TESTING SHORT-WAVE COILS—See page 63.

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EVERY WEDNESDAY

April 6th, 1940.

Contents

RADIO CAREERS

Practical and Wireless
PRACTICAL TELEVISION

EVERY WEDNESDAY
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EDITED BY
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ROUND THE WORLD OF WIRELESS

Adding Range

WHEN considering the question of increasing the range of a short-wave receiver the usual procedure is to add an H.F. stage. But there is a better scheme which not only increases range but at the same time increases the efficiency of a receiver out of all proportion to the small addition which is made. We refer to the inclusion of a short-wave converter. The only drawback to this type of unit is that the receiver with which it is employed must include H.F. amplification. A further drawback to the addition of another stage when considering mains apparatus is that the additional current is not readily obtainable, and if the supplies in the receiver are tapped off it may result in inefficiency in the receiver. In this issue we describe an efficient converter which may be used with either A.C. or D.C. receivers, and this includes its own mains section which, by making use of the A.C./D.C. type of circuit which does not include a mains transformer, cuts down expense and at the same time removes all difficulties associated with the provision of the additional L.T. and H.T. supplies. We must emphasise once again that this type of unit is only useful with receivers having H.F. amplification (and this includes superhets) whilst for the simpler type of receiver without H.F. an ordinary adapter must be employed.

Novachord Recitals

"VOX NOVACHORD," a programme featuring the unique musical instrument which simulates dozens of others, may be heard over WLW on Tuesdays at 7.15 p.m., E.S.T. Gene Perazzo (staff organist at WLW) will be the novachord artist, and will be accompanied by a string ensemble.

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Grand National

ONE of the biggest racing events of the year will again be brought right into the homes of listeners when a running commentary is given on the Grand National at Aintree on April 5th. This commentary, which has one of the biggest audiences of any programme in the year, is also to be broadcast to the Forces in France. R. C. Lyle will be responsible for the preliminaries, and the commentaries on the actual race will be by Richard North and Raymond Glendenning. The points from which the commentaries will be made are the Starting Post, the Grand Stand, and the Canal Turn.

Breathless Last Minutes in Sport

AN edition of "Fan Fare," the Scottish sports radio magazine, will be presented once again by R. F. Dunnett in the Forces programme on April 5th. This time it will be a slightly revised edition of the first war-time "Fan Fare" which was heard in the Home Service on January 16th. He has recreated in dramatised form at the microphone exciting last minutes of famous sporting encounters in Scotland—Association and Rugby Football matches won with the last kick before the whistle, and boxing matches, such as Benny Lynch's victory over Peter Kane.

The increase in interest in radio as a career lends point to this illustration of a novel service tester of the analyser type used in the G.E.C. laboratories.

"Composer Cavalcade"

THE next programme in the popular "Composer Cavalcade" series will again be devoted to that prolific melodist, Irving Berlin. There are few composers of modern popular music who could stand the strain of more than one programme of this nature. Irving Berlin is certainly one of them, and most of his 700 compositions can bear constant repetition. Some of his songs have been for some years classics in their own field. Among those which are to be broadcast on April 3rd are "Easter Parade," written for "Stop Press" in 1933; and "A Pretty Girl is Like a Melody," which was composed in 1919 but was revived for that monumental musical film "The Great Ziegfeld" in 1936. More recent is "Now it can be Told" which was the only new number in "Alexander's Ragtime Band"—based on Berlin's successes and shown in 1938; and "Back to Back" from the Sonja Henie-Tyrone Power film, "Second Fiddle." Phil Cardew, who will be remembered for his work in the recent Ray Noble programme, will again be responsible for the arrangements.

The Vale of Evesham

IN peace-time Charles Gardiner and Robin Whitworth collaborated in a programme about the Vale of Evesham and the life of the fruit and vegetable growers on its rich soil. This programme has been brought up to date, and will be revived on April 13th with local speakers. Mr. Gardiner is Clerk to the Evesham Rural District Council.

Radio Careers

There are Specialised Branches of Research Available to Experts in Certain Fields

A specialist testing insulation in an elaborate air-conditioned cabinet. This is used for special tests in conjunction with tropical apparatus.

IN previous issues we have dealt with the subject of radio as a career, and although the industry has been subdivided into various sections some of these have naturally had to be dealt with rather briefly. Radio production does not embrace merely electrical processes, but when the individual components and apparatus used in radio are examined it will be found that there are several sciences introduced in their production. Take, for example, the ordinary valve. Apart from the various mechanical details, there is also the question of the chemical composition of the filament or cathode, and in this direction trained chemists are employed on research. Metallurgists also play their part in the production of special materials for grids and anodes. Many modern radio components, and even cabinets, are now made from bakelite, and again this is a chemical production which was not special to radio in the first instance. It will thus be realised that trained physicists, chemists, etc., can also find an outlet for their abilities in modern radio, and these professions require specialised training at the end of which some academic degree would be taken.

These specialised trainings are, of course, more suited to the young man who is just finishing his education, and who is thus more easily able to transfer to one of the universities or a branch thereof.

Postal Training

There are, further, specialised training centres which cater for tuition by post to reach certain high standards such as those mentioned, but in general it is not a simple matter to obtain the necessary degrees without attending a centre where the necessary practical experience may also be obtained. A perusal of some of the "Situations Vacant" columns published in certain quarters recently will show that there are still many vacancies for specialists such as those mentioned. It is also often possible to obtain junior posts as assistants to such experts, where practical experience may be gained, although again a really sound general education is one of the most important features. As an idea of the salary to be expected, the Air Ministry recently advertised for laboratory assistants having good general education with theoretical training in electricity, practical experience of receivers or electrical testing, and at the age of nineteen the salary offered was 40s. to 70s. per week, according to the qualifications and experience of the applicant. Next week we shall deal more completely with this subject, and an important announcement will be made. Order your copy now.

Impressions on the Wax

Orchestral Recordings

PROMINENT among the record releases for this month is a number of interesting orchestral recordings. First, there is the famous "Nutcracker Suite," played by The Little Symphony Orchestra, conducted by Alexander Smallens, on three 10-in. records, complete in album with leaflet, costing 8s. 6d.—*Decca F* 7360-2. Equally well known is Offenbach's "Tales of Hoffmann" a selection from which is played by The Regent Concert Orchestra on *Decca F* 7228. In the "Permanent Music" series is a recording by The Boyd Neel String Orchestra of "Concertino in F Minor" and "Largo" (Concerto in F) on *Decca X* 148-9. Two more old favourites make their appearance—"The Whistler and his Dog" and "Teddy Bears Picnic," played by the Belgrave Salon Orchestra on *Rex* 9643.

New Record Album

ALSO amongst this month's new record releases is an album which admirably illustrates a popular song development that is probably unique. Sung by Bing Crosby, Brunswick sponsors a set of twelve cowboy songs. "Boots and Saddle" and "I'm an old Cowhand," are two examples, both of which are included in the album.

The original cowboy songs were not folk songs in the strict sense of the term. The ranch boys used any old tunes there were around for borrowing and fitted words expressive of their thoughts and actions to old tunes. The tune of "My Bonnie Lies over the Ocean" was better known as "The Cowboys' Dream." But although there were many such adaptations, it finally resulted in a great number of modern songs in cowboy vein.

Twelve of the best of these are sung by Bing Crosby in this new album, which includes, as well as the two previously mentioned titles, such evergreen favourites as "Silver on the Sage," "A Gold Mine in the Sky," and "My Little Buckeroo," *Brunswick O* 2923-8.

Gershwin's Concerto in F

A LONG overdue recording featured in the Brunswick lists this month is that of Gershwin's "Concerto in F." Most people think Gershwin's large scale works begin and end with the famous "Rhapsody in Blue." The concerto is a much more broadly planned work. Although originally written for symphony orchestra, this special version now recorded by Paul Whiteman serves, perhaps, to further emphasise the essentially jazz style of the composition. The slow movement in particular is very beautiful. Paul Whiteman shows that he is still the leader of one of the greatest dance bands ever, while his pianist, Roy Bargy, gives a fine performance of the difficult solo part. *Brunswick* 0145-6. Funny how the old tunes won't lie down. Most recent of song re-incarnation is "Oh! Johnny, Oh! Johnny, Oh!" which dates back to 1917 and which has now been introduced into the new edition of "Black Velvet." The most intriguing record of it is by Arthur Young and the Hatchett Swingtette. This unusual little band, which is built around the Novachord and uses the unique fiddle playing of Stephane Grappelly, records on *Decca F* 7045. Elsie Carlisle also sings this tune on *Rex* 9734, and couples it with "Mr. Jones (Are You Coming to Bed)."

An even older melody than the "Johnny" song is "Tristesse," which is a modern dress version of one of Chopin's loveliest tunes. Ambrose has recorded it on *Decca F* 7400, while there is an alternative version by the Inglese Tango Orchestra on *Decca F* 7395.

TESTING SHORT-WAVE COILS

A Simple Method which the Experimenter will Find Particularly Useful

TO the short-wave enthusiast, the construction of coils affords endless scope for interesting experiments. But the average home-constructed S.W. coil, though made with certain basic principles of coil construction in mind, is very often a "hit or miss" affair, which requires testing under working conditions before being incorporated in an experimental circuit. This "testing under working conditions" presents a problem, unless certain equipment is available.

Many constructors prefer the "plug-in" method of incorporating their coils, mounting them on old 4-pin or 7-pin valve bases. But, even assuming a plentiful supply of valve bases, it is annoying to complete a masterpiece of soldering only to find the coil unsatisfactory or inefficient in operation.

To obviate this difficulty, the following method was devised, and has been completely satisfactory, having the additional advantage of testing both 2-circuit and 3-circuit coils with equal facility, simply by throwing a switch. The necessary apparatus consists merely of a strip of ebonite about an inch wide and six terminals, preferably of the "telephone" type.

Ebonite Terminal Strip

The ebonite is first drilled to take a row of six terminals, spaced approximately one inch. Lacking any other suitable strip of ebonite, it may be noted that the ebonite holder of the slotted type used for supporting the old "basket" coils can be profitably employed. No drilling is necessary when this type of holder is used, since the terminals can be firmly fixed at equal intervals along the slot. Further, the slot helps to reduce surface leakage between adjacent terminals.

The ebonite strip is then fixed in an upright position by means of small angle brackets, or even pushed firmly into a slotted cork screwed to the baseboard. The terminals should be numbered 1 to 6 from top to bottom, and then the panel permanently incorporated in your favourite circuit. Fig. 1 shows, semi-pictorially, how this is done in the case of a typical frequency-changer as employed in short-wave converters. Fig. 2 gives the connections for a simple two-valver. The scheme may also be adapted for use in various other circuits.

The switch in the aerial circuit needs some explanation, as its function is important. This must be a good anti-capacity S.P.C.O. switch, since any capacity across its terminals will defeat its object, which is to enable 2-circuit (grid and reaction) coils and 3-circuit (aerial, grid and reaction) coils to be tested on the same panel. When the aerial lead is switched to terminal 2, the aerial coil is brought into circuit. Where no aerial winding is used, the change-over switch connects the aerial directly to terminal 3; that is, in the grid line.

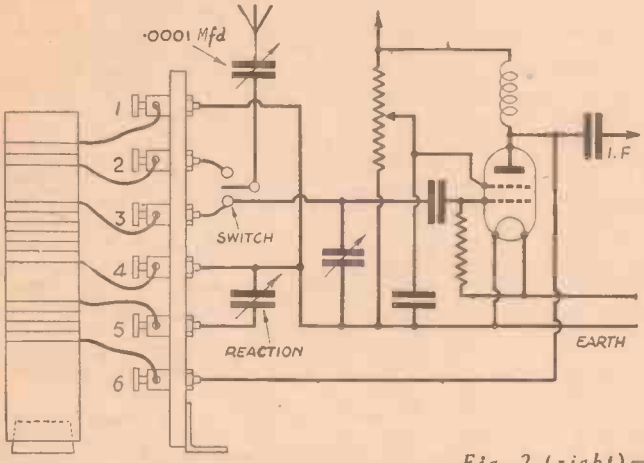


Fig. 1 (left).—Circuit diagram showing the simple coil-testing method applied to a frequency-changer circuit.

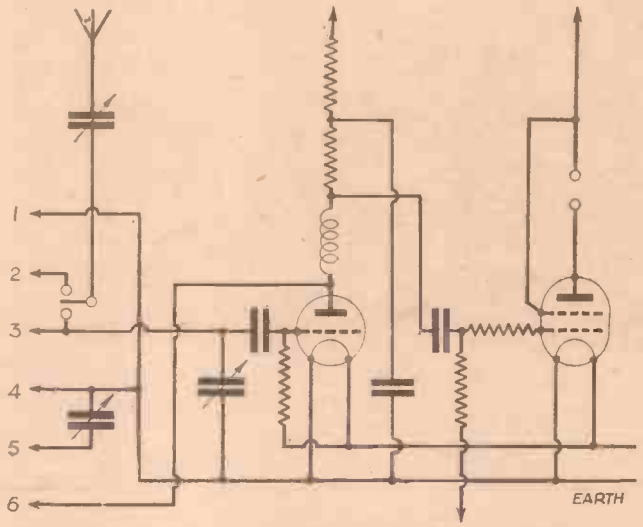


Fig. 2 (right).—Circuit diagram showing connections for a simple two-valver.

Coil Construction

When constructing coils for use with this apparatus, it must be remembered that all the windings are made in the same direction round the former, otherwise the correct "sense" will not be obtained, and the circuit will not operate efficiently, if at all.

There should be no difficulty about connecting the coils to the panel. With 3-circuit coils, beginning at the aerial end, the first lead goes to the first terminal, the second to the second terminal, and so on, down to the bottom of the reaction coil. With 2-circuit coils, terminals 1 and 2 are not used, and the aerial lead is switched to terminal 3.

