN EFFICIENT THREE-VALVE VARIABLE-MU BAND-PASS RECEIVER

THE use of complete tuning units is becoming increasingly popular with amateurs, due to the fact that such units can be bought which are accurately ganged over the complete range of wavelengths. An excellent example of the type of unit referred to is the J.B. "Linacore," a brief description of which was given in a recent issue of PRACTICAL WIRELESS on the "Facts and Figures" page.



A recommended circuit using the Linacore Unit.



The J.B. Linacore Tuning Unit.

The J.B. "Linacore" is made in two patterns, for battery-operated or mains receivers, and both provide the same general circuit arrangement. For the benefit of numerous readers who have asked for a circuit to incorporate this excellent unit, a particularly good three-valve arrangement, comprising a variable-mu H.F. pentode amplifier, detector, and power pentode is illustrated on this page. All the necessary components which are external to the unit are marked with appropriate values, but those parts which are included in the unit itself are unmarked, so that they may easily be recognized. Additionally, the terminals on the "Linacore" are shown as circles and are marked with the same letters as those used by the makers. The component values are approximate ones suitable for use with most makes of valves of the types shown, but they might need to be modified slightly in some cases to comply with the figures recommended by the makers of the particular valves employed.

THE EFFECT OF THE POWER GRID SCHEME

By J. BURNS

A PROBLEM that every amateur will come up against when house-lighting mains become available to him, is how to avail himself of the great benefit they bestow on him. Probably he has a battery-driven set that is giving every satisfaction and perhaps, after debating the problem, he may come to the conclusion that, after all, the cheapest and easiest thing for him to do would be to invest in one of the well-known makes of H.T. eliminator and battery charger that are on the market.

Bearing in mind that he has had no previous opportunity of experimenting with that frightful bogey, "mains," this view is usually taken, because of the great uncertainty of not knowing what will happen, or what to expect. But let me warn the more experienced wireless amateur that this outfit will only suit him for a limited time; soon he will see what a marvellous difference in reception and quality of reproduction he has attained, so that the small output of the eliminator he has purchased will have to be augmented,

Working on D.C. Mains

For the man who suddenly finds D.C. mains available to him, nothing would seem easier than to merely smooth the voltage with an L.F. choke and a condenser of a few mfds., and drop the excess voltage across a resistance. This would serve the double purpose of decoupling the plate circuits; the filaments in this case are the biggest problem. Of course, it is possible to still run the existing valves from the accumulator, and charge about once a week through a resistance lamp, but this is not economical, and we still have the old trouble of attending to the accumulators; so probably under these circumstances the most practical way out of the difficulty would be to invest in a complete set of indirectly heated D.C. valves, and wire the valve-holders in series.

Adapting a Receiver to A.C. Mains

The position of A.C. mains is altogether different, and most of our supply mains are now A.C. Those that are D.C. are being changed to A.C. as soon as the various companies find it convenient to do so. At first the amateur is inclined to bemoan his fate if his mains are A.C., as he realizes that for H.T. he will have to have the same smoothing equipment as his D.C. friends, with the addition of a mains transformer and an H.T. rectifier, which is the most expensive part of the H.T. eliminator. Added to this trouble it appears to him that his filaments are going to be a big problem, and the cost of the two alternative ways of dealing with this are to be carefully considered. Either he will have to charge the present accumulator through a trickle charger, over the period the set is not working, or, alternatively, scrap the accumulator and battery valves, and replace with A.C. valves. The first alternative is the way intended to be adopted by the manufacturers of the combined H.T. and trickle charge L.T. eliminators, and at first sight this seems to be the cheapest and easiest

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way of dealing with the matter, as, added to the cost of the H.T. portion of the outfit, it is only necessary to provide an additional winding on the transformer, a low-voltage metal rectifier, and a cheap resistance of some sort. Then it is possible to retain the complete set in its present form. However, this has its drawbacks, as it seems a half-hearted attempt at a complete mains set, and when the accumulator packs up, as it certainly will, its life being perhaps three to five years at the most, we need to buy another one, and, therefore, we are still not clear of the accumulator trouble. The second alternative certainly means buying new A.C. mains valves (at least, all except the last, or power, valve), and in the case of a superhet. this is no small matter.

If the set is to be worked near a high-power broadcasting station, a detector and output valves will be the only two valves necessary to give very good results from this station, and if the detector battery valve is replaced for one of the A.C mains detector valves, both the receiving valves can then be run from 4 volts A.C. obtained from a separate winding on the mains transformer that is being used for the H.T. supply. If the power valve happens to be a two-volt valve, either a resistance could be used to break down the four volts to two, or the centre tap on the four volts winding and one of the other two outer terminals could be used.

The last valve is the only valve in the set that will work equally well from either a D.C. supply from an accumulator or A.C. stepped down from the mains in this way.

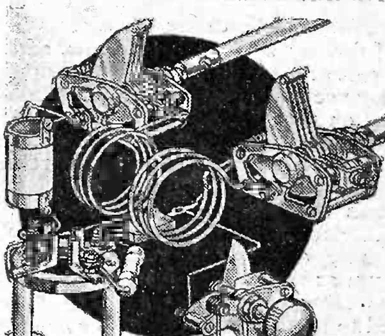
Grid Bias Supply

Having decided which method we shall use for H.T. and L.T. working, the grid bias is the only other supply to be considered, and this is most easily arranged by the aid of a resistance in the H.T. negative lead between the set and eliminator. The eliminator end of this resistance then becomes grid bias negative, and the receiving set end grid bias positive. The value of this resistance depends on the power valve used, and is usually in the neighbourhood of between 600 and 1,100 ohms; the exact figure is arrived at by dividing the voltage required for bias by the number of milliamps passing through the power valve. Expressed as a fraction of an amp. (i.e., 1 milliamp = $\frac{1}{1,000}$ amp.) the resulting figure is the number of ohms resistance required.

A.C. RECTIFIERS & RECTIFICATION

(Continued from page 688)

(for example, when using an H.T.9 metal rectifier) that the mains voltage is exactly the same as that required. In such a case the transformer might appear superfluous, but it should still be employed as a safety measure; if it were omitted there would be far more danger of receiving a nasty shock when handling the receiver, due to certain parts being "alive." In any high-tension eliminator operating from A.C. mains it is most desirable that a suitable transformer should be inserted between the mains supply and the rectifier. This is not by any means so necessary, though, in the case of a battery charger or in a unit employed for energizing a moving-coil speaker, and may be dispensed with provided that the apparatus is thoroughly insulated from "earth."



Short Wave Section

Choosing Condensers for the Short-Wave Receiver.

By MANDER BARNETT

A SHORT-WAVE receiver can be made or marred by the condensers used, and from the home-constructor's or experimenter's point of view, the amount of consideration given to the choice of the correct types will be well repaid.

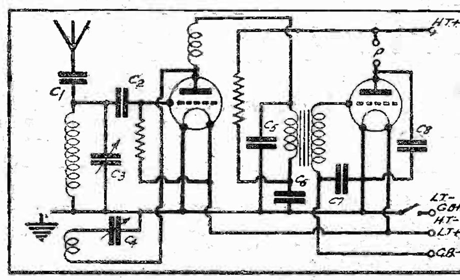
The only condensers in a short-wave receiver which require to be actually different structurally from those in a medium-wave receiver are, of course, the tuning condensers and, in some cases, the aerial coupling condenser. Short-wave tuning condensers have caused any amount of trouble in the past—some low-capacity tuning condensers are quite suitable for short-wave tuning and others, although their capacity may be correct, are definitely *not* suitable. It is impossible to lay down any hard and fast rule as to what constitutes the best type of short-wave tuning condenser, but the reader may rest assured that the present-day manufacturer who turns out a small-capacity condenser, and designates it as a short-wave model, is producing a satisfactory article. The usual capacity in use to-day is .00025 mfds. for normal short-wave work, although smaller capacities are sometimes used, down to .00005 mfds. for ultra-short-wave work, and even less. The error which must not be made, however, is in assuming that any variable condenser of a rated capacity of .00025 mfds. is suitable for short-wave tuning purposes, because some condensers, whilst they are perfectly satisfactory for service as reaction condensers, etc., in medium-wave receivers, will not work satisfactorily in a short-wave receiver, this being immediately obvious with some types by the production of loud scratching sounds as the spindle is turned. For actual tuning purposes below 50 metres, therefore, it is essential to use a condenser designed especially for this particular job. Some condensers of this type use a pigtail connection for making a satisfactory connection to the moving spindle, whilst others do not. Suffice it to say that, for really satisfactory operation, if a pigtail is used, it must consist of *insulated* wire, otherwise noise is liable to be set up on the shortest wavelengths, due to two or more turns of the pigtail coming into contact with each other.

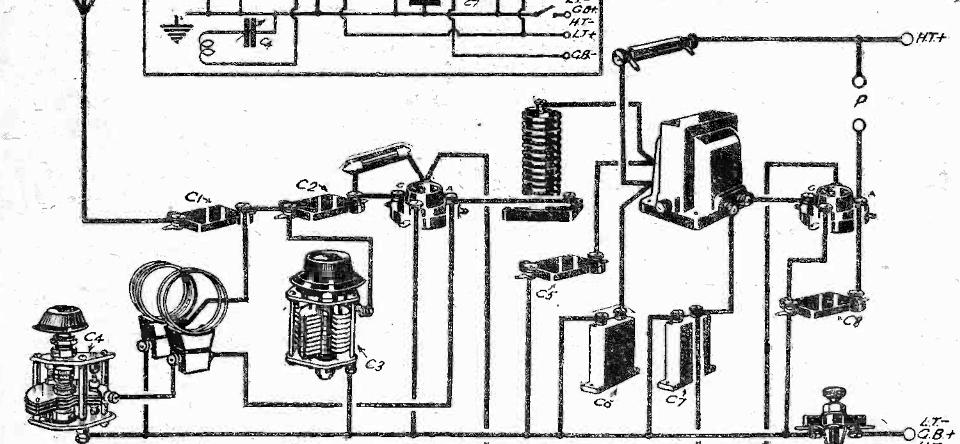
The normal capacity of .00025 mfds. is usually prescribed for use with the present-day dual-range type of short-wave coils, and this capacity is usually necessary to cover the full range without any gaps, whereas if we use plug-in coil units, we may use a smaller condenser with a capacity of about .0001 mfds. resulting in a greater efficiency and also greater ease of tuning, although on the debit side we have to use more coils to cover the same bands, and this means just so much more hard labour.

Reaction Condenser Requirements

The reaction condenser requirements do not, of course, require to be so exacting, and almost any normal type of reaction condenser with a capacity somewhere between .00015 and .0003 mfds., either of the air or solid dielectric type, will be found satisfactory, although it is undoubtedly an advantage to have some type of vernier control, as the reaction control in most types of short-wave receivers has a considerable effect on the actual tuning. This, however, can be regarded as a luxury and the average short-wave receiver does not usually incorporate a vernier reaction control.

The accompanying diagram is of an average two-valve short-wave receiver, and illustrates the points where attention has to be given to the various types of condensers used therein. Condensers for the positions occupied by C_3 and C_4 have already been dicussed. For C_1, a capacity of about .00005 mfds. is required, preferably with a small variation above and below this capacity. Condensers C_5, C_7, and C_8 are merely for high-frequency by-passing purposes, and need not exceed a capacity of about .0005 mfds. C_5 and C_8 in particular help to stabilize the receiver and should be regarded as necessities, although they are, no doubt, often omitted. The detector grid condenser, C_2 in this case, may consist of the normal capacity of .0003 mfds., although a lower capacity is sometimes prescribed for short-wave work. However, in actual practice, .0003 mfds. is a good average size, and will provide really satisfactory operation of the detector circuit. High-frequency by-passing condensers of .0005 mfds. capacity can very well be placed at the position shown in the succeeding stage or stages on the low-frequency side in larger receivers.





This typical two-valve short-wave receiver shows the various condensers and illustrates their importance.

Tuning the H.F. Stage

In receivers employing tuned H.F. stages, we are faced with the problem of another tuning control, but there is really no reason why the condensers should not be ganged in the same manner as in the medium-wave receiver. The tuning of the high-frequency stage will, in most cases, be comparatively flat on the short waves, compared with the detector stage, and thus we can allow a certain amount of tolerance with little or no loss in signal strength. Inter-stage screening will have to be very complete, but a trimming condenser will probably be found unnecessary. It will, however, be found advantageous here to use dual-range coils for each stage, rather than plug-in coils, as, if the latter were used, *two* coils would have to be changed for each wave-range.

Short-Wave Transmissions from Daventry

It is mentioned in the B.B.C. Year Book, 1934, that a good deal of useful knowledge is still to be gained in the field of short-wave transmission and reception, and that one aspect of this is already being explored. A series of experimental short-wave transmitting aerials has been erected at Daventry, and these are used for regular and experimental transmissions. There has long been a controversy as to whether high aerials or low aerials, horizontal aerials or vertical aerials, are better for short-wave transmission. A considerable amount of experimental evidence is available in relation to aerials for fixed point-to-point services, but there is much less evidence as to which aerial is best for a broadcast service which, although it can be directed in the horizontal plane, still has to be receivable over large areas of country which lie at widely different distances from the transmitter. As to receiving aerials, it is well-known that considerable advantage can be obtained by the use of directional arrays, but these are costly. Work has, however, been undertaken on the design of small aerials which the ordinary listener could erect, and preliminary experiments suggest that they could be used with advantage.