To support the coil firmly in position when all connections are made, a large tapered cork or piece of wood is screwed to the baseboard, close to the terminal panel. The coil former is pushed over this, preventing any movement and consequent variations in inductance. Changing coils is a matter of seconds and has the advantage that no soldering is necessary.

The .0001 mfd. aerial series condenser, which is pre-set or fully variable, will require different settings for different coils (and these may be easily found after a little experimenting) to remove "dead-spots."

Finally, a few hints that may make a great deal of difference.

(a) Choose a piece of good quality ebonite; leakage losses can be considerable when inferior ebonite is used. To bring these losses to a minimum, try roughening the surface with a piece of emery cloth.

(b) When wiring the terminal panel in the circuit, do not forget that most important law of S.W. construction: keep all leads as short and direct as possible.—G. W. B.

Using Television Relay Stations

BEFORE the war the use of a number of small relay stations was put forward as an alternative suggestion to the employment of a cable link for the purpose of transferring the television programme signals generated at Alexandra Palace to one or more stations in the provinces where the programme would be rediffused for the benefit of inhabitants within the local service area. The authorities went so far as to state that tests were being conducted to ascertain the merits and demerits of each system with a view to accepting one of them for inaugurating the plan of provincial television. In the United States steps have already been taken to put the relay method on trial, with the idea that subsequently this can link up a network of television stations and so furnish a television service over a very wide area. The American experiment was undertaken with a main television broadcasting station, the signals from which were received at the relay station many miles distant. A special aerial array beamed in the proper direction and supported on 400ft. masts ensured that the received signal was satisfactory in every respect. From this point the vision and sound were fed to the local broadcast transmitter, so that all receivers within the service range of the latter were provided with ample signal strength to operate the sets, although in normal circumstances the sets were well beyond the service range of the main radio transmitter.

EXTERNAL AIDS

Simple Additions which May Be Made to Any Receiver for Improvement Purposes

By W. J. DELANEY

MANY constructors have a receiver which they have built or purchased and which, whilst it is more or less quite satisfactory, would lend itself to some slight improvement in one direction or another. At the same time they hesitate to make any modification to the actual wiring or components in view of the fact that they may spoil the results they are already obtaining. It should be realised, however, that it is still possible to effect improvements outside a receiver without, in some cases, actually interfering with the wiring or components in any way. Such improvements are, by the very nature of things, limited in their scope, but it is quite possible to effect considerable improvements to the working of a receiver by such means in certain cases. For instance, a receiver may be built without an output filter. If the receiver is self-contained such a filter is not essential. But as soon as an extension speaker is needed with the set, then some form of output filter is essential to avoid the passage of the H.T. supply through long leads with a consequent loss of voltage and inefficient working of the output stage. A mains unit may be purchased for the purpose of operating a battery set from the mains, and this may result in instability. Decoupling will, therefore, have to be added, and this also may be included outside the receiver. Selectivity may not be quite good enough. A wave-trap may be added to sharpen up the tuning. These are only a few of the directions in which external aid may be included and the exact lines of inclusion will now be detailed, so that the scheme may be followed in individual cases.

Output Filter

Taking the case of the inclusion of an output filter first. This consists only of an L.F. choke and a fixed condenser, and thus may very easily be added. In commercial receivers the choke is replaced by the speaker transformer which is fitted to the receiver, and sometimes the addition of an extension speaker does not silence the built-in speaker. In other cases a special silencing switch is fitted, but this is on the secondary side so that the speaker transformer is still in circuit. However, if you wish to use a single speaker and so avoid the expense of an additional model, then when it is removed from the set and taken to another room the transformer primary must be replaced in the receiver, and this is where the iron-core L.F. choke is used. Obviously, the output arrangement would be modified so that the speaker, whether used direct against the set or in another room, is filter-fed and the new arrangement is shown in Fig. 1. The choke and condenser could be screwed on the side of the cabinet, and a pair of terminals added. One of these is joined to earth and the other to the condenser, and then the speaker may be joined to the two terminals, or the single lead from the extension point joined to the "live" terminal. The choke should be of the ordinary type, having a rating of about 20 to 30 henries and capable of carrying, say, 30 mA. The fixed condenser should be of the 2 or 4 mfd. type and capable of standing the H.T. voltage used with the set.

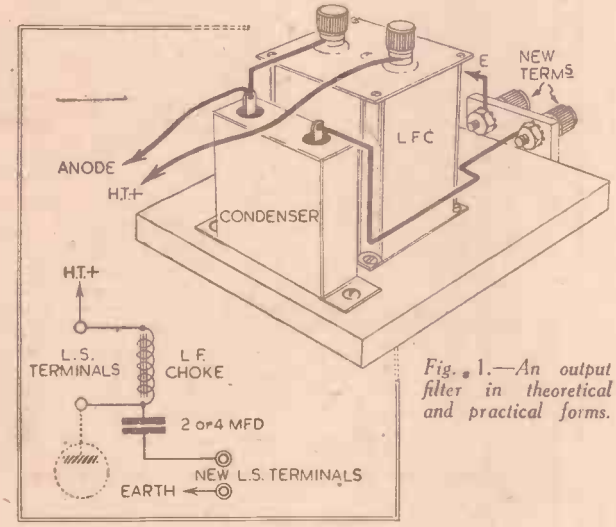


Fig. 1.—An output filter in theoretical and practical forms.

Decoupling

The problem of adding decoupling components is not quite so simple and depends to a great extent upon the type of receiver, that is, number of H.T. leads, and the type of mains unit being employed. It is often found when the S.G. or detector plugs on a simple mains unit are used for the supply of a battery set used with multi-battery cords, that instability sets in due to common coupling in the mains unit. In such a case the battery leads should be connected through decoupling circuits to a single maximum H.T. terminal on the mains unit. It may be possible to do this with only one of the battery leads, say, the detector feed, or the screen-grid feed, and therefore it may be desirable only to make up one such unit first and connect this. If it does not effect a cure, transfer it to the other lead, and if still ineffective you will have to use another circuit in the other lead. The decoupling unit itself consists merely of a fixed resistance and by-pass condenser, the latter preferably being of the 2 mfd. type and the resistance being selected according to the amount of H.T. which can be dropped in the circuit. Thus, if the detector stage is normally fed with 66 volts and the H.T. is of the 120 volt type, there is approximately 60 volts to dispose of, and the detector current will only be about 1 milliamp. This means that the resistance would be 60,000 ohms. If you wish to work out values for yourself divide the voltage to be dropped by the current in milliamps and multiply the answer by 1,000. The two components may be mounted on the cabinet or on a small piece of wood, and the H.T. battery lead joined to the junction of resistance and condenser, and the other side of the resistance is taken to the H.T. maximum socket or terminal on the mains unit. The free side of the condenser is, of course, joined to earth. If more than one unit is required it may be mounted on the same small base to preserve a compact arrangement.

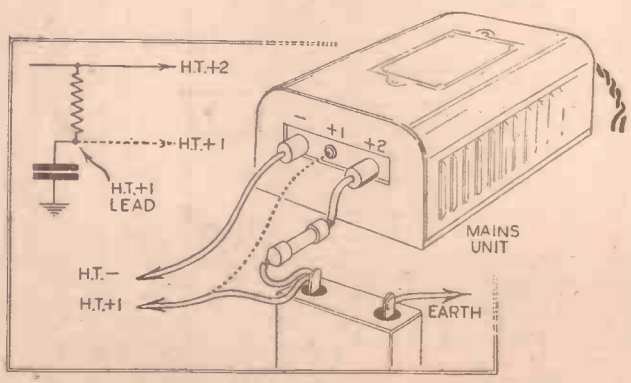


Fig. 2.—How to add decoupling components when using a mains unit.

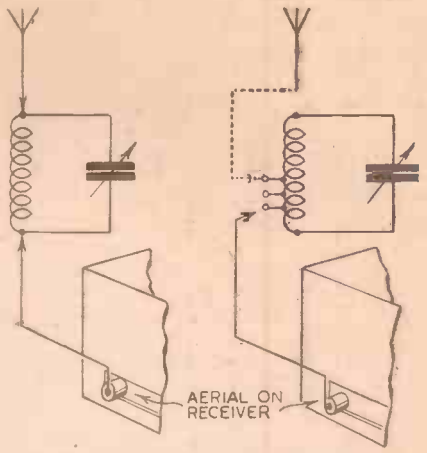


Fig. 3.—Two simple wave-trap arrangements.

Wave-trap

Where the problem is one which concerns selectivity the necessary addition of a wave-trap may be effected in an exactly similar manner. The condenser needed in a wave-trap need not be of the large, air-spaced type, but one of the small solid-dielectric variety generally employed for reaction control purposes. This may be mounted on the side of the cabinet, and the coil may also be mounted inside the cabinet near the condenser. The aerial will have to be joined to one side of the wave-trap

(Continued on page 80.)

ON YOUR WAVELENGTH

By Thermion

Definition of a Lowbrow

IN a case recently heard at Tottenham Police Court in which a lady was involved in a dispute with her husband she said :- "My husband has no ear for real music. He listens to B.B.C. concerts, operas, and such-like, but when a dance band comes on he turns the wireless off."

Now we know what a lowbrow really is.

Death of Professor Edouard Branly

THE names of Marconi, Fleming and DeForest have become so fixed in the public mind in connection with radio that few remember the pioneer work of Professor Edouard Branly who was one of the earliest pioneers of wireless. He died on March 24th at the age of 96. He invented the first practicable appliance for the detection of certain electro-magnetic waves, using as a detector a glass tube of iron filings—the primitive form of coherer. This is the device which was later used by Marconi, who in 1899 radiated his first wireless telegram from England to France. The message ran : "M. Marconi sends M. Branly his respectful compliments by wireless telegraphy across the British Channel, this splendid achievement being due to the remarkable work of M. Branly."

Future of Component Makers

THE members of the Radio Component Manufacturers Federation recently met to discuss their future prospects. I was not present at the meeting, but I have some decided views on the subject. Radio component manufacturers originally founded their businesses on the demand for components required by constructors. When set manufacturers began to overtake the constructor, the component manufacturers tried to keep a foot in both camps by supplying components at special cut prices to set manufacturers, whilst in some cases charging high prices to the constructor. The inevitable result was that in many cases it was cheaper to buy a set than to make one. I know the reasons why it is not possible to sell one component at the same discount as a gross, but this would not account for the great disparity in price.

There will always be a good market for constructor components, and I can assure the R.C.M.F. that this journal survives because of the continued interest of those thousands of constructors who still prefer to build and experiment and learn, rather than buy and listen and be bored. I suggest that whilst they are troubled about lack of orders they should revive the interest in the market which not only provided them with their businesses but also with their skilled personnel.

I am certain that there is a large and as yet untapped market for components marketed at a price more in keeping with the times, and not so reminiscent of the hey-day of home construction when constructors in their ignorance and enthusiasm would pay fantastic prices for a hank of wire in a tin box and marketed under some fancy name. Do you remember the crystal racket ? People paid as much as a guinea for a piece of bornite carefully wrapped in tissue paper with a cat's whisker and some trifling device for searching the crystal. I remember one device for connecting to the aerial which was claimed to give better reception. The device was carefully sealed up, but I smashed one open only to find that the aerial was connected to a strip of copper foil and was thus merely a connection between the aerial and the aerial terminal. They wanted 12s. 6d. for it, but after my letter and threat to expose, it was withdrawn from the market ; and do you remember the old hedgehog transformers—a bundle of soft-iron wires with copper wire wound round in any old form ? And the fancy coil winders, and the tripe which was written by alleged experts ? Where are they now ? Back to the obscurity and the obloquy from which they should never have been permitted to emerge. Their fancy talk of their laboratories used to make me sick. I knew a number of these tadpole-brained experts. Their laboratory consisted of a 5s. meter, a fretsaw, and a corner of the kitchen table. Many of them were merely schoolboys who, in order to impress, would walk about with a slide rule sticking from their pocket. They could not even read it.

Look back at some of your old wireless journals and see the nonsense which has masqueraded as powerful articles from leading experts. Some component manufacturers were merely racketeers, and they have deservedly gone to the wall, although I cannot altogether blame them. They knew nothing of radio, were merely in it to make as much as they possibly could, and retained some expert who knew even less to design their apparatus. The expert, of course, took his rake-off. Members of the public were not sufficiently knowledgeable in those days, and so the racket succeeded.

The specification of the average set looked like a combination of all the manufacturers' catalogues, and thus our solus policy was welcomed, as it gave the intending constructor a clear-cut idea of the parts actually used in our designs. Some, indeed, of the combination of parts specified in designs not sponsored by this journal would require a baseboard 6ft. square.

Now that the Augean stables have been cleansed, I suggest that the component manufacturers anxious as to their future should take stock of the past when considering the present, in order to ensure a future built on a more solid foundation than the sandy soil from which sprouted the now happily defunct mushroom racketeer wireless firms—and dealers.

Whilst I am dealing with this matter I must complete my exordium by stating that most of the racketeer dealers have gone also. Thus the manufacturers are left with ground from which the weeds and the stones have been harrowed, and in which it should be possible to plant the seeds of a successful and enduring industry.

B.B.C. Announcers

IT has been announced that not only will the B.B.C. augment the existing staff of announcers, but will broaden the scope of their duties. In future, announcing will take three specialised forms ; there will be a team of news readers and another for general programme announcements, while a third will be chiefly concerned with presenting the Forces programme.

The new arrangement will involve the introduction of about ten new voices in one or other of the three categories. The method of presentation of the Forces programme will be considerably more informal than hitherto and there is a possibility of the introduction of a new woman's voice, together with representatives from the Dominions ; the London team will include Lionel Gamlin. There will be four regular news readers in London, selected from Frank Phillips, Alan Howland, Joseph MacLeod, Alvar Lidell and Patric Curwen ; the latter, though a new recruit as an announcer, is familiar to listeners as an actor. Stuart Hibberd will shortly be going to Bristol, where for the time being he will be heard once more announcing a wide variety of programmes, ranging from symphony concerts to light variety. Newcomers to the announcing staff will also be heard from Bristol and other Regions.