By
PERCY RAY

CLASS "B" & the STRAIGHT THREE

A Practical Article Dealing With Essential Points, with Special Reference to the Pentode

ALL the general aspects of Class B Amplification have been fully dealt with by PRACTICAL WIRELESS, but there are a number of points that arise when the fitting of Class B to a Det. and 2L.F. set is contemplated, and before going into the question farther a proper understanding of the driver is essential.

The function of the driver valve is to supply the necessary voltage input required by the Class B valve, and in addition, it must be capable of delivering up a certain amount of A.C. current without distress. When the Class B valve is required to deliver 2 watts the driver valve will be called upon to deliver 65 to 75 milliwatts, and when the Class B valve is only required to deliver 1 watt the driver valve will only require to give an output of about 35 to 40 milliwatts. It is therefore evident that any valve capable of delivering these small outputs may be used as a driver valve provided that a suitable ratio of output transformer is available.

The reason for this will readily be understood when it is realized that a certain voltage must be developed across the secondary to drive the Class B valve, and with an unsuitable transformer the voltage available might be too small even though the output in milliwatts is adequate.

The grid-filament path of the output valve is in shunt with the secondary, therefore the total impedance of the secondary circuit must always be less than the grid-filament impedance, and this figure is often too low to act as the load for the driver valve.

It will be necessary to diverge from the subject slightly in order to draw attention to the fact that any resistance connected across one side of a transformer will be virtually across the other winding in proportion to the ratio. To take a concrete example: suppose that the grid-filament impedance of the Class B valve at working peak is 5,000 ohms, this 5,000 ohms will be in parallel with the secondary, and if the ratio of the transformer is 1:1, the anode load will be practically the same as the impedance of the secondary.

Transformer Ratios

When a valve such as the 210 L.F. is used an anode load of 5,000 ohms would be inadequate, although the output from this valve would be ample to act as a driver for a Class B output valve adjusted for a maximum of 1 watt. This valve has an impedance of 10,000 ohms, and an anode load of about 20,000 ohms would be suitable; thus it will be necessary to use a transformer having a step-down ratio of 2:1, or of 4:1 overall. This should not be confused with an ordinary 2:1 transformer, which has a step-up ratio, *i.e.*, voltage across the secondary is greater than the voltage across the primary.

The above remarks show that any valve capable of an output of 70 milliwatts (if two watts are required) or 35 milliwatts (if one watt is required), could be used, providing that a *suitable* transformer is available. This raises the possibility of using a pentode valve as a driver, which, in turn, makes possible the use of a Class B output of a receiver of the popular detector and 2L.F. type.

Fig. 1 shows a circuit diagram of a typical detector and 2L.F., which, like all other receivers of its class, will have a very small output, and for this reason will not lend itself for use as a radiogram. Conversion of this receiver to Class B would raise the output available 10 to 15 times, providing that the Class B output valve could be given sufficient signal voltage to drive it.

The apparent method of converting this receiver would be to keep the detector as it is, use the middle valve as the driver, and replace the output valve by a 240 B. This is one of the biggest pitfalls into which the constructor can fall, as the result would be most disappointing unless used as a local receiver only relatively near to a station.

Driver and Class B Valve as a Single Stage

The driver valve and the Class B valve must be considered as one stage, because the driver valve will give little or no gain as the grid current drawn by the Class B valve is wasted energy, with the result that the stage gain of the driver and Class B valve will only exceed that of an ordinary output valve by sufficient amplification to provide the increase in volume that the output valve is capable of.

Referring again to Fig. 1, it will be seen that if we make the L.F. valve do the duty

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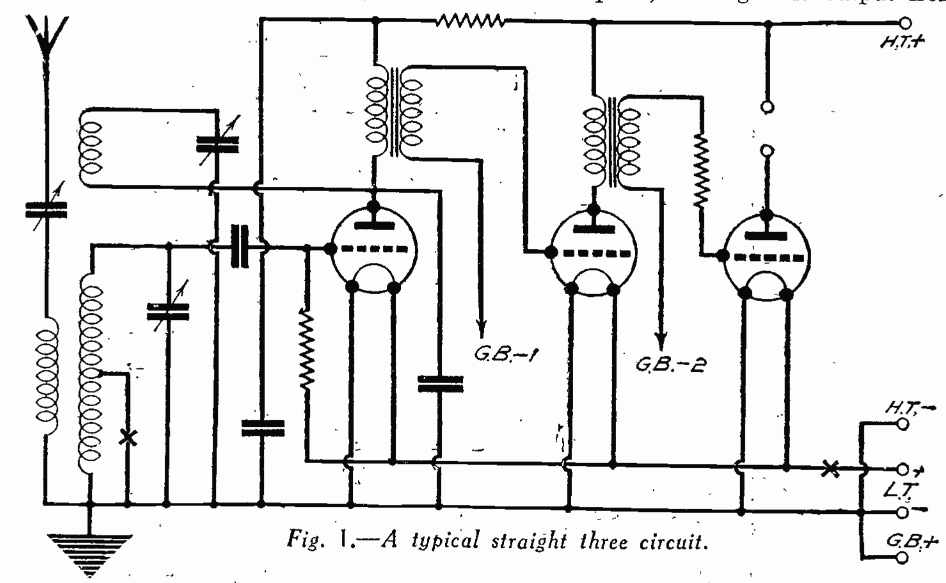


Fig. 1.—A typical straight three circuit.

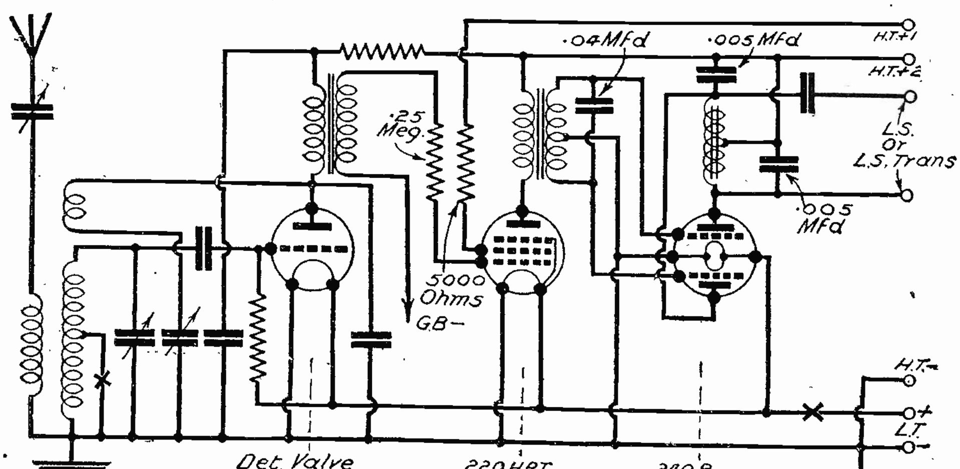


Fig. 2—The entire detector stage shown in Fig. 1 is unaltered and a pentode driver and Class B stage have been added.

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

An Instructive Article in Which the Author Gives a Lucid Explanation of the Word "Potential" as Applied to Radio, and also Demonstrates the Use of Potentiometers and Potential Dividers in Wireless Circuits

"POTENTIAL" is a word which crops up very frequently in connection with radio. We talk of "potential difference," high potential, low potential, etc.

Although we use these terms quite

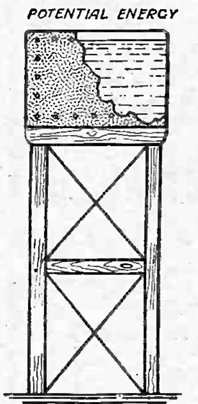


Fig. 1.—Difference of potential illustrated by the height of a tank of water.

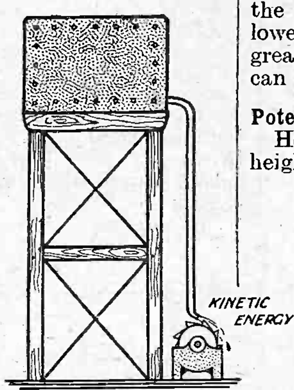


Fig. 2.—How work may be done by virtue of the difference of potential.

freely there is no doubt that in the minds of many readers their meaning is not at all clear. This is probably due in a large measure to the somewhat abstract nature of the word *potential* itself. The dictionary tells us it means "Existing in possibility, not in act, latent. Expressing power, possibility or obligation; anything that may be possible," etc. Incidentally, it is used both as an adjective and as a noun.

Perhaps an example of the use of the word outside the realm of radio will help to make its meaning clear. Suppose, for instance, there is a tank of water suspended at a height above the ground as in Fig. 1. The water is not moving and does no work. However, owing to the force of gravity it only needs a pipe from the tank down to the ground level to enable it to perform useful work, such as driving a pump or water wheel. The energy is there, although it is not actually being used. It is called *latent* or *potential* energy. Of course, as soon as the water is allowed to flow down a pipe, as in Fig. 2, the stored-up energy is released—it does work—it is no longer potential but *kinetic*.

This is an example of the use of the word in its adjectival sense. Using it as a noun we say that the water in the tank is at a certain potential above that of the ground. The potential at the ground level is zero, but the potential of the water is high; the actual value being represented by the number of feet it is above ground level. If the height be increased the potential will become still higher, for, naturally, the farther the water has to fall the greater will be the pressure at the lower end of the pipe, and, therefore, the greater will be the amount of work it can do.

Potential Difference

Here we see potential is represented by height or level. Of course, potential is

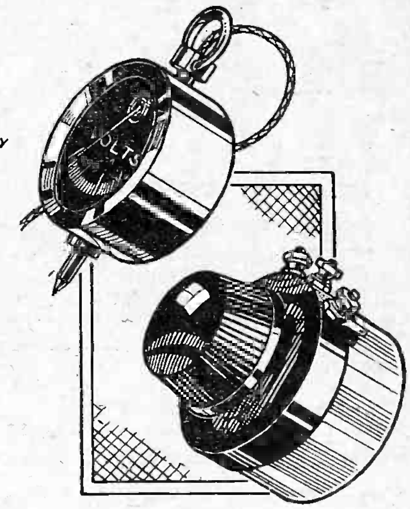


Fig. 3.—A voltmeter is a true potentiometer. The volume control on the right is, strictly speaking, a "potential divider."

purely relative. For instance, there may be a tank or reservoir of water situated, say, 100 ft. above ground level, which empties into another tank 40ft. above the ground. The energy being expended here is not proportional to the height the first tank is above the ground but to the height of the first tank above the second tank, that is, by the difference between the heights of the two tanks.

It is the *difference of height or potential* which is the important thing.

The same thing applies to other forms of potential, such as heat potential and electrical potential. Heat potential is represented by *temperature*. A high temperature in itself does not necessarily signify a large amount of available energy. If everything is at the same temperature, whether it be high or low, no energy will be available. For example, a hot-air balloon will not rise if the outside air is equally as hot as that within it. It is when there is a *difference* in temperature between the air inside and that outside that it rises. Similarly with electricity. Electrical potential is measured in volts, but it is the *difference of potential* or voltage between two points in a conductor which causes a current to flow and energy to be expended. For instance, a

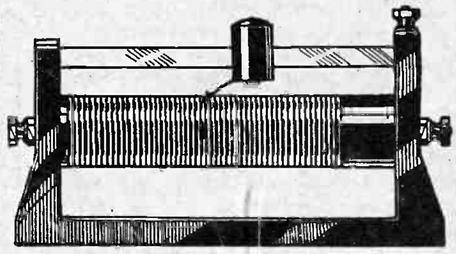


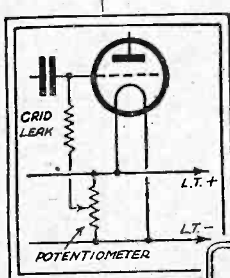
Fig. 4.—A variable potentiometer of the slider type.

battery or dynamo produces a current when its two terminals are joined with a wire, because these two terminals are at a different electrical potential. The current flows from one to the other like water flowing down a hill. On the other hand, without a difference of potential no current can flow. Potential alone is not sufficient, for two bodies may each be heavily charged with electricity to a very high potential, but if the potential is the *same* in each case then no current will flow between them on joining them with a wire. Just in the same way that no water would flow between two lakes high in the mountains and connected by a pipe, if each lake were the same height above sea level.

Electricity is only useful when it moves. When it is static, as in a charged condenser, no work is done. The potential difference existing between the plates may be very high, yet until they are joined by a wire or other conductor no current can flow. Of course, if the P.D. is excessive then the insulation between the plates will break down and a spark will jump between them. The energy stored in the plates will be then manifested by the heat, noise, and light of the spark.

Potentiometers and Potential Dividers

Difference of potential is measured by means of a voltmeter or *potentiometer*.