Wave Mechanics

A LECTURE by Professor D. R. Hartree, M.A., F.R.S. (Manchester University), on "Wave Mechanics" will be given on Friday, April 5th, before a meeting of the Institution of Electronics. The meeting will be held at 6 p.m. at the Royal Society of Arts, John Street, Adelphi, W.C.2, and readers of PRACTICAL WIRELESS are cordially invited to attend. Tickets can be obtained from the Secretary of the Institution of Electronics, A. H. Hayes, 27, Fetter Lane, E.C.4.

Comment, Chat and Criticism

Studying Music—1

In This Article Our Music Critic, Maurice Reeve, Appeals to Those Who Have Postponed or Abandoned Their Musical Studies

THE study of music was gravely affected by the outbreak of war. In the large centres of population the paralysis that overtook it was comparable to the cessation of scholastic education. Thanks to the leniency of the mighty Field-Marshal Goering in having so far spared us the horrors endured by the Poles and the Finns, it has revived a little; but only a little. People, and more especially parents, no longer feel terrified at the prospect of going a journey for their music lesson, as they did last September, and consequently many of those remaining in the big towns have resumed something approaching their normal routine and mode of life. But the profession is still very hard hit by the evacuations, and more especially the exodus of the big public schools, and many hundreds of teachers have been left high and dry. And a large number of adult students have either left town with their firms or joined the Services.

I would like this article to appeal to those left behind who, for one reason or another, have stopped their musical studies: and to those who have abandoned, through the war, any ideas they may have formed of commencing taking lessons. My urgent advice is—reconsider your decision at once. To those of you who stopped learning, I would say "resume your lessons as soon as possible"; whilst to the others who gave up the idea of studying, I say, "commence straight away." I will deal with each of these groups separately.

Existing Students

At the outset I would emphasise that my remarks are not addressed to any particular class of student or musician, and certainly not the so-called "high-brows." I appeal to anybody who studies an instrument for no matter what purpose.

Although success in the playing of an instrument can only be finally achieved through interpretative qualities, and the ability to "say" something original and appealing on that particular instrument, the goal can only be reached through mechanical means. What we have to say must finally depend on *how* we say it. I am not trying to put the cart before the horse, but just as the very finest motor-car or *de luxe* train would be impossible and unrealisable without certain essential prerequisites of permanent way or road surface, signalling or traffic control and other details, so is a concert artist impossible unless the mechanical apparatus through which alone he can convey his message to us and interpret his music is always in perfect condition. When appearing before us as an artist he naturally makes of his technical equipment a means to an end—the end being the interpretation of the music. But this mustn't hide from us the fact that his technique *must* be acquired first and constantly maintained at "concert pitch" just as the modern metalled highway was brought to its present state of perfection the moment the potentialities of the motor-car were realised.

Now, one of the chief objects when taking a course of lessons is to acquire a technique, with which we can later on interpret music and play it generally and, within our individual limits, so to gain a comprehension of the mechanical side and manipulation of a given instrument that, when pronounced ready, we can, to continue in a metaphor already employed, "become our own chauffeur," and "drive our own car." Side by side with the lessons, and the one acting as the complement of the other, comes the daily practice. It is this constant and unfailing seeing to the mechanism, plus the correction and further instruction at the weekly lesson, that is so essential. For, like all things mechanical, it *must* be maintained in all its parts, and its "running efficiency" regularly proved. Just as an engine cannot be parked indefinitely without a steady deterioration taking place in it, so a student cannot suddenly cease his studies without losing his technical efficiency. Only in music the decline is infinitely more rapid. What has been laboriously built up after months of careful and earnest cultivation disappears as snow before the sun.

The muscles become hardened very quickly, with a consequent loss of responsiveness in the fingers. Several months are often required to recover one's former status, and to merely restore the *status quo*. For this reason alone I would earnestly appeal to all those who, with the best reasons in the world, have decided to "park" their lessons for the duration to reconsider things, and if they had the slightest pretensions to being serious over it, to recommence them with as little delay as possible.

Resuming Studies

The remainder of this article will consist of a reasoned appeal to those who have decided to postpone their study of an instrument until after the war to reconsider that decision, always provided that no insuperable barrier to their doing so, such as a serious diminution of their income, has arisen.

Few, if any, of us will ever become Paderewskis no matter how long we study. For the vast majority of us it may not even be possible to reach what I may call an ordinary concert standard. For this we ought to be profoundly grateful; there is absolutely no pleasure in such a livelihood, whilst the toil and sacrifice demanded have been testified to by the most renowned artists.

But the pleasures, and profit to many, that are open as the reward of four or five years of careful and diligent study are many and varied. Take accompanying to start with. I should say without hesitation that to be able to play a good accompaniment is easily the biggest reward one can have for their labour, and that justifies up to the hilt any expenditure of time or money that may have been made.

First, a good accompanist *must* be a good, intelligent and musical player. It is always possible for a soloist pure and simple to be out of action at any time, and for any reason. During such periods the decline in mechanical efficiency will place him *hors de combat*, for the reasons entered into above. But the accompanist can always go into action, and show his mettle and prowess.

Secondly, as a social asset, his value is enormous. He is in the proud position of knowing that, without his co-operation, all vocalists, violinists, etc., are utterly immobilised; they can do nothing until he is found. If he is at all good at the job, he is going to be absolutely *persona grata* in any house whose circle of visitors needs his services.

Thirdly, he constantly acquaints himself with one of the most important and beautiful portions of musical literature—a big enough reward in itself.

Fourthly, there is many a useful guinea to be picked up by a good accompanist; guineas that are utterly beyond the reach of soloists, whilst a really excellent master of the craft can possess a splendid career. Although the soloist takes the credit for any success achieved, much of it belongs to the accompanist, which can at least be a source of secret satisfaction to him.

Fifthly, there is the ability to read all the operatic scores in the form of piano reductions; the key to a treasure house indeed.

Reading Music

All this can go on in spite of wars and black-outs; in fact, its value is enhanced thereby. Without any question whatever, your studies will amply repay you if you can gain the art of reading music efficiently and profitably.

Whilst on the question of reading music, I must not refrain from emphasising the enormous pleasure gained from reading the piano reductions of the famous symphonies. Also that one must attain a reasonable degree of proficiency as a player in order to cull the full satisfaction from this most delightful pastime.

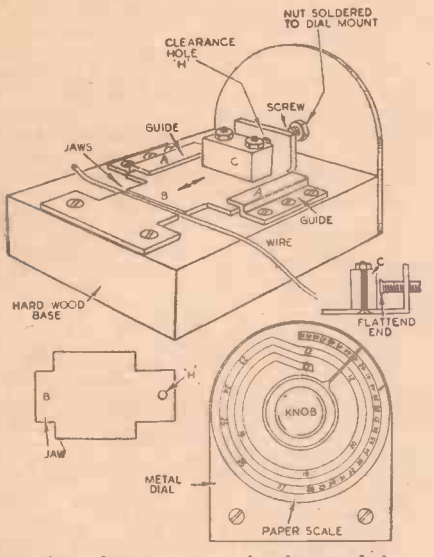
To the jazz fiend I would say that you must acquire a considerable degree of finger agility, enabling you to maintain the rhythmic urge of your numbers, even though you will not have to call into play the subtleties of tone colour and interpretation. A good rhythm player must have a period of orthodox study in order to gain this facility before branching out into it with hopes of success.

As a form of spending it cannot conflict in any way with the nation's needs for economy, and with any of the advice tendered to us by those in authority. And as a form of mental and physical relaxation in these strained and taut times it can have few rivals. I strongly advise you to study some branch of music even though the war may prevent your freedom to decide for some time exactly what you will do with its result.

Practical Hints

A Simple Wire Gauge

THE accompanying sketches give details of a simple but accurate wire gauge. The jaws are constructed from heavy gauge aluminium, or other suitable material, and the base is a piece of hardwood. The moving jaw is kept in position by two shaped pieces of metal (A), as indicated.



A simple wire gauge with indicating dial.

The dial, which is of the same metal as the jaws, is screwed on to the wooden base, and a nut is soldered to the centre to hold the threaded rod to which the pointer is attached. On one end of the moving jaw is a projection which is bent at right angles to the jaw. Through the centre of this a hole (H) is bored and the rod is passed through, the end of it being flattened slightly to prevent it from coming out again. Next a piece of metal (C) is screwed on to the jaw near the raised projection so that the threaded rod is fixed to the jaw, and can push it along.

The pointer is a piece of stiff wire, and is soldered to the knob. Other details are clearly shown in the illustrations.

The dial consists of a piece of paper stuck to the metal front.

If the threaded rod has a pitch of 1/36in. then one turn of the pointer will be sufficient for gauges 50-22, and a second turn for gauges 22-17. The gauge can also be used for sheet metal.—F. R. FREDERICKS (Finchley).

A Jack and Plug Adaptation

WHEN modifying my short-wave receiver recently I decided to make provision for using the 'phones by tapping the first L.F. stage in the manner shown inset in the accompanying sketch.

Experimenting with different forms of switching so that the simplest operation could effect change over from 'phones to speaker, at the same time interrupting the filament circuit to cut out the final tetrode valve, I hit upon the scheme illustrated.

This arrangement required a little extra care in modifying the plug shank to act as a combined insulating and contact operating cam. On dismantling the plug by removing the sleeve and terminal screw plate inside (tip contact fitment), I then pulled the tip contact centre shank free with the aid of a vice and pliers. This left me with a "shell" (sleeve) and ebonite insulating medium. I then inserted the plug in the jack and scribed off the limits of the jack (determined by the raised ebonite portions separating the contacts).

After this, it was necessary to file down the brass sleeve within the limits shown in the illustration, but the ebonite tip insulator "T" was removed first of all by gently tapping this out. The sleeve had to be filed down below the level taken by the slightly-filed ebonite piece "T," this providing the insulated cam action, whilst the depth should be sufficient to provide a suitable contact movement.

After checking carefully by a trial assembly, the plug was again dismantled and thoroughly cleaned of the brass filings which worked into the sleeve.

The inset circuit clearly shows how the by-pass capacity "C" is returned to positive L.F. to permit the combined function of switching and by-passing.

When the plug is turned to engage the extra contact "X" it will be apparent that it becomes locked in the jack, but this serves no intended purpose.

The extra contact comprises a brass washer, with an extension piece, fitted between the jack and the back of panel washer "W," the contact proper being of thin resilient copper soldered to the shank.—W. E. WELLS (Brentwood).

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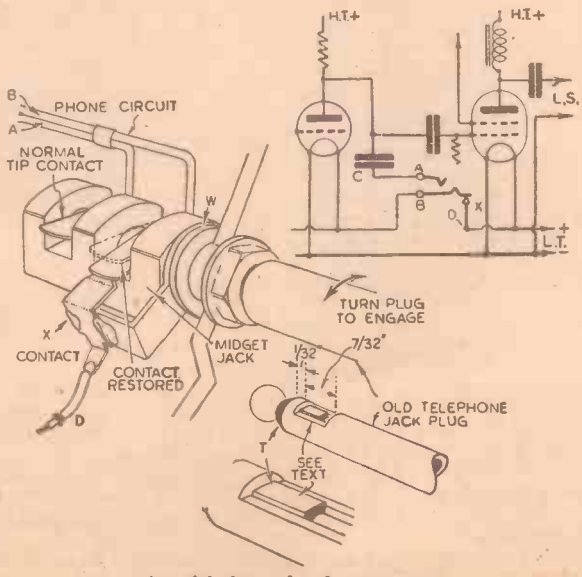
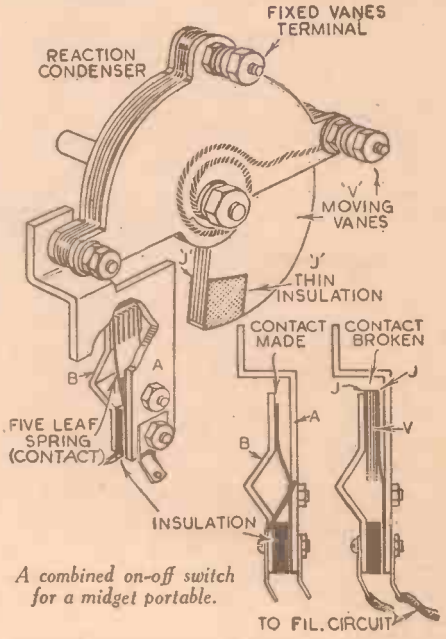


A useful plug and jack arrangement.

A Combined On-off Switch

WHILE building a midget portable, I found that I wanted, for convenience and appearance, three knobs on the front instead of four. I then hit upon the following dodge to reduce the number of controls. On to the reaction condenser I fixed a metal strip (A), as shown. Fixed to the top of this, but insulated from it, I fixed another strip on the other side of the moving vanes. When the moving vanes are wide open they separate the spring from the strip (B) and, as they are insulated, the contact between (A) and (B) is broken. When the volume control is open the set is off, and to switch it on the vanes are closed a little, enough to release the spring, and then the required volume can be had by shutting the vanes more.—D. ATKINS (Hounslow).



A combined on-off switch for a midget portable.

Checking Your Accumulator's Charge

A Novel Device which Automatically Checks Up on Your Charging Station - - - By DEREK ARCHER

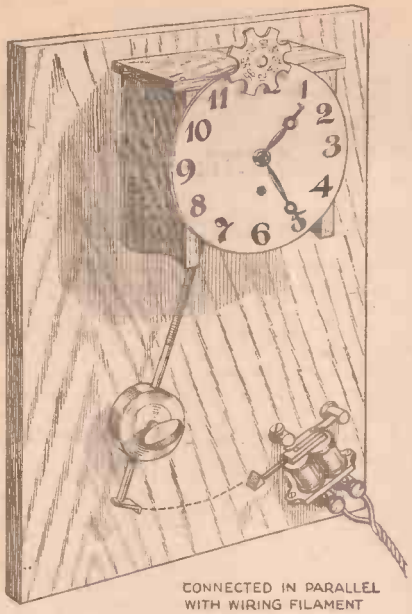


Fig. 3.—A general view of the finished clock.

SOME accumulator charging stations are not exactly what they should be, and possibly due to carelessness or too many accumulators to charge on an inadequate plant, it is found that one's accumulators last for different periods each time of charging. Whereas sometimes the accumulator lasts a week, other times it lasts a fortnight. The writer has had much experience of this, and much argument with the charging station, and for some time kept a log. Although this was satisfactory up to a point, one cannot expect other users of the same receiver to have the same interest, and, therefore, the log was not an accurate one. To remedy matters the writer rigged up the following device, which has given some satisfactory service, but has opened up interest from many points of view. The device counts up the actual time the receiver is in use, and gives a true account of the life of the accumulator charge. It also indicates the hours the receiver is used by others than the writer, and indicates over longer periods the life of an H.T. battery—not by so many months, but by the actual hours.

Mounting the Clock Movement

Obtain an eight-day clock movement, one with a pendulum, or an ordinary one-day clock will do, providing the winding is not forgotten. A clock with a rotating flywheel is not recommended, as it is nearly impossible with simple mechanism to make it start by itself once it is stopped. Also obtain an electric bell movement in good condition. Mount the clock movement on a piece of stout board towards the left-hand side. The principle of the idea is fully explained, and the details can be decided as the mechanism is put together. Remove the brass ball at the end of the stem of the bell movement and solder in its place a brass pallet-shaped, as shown in Fig. 1. The faces of the pallet should be smooth and free of solder. Then solder to the end of the pendulum rod another pallet made from thin brass strip. This should be made fairly light so that the timing of the clock is not affected more than can be corrected by the usual adjusting screw. Now set up the clock movement to work in its proper position, and offer up the bell movement so that the pallet on the pendulum just misses the pallet on the end of the bell arm when the armature of the bell is pressed up against the pole pieces. Secure the bell movement in this position. The movement can be secured to a piece of wood provided with slots so that adjustments can be made after it is mounted. Then adjust the usual contact screw, which will now be used electrically to push the armature towards the pole pieces so that the two pallets just engage in one another when the armature is released. Sufficient engagement should be allowed to hold the pendulum back just at the top of its swing.

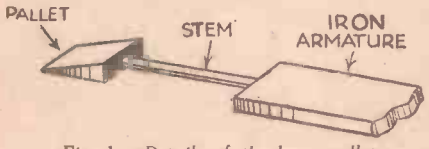


Fig. 1.—Details of the brass pallet and armature.

The Wiring

Disconnect the two wires of the bell movement and take the two wires from the coils to two conveniently placed terminals on the clock board. These two terminals are then connected up by flexible wire to the receiver. The wires are connected direct to the two filament terminals of one of the valve-holders, so that current is only applied to them when the receiver is switched on. The circuit and the complete arrangement is shown in Fig. 3. It is important to note that the two wires must not be connected across the accumulator terminals or across the filament switch. Some tests should now be made to see that the device is working correctly. Catch the pendulum up on to the bell pallet and switch on the receiver. The current should then traverse the windings of the coils and magnetise the cores. The armatures should then be drawn up to the pole pieces and the pendulum released and the clock started working in the usual way. The receiver should next be switched off when the armature returns to its normal position against the adjustment screw. The pendulum on its next swing will thus catch up on the pallet and the clock will be stopped. There are one or two points which require attention. It may be found that the armature refuses to "come unstuck" when the receiver is switched off. This is due to the residual magnetism in the cores and the armature, but this may be overcome by securing a piece of paper to the ends of the cores or on the back of the armature so that the armature and the ends of the cores do not come into contact with each other. Another method is to run a small blob of solder on the top of each core—anything to prevent the armature and the hole pieces touching, and so sticking together when the current is switched off. Another point which may require attention is the fact that the armature may not release when the set is switched on owing to the weight of the pendulum pressing too hard against the pallets. The faces of the two pallets should be filed so that they slide over each other easily, and, if necessary, they can be polished. Another point which requires attention is the two coils of the bell movement. Usually, these coils are of a very low resistance, the pair used by the writer being 4 ohms, and therefore, pass a fairly large current. In fact, the coils can use up as much current as the valves in the receiver. This must, of course, be cut down considerably. The insertion of a 400-ohm resistance in one of the leads to the coils cuts the current down to about 5 m/A, which is quite small compared with the current taken by the receiver. However, it may be found that the ampere turns on the coil have been cut so low that the armature will not operate with so small a current. The bobbins can be rewound with No. 40 enamelled wire, and the resistance will then come up to several hundred ohms.

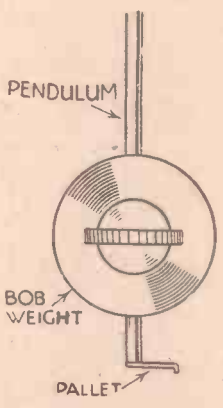
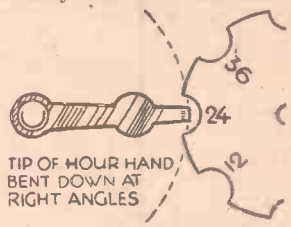


Fig. 2.—A pallet is also fitted to the end of the pendulum.

Fig. 4.—Showing how additional hours may be recorded.



Radio in the Services

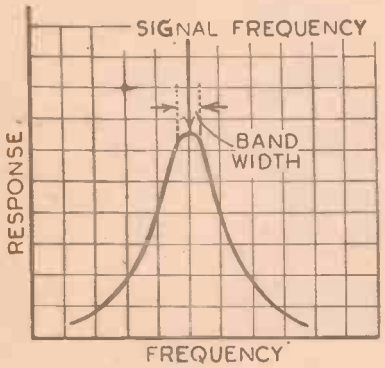
A Refresher Course for the Radio Mechanic—4

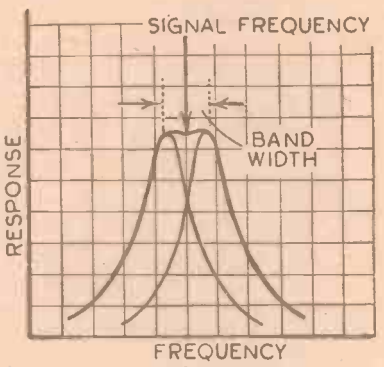
By Frank Preston

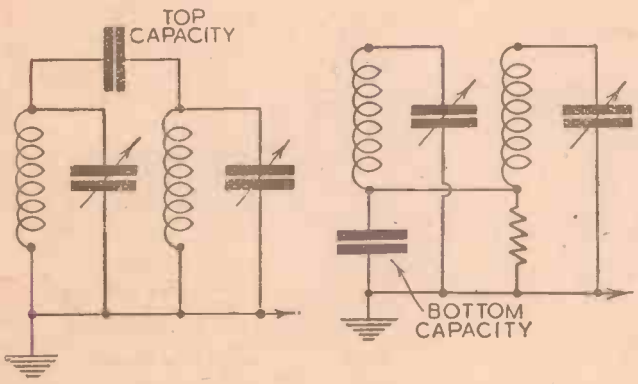
A Further Series of Questions Such as May Be Asked of Applicants for Enrolment as R.A.F. Radio Mechanics, Along with Appropriate Brief Replies

EXPLAIN as simply as possible the difference between trimming and tracking, as applied to tuning circuits.

Trimming consists of balancing the tuning circuits—generally by adjusting the pre-set condensers associated with the different sections of a gang condenser—to compensate for stray capacities. In other words, the object is to ensure that each tuning circuit shall resonate at precisely the same frequency for any setting of the tuning condenser. If this were not done, one circuit may be tuned to a slightly different frequency or wavelength from the rest, with the result that tuning would be broadened and sensitivity reduced.







(Above) Two simple graphs to show a "peaked" tuning curve for a single-circuit tuning and the flattened curve obtained with a band-pass tuner by combining two tuning peaks. (Left) Two simple band-pass circuits.

Tracking consists essentially of balancing the tuning circuits of a superhet to ensure that the difference in frequency between the signal-input circuit and the oscillator circuit remains constant irrespective of the position of the tuning control. The important point is that the rate of change of frequency for any given movement of the tuning control is different for the two circuits if the frequency difference (intermediate frequency) is to remain constant. A pre-set condenser, or more than one such condenser, is used for tracking, but this is not in parallel with one section of the tuning condenser, but is more usually in series with either the oscillator section of the condenser or with the oscillator coil.

What purpose is served by a band-pass tuner? Give a diagrammatic band-pass circuit to illustrate your answer.

The object of a band-pass filter is to provide the utmost useful selectivity combined with a sufficiently wide tuning channel to avoid the cutting of high audio frequencies, or high notes. It is well known that if a single-circuit tuner is made highly selective the tuning "peaks"; in other words, the required signal can be heard over only a very narrow band on the tuning scale. This means that all the higher audio frequencies are lost, or not passed on to the circuit following the tuner.

To obtain satisfactorily good reproduction from a modern broadcast transmission it is necessary that the receiver should respond evenly to a frequency band of at least 8,000 cycles. This means, in effect, that the tuning circuit should give even response to frequencies between 4,000 cycles below and 4,000 cycles above the fundamental or signal frequency.

This is achieved by combining two sharply tuned circuits, one "peaking" at a slightly higher frequency than the other. Thus, the two together give a flat-top-peak tuning curve. The adjustment of the two circuits is generally made so that the top of the "peak" extends over about 9,000 cycles or 9 kilocycles.

Two different forms of band-pass filter are shown in the accompanying circuits. In one case the coupling is by means of top-capacity (a very low-capacity condenser joining the high-potential ends of the two coils), and in the other case by bottom capacity. In the former case tuning is sharpened, or the band width reduced, by reducing the capacity of the condenser; in the latter, the band width may be reduced by increasing the capacity of the condenser.

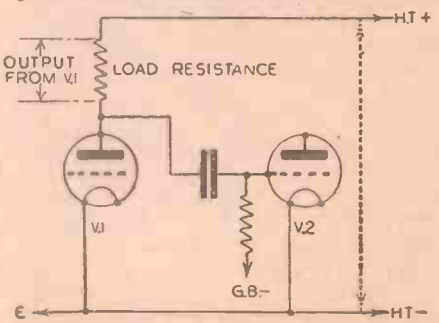
How could you tell whether or not an H.F. or detector valve was oscillating?

In the case of a detector valve the simplest method is to touch the grid terminal with a moistened finger tip. Oscillation is generally indicated by a "plop" in the 'phones or speaker. Another method is to include a milliammeter in the anode circuit of the valve and notice any change in reading as the grid terminal is touched. This test can generally be applied to either an H.F. or detector valve.

Should the current rise as the grid terminal is touched the valve is in a state of oscillation—or at least it was until the grid terminal was touched. Touching the terminal stops oscillation, and thereby causes the anode current to rise.

What is a load resistance?

It is a resistance used in the output circuit of a valve or rectifier. The output from the stage (it may be a valve, H.F. metal rectifier or crystal detector) is built up across this load resistor, so that there is a potential difference between the two ends; it is this which is used to operate 'phones, a speaker or a following valve.



A load resistance is included in the output circuit of an amplifying stage, and it is across it that the output is developed. This is applied to the following stage. A broken line is used to show the completion of the circuit through the H.T. supply.

It is not necessary for the resistance to be a normal resistor, but it may be an H.F. choke (in an H.F. circuit), an L.F. choke or the primary of a transformer. When not a resistor, the output-coupling device would be referred to simply as the output load or anode load.

Draw an outline circuit showing the connections for a parallel-feed transformer, and explain the chief advantages of this method of coupling.

A diagram is shown on page 71, and from this it may be seen that the anode current for the valve preceding the transformer is carried entirely by the fixed anode (or

(Continued on page 71.)

New Detector Circuits

Detector Valves which Give Fidelity with Some Degree of Amplification are Described in this Article

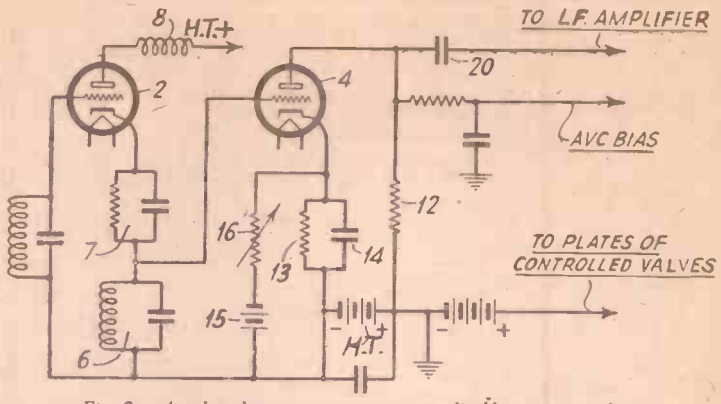


Fig. 2.—Another detector arrangement applicable to a superhet.

ALTHOUGH linear detectors, such as the diode type and the triode type with cathode feedback, are now well known, these detectors both suffer from lack of amplification, and other detectors giving comparable fidelity with some degree of amplification are of interest.

A modified form of anode bend detector with some interesting properties will now be described. Referring to Fig. 1, the secondary winding of the I.F. transformer 5 of a superheterodyne receiver feeds the signals to the valve 2 which in turn feeds the detector valve 4. In order to provide the amplifier stage with a low internal impedance, the circuit 6 is disposed in the earthed cathode lead of valve 2. The usual bias resistor-condenser network 7 is disposed between cathode and the circuit 6 for providing a normal bias on the amplifier grid. Appropriate positive potential may be applied to the anode of amplifier 2 through a radio-frequency choke coil 8.