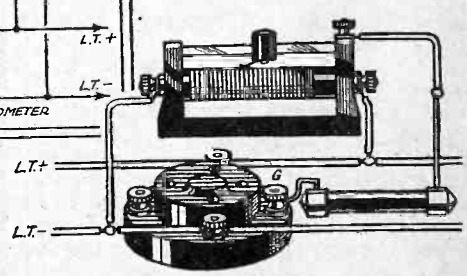


Fig. 5.—How a potentiometer may be connected to the detector valve to overcome "ploppy" reaction.

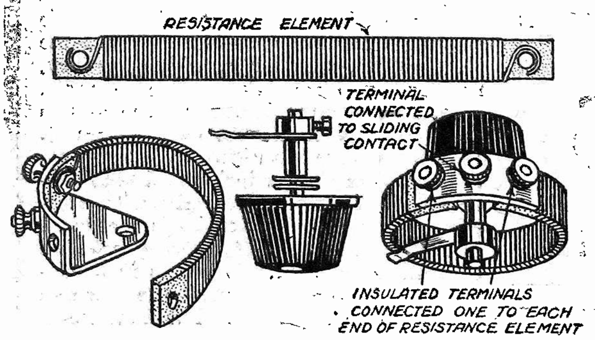


Fig. 6.—Details of the construction of a simple potentiometer of the circular type.

Every radio fan knows what a voltmeter is, but the term "potentiometer" has been so abused that its real meaning has been lost sight of. A potentiometer is obviously a *measurer of potential.* The ordinary tapped resistances and volume controls, etc., are not potentiometers but *potential dividers.* They are not instruments for measuring, but simply devices for providing intermediate potentials between two points.

A true potentiometer may take the form of a voltmeter, or a Wheatstone bridge, or similar apparatus. Only the voltmeter will concern the average constructor. However, the so-called potentiometers, that is, the potential dividers just mentioned, figure largely in the make-up of modern receivers. Let us have a look at a few. Fig. 4 shows a simple form of variable potentiometer. It consists of a tube of some insulating material wound with bare resistance wire spaced between each turn, to each end of the resistance wire is connected a terminal, while a third terminal makes contact with a slider which moves up and

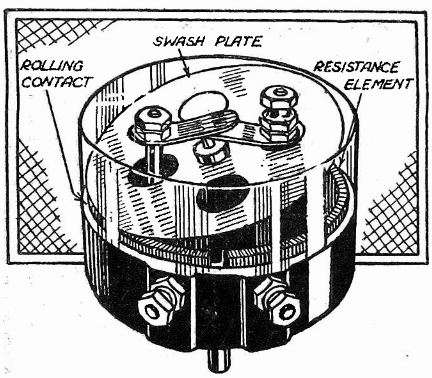


Fig. 7.—The ingenious swash plate device of the Lewcos potentiometer provides a rolling instead of a sliding contact.

down the whole length of the coil. The instrument is used by connecting the two end terminals to the two points in the circuit between which it is desired to obtain an intermediate potential. The part of the circuit or the component which is to be connected to this intermediate point is then joined to the slider terminal. By moving the slider from end to end of the resistance element any voltage between that of the two extreme ends can be obtained. Let us take an elementary example of the use of such a potentiometer.

Adjustment of Grid Bias with a Potentiometer

In a battery set with leaky-grid detection the "lower" end of the grid leak is usually connected to L.T.+. that is to say, it is connected to a point which is 2 volts positive in respect to "earth" (assuming the negative side of the usual 2-volt L.T. battery is earthed). Now, it is often found that this connection, although it gives the most sensitive working of the detector valve, yet is inclined to give fierce or "ploppy" reaction. On the other hand, connecting the grid leak to L.T.—, that is to say, to zero potential, will give smooth reaction, but at the same time will reduce the sensitivity of the valve considerably. Clearly the ideal potential for the grid is some point between zero and 2 volts positive (usually at about 1 volt positive). To obtain this intermediate position a potentiometer is connected across the low-tension leads to the valves, and the grid leak is connected to the slider of the potentiometer, as in Fig. 5.

By connecting the potentiometer across the L.T. leads in this way there is a difference of potential of 2 volts between the two end terminals, in other words, one end of the potentiometer must be at the same potential as L.T.+ while the other end is at the same potential as L.T.—. The potential of the resistance wire must therefore drop from 2 volts positive to zero throughout its length. The slider traversing this wire is able to select any intermediate potential between these two points so that by connecting the grid leak return to the slider we can give the grid any bias between 0 and 2 volts positive by adjusting the position of the slider.

Incidentally, a potentiometer connected in this way must be of fairly high resistance, since it is connected directly across the L.T. terminals and therefore takes current from the accumulator. The higher its resistance the less will be the current consumed.

Different Types of Potentiometers

A more familiar form for the variable potentiometer is the circular type. Details

TOPICAL TECHNICALITIES

Time and Frequency.

Frequency may be defined as the "regularity or rate of recurrence of phenomena which occur in cycles." That is to say, any event which takes place over and over again at regular intervals may be said to have a frequency, and each occurrence may be said to be a cycle. As with all measurements, a standard is used as a basis upon which to calculate the recurrence, or frequency, and this is based upon the rotation of the earth. The earth takes one sidereal day to make one complete revolution, and this is the fundamental "time interval." The rate of rotation, namely one cycle per sidereal day, is the standard fundamental frequency standard. Thus from this data it is possible to calculate any other frequency. By means of recording time-pieces (or astronomical clocks) the time period of one (solar) day may be accurately recorded at any given moment, and by comparing the movement of any other cyclical phenomena with this passage of time, its frequency may be determined. Thus, if we set a pendulum oscillating, and by recording its movement ascertain that during a period of one day it gains (or shows an advancement of) "x" times, we can calculate its frequency by adding this number to the number of seconds in a day (86,400) and dividing the sum by the latter figure, thus $\frac{86,400+x}{86,400}=y$ *cycles per second.*

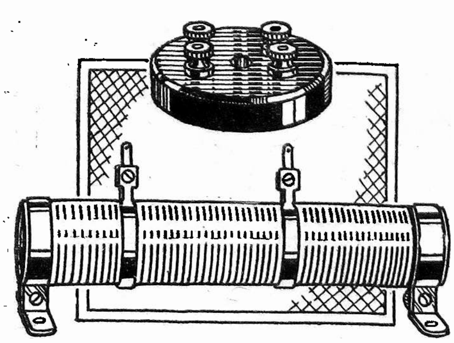


Fig. 8.—Examples of a fixed and a semi-fixed potentiometer.

of the construction of a simple instrument of this form are given in Fig. 6. The resistance wire in this case is wound round a flat fibre strip. This strip is bent into circular form and fitted with terminals connected to each end of the wire. It is held in position by a skeleton metal framework on which is mounted a revolving arm or spring contact. The arm bears on the edge of the resistance element and can be rotated by means of a knob so as to make contact with the wire the whole way round. Modern circular potentiometers, however, are usually of more sturdy construction than that shown in Fig. 6, the body of these instruments being of moulded bakelite. Various devices are used to ensure smooth and even contact. One par-

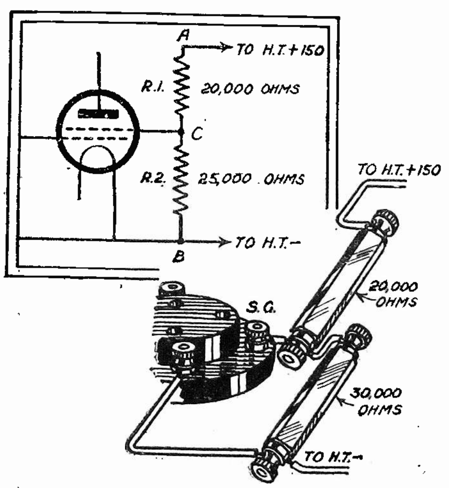


Fig. 9.—Potentiometer method of obtaining screening grid volts.

ticularly ingenious method consists of a swash plate of thin springy steel which rocks in a circular manner as the knob is rotated, thus the edge of the plate makes a rolling contact with the edge of the resistance element. There is no rubbing as with the ordinary type of arm, and therefore very little wear at the point of contact. This naturally makes for good electrical contact throughout the whole movement as there is no production of metal dust due to any scraping action. A potentiometer of the swash plate type is illustrated in Fig. 7.

Another type of potentiometer, this time of the semi-variable kind, is shown in Fig. 8. This particular model is

(Continued on facing page)

(*Continued from page 704*)

designed for mains use, and is wound on a porcelain former. As with other types, a terminal is fitted to each extremity of the wire element.

Apart from the variable and semi-variable types of potentiometers there are also one or two fixed types such as that also shown in Fig. 8. This has a composition resistance element and is provided with two fixed tappings. Its use is for providing suitable grid bias for the detector valve as already described.

Screen-grid Volts by Potentiometer Method

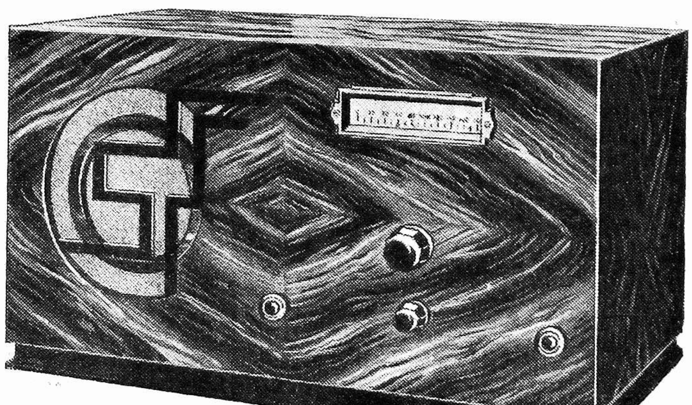
Of course, the usual way of providing a fixed potentiometer is to use two or more ordinary fixed resistances in series, and to take the tapping or tappings from the connecting point between the resistances. This method is extensively used for obtaining the necessary voltage for the screen of a screen-grid valve. Suppose, for instance, the maximum H.T. voltage available in a receiver is 150 volts, and the screening grid of the S.G. valve requires only 70 volts. The usual way to lower the voltage to this figure is to use the potentiometer method shown in Fig. 9. Two resistances, R.1 and R.2, are connected across the H.T. supply as shown. Naturally, the potential difference or voltage drop between the two extreme ends is 150 volts, since the "top" end A of R.1 is at 150 volts positive, and the "bottom end B of R.2 is at zero volts (earth potential). Now if we take a tapping anywhere between A and B, the potential or voltage available will be something between 0 volts and 150 volts, therefore, by seeing to it that the two resistances are of suitable values, the connecting point C can be arranged to be at the desired potential of 70 volts. I will explain how the values of 20,000 ohms and 25,000 ohms for R.1 and R.2 respectively are arrived at in this particular case. First of all, the current passing through the potentiometer from A to B must be large compared with that taken by the screen of the valve. This is in order that fluctuations in the screen current shall not appreciably affect the voltage on the screen. Assuming the screen takes no more than 1 milliamp, then a current of 3 milliamps through the potentiometer would be suitable. Now let us see what are the necessary individual values for R.1 and R.2. First of all take the case of R.2. The voltage drop across this is the voltage required by the screen, namely, 70 volts. To take 3 m.a. at 70 volts, it must have a resistance of 70 divided by $\frac{3}{1,000}$ = 23,333 ohms (by Ohm's law $\frac{E}{C}=R$, where R is the required resistance, E the E.M.F. or voltage, and C the current in amperes). The nearest standard value to 23,333 ohms is 25,000 ohms, so we must be content with this value.

Now consider the case of R.1. Firstly, the current through R.2 will be 70 divided by 25,000 = 2.8 milliamps. Now, not only will this current of 2.8 milliamps pass through R.1, but the current taken by the screen as well, namely 1 m.a., giving a total of 3.8 m.a. Well, since R.1 has to drop 80 volts (150—70 = 80), then its resistance must be 80 divided by $\frac{3.8}{1,000}$ = 21,053 (approx.). The nearest standard resistance, namely, 20,000 ohms, would be suitable.

OUR VIEWS ON RECEIVERS

Peto-Scott Screen-Grid Battery Three

A CHEAP battery receiver, housed in an attractive cabinet, and containing a moving-coil loud-speaker. These, in brief, are the salient points of the new Peto-Scott Receiver. The cabinet is well known, having been used in more than one of our own receivers, and the attractive lines and fret details of this need no emphasising. The general appearance of this receiver is enhanced by the new straight-line full vision scale which is fitted, and probably to many the fact that there are only three knobs (in addition to the wave-change switch) will also prove a most valuable feature. When the back of the receiver is removed, all that can be seen of the actual receiver is a neat all-metal chassis with a completely enclosed ganged condenser, and three valves. By the side of this is the moving-coil speaker, and ample room is left behind this for the batteries. An interesting point when first examining one of these receivers is the manner in which the battery leads are fixed to the bottom of the cabinet and retained in position by an instruction sheet, so that the receiver cannot be placed into commission in an incorrect manner owing to the user's attention being so clearly drawn to the correct manner of connecting up.



The Peto-Scott Screen-Grid Three-valve Battery Receiver.

Specification

The receiver embodies the well-tried arrangement of screen-grid H.F. stage, detector, and L.F. valve. As is already proved, this arrangement, when properly designed, provides the best all-round performance, delivering power with good distance-getting properties. In this particular receiver the aerial coil and the H.F. coupling coil are of the totally screened type, and are situated beneath the chassis, thus ensuring short wiring with a minimized risk of direct pick-up on the wiring should the receiver be used in a situation close to a main or high-powered station. Transformer coupling is provided between detector and output valves, and the wiring and layout of all the components has obviously been the result of some thought with regard to general efficiency and stability. In place of terminals, socket strips are provided for aerial, earth, loud-speaker and pick-up connections, and a neat self-contained aerial device has been included. This consists of a length of flex pinned to the top of the cabinet and to one side of it also, and is fitted with a plug which may be inserted into the aerial terminal. One other point is worth mentioning, as it is often overlooked by many manufacturers, and that is the fact that the chassis is stamped, in large letters, with the valve identification for each socket. There is thus no likelihood of the wrong valves being inserted.

Controls

The three control knobs are arranged as follows: the centre knob controls the gang condenser and tunes both aerial and H.F. coupling coil. The right-hand control operates a solid dielectric reaction condenser, and the left-hand knob controls a combined on/off switch and volume control. This operates on the H.F. valve, which is, accordingly, of the variable-mu type. A small central knob is fitted for wave-change purposes.

Results

The receiver was connected exactly as recommended, and was tested in a locality which is known to be good for general reception. The general first impression is one of extreme liveliness, and a run round the dial, with reaction advanced to a position about one-third, produced a fair number of stations. The receiver was then handled with more care, and judicious use was made of the reaction and volume controls, with the result that the receiver seemed to produce a station at every degree on the dial. The outside aerial was then removed and the small internal aerial plugged in, with, of course, a substantial reduction in power. Although small, however, this aerial seemed to be very effective, and enabled Hilversum on the medium waves, and Radio-Paris on the long waves to be received at quite comfortable volume with only the slightest trace of reaction. It was possible to increase this strength and obtain sufficient volume for normal listening purposes without any difficulty, although under this condition the general background noise was rather too prominent for comfortable listening. Tested in an area where results are usually very bad, the receiver seemed to be above

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the average in general performance. Stations which, generally speaking, are difficult to tune seemed to be obtained easily on this receiver, and this is apparently due to the method of coupling the aerial circuit to the first valve. Quality on all stations was of a high standard, due to the moving-coil loud-speaker. The general brilliancy of reproduction was one of its most favourable features, resulting in very distinctive speech and fine brilliancy on music. Such instruments as the violin, cymbals, piano, and similar types, which rely for the characteristics on the higher notes in the scale, were splendidly reproduced, whilst there was no absence of bass. In place of the customary bass thump there was a clearly defined low-note response which, whilst not so full as is obtainable with larger output valves and adequate H.T., was yet sufficiently powerful to enable a dance band to be reproduced at full room strength with the drums and other bass instruments well in evidence.

This is a splendid general purpose receiver which may be relied upon to provide good quality reception from a number of stations under practically any conditions, and which is also most economical in upkeep costs. The price of this receiver is Eight Guineas.

MAKING YOUR OWN SCREENED COILS

(*Continued from page 684*)

to overcome it. It should be emphasized that this break-through is not troublesome in all localities, but generally only in those fairly near to a medium-wave transmitter. Consequently, if break-through is not experienced either of the coils already described will prove perfectly satisfactory. Where break-through is experienced, a coil giving the circuit arrangement shown in Fig. 6 is very suitable. It will be seen that a loose-coupled aerial winding is employed in addition to the two tuned windings and the reaction one. The extra winding is so connected that it is in series between the aerial lead-in and the centre-tapping on the long-wave winding when the wave-change switch is in the long-wave position. But when the switch is changed over for medium-wave reception the winding is connected between the aerial and earth so that the coupling between it and the tuned winding is purely an inductive one. To permit of the necessary changes of circuit a two-pole double-throw switch is required for wave-changing, and this tends to complicate the arrangement to a certain extent. Nevertheless, the arrangement is a good one and well worth trying. The object of the extra winding is to act as a rejector wave-trap on long waves and as an ordinary loose-coupled aerial coil on medium waves, and thus it serves, not only to prevent break-through, but also to improve selectivity on the lower waveband.

The method of construction in respect to this coil is very similar to that employed for previous ones, but it will be seen from Fig. 7 that an extra winding section is needed on the former. This is provided by arranging two of the paxolin spacers about ½in. apart at the top of the tube and ¼in. away from the medium-wave windings. The anti-break-through winding consists of 100 turns of 34-gauge wire (again either d.c.c. or enamelled is suitable) wound in the newly formed slot at the top of the former. For this particular coil seven terminals are required.

WHAT IS ITS RESISTANCE?

A Simple Method of Calculating the Resistance of Milliammeters.

THIS is one of the most perplexing questions that experimenters and amateurs are confronted with, when they find that they want to extend the range of their milliammeters and are at a loss to know what is the resistance of their instrument.

Let us take a milliammeter reading from 0 to 5 milliamps., and assume we are desirous of finding its resistance so that its range can be extended.

Now consider the accompanying circuit diagram. In it we have a 2-volt accumulator, a variable resistance of approximately 1,000 ohms, capable of carrying the current of 5 milliamps., and a milliammeter reading from 0 to 5, and, although not shown in the diagram, a 30-ohm variable resistance.

Connect up the apparatus as in the diagram, and we are then in the position to start our calibration.

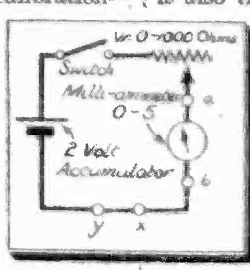
In the diagram there are two points marked x and y, and these should be connected together for the time being with a piece of thick copper wire, then with the variable resistance—marked Vr—in the 'all in' position, switch on the accumulator.

We shall now get a reading on the milliammeter, the value of which will depend on the voltage of the battery, and the amount of resistance in circuit. Adjust the variable resistance until the milliammeter indicates that the maximum current it will carry is flowing, namely, 5 milliamps.

Our next step is to connect the 30-ohm variable resistance—leaving the arm in the central position—across the terminals of the milliammeter, keeping the connecting wires as short as possible. This will be across the points marked a b.

You will now find that the milliammeter will have a different reading, depending upon the value of this resistance, and the greater the ohmic value of this resistance, the nearer to 5 milliamps. will the instrument read, and vice-versa.

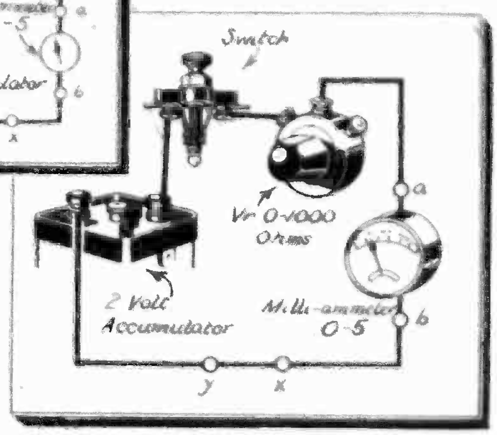
Keeping the variable resistance Vr in the same position—and do not alter it during the remainder of the calibration—vary the 30-ohm resistance until we get the milliammeter reading half its maximum value, namely, 2.5 milliamps. As we have now halved the current through the milliammeter, it follows from Ohm's Law that the values of both paths of this divided circuit are equal, and that therefore the resistance of the milliammeter must be equal to the value of the resistance shunted across its terminals. Our next step is to determine the value of this resistance.

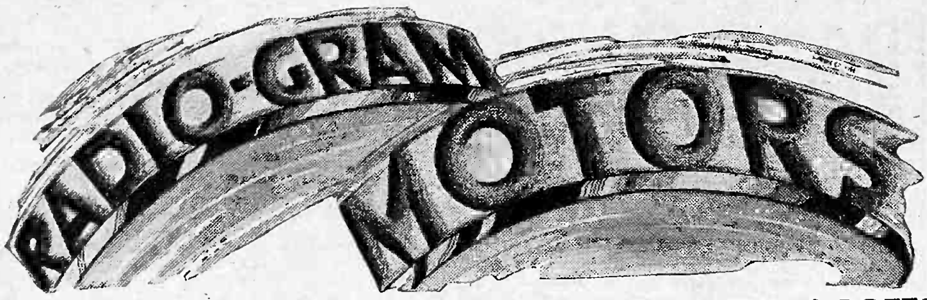


We know that the current flowing in the circuit was .005 amp.—5 milliamps.—and that by Ohm's Law the total resistance of the circuit will be given us by R = E/C and that is 2/.005 = 400 ohms. This 400 ohms includes the value of the variable resistance, the resistance of the milliammeter, and the internal resistance of the accumulator. These individual values do not matter to us, as we only want to know the total resistance of the circuit.

Keeping the variable resistance Vr in the same position, and breaking the circuit at x and y, we insert the adjusted 30-ohm variable resistance. On completing the circuit by the switch we find that we shall get a new reading on the milliammeter. In the case under discussion this was 4.78 milliamps. We now find that the total resistance of the circuit is 2/.00478, which gives a total resistance of 418 ohms, and, as the total resistance has increased from 400 ohms to 418 ohms, it follows that the added resistance is 18 ohms, and this is also the resistance of our milliammeter.

This result was checked by another method and the results agreed very closely.





Including Some Practical Points About Needles.

By ALFRED J. POTTS

IN response to many requests I propose in this article to enlarge upon that recently published in PRACTICAL WIRELESS, and to add several new points and hints.

In the previous article I dealt with the various types of motors, including the synchronous type, which during the description of this type, I stated to be only suitable for use with A.C. mains. This, of course, was quite true, and still remains so, but it should be added that since the article was written at least one of the manufacturers of this type of motor has put a converter on the market to enable these motors to work from D.C. mains. This is, of course, carried out by converting the D.C. to A.C. and working the motor from the latter. Unlike most converters sold for similar purposes, this one is quite cheap, in fact, the motor and converter can be purchased together and yet still be cheaper than any of the universal motors. In addition, one has the satisfaction of knowing that even if the mains should be changed from D.C. to A.C., the motor is still perfectly satisfactory, all that has to be done is to disconnect the converter and carry on with the motor in the ordinary way. Fuller details can be obtained if required from the makers of "Simpsons" Electric Turntable, which is a very compact type of this motor.

Spring Motors

Dealing with spring motors, I mentioned that spring "barrels" should be kept filled with a thick grease, and I have been asked what grease should be used for this. There are many suitable greases available, but probably the best for the purpose is "graphite grease." This consists of a fairly thick grease in which *very* fine powdered graphite is mixed. This graphite helps to reduce friction to the very minimum, and helps to prevent the grease from changes in consistency which often takes place in the ordinary greases. It should be added here that the mixing of the graphite in with the grease is a very difficult job, so do not attempt to do it yourself. In any case, it is not expensive to purchase, and a double spring motor can be re-greased for about a shilling, whereas if you try mixing it yourself you might soon be needing a new motor! By the way, it is best to put the new grease into the barrels after the old has been cleaned right out; do not put in just enough new grease with the old to make up the required amount.

As mentioned before, particular care should be taken when removing the spring from the case. I have known one to spring out and inflict severe cuts on the hands, and the damage which might be done to the face can easily be imagined. If you *must* take the spring out, tie it before removal with strong wire twisted tightly round it with pliers, before attempting its removal, in a similar way to which new springs are tied when purchased separately.

Lubricating Oil

The motor must be kept well oiled, but do not drown it as when working all the excess oil will be thrown about owing to centrifugal force. For the same reason the oil used, while it must be fairly thin, should not be *too* thin. Remember, it is far better to oil a little at frequent intervals rather than apply a lot of oil at long periods. With regard to rattles and humming sounds which are caused by bad design of the motor, most motors are supplied with some form of anti-vibration washers, very often of fairly soft rubber. These are put one each side of the motor board and the fixing screws passed through them to the motor. If these washers are to act satisfactorily they must not be screwed up so hard that they are squashed flat. They should only be screwed up sufficiently hard to firmly fix the motor so that when the turntable is placed on its spindle it does not "wobble." If the edge of the turntable is pressed down hard with the hand a slight give should be felt. This will indicate about the best adjustment for use.

Correct Mounting

Another point often overlooked when a gramophone motor is being mounted is the necessity of having it mounted perfectly level. It is very important, both from the point of view of wear and quality of reproduction, that this should be done. If it is not level, the needle will press far more on one side of the groove than the other, thus causing very uneven wear, and consequent ruination of both record and quality. A good test as to whether the turntable really is level is to place a record on it and start the motor; then bring the pickup over the edge and carefully lay it on the *blank* part of the record at the outside edge. This is usually about ¼in. to ⅜in. wide, and if the needle is placed in the centre of this it should stay there all the time when it is released. If it tends to slide towards the centre, or into the grooves, it is not level, while if it slides off the edge of the record, the same remarks apply.