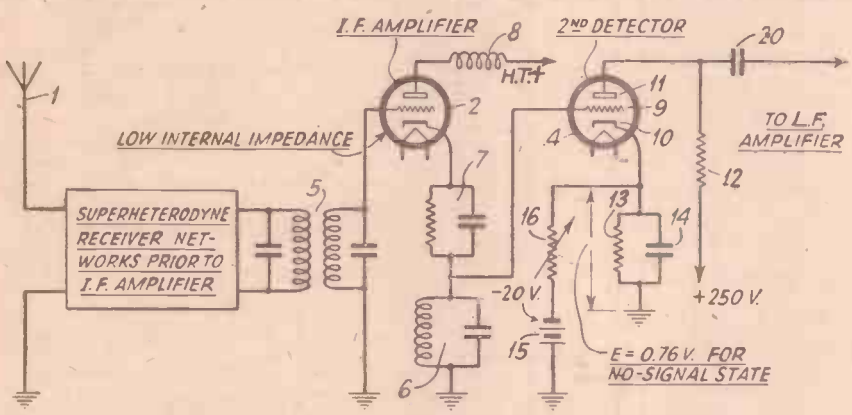


Fig. 1.—Detector stage, showing the cathode circuit improvement.

Circuit 6 is resonated to the operating I.F. value, and is effectively connected between the control grid 9 and cathode 10 of the detector valve 4. The valve 4 can be a triode of the 6F5 type, and the anode 11 thereof is connected to a current source, through an anode load resistor 12. The resistor may have a magnitude of approximately 100,000 ohms, and a potential of about 250 volts is applied to the anode 11. The cathode 10 is connected to earth by a resistor 13 of about 700 ohms; the resistor is by-passed for I.F. currents by condenser 14 having a magnitude of 0.2 mf. There is provided in shunt with the self-bias resistor 13 an auxiliary 20-volts current source 15, the negative terminal of which is connected through adjustable resistor 16 to the cathode end of the bias resistor. The resistor 16 is preferably adjusted so that the effective potential E across resistor 13, in the no-signal state, is 0.76 volts.

Distortionless Rectification

The relation between RMS volts input and the magnitude of E is illustrated in Fig. 3. It will be observed that there exists a wide region of distortionless rectification, as shown by the area between the vertical dotted lines. The curve demonstrates that the grid bias of the detector valve is influenced by the signal input and by the current from auxiliary current source 15. The latter may be, if desired, a bleeder resistor in the common voltage supply source of the receiver. With no signal input to detector 4, the bias on grid 9 is determined by the normal flow of current of the triode, and by the current from 15. In this case, since the source 15 opposes the space current flow through resistor 13, the normal self-bias of the valve has its value reduced, as is shown by the initial portion of the curve. Between the region of 0.3 volts and 2.0 volts (RMS input) is the region of operation which produces no distortion in the output of the triode. The constants of the detector circuit are so selected that the necessary bias E is developed to produce distortionless operation with any input between the limits quoted.

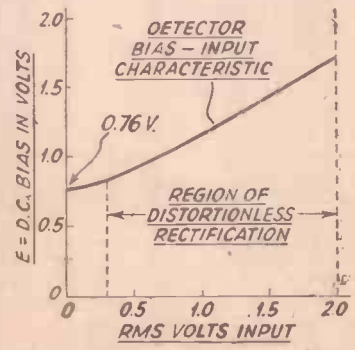


Fig. 3.—Relation between input and bias.

The audio voltage is tapped off across the load resistor 12, and the voltage is transmitted to the audio utilisation-network through condenser 20. Since the grid bias of the detector valve is close to zero, the signal source coupled to the detector input circuit 6 is of low internal impedance. The amplifier 2 has circuit 6 in its cathode lead to provide such a low-impedance source. Of course, any other type of signal network which has a low internal impedance may be used in place of the cathode loaded amplifier valve 2. For example, a power triode could be used.

A.V.C. Bias

This detector circuit has substantial gain; high R.F. amplification is not needed. It can readily feed the usual audio amplifier network. Further, it provides carrier amplification, and hence delivers sufficient direct current voltage for A.V.C. bias purposes. This is secured by a rearrangement of earthing points to permit the D.C. voltage across resistor 12 to be applied to the grids of controlled valves. One connection, shown in Fig. 2, which provides this is to earth H.T.+ of the detector valve, and replace the present earth by the negative terminal of the H.T. source, which is by-passed to earth for low R.F. impedance. The control valves have a higher H.T. voltage above earth for their anode supply. In this respect the detector is of advantage over a diode rectifier or a degenerative plate circuit detector (also termed an infinite impedance diode detector). The latter have no gain, and hence need substantial radio-frequency amplification prior to detection.

Again, the present type of detector circuit is of advantage over the so-called linear power detector circuit, wherein the linear portion of the biased detector characteristic is utilised. In the latter type of detector circuit it is required to utilise sufficient radio-frequency amplification prior to the detector input circuit in order to operate along the linear part of the characteristic. Again, it is necessary to utilise a high negative grid-bias in such a circuit. In the present detector circuit the range of signal input voltage is relatively wide, although the magnitudes of the signal voltages themselves are small. A gain of 30 can be expected from this type of detector. With 1 volt RMS input on the grid, as high as 40 volts D.C. can be secured.

Harmonic Distortion

Distortionless detection is secured by virtue of a distortion balancing action. While it is believed unnecessary to enter into a discussion of the theoretical aspects of the functioning of the detector circuit, yet it is pointed out that, in general,

(Continued on facing page)

NEW DETECTOR CIRCUITS

(*Continued from previous page*)

harmonic distortion created by curvature in the square lower detection characteristic is balanced out by complementary distortion introduced by proper choice of the detector circuit constants. In other words, the resulting detector characteristic is not necessarily a linear one ; it is more accurate to describe the detector circuit as being distortionless in operation over a predetermined wide range of signal input voltages. Hence, it will be seen that the present detector circuit not only provides freedom from harmonic distortion but at the same time produces sufficient audio voltage and carrier voltage gain to render the network desirable for use in the standard type of broadcast receiver.

In Fig. 4 there is illustrated a circuit arrangement wherein the detector circuit performs an additional function. The numeral 30 designates a valve of the 6E5 type. Briefly, this type of valve comprises a triode section which includes cathode 31, control grid 32 and anode 33. The valve also includes a fluorescent target 34, and an electron ray control element 35. The control element 35 is disposed between the target 34 and a second cathode 36, both cathodes 31 and 36 being at a common potential. The observer views the interior face of the target which is coated with a fluorescent material, and the target is usually cone-shaped. The control electrode 35 projects from the anode 33, and both electrodes are connected through the load resistor 12 to a source of positive potential H.T. The target 34 is connected to the positive end of load resistor 12.

Biasing Network

In this arrangement the triode section 31-32-33 functions as the biased detector section, and the biasing network connected in the cathode circuit is the same as in the case of Fig. 1. The audio voltage is taken off from the negative end of load resistor 12. Normally the positive target 34 receives electrons from the cathode 36. These electrons cause the fluorescent coating on the inner face of the target to glow, and the target has the appearance of a ring of light. When the potential of electrode 35 is less positive than the target, electrons flowing to the target are repelled by the electrostatic field of the control electrode, and, therefore, the electrons do not reach that portion of the target directly behind electrode 35. The control electrode 35 is said to cause shadow on the glowing target. Since the potential of electrode 35 varies in response to the potential drop across load resistor 12, it will be clear that the shadow on target 34 is of variable width. Therefore, it will be seen that the electron indicator is able to indicate the signal carrier amplitude by virtue of the direct current voltage drop in the detector plate circuit. H.T. supply may be 250 volts, and the load resistor 12 can be 500 ohms.

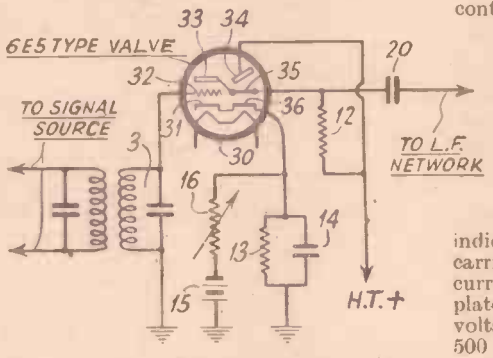


Fig. 4.—In this arrangement the detector performs an additional function.

These circuits were developed in the R.C.A. Laboratories.

RADIO IN THE SERVICES

(*Continued from page 69*)

load) resistor. Only the audio-frequency currents are passed to the transformer, these being applied through the .01-mfd. coupling condenser. In consequence of this method of coupling, the transformer primary winding is relieved of the need for carrying D.C. as well as A.F., and therefore it can be wound with finer wire. A more important point is that the effective inductance of the primary, for any given number of turns and core size, is appreciably greater than if a heavy D.C. current had to be carried. Conversely, the required inductance can be secured by employing a smaller transformer ; this has the practical advantages of cheapness and compactness.

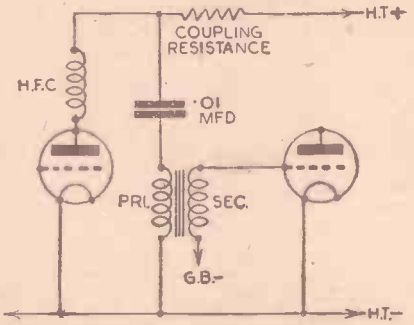
There is another less-important advantage of parallel-feed, which is that a number of different coupling ratios can be obtained by varying the connections to any one transformer. Thus, a ratio of unity would be obtained by connecting primary and secondary windings in series and joining both the grid of the following valve and the anode-coupling condenser of the preceding valve to the upper end of the windings. The highest ratio is obtained by connecting the windings in series, joining one end of the secondary to the grid, one end of the primary to the G.B.— and the series junction to the coupling condenser. By this means an effective ratio of 1 : 4 would be obtained when using a 1 : 3 transformer.

What is the object in screening components and sections of a receiver?

The screen is primarily intended to prevent the magnetic fields of two components from linking ; if they did link there would be inductive coupling between the components. And if, for example, the grid coil and anode-circuit H.F. choke of an H.F. amplifier were coupled together, the valve would be thrown into a state of oscillation. By placing an earthed screen between the two, the components would be isolated as far as their magnetic fields are concerned.

Precisely the same conditions apply when a whole portion or stage is screened, or even when a connecting lead is screened. For H.F. circuits the screen must be non-ferrous if losses due to eddy currents are to be avoided. Copper is probably the best metal for screening in an H.F. circuit, but aluminium, which is a good deal cheaper, is completely satisfactory in nearly every case.

For screening in low-frequency circuits or in A.C. mains power-supply circuits, soft iron is the most effective material. It should be of fairly heavy gauge.



Parallel-feed transformer connections, where a detector valve is shown coupled to an L.F. amplifier.

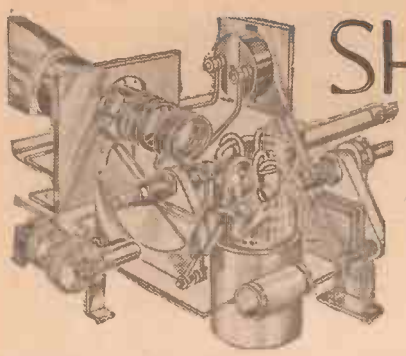
What is (a) mutual conductance, and (b) conversion conductance?

Mutual conductance is a measure of the "goodness" or efficiency of a valve, and is stated in milliamps per volt. It is the ratio of the small change in anode current of a valve brought about by a small change in grid voltage, when all other voltages remain unaltered. The term is often described as the "slope" of a valve, since mutual conductance is indicated by the anode current-grid volts curve ; the steeper the slope of the curve, the higher the mutual conductance.

Conversion conductance is a term used in connection with a frequency-changer, and is expressed as microamps per volt. It is the ratio between the I.F. current in the output circuit to the corresponding input signal voltage applied to the grid of the valve. Conversion conductance is really the counterpart of mutual conductance of an amplifier valve.

Frequency Modulation and Television

ALTHOUGH it was known that a few months ago the question of frequency modulation as a means of radiating television signals was being investigated in this country, the advent of war completely upset the plans for conducting practical tests on a really large scale. This has not been the case in America, however, where the development of a public service on financially self-supporting lines is being tackled in a determined fashion by co-operation with advertisers. It is, of course, known in that continent that the use of frequency modulation would make an enormous difference to the signal-to-noise ratio, but unfortunately there is the corresponding disadvantage that the channel width would have to be increased. Consideration is therefore being given to the possibility of a compromise whereby the theoretical essential increase in band width can be omitted, and a practical use made of a figure below this. By this means the full advantage of noise reduction would not be forthcoming, but there would be an important compensating factor introduced. That is to say, the peak power of the transmitter could then be made to coincide with the carrier power instead of having to be four times this figure, as in the case of the more orthodox amplitude modulation. This would straightway increase the range of the broadcasting station, as well as showing a marked improvement in the results observed in sets already within the accepted service area. Within the service area alone, therefore, there would be a substantial increase in the number of people able to enjoy noise-free television pictures, and for this reason the new system merits a very close investigation. This should be done before the number of viewers reaches a high figure, as complications arising from compensation for replacements or modifications could then be kept within reasonable limits.



SHORT-WAVE SECTION

AN A.C.-D.C. SHORT-WAVE CONVERTER

An Efficient Three Wave-band Unit, which is Simple and Cheap to Construct — By THE TECHNICAL STAFF

CORRESPONDENCE indicates that there is now a far greater demand for a converter unit than the early type of adapter. Although the latter is quite satisfactory, when used in conjunction with a reasonable design of the detector and L.F. type of broadcast receiver, it would appear that superhet and H.F.-Det.-L.F. circuits are now more widely used, therefore, it is a far better proposition to use a S.W. converter and make use of all the stages in the receiver.