Of course, the record used must be a fairly new one and must not be buckled. In any case, it will not damage the record, as the proper way to place the needle on the record is to place it on the edge and to slide it gently into the grooves. Most of the scratches and damage that takes place in the first few grooves of records are caused through carelessly placing the needle on the record.

About Needles

While on the subject of needles, it will not be out of place to mention that most people choose a "loud" or "extra loud" needle and let it go at that. Others choose the semi-permanent type of needle, while others choose the so-called "permanent" type, which are claimed to play 150 times. I will deal briefly with each type in turn.

First, then, the ordinary steel needle. In almost every case where a pick-up is used with "extra loud" and "loud" needles a volume control has to be used rather drastically. There are many good reasons for using the softer needles. They bed down deeper in the grooves and do not cause so much wear on the sides of the grooves.

Next there is the semi-permanent type of needle. The makers of these state each can be used ten times, which means ten *sides*, or five records. They are usually of medium tone, and with most pick-ups give very good quality.

Then there are the so-called "permanent" type, some of which are claimed to give 150 playings. These needles are made of fairly soft metal, with a very fine, short wire of an extremely hard material inserted for the point. This gives a much longer playing time to the needle, but once inserted they must not be taken out until worn out, as they cannot be replaced without causing damage to the records.

There is one other type of needle and that is the fibre kind. These needles certainly do minimize wear, but they have to be often resharpened for good results.

CLASS "B" AND THE STRAIGHT THREE

(*Continued from page 702*)

of driving, we shall have turned our 3-valve set into a 2-valve set from the point of view of sensitivity, which would seriously diminish volume on the local stations unless they are close, and remove altogether the foreigners.

To preserve the necessary three stages it will be necessary to add the 240 B as an extra valve, which would make stability difficult to obtain when decoupling is so limited by the high-tension battery voltage.

The solution for those who wish to use a straight three is to use the first L.F. valve as a driver, but to employ a suitable pentode which will more than make up for the loss of one stage.

Using a Pentode as Driver

Fig. 2 shows the diagram of a three-valve set with a pentode as driver. The pentode valve used should be one of the economy type, and will therefore require a very high anode load. This load is not critical, but an ordinary 1:1 transformer would be useless, and recourse must be made to a Class B transformer having a step-down ratio as high as 3:1 each half.

The bias on the pentode valve may be somewhat critical, but as there is only one grid-bias plug the best value will be easily found, remembering to use the highest possible bias without impairing quality of reception, as this procedure will effect an economy in H.T. current consumption.

It will be seen in Fig. 2 that a condenser has been placed across each half of the primary and the driver secondary, which is a precaution that is strongly recommended, as it prevents any possibility of parasitic oscillation, which would cause the anode current to rise so high that the H.T. battery life would be greatly reduced.

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, entitled "Modern Radio Practice," was given by Mr. P. W. S. Valentine, A.M.I.E.E., of Messrs. Mullard Wireless Service Co., Ltd., at the meeting held last week. After stating that the improvements in the last year or two had been far-reaching, and that he was dealing with the subject from the aspect of valves, he mentioned early circuits and triodes and the development of the screen-grid valve. He then passed on to the variable or multi-mu valves, screened pentodes and multi-mu screened pentodes. A number of excellent slides were shown, including eight which showed the stages of manufacture of the screened pentodes. A.V.C. and modulation came next, after which followed Class A and Class B amplification.

A lantern lecture entitled "Sea routes to the East, Gibraltar to Malta" was also given by Lieut.-Commander Brewster recently. Commencing with the Straits of Gibraltar there followed a most interesting description of the Rock, general conditions and a short history. Passing on to Malta here again a very complete description of the town and the inhabitants was given. A large number of excellent slides were shown, some of them proving of considerable interest. The lecture was thoroughly enjoyed by all present especially as the lecturer was able to recount a number of personal experiences. The Society, which offers exceptional facilities to anyone interested in wireless, still has room for new members. Details and advance programme can be obtained from the Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

THE CROYDON RADIO SOCIETY

The Croydon Radio Society discussed Electronic Music for its meeting on Tuesday, November 14th, at St. Peter's Hall, South Croydon. The lecturers were Mr. Harwood and Mr. Budd, who brought an electronde to demonstrate electronic music. The instrument was described as one in which the player produces electrical vibrations which by a loud-speaker are changed to sound vibrations. Mechanical and electrical means were used to produce the electrical vibrations. The electronde was an example of the latter method, having two oscillating valves and tuned circuits, one at a fixed frequency and the other's frequency was varied by the player's hand moving to and fro. This instrument was connected to the aerial input of any wireless receiver, and Mr. Harwood showed what it could do. In performance a wide frequency range was obtained, nine and a half octaves being possible.

Mr. W. J. Bird, a member, gave his maiden lecture on Tuesday, November 21st, at St. Peter's Hall, South Croydon. The topic was "Electrical Measuring Instruments, and their Application to Wireless Receivers." He was soon relating in a brisk manner the design of various types, such as the moving-iron, moving-coil, hot-wire, electrostatic and other types used for particular purposes. Mr. Bird explained very clearly just why one type of meter had an advantage over another, and the percentage accuracy of each. It was pointed out that 100lbs. per square inch might be the pressure on an instrument's pivot, and its shape was discussed in detail. For the point, jewels were used, sapphire being most popular. Finally, Mr. Bird demonstrated various meters, some unique types being on exhibition.

Another short-wave night was held on Tuesday, November 28th, at St. Peter's Hall, S. Croydon. Mr. P. Deacon, head of the short-wave section, described improvements he had effected in his receiver. For instance, a screen-grid detector now gave increased amplification, and what was more, resulted in the almost entire elimination of hand-capacity effects. Mr. Deacon described other experiments such as on the new tuning inductance with special wire, and his home-made choke. In the demonstration which followed, two Empire stations, two Moscow transmitters and a German, as well as many others unidentified were all well received. A discussion on harmonic interference, heterodyne whistles, dead spots and anode feed resistances, concluded a most instructive meeting. The next short-wave night is on Tuesday, December 19th, the last meeting of 1933. The New Year's fixture cards are nearly ready, and PRACTICAL WIRELESS readers are invited to write for one.—Hon. Sec., E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

THE SOUTHALL RADIO SOCIETY

A lecture entitled "Modern Radio Practice" was given by Mr. Carter of Mullard's Wireless Service Co. at the meeting held last week.

After dealing briefly with the developments in H.F. and L.F. amplification, he proceeded to describe the H.F. screened pentode, double-diode-triode and Class "B" Valves. Particular mention was made of the necessity for coils of high dynamic resistances for the full benefits of the H.F. pentode to be realized.—Hon. Sec., Mr. A. J. Stephens, 98, Pole Hill Road, Hillingdon.

BEC RADIO SOCIETY

A series of interesting and instructive lantern slides, explaining step by step how the Catkin valve is manufactured, were displayed to members of the Bec Radio Society during a lecture on the "Catkin Valve" which was given by Mr. W. G. J. Nixon, of the General Electric Co., Ltd., at the Society's headquarters on Thursday, November 23rd.

The method of assembling the electrodes in the Catkin valve was of particular interest. Whereas in the ordinary valve the makers are obliged to introduce curves in the wires and supports of the electrodes, this disadvantage has been overcome, and now a straight assembly of the electrodes gives almost complete uniformity. The introduction of the rubber mounting, and the special mica separators for the electrodes, were other points demonstrated on the screen.

Mr. Nixon gave some useful information regarding the double-diode-triode, the indirectly-heated cathode rectifier and the D.A.100, and concluded his lecture by demonstrating a G.E.C. super-heterodyne receiver employing the new valves. Prospective members desirous of enrolling for the new session should communicate with Mr. A. L. Odell, Hon. Sec., 9, Westway, Grand Drive, Raynes Park, S.W.20.

INTERNATIONAL SHORT-WAVE CLUB, LONDON

The subject at the London Chapter meeting held on Friday, December 1st, at the R.A.C.S. Hall, Wandsworth Road, S.W.8, was "Short-Wave Reception and Superhets." A very interested assembly listened to Mr. J. L. Hills, who lectured on superhets. He afterwards demonstrated a Faraday S620L, A.C. All-wave Receiver. Members were particularly interested in the application of A.V.C. on stations which showed deep fading. Among the features arranged for future meetings are morse instruction at each meeting from 7.45 to 8.15 p.m., lectures, demonstrations, and set construction, etc. All PRACTICAL WIRELESS readers are welcome.—A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

THORNTON HEATH RADIO SOCIETY

A meeting of this Society was held at St. Paul's Hall, Norfolk Road, on Tuesday, November 21st. Mr. S. J. Meares presided. By the courtesy of Messrs. Igranic Electric Co., Ltd., a lecture was given on short-wave reception illustrated with lantern slides. The lecture was delivered by Mr. Dabbs. After dealing with the general phenomena accompanying the propagation of short-waves, the principle of short-wave reception was dealt with, and also the circuits most suitable for the reception of short-wave signals, namely, the "straight," the super-regenerative, and the super-heterodyne. The various circuits were shown on the screen and their outstanding points described. Particulars of future lectures and demonstrations can be obtained from the Hon. Sec., Mr. J. T. Webber, 368, Brigstock Road, Thornton Heath.

PROPOSED RADIO CLUB FOR WOOLWICH AND DISTRICT

Readers interested in the proposed formation of a Radio Club for Woolwich, Plumstead and district, are invited to write for further particulars to Mr. D. J. Fryer, 151, Griffin Road, Plumstead, S.E.18.

GOLDERS GREEN AND HENDON RADIO SOCIETY

The greatest interest was shown in a recent meeting organized by the above Society. Over 250 members were present, including representatives from the Radio Society of Great Britain, Northwood Radio Society, and a number of other clubs. Mr. F. Harwood, describing the various types of electronic musical instruments, pointed out that these instruments could be broadly divided into two classes: those in which the electrical vibrations were produced by mechanical means and those where the vibrations were produced by purely electrical means. Examples of the numerous effects produced by the various types of electronic instruments were given by means of gramophone records. The mechanical class was first shown. Amongst the electrical class which utilize in some form a thermionic valve or a Neon discharge tube to generate purely electrical vibration, may be mentioned the Trautonian, which is fitted with a number of tone-control knobs. The two records heard showed eight different timbre effects. The electronde is designed to be attached to a wireless receiver. Pitch is controlled by movement of the hand towards a metal rod. Interruption of sound is effected by a switch in the other hand and volume is controlled by a simple foot pedal. Various pieces of music of a classical nature were played on the apparatus, and were greatly appreciated by those present. K. Ashley Scarlett, Vice President, 60, Pattison Road, London, N.W.

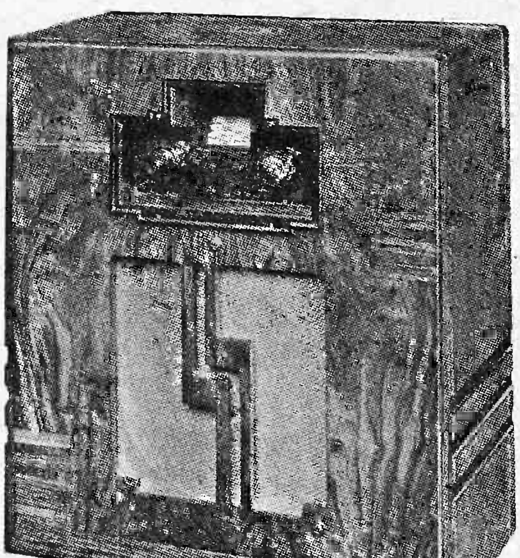
HACKNEY RADIO AND PHYSICAL SOCIETY

Recently Mr. Ashby, B.Sc., gave a very interesting lecture on Metal Rectifiers. After prefacing his remarks with a description of the components making up a metal rectifier and the method of manufacture, the lecturer compared the metal rectifier with its counterpart—the valve—and spoke on the advantages and disadvantages of both types of rectifiers. The various methods of utilizing metal rectifiers were then dealt with at length, various ways of using the Westector being of exceptional interest. In a very novel way the function of an input transformer and metal rectifier was demonstrated with a cinema film. Lantern slides depicting voltage regulation curves, etc., were also shown. Details of further meetings will gladly be sent to any local reader of PRACTICAL WIRELESS on request to the Secretary, A. F. Rogerson, 19, Sewdley Street, Clapton, E.5.

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

WATBRO D.C. ELIMINATOR

A VERY good example of a D.C. eliminator has been received from Messrs. Watkins Bros. & Co., and has been thoroughly tested in our laboratories. The eliminator is finished in the usual metal case with a black "crackle" coating, and the front portion is sloped and provided with four sockets and a control knob for a variable tapping. The sockets are marked "—," "S.G.," "90," and "150." A really substantial length of connecting flex furnished with a mains plug is attached for connection to the nearest lighting main socket. On the underside a small terminal is fitted and a label fastened to this emphasizes the necessity for removing the earth lead from the receiver and connecting this instead to the terminal on the eliminator. This is, of course, necessary in order to avoid the possibility of short-circuiting the mains should the positive main lead be earthed. The unit was connected and loaded to provide various voltage readings and these were checked off against the makers' figures. The total output is rated at 30 m.a., and this figure was given with a voltage of 155 against the makers' 150. At this load the detector tapping of 90 volts was slightly below that figure, with the S.G. tapping at its minimum figure. It was found possible to obtain an output of 150 volts at 25 m.a., with 90 volts at 5 m.a., and then to permit of an adjustment on the S.G., potentiometer of 0 to 40 volts. These figures show that the eliminator is highly suitable for the operation of the standard type of receiver; and the tapping points in the unit are adequately decoupled, thus preventing the possibility of instability due to back-coupling. The price of the unit is 22s. 6d.