For the benefit of those not too familiar with the two forms of S.W. units under discussion, it should be noted that an adapter, as its name implies, allows only the detector stage of the receiver to be adapted to tune over the short-wave bands, but with a converter, the receiver circuit, provided it incorporates one or more stages of H.F. amplification, is actually converted into a very efficient short-wave set operating on the superhet principle. This arrangement gives greater sensitivity and selectivity, and once the operator has got the touch of the controls, some very satisfactory and surprising results, bearing in mind the simplicity of the apparatus, can be obtained.

The early form of S.W. converter made use of a single triode valve acting as an autodyne arrangement, which virtually allows the valve to act as a detector and oscillator. Owing to the operating characteristics of this type of circuit, there are one or two defects which can prove rather annoying; therefore, with the introduction of the modern frequency-changing valves considerable progress has been made in the design of S.W. units, and all the early snags and inefficiencies eliminated.

The unit described in this article is a typical example of what can be done with a single modern multi-electrode valve, plus well-designed coils. As a matter of fact, the circuit itself is built round the commercial coils specified and differs in one or two respects from the original bench test model. The circuit can, of course, be used with suitable plug-in coils, as in the case of the initial design, but when the several advantages offered by the three-range coils specified are appreciated, it will be realised that the change in circuit design is well worth while. The objection to multi-range coils, or should we say, the objection which used to be raised, namely, losses due to complicated switch wiring and switches with high H.F. losses, no longer exist, if one takes the trouble to examine the details of the suitable modern components now available. A proof of this will be found in the examination of many of the finest communication type of receivers.

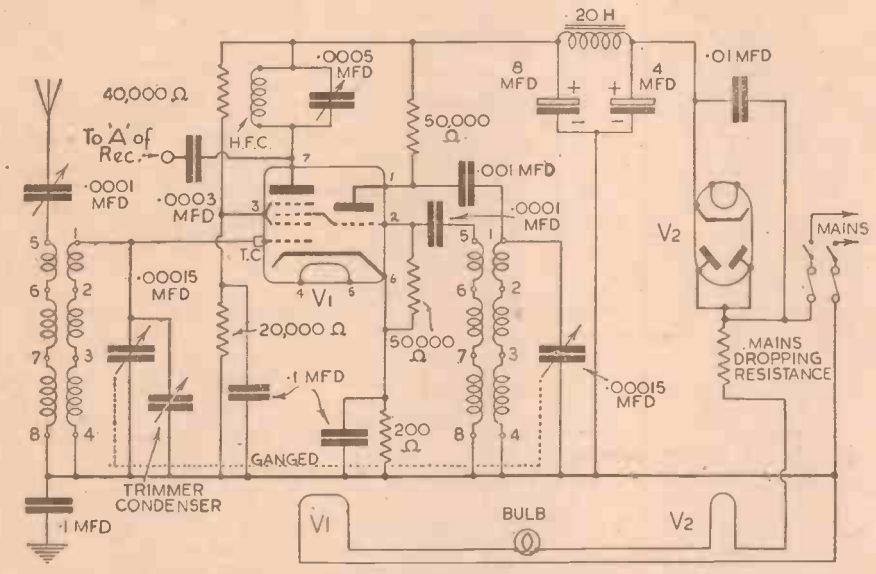


Fig. 1.—The coil switching has been omitted from this circuit for the sake of clearness. Note valve pin connection numbers.

The Circuit

An examination of Fig. 1 will show that the circuit is a straightforward frequency-changing arrangement making use of a triode-hexode. This type of valve is ideal for short-wave work as it is invariably better on the higher frequencies than, say, a heptode. The valve used was an Osram X31 for universal operation, but an X41 is recommended if the unit is to be used on A.C. supplies only.

On the mains side, a U30 is employed for rectification of the A.C., and as the circuit is equally suitable for A.C. or D.C. supplies, it is connected as a half-wave rectifier. No mains transformer is, of course, necessary, but it is essential to incorporate a suitable resistance in series with one side of the supply and the heater circuits to provide the necessary voltage drop. The component for this purpose is the Bulgin mains-dropping resistance type No. N.R.45. For visual indication purposes, to show when the unit is switched on, a pilot light is connected in series with the heaters. Smoothing is provided by any good make of L.F. choke, having an inductance of, say, 25 Henries at 30 mA., in conjunction with a 4-mfd. and an 8-mfd. fixed condenser.

Coils

Two coils are required, namely, types S.W.65 and S.W.66, both being produced by Bulgin. The former is for the aerial circuit and the latter for the oscillator. It should be noted that it is not necessary to employ padding condensers with the 66 as it is quite sufficient for accurate tuning over the three bands if a small parallel variable condenser is connected across the aerial tuner. Both tuning condensers have a capacity of ·0015 mfd. each, and

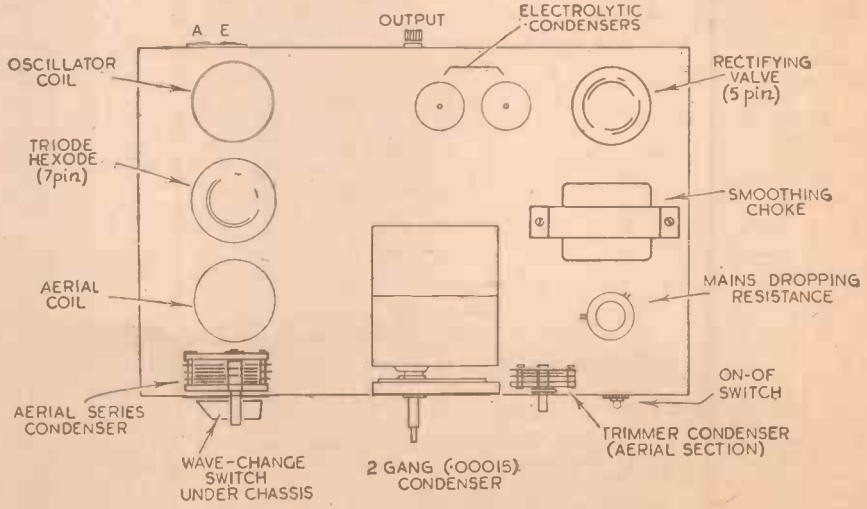


Fig. 2.—A suggested layout for the unit. Slight modifications can be made providing attention is given to coil location.

the small trimming component should be in the neighbourhood of .00005 mfd.

With the tuning condenser mentioned, the actual wave-ranges of the coils will be 11 to 25 metres, 22.5 to 50 metres, and 45 to 95 metres, thus covering all the important frequencies.

The inductance of the oscillator section is such that an I.F. of, approximately, 250 kc/s, or, in other words, a wavelength of 1,200 metres, is produced, thus allowing the L.W. section of the broadcast receiver to be tuned to that frequency for the I.F. amplification.

The two tuning condensers can be ganged if so desired, although if two separate condensers of the correct capacity are to hand, then they can be used without complicating the tuning to any appreciable degree. With a circuit of this type, there is a lot to be said for two separate controls, as once their relative settings have been noted, it is often possible to obtain just that little bit extra adjustment which sometimes makes all the difference between a good and a passably good signal. However, that is a matter of personal taste and the gear available.

Construction

A suggested layout is shown in Fig. 2. We would advise metal chassis construction as this allows a neat assembly, good location of the components, and short wiring, but if reasonable care is taken a baseboard arrangement can be used.

The wave-band switching is not so complicated as it might appear from the theoretical diagram as one switch unit, Bulgin type No. S. 122, does all that is necessary. It will be seen that the unit is really connected to form four simple short-circuiting switches.

With any apparatus of this type, it is advisable to pay particular attention to all connections made to the metal chassis or the common negative line; see that perfect contact is made and that the wires are as short and as stout as possible. It is also vitally important to remember that with an A.C./D.C. circuit, a direct electrical connection *must not exist* between the earth and the common negative line, which, in this instance, is the chassis. The reason for this should be obvious, when it is remembered that one side of the mains supply is also connected to the chassis. The correct thing to do is to make the earth connection to the metal work via a fixed condenser having a capacity of, say, .1 mfd. The actual capacity is not critical, but the condenser must have a working voltage higher than that of the mains.

The other components, i.e., fixed condensers and resistances, etc., can be perfectly standard parts, but the variable condensers should be of reliable S.W. types if the maximum efficiency is expected.

The number connections for the valve-holder of the triode-hexode follow normal practice, and by making reference to pages 7, 8 and 9 of the "Radio Engineer's Handbook" (our issue of February 10th last) no difficulty should be experienced in making the correct connections to the 7-pin holder. The rectifier valve requires a standard 5-pin holder.

Operation

Before making any connection to the supply mains, go over all wiring and make quite sure that everything is connected according to the diagram. At this stage, a word of *warning* is necessary. With an A.C./D.C. circuit and *especially* when a metal chassis is in use, remember that the chassis (the common negative earth line) can be at a much *higher potential than the actual earth*.

One side of the supply mains is always earthed. Supposing in your district it happens to be the positive side, well, that means that you would feel the full supply voltage if you made contact with the chassis and the ground, so *be careful*. To be on the safe side, see that you are standing on a dry carpet, or board if you are likely to touch the chassis, or, better still, switch off the mains before making any adjustments.

With the aerial connected to the *converter* aerial terminal, join the aerial terminal of the set to the output terminal of the unit, and after seeing that the earth connection is on, plug in the mains making quite sure in the case of D.C. supplies that the polarity is correct. The broadcast set must be switched over to the long waves and tuned to about 1,200 metres, and the volume control set to about mid-on. When all valves have warmed up, it should then be possible to tune in the S.W transmissions by adjusting the tuning controls of the unit only. The aerial series condenser must be adjusted to allow maximum efficiency to be obtained on all the wave-bands.

The same remarks apply to the operation of this unit as to all other S.W. apparatus, have a little patience, spend some time getting the hang of the adjustments, and remember that S.W. transmissions are not always consistently good. Don't condemn the unit because of a bad evening or lack of tuning skill.

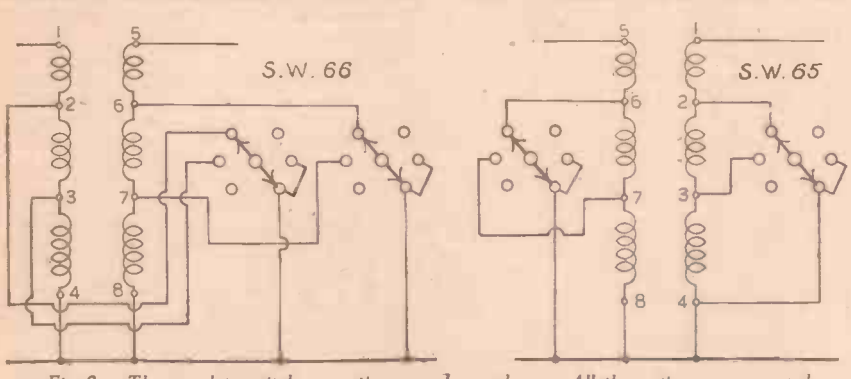


Fig. 3.—The complete switch connections are shown above. All the sections are operated by one control.

PRACTICAL TELEVISION

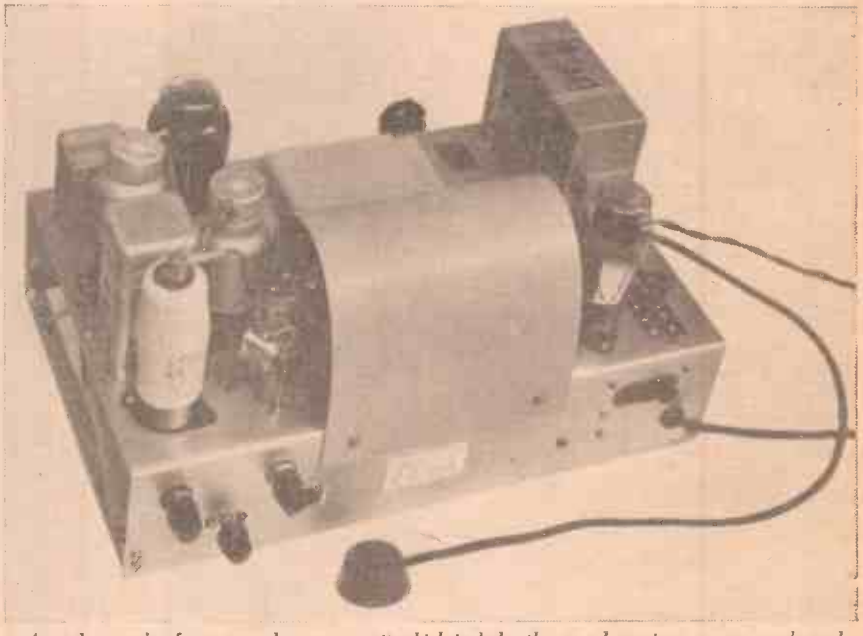
April 6th, 1940. Vol. 4. No. 197.