The new H.M.V. Portable Grand which was referred to on page 547 of the Nov. 25th. issue.

BENJAMIN CLASS B OUTPUT CHOKE

THE latest type of Benjamin Class B choke is provided with four tapping points, permitting of matching with practically any type of Class B valve, whilst also enabling the choke to be employed, if desired, with pentode valves in Quiescent Push-pull. The primary winding is rated at 400 ohms, and on test was found to be actually this value. The tapping points provide ratios of 1.2 to 1, 1.6 to 1, 1 to 1, 1 to 1.6 and 1 to 1.9, and these various ratios are obtained by joining the loud-speaker and the anodes to the terminals in various combinations. Thus, the anodes joined to the two ends of the winding and the speaker joined to terminals 1 and 4 gives a ratio of 1.2 to 1, whilst by joining the anodes to terminals 2 and 3, and connecting the speaker to the two ends of the winding enables the ratio to be altered to 1 to 1.9. The choke is thus truly universal, and will enable many variations to be carried out in the output stage so that the optimum setting can be found under any conditions. The price of this handy choke is 11s., and the makers are Benjamin Electric Ltd.

VARLEY POWER PUNCHER

THE title of this component may seem rather out of the ordinary for wireless components, and, indeed, its use may not seem actually to be supported by its title. It does not punch power out of a receiver, nor does it actually add more punch to a weak receiver. What it does is to economize in H.T. current and thus permit the use of a small output valve and H.T. battery whilst enabling loud signals to be obtained without distortion. The effect is very similar to that obtained with a Class B valve, namely the anode current varies with the signal strength. The device consists of resistances, condensers, and a metal rectifier, and it is included in the anode circuit of the output valve somewhat after the manner of a filter-fed loud-speaker. As the anode current passes through the device and is rectified by the metal rectifier the bias applied to the output valve is varied, and this enables a preliminary excessive bias to be applied with a consequent economy in H.T. current. As the signal increases in strength the bias is automatically reduced, thus permitting a larger anode current to flow. In this way a smaller H.T. battery may be used, and will last for a considerable period, owing to the fact that the excess bias keeps down the anode current consumption, and provided the receiver is not adjusted so that very great volume is obtained for the whole of the listening period, there will be a consequent economy. The price of the Power Puncher is 15s. 6d.

NEW FERRANTI RECEIVER

NEWS is to hand of a new Ferranti receiver, namely the Arcadia Console. This is of the pedestal type, just under three feet in height, and has the novel feature of a pair of openings through which the tuning scale is viewed, and these are fitted with lenses giving great magnification. The actual setting of the tuning condenser is therefore obtained with ease. The price is 23 guineas.

W. B. EQUILODE.

A NEW speaker announced by the Whiteley Electrical Radio Co., Ltd., is intended to fulfil as an extension speaker the same function as that performed by the "Microlode" as the set's principal reproducer. In the same way that the "Microlode" is arranged to match any output stage, so the new "Equilode" can be used as an extension from the "extra speaker" terminals of any set on the market. The necessity for a speaker of this type is due to the lack of any standard practice among set manufacturers in their method of arranging extra output terminals. Some allow for the use of a speaker fitted with an output transformer having a similar primary impedance to the one already fitted in the set and connected in parallel with it. Others take leads from the existing speech-coil connections, and stipulate the use of an extra speaker having a speech coil of similar impedance and connected direct without transformer. Even in this latter case different speakers are normally necessary for different sets, for some use a speech coil of 3 ohms impedance, some of 5 ohms, and three well-known makes require a 9 ohms speaker. In the "Equilode" an adaptation of the "Microlode" method is used to match the speaker accurately to the set and existing speaker. It is emphatically claimed by the makers that in each case volume on the "Equilode" is exactly equal to that of the set's principal speaker, and they have so far found no case where the use of the two speakers instead of one entails appreciable loss of volume. Full instructions are, of course, issued with each instrument. The price is 33s. 6d. in chassis form and 48s. 6d. in a walnut finished cabinet with the characteristic "W. B." fret.

NEW TRIOTRON UNIVERSAL VALVES

A NEW range of Universal A.C./D.C. valves is announced by the Triotron Radio Co., Ltd. These have a 20 volt filament taking .18 amps. The Variable-mu H.F. pentode is designed for a maximum anode voltage of 200 and a screening-grid voltage of 100 volts. The price is 12s. 6d. The H.F. pentode having similar characteristics with the exception of the variable grid bias control is priced also at 12s. 6d. A special detector, having an amplification factor of 100 and a slope of 4 m.a./v costs 8s. 6d., whilst an output pentode, delivering an undistorted output of 1,350 milliwatts, costs 12s. 6d.

NEW COLLARO AUTOMATIC RECORD PLAYER

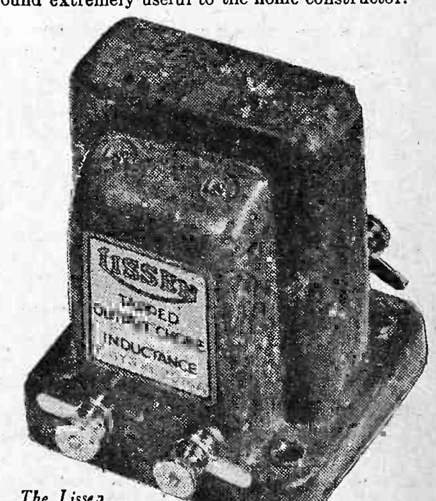
FROM Messrs. Collaro, Ltd., we have received details of their new automatic device which enables one to instantly convert a radio receiver into an automatic radio-gram, and has the added advantage that no lid has to be opened for the purpose of placing the record on the turntable or changing the needle. It will play any size of record without any adjustment. There are no controls and the record is automatically returned when it has been played through. A slot is provided near the top of the instrument and the record is inserted into this slot in the course of which it switches the current on. If desired the record may be rejected before the playing is concluded. As the record passes out through the slot the current is automatically cut off so that no waste can occur. At the present moment the instrument can only be obtained for operation from A.C. mains, but it is stated that a D.C. model will shortly be obtainable. The ingenious "Empire" self-starting induction motor is fitted, together with the well-known Collaro "No. 20" Pick-up. As a table model the cost is £8 17s. 6d., and as a low-boy model the price is 10 guineas. In addition, a special chassis type is available at £6 18s. 6d.

G.E.C. BATTERY H.F. PENTODE

THE new battery pentode, type VP.21, has now been received and tested. The valve is obtainable only with a metallized surface, and, unlike the ordinary metallized valve, this coating is joined to one of the pins on the valve base, which in this case is fitted with the new seven-pin arrangement. A further novelty lies in the fact that the suppressor grid is also brought out to a separate terminal. Thus, the pins on the base of this valve are joined to filaments, control grid, suppressor grid, metal coating and screening grid; one pin being left unconnected. The anode is joined to the terminal on top of the valve in the usual S.G. arrangement. The valve was first tried in a normal H.F., Det., and L.F. receiver, with marked superiority in the results. The actual applied potentials were not by any means correct, but the change revealed a splendid improvement. The various voltages were then adjusted to operate the valve at its best point, and the metal coating was joined to earth. The actual H.F. gain was very noticeable, many stations previously only just audible being brought up to comfortable strength, and no sign of instability being discernible. The valve will prove extremely valuable to the battery user and enable him to gain many of the advantages of the mains receiver with no additional cost. The price is 15s. 6d.

LISSEN TAPPED OUTPUT CHOKE

THIS choke is intended for use in any circuit where its characteristics render it applicable, and these are quite a number. For instance, it may be employed as a smoothing choke in a mains unit; as an output choke following a power valve; as a low-frequency coupling choke, or as a push-pull output choke. It is thus of the universal type, and although fitted with four terminals it is actually only a centre-tapped choke. One end of the choke is taken to one terminal marked "P," whilst the centre-tap is marked L.S.—. The other end of the choke is joined to two terminals, marked H.T. and L.S. positive. In an output position the choke may be included in the anode lead between H.T. positive and the anode of the valve, and a loud-speaker may be filtered from the centre-tap or from the anode, thus permitting two different ratios. In a push-pull circuit the two ends are connected to the two anodes with the centre-tap to H.T. positive, and the speaker fed from the two anodes, either direct or through 2 mfd. fixed condensers. The inductance at 7 m.a. is 18 henries, and at 40 m.a. this drops to 12 henries only. The D.C. resistance is 400 ohms, and the maximum permissible current is 50 m.a. At 7s. 6d. this represents very good value and will be found extremely useful to the home-constructor.



The Lissen Tapped Output Choke.

RECORDS for CHRISTMAS

A Selection of Some Bright Numbers for the Festive Season

FROM Caruso's re-created voice singing in English to a complete recording of a Gracie Fields music hall act is the scope of the December issue of new "His Master's Voice" records. This is probably the finest collection of records that has ever been issued at one time. Every record is made by a celebrity.

During the past year "His Master's Voice" have made great strides in perfecting their process of voice re-creation, and the two new Caruso records—*For you alone* and *A Dream, H.M.V. DA*1349, and *The Lost Chord* and *Ombra mai fu, DB*2073—are the outcome of the new improved process. These records headed the list of Caruso's best sellers during his lifetime, and he learnt English to make the records specially for "His Master's Voice" in English. The first two titles were made in the big studio at St. John's Wood with a special orchestra conducted by Lawrence Collingwood. Wearing headphones, he alone of the musicians was able to hear the voice of the dead singer. The other titles were made with organ accompaniment at the Kingsway Hall. Herbert Dawson, the organist at St. Margaret's, Westminster, who is responsible for the new accompaniment of these records, said, after the session, that it had been one of the eeriest of his life to accompany a singer he had never heard in person.

These latest Caruso records will be an excellent medium for introducing a new generation to the greatest tenor of all time.

Elgar Conducts Own Compositions

First thoughts of English music bring to mind Sir Edward Elgar and his many compositions depicting English life. This month "His Master's Voice" release a new recording of the *Cockaigne Concert Overture* on *DB*1935–6, in which Sir Edward conducts the B.B.C. Symphony Orchestra. These records were made just prior to his illness. They are wonderful recordings and every tone of the great orchestra has been faithfully captured on wax. The work depicts in music a stroll round London at the beginning of the present century. There is no doubt about the brilliance of the sun in the opening bars—we can see the Houses of Parliament, the river and the bridge over it, the horse buses and Whitehall looking fresh and clean in the warm sun. We watch a pair of lovers strolling intimately through a shady side way (what tender, loving music Elgar writes for them) until a group of Cockney urchins catches our attention. Now a military band comes within earshot with its grand brassiness and swagger of the dawn of the century. The urchins follow them and are soon lost to sight, but we can still see the lovers, although we forget them when a Salvation Army band, playing rather out of tune, demands our attention. Now the lovers turn into a quiet church, and we hear the deep notes of the organ as we watch their mutual absorption. Back we go to the street, and Elgar leaves our love of London, our pride, our humour and our inborn gusto for life.

On the last side, *DB*1936, Sir Edward conducts the B.B.C. Symphony Orchestra in giving a grand representation of his own *Pomp and Circumstance March No.* 4, which is considered by many to be finer than the one *Land of Hope and Glory* was derived from.

The other records of serious music in the first consignment of *H.M.V.* December discs is a new recording of the most popular concerto in Britain—Greig's *Concerto in A Minor, H.M.V. DB*2074–6.

Stroh Violins in Orchestra

In 1909 Wilhelm Backhaus created another milestone in musical history by making the first gramophone records of a concerto—Greig's in A Minor. He tells us that it is practically impossible to realise now the difficulties under which these records were made. The sounds of the orchestra and soloist were captured on to wax by a crude mechanism of two horns and a thin glass diaphragm actuating a sapphire point. "A full-size orchestra was out of the question," said Mr. Backhaus. "We had to use Stroh violins with horns in place of the ordinary instruments, and I remember that all players discarded first their coats, waistcoats, shirts and eventually finished the recording session wearing only their trousers, as the heat in the small recording room, with no ventilation, was so great."

This new recording of Greig's Concerto in A Minor by Wilhelm Backhaus and full Symphony Orchestra was made under vastly different conditions in one of the new H.M.V. studios at St. John's Wood.

Gracie Fields' Act Recorded Complete

The most unusual records to be issued since the first of the re-created Caruso records twelve months ago are H.M.V. C2625–7, on which is recorded a complete performance of a Gracie Fields act at the Holborn Empire. The applause of the audience and the whole atmosphere of the English variety stage is captured on these records. Gracie sings nine of her songs and the wildly enthusiastic welcome she is given, can be clearly heard.

These records are quite unique. They were made under conditions of the utmost secrecy by means of a number of microphones secreted in the foot-lights and in the wings of the theatre; special wiring connected these microphones with the "His Master's Voice" Mobile Recording Laboratory which was parked at the side entrance of the theatre. In order not to arouse suspicion the Laboratory was disguised as a furniture pantechnicon, special canvas covers bearing the name of a well-known Furniture Store being mounted on the Laboratory for the evening.

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).

The "Orbit" Again

SIR,—I would indeed be an ingrate if I failed to express to you my *complete* satisfaction and appreciation of your "Orbit." It leaves nothing to be desired, as far as my opinion is concerned. Undoubtedly, it is the ideal family set. If you could see my "junk-box" you would realize how many circuits I have constructed and then discarded as not being up to my hyper-critical standard. I could always find something lacking with them. Anyhow, I shall not have any inclination to pull the "innards" out of my "Orbit," of that I am certain. I had to wait three weeks before my dealer obtained the coils and an additional week before he got the A.V.C. unit. When I switched on, I heard the locals all over the dial on both wave-lengths. After a few hours the volume fell to nothing. It took hours of patient searching before I found out that both coils No. 1 terminals were making poor contact with the soldering tags and eyelets. Pulling the connecting wire did not disclose the trouble. A spot of solder on each soon put them right, and in a very short time I realized what you meant when you described the set as being like a superhet.

Wishing you every success and thanking you for a very fine circuit.—C. T. HOWARD (London, N.15).

From a Chinese Reader

SIR,—I am glad to tell you that I have received my Encyclopædia. I have read every page of it, and can definitely say that it is "the book" for the wireless enthusiast.—CHAN WAH LEE (Singapore).

An All-Pentode Three Wanted

SIR,—I think it is time that you included in your excellent paper an All-Pentode Three. What I require is an A.C. set, consisting of perhaps Colvern Ferrocart coils, F1, F2, and F3. A Mullard V.P.4, Mullard S.P.4, and a Mazda A.C.-Pen, a reliable 3-gang condenser, a good transformer, and a good speaker would complete it. I think we might get some good stuff from this.—M. A. FLOOK (Gloucester).

The "Orbit" Still Going Strong

SIR,—I thought it would interest you to know we have two "Orbits" in the family now, and I'm shortly going to construct a third, so that we shall all have the latest type of receiver. Please don't tempt us by bringing out yet another battery set; let's wear this one out first. I started wireless in the good old days of the crystal, and amplifiers and long, long handles, and, of course, the units, and then —well, progress beat my pocket, so for some years I dropped it. Strange as it may seem, I happened to go on a long train journey and bought a copy of PRACTICAL WIRELESS No. 1 by mere accident, for I certainly had not heard of its publication. Since that time I have built many sets. I now have all the issues of PRACTICAL WIRELESS up to date, and what an asset they have been. Going back to my second "Orbit," with the two separate tuning condensers (I do not like ganged ones, because I do not think one has so much control), at 3.55 a.m. on a Monday morning recently, I again heard Schenectady, U.S.A., and on the L.S. this time, but using a separate amplifier. The "Nicore" does definitely remove fading, especially on Athlone, Poste Parisien, and Fécamp.—A. J. PEDLAR (Holloway).

"Action and Reaction"

SIR,—Although I always read with deep interest the articles by "Photon," I feel called upon to hurl my gauntlet into the lists in a friendly spirit when he attempts to answer that "ridiculous" question: "What happens when an irresistible force is brought to bear on an immovable object?" by the statement that "the abutment gives way." Now honestly, sir, this is a most unfortunate example to choose as, logically, one cannot have an "irresistible force" if one allows an "immovable object."—J. E. BISHOP (King's Cross).

[*Our contributor was merely being humorous.—Ed.*]

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT the short-base variable-mu valve offers the same degree of control with its short grid-bias adjustment as the ordinary type with a much greater variation.

—THAT in view of the above, the battery short-base valve requires only a 9-volt bias battery instead of a 15- or 16-volt battery.

—THAT when placing a variable resistance across the secondary winding of a transformer care should be exercised that the quality is not impaired, as the characteristics of the transformer are considerably altered by this method of control.

—THAT when tightening nuts on components in a receiver it is sufficient only to lock the nut to finger tightness—there is no need to use grips or pliers.

—THAT several faults in receivers sent to us for test have been found to be due to the excessive tightening of a nut resulting in the rear portion coming away, or wires being sheared off.

—THAT soldered connections should also be carefully made in order not to loosen the internal connection in components such as transformers, fixed condensers, chokes, etc.

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.*

"ORMOND" PRODUCTS

IN addition to a fine range of loud-speakers and condensers, a new Logging Drum Dial is shown in the latest booklet issued by Ormond Engineering Coy., Ltd. This dial is a distinct advance in design as, in addition to its attractive appearance, provision is made for logging stations on either side of the graduated scale round the drum, the dial surface of which can be illuminated. A well-finished bakelite escutcheon plate, with control knob to match, is provided, and the slow-motion device incorporated is of strong construction, the action being remarkably smooth. Condensers can be connected on either side, the whole assembly being extremely simple. In the loud-speaker section there are models designed for use with Class B and Q.P.P. output, and mains energized instruments for use on D.C. supplies. Another new Ormond component is a three-gang condenser which has been developed after careful research work, and incorporates the latest principles in modern practice. Maximum rigidity is assured by the all-steel frame, and each section is provided with an individual trimmer. The capacity of the trimmers is 70 mfd. Also included in the booklet are slow motion midget and differential condensers, and small solid dielectric condensers. Copies of this useful booklet can be obtained from Ormond House, Rosebery Avenue, London, E.C.1.

HIVAC VALVES

HIVAC valves are the result of several years of intensive research work, and no pains have been spared to produce a high-class valve at a reasonable price. They embody the latest and most advanced methods of construction, and great care has been taken to ensure that individual valves are up to characteristics. In a neat folder, just issued, comparative tables are given of equivalent valves, from which can be seen at a glance the characteristics and prices of Hivac valves in comparison with similar valves of other makes. Full particulars with characteristic curves of the full range of Hivac valves is given in a booklet of data strips, copies of which can be obtained on application to The High Vacuum Valve Coy., Ltd., 113–117, Farringdon Road, London, E.C.1.

THE WESTINGHOUSE BATTERY SUPERHET

WE have received from the Westinghouse Brake and Saxby Signal Co., Ltd., a copy of their envelope containing constructional details and operating instructions for their new battery superheterodyne receiver. This receiver has been designed particularly for the use of constructors who wish to make the best use of Westectors, of which two are used in the circuit. A number of recent developments are embodied in the receiver, which employs five valves and provides first-class reception of a large number of alternative programmes. Single dial tuning is provided, with a scale calibrated in actual wavelengths. The design has been simplified as much as possible in order to utilize only those materials which are readily available, and in many cases components requiring soldered connections have been chosen with a view to reducing cost. The layout of the receiver is particularly neat and businesslike, the speaker being arranged at the side of the chassis. Amongst the refinements included in the circuit are A.V.C., pentode output, battery economizer circuit, tone correction, and provision for pick-up. Westectors are used as a second detector and in the battery economizer circuit. It may be mentioned here that it is not the intention of the Westinghouse Coy. to construct and market these receivers, nor will it be possible for them to undertake construction, test, or servicing for the constructor. The envelopes, which contain, in addition to the book of instructions, full size prints of the wiring diagrams, chassis, and panel layouts, are priced at 1s., and can be obtained from The Westinghouse Brake and Saxby Signal Coy., Ltd., 82, York Road, London, N.1.

RAWSWOOD TRANSFORMERS

MODERN machinery and the finest quality raw materials combine to make Rawswood mains transformers high-class and dependable components. They undergo stringent stage by stage tests, leaving an ample margin of safety against overload and breakdown. Windings carrying normal loads are wound with enamelled copper wire, the windings of high potential are of enamelled S.S.C. copper wire, whilst the low-tension windings conveying heating current to wireless valves are of D.C.C. wire. A full range of these transformers is given in an attractive folder, in which filter chokes, power packs, H.T. eliminators, and trickle chargers are also listed. Interested readers are advised to write for a copy of this folder to The Rawswood Electrical Coy., Preston New Road, Blackpool.

"THE WIRELESS AND GRAMOPHONE TRADER YEAR BOOK AND DIARY"

THE 1934 edition of "The Wireless and Gramophone Trader Year Book and Diary," just published, contains many new features of great assistance to retail traders. This is the tenth successive year of its publication, and the size of the book has been doubled, which makes it much more convenient for reference purposes. There are several new features, including a section giving complete technical data regarding all makes and types of valves on the market, accompanied by an article explaining the functions of all the new multiple valves. Complete details of two entirely new manufacturing licences (the "Pool" A.4, and the Phillips-Mullard), are included with lists of important patents. "Practical Methods of Fault Finding" deals generally with repair work. Full instructions are given for the building of a "Universal Valve-testing Panel" to test every type of valve and an A.C. Public Address Amplifier capable of giving up to 15 watts undistorted output. All the regular features which have proved valuable in the past are retained, including the list of mains voltages throughout the country. The Directory Sections have been re-arranged to provide more rapid reference. These include a Classified Buyers' Guide; the Directory of Trade addresses, giving manufacturers, agents, and allied firms addresses, branches, telegraphic addresses, and 'phone numbers; "Directory of Wholesalers", arranged alphabetically and territorially.

In addition, there is an excellent diary (two pages to one week), ruled with cash columns. Altogether this is a book no trader can afford to be without.

The price of the book remains the same, *viz.*, 5s. 6d. post free, with a special rate of 3s. 6d. post free to subscribers to "Trader" Journals. It is published by The Trader Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.

WESTINGHOUSE METAL RECTIFIERS

THE construction of H.T. battery eliminators and battery chargers, embodying Westinghouse Metal Rectifiers, is fully dealt with in a useful handbook entitled "The All-Metal Way, 1934." The book, which is primarily of interest to home constructors who prefer to build their own apparatus, covers the subjects of rectification, battery elimination problems, mains conversion, and battery charging. New units are introduced for use with receivers employing Q.P.P. or "Class B" amplification. There is also a section devoted to Westectors and their uses in various circuits. The book is well illustrated with diagrams which should be very useful to the home constructor. Copies of the handbook can be obtained for 3d. each, post free, from The Westinghouse Brake and Saxby Signal Company, 82, York Road, King's Cross, N.1.

REPLIES TO BROADCAST QUERIES.

SEARCHER (Westbury): Madrid (EAJ7); gramophone records and election speeches. R. H. M. (Bromsgrove): Amateur transmitters: G6OI, Major J. Timbrell, King Edward VI School, Stourbridge, Worcestershire; G2NV, H. Littley, "Radiohm," Bridgnorth Road, Stourton, Stourbridge, Worcestershire. It is impossible to trace telephony transmissions without some idea of wavelength. RECEIVEM (Nottingham): We can trace the following call signs: G6UB, S. W. J. Butters, "Walla Brook," 84, Guy Road, Beddington, Croydon, Surrey; G5RD, A. R. Gardner, "Ashleigh," Abbots Langley, Watford, Herts.; G5SR, S. Riesen, 35, Wood End Road, Sudbury Hill, Harrow, Middlesex; G6KO, J. B. Sturrock, Kirkbuddo, Forfar, Angus, Scotland; F8VM, Michel, 53, Avenue de Lyon, Clermont-Ferrand (Pûy-de-Dome), France; F8WZ, Antonin Michel, Argeres-en-Beauce, France; F8JJ, Etabl. Bélin, 296, Avenue de Paris, Rueil-Malmaison (Seine-et-Oise), France; F8JD, Bastide, 26, rue Taupin, Toulouse (Haute-Garonne), France; F8LO, Jourdan, 15, rue Hoche, Cannes (Alpes-Maritimes), France; F8TR, Thibault, 7, rue des Ecoles, Villeneuve-St. Georges (Seine-et-Oise), France; F8QI, Nicaud, 104, rue Victor-Hugo, Tours (Indre-et-Loire), France; ON4AJ, A. Redemans, 150, Chaussée de Charleroi, Brussels, Belgium. KEITH WRIGHT (Lancs.): Very much regret, but we are unable to trace the amateur call signs you give as they are not published in the latest lists. BALCH (Derby): (1) WIOD, Miam Beach (Fla.), 230.6 m.; (2) Either WTAM, Cleveland (Ohio), 280.2 m., or WTIC, Hartford (Conn.), 282.8 m.; (3) WCAU, Philadelphia (Pa.), 256.3 m. QRA'S PLEASE (W.1.): We can trace the following call signs: (1) EAR185, Edmundo Mairlot, El Caleyo, Asturias, Spain; (2) G6TA, C. D. Abbott, 120, Cavendish Road, Balham, S.W.12; (3) G5VB, A. F. Elton Bott, "Francisca," Barlow Road, Hampton, Middlesex; (4) G5YH, C. H. Chorley, 78, Nightingale Lane, Balham, S.W.12; (5) W6DRE, H. F. Rawls, 80, West Lewis Avenue, Phœnix (Ariz.); (6) W1EW, Albert L. Roberts, Chatham (Mass.); (7) EAR182, Rafael Fernando, Avenida Alfonso XIII, 323, Barcelona, Spain; (8) CT1BG, José Pinheiro, 1, Sargento da G.N.R., Vizeu, Portugal; (9) G2YC, H. J. Stannard, 18, Wimpole Mews, Cavendish Square, W.1.; (10) EAR73, Martin Colon and J. Mangrave, Mallorca 152, Barcelona, Spain; (11) OK2RP, amateur transmitter, Czecho-Slovakia; (12) CT1JC, Claudino Diniz, Penafiel, Portugal; (13) G6QK, R. F. Hilton, 14, Overton Drive, Wanstead, E.11; (16) VQ3BAL, amateur transmitter, Tanganyika; (17) G6CJ, F. Charman, "The Cottage," Parkway, Long Lane, Hillingdon, Middlesex; (18) G2ZQ, J. Hunter, 63, Hervey Road, Blackheath, S.E.3; K. YARNOLD (Gloucester): W2ZG, Fred J. Becker, 905, South Alden Street, Philadelphia (Pa.); K4SA, Richard Bartholomew, Barrio de Sabana Hoyos Garrochales, Porto Rico. TIGER ISLAND (Ingatestone): W3BMS, G. F. Hall, 535, West Horter Street, Philadelphia (Pa.); W2KI, R. P. Liptrott, 1,422, Beverly Road, Brooklyn, New York, U.S.A.