Compact Packs

THE problem of providing a satisfactory and efficient form of power supply for the television receiving-set has been solved in a variety of ways by different designers. With the original high-definition sets, the development of the appropriate voltage for the cathode-ray tube anode supply was undertaken by a fairly bulky separate unit, while the cathode and anode supplies to the sound and vision receivers was developed in another comparatively large unit. To provide accommodation for these two units meant that the cabinet itself had to be correspondingly large, and although in the initial phase of a new and novel entertainment service public reaction was not against a bulky set, as soon as the novelty began to wear off the size of sets became an important feature. It was felt that television sets should not be very much larger than the household radio set, and every section of the complete television receiver was therefore examined carefully to ascertain where space could be saved. The dimensions of the glass bulb of the cathode-ray tube were reduced in a very drastic manner, while the newer vision chassis seemed to bear no relation to the earlier prototypes in so far as bulk was concerned. The final designs both in this country and abroad tended towards the separation of the set into two units. The first of these accommodated the time-base generator, deflector equipment, cathode-ray tube and vision receiver, while the second housed the sound receiver together with the anode and power supplies. A very interesting example of the compact form taken by the latter is furnished by the accompanying illustration. On the left-hand side is the sound receiver, in this case a three-valve set without any provision for a main tuning control, since the television sound is radiated on a single carrier frequency and there is, therefore, no question of searching the ether for ultra-shorts. Since the high-voltage feed for the anode of the cathode-ray tube was of a much lower value than the early sets, the rectifier and associated parts were located behind the semi-cylindrical insulating shield and gave a voltage of the order of 4,500. The balance of the power supply units are mounted above and below the chassis, and can be seen on the right, while in the foreground is the high voltage cap for clipping on to the terminal brought out for that purpose on the truncated glass wall of the cathode-ray tube. This neat and compact chassis as a rule was accommodated in the base of the cabinet and gave first-class results, being indicative of the advances made in this particular branch of the apparatus.

Allowing for Development

IN a recent paragraph of these columns the attention of readers was drawn to the suggestions put forward in America in relation to the television service in so far as it affects development. Is it better to make provision for a preliminary period while improvements in the apparatus at both the transmitting and receiving ends are being undertaken, or would it be preferable to standardise the pictures now, and maintain that standard for a period of years before any changes are made? Both suggestions have their adherents, but no decision has as yet been arrived at, and until this is done the industry is not likely to make the progress essential for placing it on a sound economic basis. It is for this reason that a good deal of attention has been directed towards the Dumont method of television transmission and reception, for it is claimed that this is so flexible that it will automatically take cognisance of improvements in picture definition without any changes having to be made in the receiver, with the result that each set purchaser is protected against early obsolescence. For this to happen, the complete control of the television chain is transferred to the transmitting end. In the more common form of television service the cathode-ray tube receiving set is built so that the scanning action of the tube's beam of electrons is furnished by impulses built up in the time-base generator. The speed with which these pulses function is dependent on the electrical constants of the line and frame circuits, and the synchronising pulses injected into the radiated vision signal merely serve to maintain a check on the triggering action at the receiving end. If there is a change in picture definition, therefore, the electrical constants of every receiver in use have to be altered, and the more drastic the change the higher becomes the cost involved to each individual purchaser of the television set.



A good example of a neat and compact unit which includes the sound receiver, power pack, and anode supply for a television receiver.

Special Advantages

TO carry this special scheme into effect the movement of the cathode-ray beam across the screen of the tube in the line and frame directions is undertaken by what is perhaps best termed automatic sweep circuits. This is quite distinct from the self-oscillating circuit, and is only brought into action by the application of a synchronising pulse. The range of speed is such that the circuit will work over very wide limits, and can be regarded as an amplifier. That is to say, the line and frame sweep pulses are in effect included in the radiated sound wave, and when received at the set are filtered out. These pulses at line and frame frequency are then amplified by the automatic sweep circuits, and applied to the cathode-ray tube to move the beam at exactly the same speed as that originally generated at the transmitting end of the chain. It is clear, therefore, that both the number of lines in the received picture as well as the number of frames and complete pictures per second are under the absolute control of the transmitting end, and can be increased or decreased at will according to the dictates of the service. This really simplifies the controls at the receiving end, and also ensures that none of the annoying difficulties arising from lack of synchronisation in the set arise in practice. The form of synchronising signal necessary to put this scheme into effect differs from the waveform employed with present-day practice, but the prime advantage of flexibility to suit any standard of picture is one which merits a very close investigation by the American authorities, who are now in the throes of attempting to find satisfactory solutions to all the television difficulties with which they are confronted.

LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes, price 2s. each.

Abstracts Published.

TWO-PART COUPLINGS.—Yoshida, K. No. 502421.

A connection board for wireless receiving sets has a number of layers, each consisting of a pair of insulating boards with connecting strips between them, placed one upon another with a metallic plate interposed between adjacent layers. The boards and

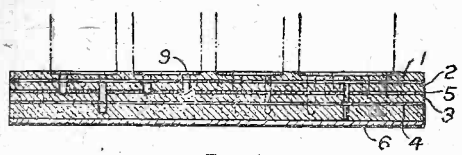


Fig. 1

plates are provided with sockets to receive plugs on the bases of the components, these sockets being appropriately joined by the connecting strips between the boards. The upper layer, consisting of boards 1, 2 (Fig. 1), is separated from the lower layer i.e., boards 3, 4, by a metal sheet 5, and may have a metallic plate covering its upper surface. Sockets 9 serve to connect the plugs on the components with the connecting strips, some between boards 1, 2 and others between boards 3, 4. A further metal plate 6 is placed on the bottom of the complete baseboard and the whole is held together by screws. The object of separating the wiring into layers is to reduce coupling and for this purpose several layers may be used. The whole may be enclosed in a metallic casing to provide complete screening of the wiring (not shown).

CONDENSERS; WIRELESS RECEIVING-APPARATUS.—Standard Telephones and Cables, Ltd., Leno, J. A., Edwards, J. C. No. 507604.

A condenser casing 1 (Fig. 2) is cylindrical with sides cut away from the top to form two shelves as at 3 by means of which it can be secured either to screws 5 to a base as shown or direct to a panel, etc. Leads from the condenser may pass downwards and out through the sides of the base as at 22, 23, 24, or laterally from the flattened sides of the casing 1. The under side of the casing 1 may be constituted by a plate which can carry fuses in clips, connection to terminal posts mounted in the base being effected by spring clips. The cylindrical form enables it to be combined with a coil—for example to form an interference suppressor—by mounting within the coil former.

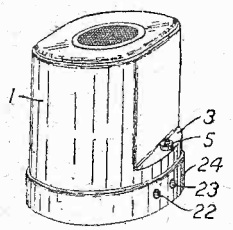


Fig. 2

ADJUSTING WIRELESS APPARATUS; INDICATING APPARATUS.—Murphy Radio, Ltd., and Fisher, L. No. 507948.

In order to open the scale of the short-wave band of a radio receiver, the short-wave tuning scale 8 (Fig. 3) is combined with a vernier 9 comprising a part moving with the tuning means, such as the drum 1, and marked with a number of evenly spaced transparent lines, and a fixed part comprising a number of evenly spaced transparent lines on the transparent fixed plate 7, the spacings differing in known manner for vernier scales. The plate 7 carries an index mark 4 and each station in the long and medium wave bands 3, 2 is indicated by a registering mark 6. The scale arrangement and illumination is such that a mark on the moving scale is only illuminated against a dark background when it coincides with a mark on the plate 7. Alternatively, the vernier may be constituted by a circle of translucent dots containing numerals and co-operating with a series of spiral dots on the rotating drum 1. Greater subdivision may be obtained by mutually inclining the two sets of gradations and extending their length.

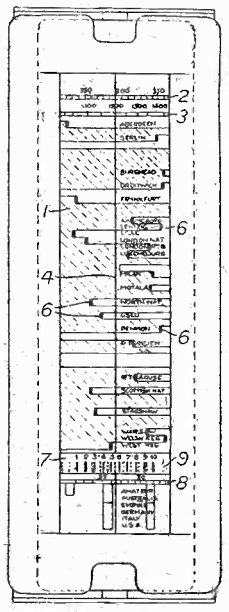


Fig. 3

NEW PATENTS

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Latest Patent Applications.

4237.—Loewe Radio Co., Ltd.—Television transmitters. March 5th.

4238.—Loewe Radio Co., Ltd. (Schlesinger).—Electronic systems for television, etc. March 6th.

4239.—Loewe Radio Co., Ltd. (Schlesinger).—Means for selecting electrical signals or impulses for television. March 6th.

Specifications Published.

518480.—Jones, J. E. Rhys.—, Barrett, J. O. G., and Plessey Co., Ltd.—Electrical frequency-dependent control means, primarily for radio apparatus.

518491.—Eichhorn, C. E.—Vibration-translating devices, such as loudspeakers or phonographic pick-ups.

518574.—Marconi's Wireless Telegraph Co., Ltd.—Cathode-ray tubes.

518615.—Kolster-Brandes, Ltd., Smyth, C. N., and Tiller, P. A. —Television receivers.

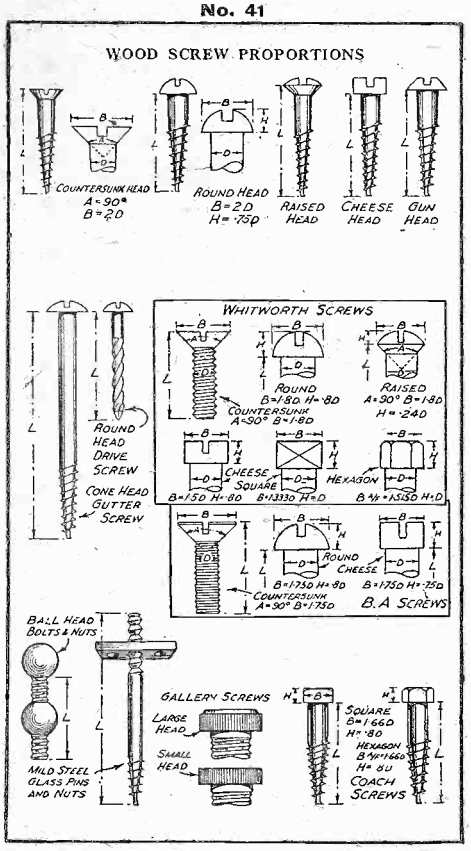
518616.—Kolster-Brandes, Ltd., and Smyth, C. N. — Television receivers.

Printed copies of the full Published Specifications only may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 41



No. 42

Equivalents of Imperial and Metric Weights and Measures

IMPERIAL		METRIC
Linear Measure		
1 Inch	= 25.400 Millimetres.	1 Millimetre (mm.) (1/1000 m.) = 0.03937 Inch.
1 Foot	= 0.30480 Metre.	1 Centimetre (1/100 m.) = 0.3937 ,,
1 Yard	= **0.914399 Metre.**	1 Decimetre (1/10 m.) = 3.937 Inches.
1 Fathom	= 1.8288 Metres.	**1 Metre (m.) = 39.370113 Inches. = 3.280843 Feet. = 1.0936143 Yards.**
1 Pole	= 5.0292 ,,	
1 Chain	= 20.1168 ,,	1 Decametre (10 m.) = 10.936 Yards
1 Furlong	= 201.168 ,,	1 Kilometre (1000 m.) = 0.62137 Mile
1 Mile	= 1.6093 Kilometres.	
Square Measure		
1 Square Inch	= 6.4516 Square Centimetres.	1 Square Centimetre = 0.15500 Square Inch.
1 Square Foot	= 9.2903 Square Decimetres.	1 Square Decimetre = 15.500 Square Inches.
1 Square Yard	= 0.836126 Square Metre	1 Square Metre = 10.7639 Square Feet = 1.1960 Square Yards.
1 Rood	= 10.117 Ares.	
1 Acre	= 0.40468 Hectare.	1 Are = 119.60 Square Yards.
1 Square Mile	= 259.00 Hectares.	1 Hectare = 2.4711 Acres.

No. 43

Equivalents of Imperial and Metric Weights and Measures—continued

IMPERIAL		METRIC
Cubic Measure		
1 Cubic Inch	= 16.387 Cubic Centimetres.	1 Cubic Centimetre = 0.0610 Cubic Ins.
1 Cubic Foot	= 0.028317 Cubic Metre.	1 Cubic Decimetre (c.d.) = 61.024 Cubic Ins. = 35.3148 Cubic Feet.
1 Cubic Yard	= 0.764553 ,, ,,	1 Cubic Metre = 1.307954 Cubic Yards.
Measure of Capacity		
1 Pint	= 0.568 Litre.	1 Centilitre (1/100 litre) = 0.070 Gill.
1 Quart	= 1.136 Litres.	1 Decilitre (1/10 litre) = 0.176 Pint.
1 Gallon	= **4.5459631 Litres.**	1 Litre = **1.75980 Pints.**
Avoirdupois Weight		
1 Grain	= 0.0648 Gramme.	1 Milligramme (1/1000 grm.) = 0.015 Grain.
1 Dram	= 1.772 Grammes.	
1 Ounce	= 28.350 ,,	1 Centigramme (1/100 grm.) = 0.154 ,,
1 Pound (7,000 Grains)	= **0.45359243 Kilogramme.**	1 Gramme (1 grm.) = 15.432 ,,
		1 Kilogramme (1,000 grm.) = 2.2046223 Lb. or 15,432.3564 Grains.
1 Hundredweight	= 50.80 Kilogrammes. = 0.5080 Quintal.	1 Quintal (100 kilog.) = 1.968 cwt.
1 Ton	= 1.0160 Tonnes or 1.016 Kilogrammes.	1 Tonne (1,000 kilog.) = 0.9842 Ton.
1 Grain (Troy)	= 0.0648 Gramme.	1 Gramme (1 grm.) = 0.03215 Oz. Troy. = 15.432 Grains.
1 Troy Ounce	= 31.1035 Grammes.	

No. 44

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7
19	2781	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	6
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4

No. 45

LOGARITHMS—(*continued*)

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	7
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7

No. 46

LOGARITHMS—(*continued*)

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	3	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	3	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	3	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	3	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	6
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5

Open to Discussion

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

A Clacton Reader's Den

SIR,—I have been a reader of PRACTICAL WIRELESS for the past year, and have found it very helpful in numerous cases, and I wish it every success in the future. I enclose a photograph of my den, together with a log from February 1st, 1940, to March 10th, 1940, hoping these will interest other readers.