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.

VOLUME CONTROL

"I wish to fit a volume control to my set, the circuit of which is enclosed herewith. What do you think would be the best form of control to fit? I have not yet bought anything for the control, so that I am perfectly free to buy just what you recommend."—J. L. (Hampstead).

The circuit which J.L. encloses is of the standard H.F., detector and L.F. type, and is battery-operated. In view of your situation there is a possibility that the input from the London stations may be sufficiently powerful to overload the detector valve so that this indicates that a pre-H.F. volume control should be fitted. This may consist of a differential reaction condenser wired in the aerial circuit, with the aerial joined to the moving plates, and one set of fixed plates connected to the normal aerial terminal, and the other set connected to earth. On the other hand, there is the possibility that you need a control which also will be operative when using the receiver for gramophone reproduction, in which case we would recommend the inclusion of a variable resistance across the primary of the L.F. transformer. The value will, of course, have to be chosen with care in order not to spoil the quality of reproduction, and you should consult the transformer manufacturer's data sheet regarding the actual value.

FOUR-VALVE SUPERHET

"I have four good mains valves by me, namely, H.F. pentode, S.G., det. and pentode, and I should like to make up a really powerful set with these. I am not certain of the best circuit to include these in, and wondered whether the A.C. Fury Four would be worth making, using these valves instead of those you suggested. I do not mind how much I spend on the set, but I should very much like to use the valves, as they were a present, and I would like to do them justice. Is it possible to use the superhet arrangement with these particular valves?"—T. C. A. (Leicester).

Quite a good modern circuit may be made up with the particular valves which you have, T. C. A. You would require a pair of band-pass coils and an oscillator coil, together with two I.F. transformers. The band-pass circuit would be used to couple the aerial to the pentode, which would perform the dual function of first detector and oscillator, and the oscillator coil would be fed by the cathode injection method. The variable-mu S.G. valve would serve as I.F. valve, and the ordinary valve would be used as second detector. The pentode would be coupled by a transformer or resistance-capacity coupling in the usual manner. Either a metal-oxide or valve rectifier should be employed in the mains portion of the apparatus, and this would give you a very good receiver.

TONE CONTROLS AND QUALITY

"I notice that in most of your circuits using a pentode valve, and in some others as well, you include a tone-control. I have been thinking round these devices, and it appears to me that they must spoil the quality as must also the whistle filters, which I have seen you recommend before. Surely, if a device is used to cut out the top notes the quality of a band, for instance, will be impaired. I should like to have your remarks on this question."—T. Y. (Blackheath).

A tone control device employed with a pentode valve is included solely for the purpose of removing the *excessive* high-note response. This valve has the peculiarity that certain high frequencies are amplified to a greater extent than some of the low frequencies, and this results, if not corrected, in an unbalanced reproduction rather on the shrill or squeaky side. The high-note filter, or tone control, serves to remove some of this, but it must not be adjusted to remove all of it, as the fault will then be present in another form. The whistle filter, on the other hand, is designed to cut off all frequencies above a certain value in order to avoid reproduction being spoilt by the presence of a high-pitched whistle which is received with the carrier wave, and although it is obvious that top notes of certain values will also be eliminated, it is a question of the lesser of two evils. If the music cannot be tolerated with the higher notes removed, then it surely cannot be tolerated with a whistle accompanying it. Actually, however, the frequency is so high that no cut-off will be noticeable unless the apparatus, including the loud-speaker, is so good that these frequencies are reproduced with the full volume, and all that will be appreciated when the device is included is a slight change in tone, with the whistle completely eliminated.

DATA SHEET No. 65.

Cut this out each week and paste in a notebook.

BRITISH ASSOCIATION (B.A.) SCREW THREADS

B.A. No.	Effective Diameter m.m.	Diameter m.m.	Pitch m.m.	Depth of Thread m.m.
0	5.4	6.0	1.0	.6
2	4.215	4.7	.81	.485
3	3.66	4.1	.73	.44
4	3.205	3.6	.66	.395
5	2.845	3.2	.59	.355
6	2.48	2.8	.53	.32
7	2.21	2.5	.48	.29
8	1.94	2.2	.43	.26
9	1.665	1.9	.39	.235
10	1.40	1.7	.35	.21
12	1.135	1.3	.28	.17

D.C. CHARGING

"My house has now been fitted with D.C. mains, and I am wondering whether it is worth while fitting a D.C. charger for my accumulator. I have bought an H.T. unit, but I read that the charger will have to dispose of 190 odd volts, and as this must be wasted, I am wondering whether the waste will be more than the cost of charging. What do you advise?"—G. J. (Muswell Hill).

The accumulator requires to be charged, say, as half an amp, and if you are on 200-volt mains, this means that you will need a 100-watt lamp in series with the accumulator in order to give the correct charging rate. If you use a lamp of this order in the living-room, there is no reason why you should not fit up a small charging board and only charge the accumulator when you are using the lamp. It should not be difficult to find one or two evenings when there is nothing in the programme to interest you and thus enable the accumulator to be charged, or alternatively, you can buy a second accumulator. Naturally, if you are going to put such a lamp in circuit during the daytime there will be no save to you, but by adopting the above arrangement you should certainly be able to keep the battery in good condition.

THE WAVE-LENGTH SHUFFLE

"I read in the papers that most sets will become obsolete when the new wavelengths come into operation next year. Surely this cannot be so, as I cannot imagine the B.B.C. allowing anything to happen which will render the majority of sets obsolete. I should like your re-assurance on this point."—T. B. S. (Margate).

You need have no worry at all regarding the forthcoming change-over. All that will happen is that certain stations will change their position on your tuning dial, and if your particular dial happens to have the station names *only* on it, then it will be a little more difficult for you to find the new positions, but beyond that there will be no other ill-effect. On the contrary, there will be some improvement as Radio-Paris, for instance, will be found much lower down the dial, thus permitting of its easier separation from Daventry on the simpler types of receiver, whilst Königswusterhausen will also be found in a more easily-tuned spot on the dial.

SPARKS AND FLASHES

"I have a mains set which I bought from a cheap wireless store near me, and I am rather afraid to use it. We are on D.C., and when I switch on, although I can hear music, the set gives off flashes now and then, and sometimes you get a shock when you turn the switch. The shopkeeper said it is all right, but we are afraid to use it. Can you suggest what is wrong?"—S. T. (Holloway).

We do not know whether S.T. is pulling our leg, but certainly if the set gives off flashes it is dangerous to use it. However, we rather think that this query is meant to be a joke, in which case, of course, we can only treat it as such and offer no solution. If, however, the case is genuine, we shall be glad to offer some suggestions on receipt of more detailed information.

TESTING AN H.F. CHOKE

"I have got one or two old components by me and am rather doubtful as to their efficiency, etc. I have tested the fixed condensers by means of charging up, as you have mentioned before, and the resistances have been measured and found in order. I have, however, got an old un-named H.F. choke and I should like to get some idea of its values. Can you help me to do this?"—D. B. (Croydon).

The resistance of the choke may, of course, be measured by means of a meter and battery. By connecting a milliammeter in series with the choke and battery the current flowing will enable you, from Ohm's law, to ascertain the resistance. The voltage is divided by the current expressed in amps, giving you the resistance in ohms. It will help you if you remember that the resistance is most likely of the order of 400 ohms or so. The inductance and self-capacity need not be measured so long as you can ascertain that the choke acts as it is intended, and this can be checked by joining it across the tuning condenser in a standard receiver.

FRAME AERIAL CONSTRUCTION

"I wish to build a set with self-contained frame aerial and should like to know whether I would gain anything if I made this absolutely efficient in every direction. That is to say, if I used Litz wire, made a framework which had only the very minimum of solid material in it, and used ebonite combs for holding the wires, would I get louder signals? Perhaps you could give me some hints?"—Y. A. F. (Pontnewydd).

The frame aerial should, of course, be made fairly efficient, although there would be very little gain from going to all the trouble you mention. The difference in signal strength obtained with a thick wire frame as compared with a Litz wire frame would not be noticeable and would certainly not justify the expense of the latter wire if you intend to construct a small frame for a small self-contained receiver. On the other hand, self capacity should be kept down, and by using spacing strips at the corners, and removing some of the wooden framework you would certainly add slightly to the efficiency. Space the medium-wave winding with about one-tenth of an inch between turns, and keep the long-wave winding about half an inch from the medium-wave winding.

FREE ADVICE BUREAU

COUPON

This coupon is available until Dec. 23rd, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 16/12/33.

PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these columns at the rate of 3d. per word. Minimum charge 3/-. All advertisements must be prepaid.

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).

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, T.C.C. 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 milliamps with 4v. 3-5 amps. C.T., L.T., 37/6.

T.C.C. Condensers, 750v. working 2 mf. 3/6, 4 mf. 6/-, 4 mf. 450v. working 4/-, 250v. working 1 mf. 1/3, 2 mf. 1/9, 4 mf. 2/6; aqueous electrolytic 440v. working, 4 mf. 3/-, 8 mf. 3/6.

ALL the following Lines 6d. each or 5/- per dozen: 5-pin chassis mounting valve holders; shielded screen grid or pentode leads 1-watt wire end resistances, any value; 0.1 condensers; on-off switches push-pull; .01, .05 and 0.5 condensers.

AMSCO Triple-gang 0.0005 Condensers, with trimmers, 4/11.

T.C.C. Electrolytic Condensers, 100 volts working 15 mfd., 1/3.

PREMIER Chokes, 40 m.a., 25 hys., 4/-; 65 m.a., 30 hys., 6/-; 150 m.a., 30 hys., 10/6.

PYE Chokes, 20 hys., 4/-; Premier multi-ratio output transformers, giving 15 different ratios, 7/6.

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

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 50,000 ohms, any value; 3/6.

KOLSTER BRANDES Gramophone Motors, dual type, can be worked by clockwork or mains, induction type 100-250 volts, 27/6; complete with all fittings and turntable.

SPECIAL Offer.—Microphones by prominent manufacturer, high sensitivity, uniform response, complete with stand, transformer and battery; listed £3/15, our price 18/6.

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

ORMOND Condensers, 2-gang, semi-shielded; 2/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-115v. or 200-250v., output 180-0-180 volts, 40 m.a., 4v. 1a., and 4v. 3a., 4/6; 100-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have engraved terminal strips with terminal connections, input 200-250 volts, 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v., 60 m.a., rectified, with 4v. 1-2a. and 4v. 3-5a., L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER H.T.9 Transformer, 300v. 60 m.a., rectified, with 4v. 1-2a. and 4v. 3-5a. L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. L.T. and screened primary, 15/-; with Westinghouse rectifier, 26/-.

CENTRALAB POTENTIOMETERS, 200 ohms and 400 ohms, 1/-. 250,000 ohms, 50,000 ohms and 500,000 ohms, 2/6.

ROLA F7 MOVING COILS, 1,000 Ohms. FIELD, 20/-; MAGNAVOX 142, 1,000 Ohms. FIELD, 22/-. PLEASE STATE WHETHER POWER OR PENTODE TRANSFORMER REQUIRED. A.C. CONVERSION KIT 10/- extra.

FOLLOWING VALVES USED FOR TEST ONLY. CALLERS ONLY. MS4B, MS4, DSB, DS, PT4, S4VB, ALL HALF PRICE.

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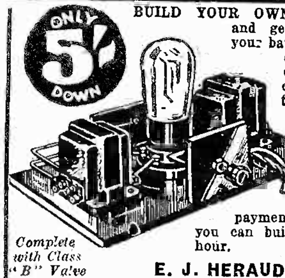

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