My RX is a home-constructed A.C. mains straight three with coils, and the following stations were heard on 14 mc/s: W1JFG, W1DIC, W1AEP, W1FVO, W1KIU, W1BLO; W2FYO, W2KZG, W2IXY, W2GMQ, W2JT; W3GPM, W3FRE, W3EOZ, W3FJU, W3EMM; W4DSY, W4BMR, W4AHH; W8CFA, W8BUO. W8LUQ, W8QKS, W8CUO, W8MHC; I1JKV, I1RE; ES5C, ES5D; ES4G, XUIB, LYIJ, K4FKC, HA6T, HA7P, HA9Q, YV1AQ, EA7BA and UK3AH.—A. HAZELTON (Clacton-on-Sea).

The Kestrel S.W. Four

SIR,—You may be interested to hear about my experiences with the Kestrel S.W.4.

I constructed it as near the original as my very meagre supply of pocket-money would allow. I obtained a piece of sheet steel the required size for the panel, whilst the sides of the chassis are made of ¼in. oak. The top is of plywood, the whole being lined with sheet tin obtained from motor oil tins. I also screened the H.F. coil and tuning condenser with a screen made from the same material. The tuning condensers are "Premier," and Eddystone coils, 4-pin H.F., are used together with Utility microdials, with electric bandspreading. In the H.F. stage I am using a Tungsram HP210 valve with a 50,000 ohms potentiometer for grid bias to the grid. A Cossor SPT210 is used as detector, Mullard PM2HL as first L.F. and a Triotron P225 in the output stage. The L.F. transformer is a R.I. Parafeed. I might add that it is the best S.W. set I have constructed so far.

As to results, I can get practically all the European stations, Athlone, TAP (Ankara), VUD2 (Delhi), CXA2 (Montevideo), VLQ (Sydney), XGOY (Chungking), WGEO, WRUL, WCBX, WPIT and WNBI.

I heard a station the other evening between 10 p.m. and 10.30 p.m. on 49 metres which announced itself as KBRM, Manila, Philippine Islands. I cannot find Manila in any tabulated list of stations on 49 metres.

Try as I will, I have never been able to hear any station in Canada or S. Africa on this or any other set. I am somewhat puzzled about this, as the American stations come in loud enough to burst the speaker when conditions are favourable, but I cannot obtain even a very weak headphone signal from Canada.—J. KIDD (Melton Mowbray).

SIR,—Herewith is a further log of stations received on the Kestrel S.W.4 at various times from February 18th to date. Aerial, 30ft. inverted-L facing N.S. All stations heard on speaker: 20-metre Amateurs: W1MF, BLO, KIU, IGL, JEL, FOV, AEP, BES, JFG, JQM; W2GIZ, IXY, DMJ, IJD, FOY; W3IGL, DOK, SMY, CGF, EOZ, FJU; W4CK, DSY, BMR; W7GBY, W8RHP, OBP, GFF, HLK, BF, QSK, PYA, ACY, JOE, DBC; W9BEU, K4FKC, ES4G.

31-metre band: Athlone testing, VLQ. On 20 metres I heard PSE at R7. The

A corner of Mr. A. Hazelton's den.

programme was destined for Germany. Motala comes in very well on 19 metres. Readers will note from the above that this set has proved itself capable of picking up Sydney, Australia. I have heard this station three times so far at signal strengths varying from R4 to R7.

In closing I should like to make a few suggestions which I feel would have an appeal to many readers.

1. Why not have some S.W. superhet circuits? I suggest simple circuits to start with, using valve combinations such as an FC2A, VP210, TDD2A, PM22A, then go on to something more ambitious at later dates.

2. I, like many other readers, would like to see the return of "Leaves from the Short-wave Log," or similar articles.—E. ANDREWS (Brighton).

A Survey of S.W. Reception Conditions!

SIR,—I would like to second the suggestion of your correspondent, Mr. Horrocks, in a recent issue, that you should publish a survey on reception conditions.

For instance, readers could send in their logs of short-wave broadcast stations monthly; the logs should contain the time at which the stations were logged, and the signal strength of the station and its frequency. They should also state the type of receiver used. The best log or logs received each month could be published.

I realise that space in your paper is valuable nowadays, but would it not be possible once a month to publish a reception log on the lines mentioned? Such a log would surely stimulate interest in the short-waves among the non-short-wavers and promote friendly rivalry among DX-ers.

I would like to get in touch with two or three readers of PRACTICAL WIRELESS, residing anywhere outside of Great Britain, with a view to corresponding regularly. I will reply to every letter received.

I have been a short-wave fan for about a year and have received QSLs from VLR3, XGOY, Burgos, WPIT, WRUL, WNBI, WGEA, WGEO, and I am waiting for veries from CR7BE, K2RH, TAP, WCBX.—J. PARKIN, JUNR., 18, Rowley Grove, Cottingham Road, Hull, Yorks.

A DX Log from Wallington

SIR,—Looking at the different logs printed in your fine magazine from time to time, I think that perhaps my DX log may prove interesting to other readers. Here it is: The numbers in brackets are approximately how many stations I have received:

CO (4), CX (2), PY (22), YV (4), LU (2); HC (2), YP3, VP5, all W. States and all VE districts. PK (3), KA (5), VK (7), J, VU, U3-4-5-9, CR6, CR7, OQ5, ZS1-3-4-5-6 (13), HP, K4 (4), K5 (2) and K6 (1), and the following broadcast stations:

COBX, COCM, COCQ, CORJ, TGWA, TGWB, PRA8, CXA2, CXA4, MTCY, FZR, KGEI, XEXA, LSI, LRX, HJ4ABE, HC1GO, KZRM, KZRF, XGOY, JZI, JZJ and JNJ.

The receiver is a home-built 0-v-1, and the aerial is an inverted-L type 36ft. long and 12ft high, running N.E.-S.W.—S. GARNER (Wallington).

Prize Problems

PROBLEM No. 394.

BARLOW decided to use an extension speaker with his three-valve battery set and accordingly purchased a coil of bell-wire, which he laid round his skirting board from one room to another. He laid the wire double and connected the speaker to one end, joining the other two ends to the speaker terminals on his receiver. When he switched on he found that volume was very poor and although the speaker was the same one as he used originally with the receiver, and was in order, he could not obtain satisfactory results with it in use as an extension model. Why was this? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 394 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, April 8th, 1940.

Solution to Problem No. 393.

When Marshall connected the resistance from anode to earth he short-circuited the supply, and he should have connected a fixed condenser in series, not only to avoid the short-circuit but also to complete the tone-control circuit.

Only one reader successfully solved Problem No. 392, and a book has accordingly been sent to G. Barrow, 9, Meadow Lane, Long Eaton, Nr. Notts.

Practical Wireless
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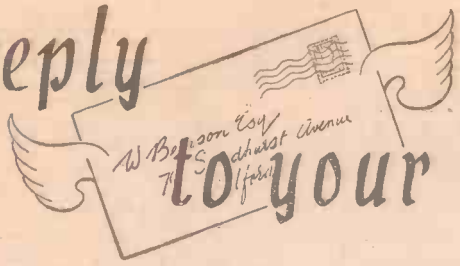
Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS	Date of Issue.	No. of Blueprint
CRYSTAL SETS		
Blueprints 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve : Blueprint, 1s.		
The Signet Two (D & LF)	24.9.38	PW76
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three ((SG, D, Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen)	—	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-Valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	—	PW52
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	—	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model / Push Button 4, A.C. Mains Model	22.10.38	PW95
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
Simple S.W. One-valver	23.12.39	PW88
Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	1.10.38	PW68
PORTABLES.		
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS		
Blueprint, 1s.		
S.W. Converter-Adapter (1 valve)	—	PW48A
AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
B.B.C. Special One-valver	—	AW387
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
£5 5s. S.G.3 (SG, D, Trans)	—	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen)	—	WM384
The Auto Straight Four (HF Pen, HF, Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home Lover's New All-Electric Three (SG, D, Trans) A.C.	—	AW383
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM329
Harris' Jubilee Radiogram (HF Pen, D, LF, P)	*May* '35	WM386
SUPERHETS.		
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four	*Oct.* '35	WM395
The Request All-Waver	*June* '36	WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
Rome Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-Short Battery Two (SG, det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	—	WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	*Mar.* '36	WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

In reply to your letter



Degenerative Feedback

"Could you please tell me what degenerative feedback is and how I could connect the arrangement to my set? I am told it gives better quality."—C. B. (Torquay).

THE term is merely another expression for "negative feedback." This consists of an arrangement whereby a proportion of the output voltage is fed back to the grid circuit, and is mainly used with pentodes and tetrodes. It is, in effect, a resistance-capacity feedback scheme, and it was dealt with in our recent series of articles on the valve as an amplifier. We cannot tell you how to add it to your set without a diagram, and if you are using good triodes it should be unnecessary to use it.

Smoothing

"I have a small A.C. set, but the smoothing does not appear adequate. I have another choke but am not sure whether I should include this in series with the existing choke or put it in the H.T. negative line. I believe I once read in your paper that it was not advisable to do the latter, but I should like you to confirm this."—W. N. U. (Amersham).

THEORETICALLY, it would be desirable to add the choke in series with the existing circuit, including another condenser, of course, on the receiver side to complete the smoothing circuit. If you put it in the H.T. — line the only point to watch is that the choke is so placed that there is no coupling between it and the other choke, as this would aggravate the hum trouble. This was the point which was raised in these pages some time ago.

Condenser Reactance

"I am interested in working out the various smoothing effects of condensers in mains and other apparatus carrying A.C. —such as would be encountered in an A.C. quality receiver. I should like you to give me again the formula for the reactance of the condenser, as I have mislaid a data sheet containing this which you gave away some time ago."—L. I. (Swanage).

THE reactance of a condenser on A.C. increases as the frequency decreases, and the formula for reactance is:

$$\text{Frequency} = \frac{1}{2\pi fC} \text{ ohms.}$$

where f is the frequency of the supply, C is the capacity in farads, and π is, of course, the standard 3.14.

Link Coupling

"I enclose a cutting of a circuit which I have just found and which looks as though it might offer possibilities for short-wave reception. There is one arrangement about which I am not clear and I should be glad if you would explain just what is intended in the area enclosed in the blue pencil. This does not appear to have been used in any circuits in your pages since the time I have been taking your paper."—R. W. T. (Taunton).

THE circuit is of a two-stage transmitter, consisting of crystal oscillator (tritet) and a push-pull P.A. stage. You could not use this circuit for reception, and it is, of course, illegal to make up transmitting equipment now. The part you have ringed round is the output circuit of the oscillator and the input of the P.A. stage, and we presume that your difficulty lies in the peculiar wavy lines with the two loops. This indicates what is known as link coupling, and illustrates a single loop coil, coupled to each of the two tuned circuits mentioned, and the loops then joined by a link of ordinary twisted flex.

RULES

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.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

D.C. Charging

"I have been told that I can charge my accumulators straight from the mains if they are D.C. with the aid of a lamp? Could you send me details of the connections from a heat plug and size of lamp? The voltage of the mains is 230. Also, does the lamp use any current?"—T. S. (E.12).

THERE is just one point to watch and that is that the heat plug is not rated at double the lighting circuit, namely 460 volts. Otherwise, it is quite in order to use the mains for charging, with a lamp in series. You should make up a small charging board so that no live wires or contacts are available on the high voltage side, and the size of the lamp is dependent upon the charging rate you require. Using ordinary electric lamps the following rates would be obtained—approximately:

Wattage of lamp	Charging current rate
40 at 200 v.	.2 amps
60 ,,	.3 ,,
75 ,,	.35 ,,
100 ,,	.5 ,,

You should include fuses in the interests of safety. The lamp as well as the complete accumulator circuit consumes current at the rate given above.

H.T. Potentiometer

"I am thinking of making up a simple converter from the circuit and details given in your article on the Frequency-Changer in the issue dated February 24th last. There appears, however, to be a misprint in the circuit Fig. 1, on page 479. As I see it there is a short-circuit across the H.T. through the potentiometer which is used for the screen of the valve. Perhaps you could give me the correct arrangement for this."—T. G. (Bury St. Edmunds).

THERE is no mistake in the circuit in question, as the potentiometer must have a current flowing through it in order to carry out its function of applying a varying H.T. voltage to the screen. This is quite a standard arrangement and you are apparently confused with a series resistance method of control. This is not advised for H.F. screen control purposes. The only point to watch is that an on/off switch is included somewhere in the H.T. supply so that the H.T. will not drain away through the potentiometer when the set is switched off. Usually, this is carried out by including a three-point switch for the purpose, one pair of points being used for L.T. and the other point being joined between the lower end of the potentiometer and the H.T.—line.

Reaction Control

"I find that when I have my reaction control at zero, there is still some form of distortion, which I can clear by disconnecting the condenser leads from the anode. When I disconnect the condenser from the coil it does not make any difference. I should be glad if you could explain this and tell me how to overcome the distortion."—D. C. E. (Barnes, S.W.13).

THE trouble may be due to the fact that you are using a by-pass condenser across the anode circuit, and that this is large and, in parallel with the residual capacity of your reaction condenser, acts as a tone control. We suggest that you try the effect of bending up a corner of one of the end vanes of the moving portion of the condenser so that when in the zero setting the condenser is short-circuited. To avoid short-circuiting the H.T. supply a small capacity fixed condenser may be included in series with the condenser and the anode. Perhaps the tone-control circuit shown on page 325 of our issue dated December 30th last may interest you.

Choice of Circuit

"I wish to build myself a receiver for general purpose working, that is, on all wavelengths. I am not anxious to obtain the highest quality, but I want a set I can play about with, without undue restriction as to scope. I wonder if you can recommend anything from your list of Blueprints."—N. R. W. (Sheffield).

THE best type of set in a case such as that outlined would be one employing plug-in coils. This would enable you to tune to any desired wavelength and with a suitable type of circuit the quality should be quite satisfactory. We would suggest a three-valve circuit, detector and two L.F. stages, band-spread tuning for simplicity on the short waves and good quality components throughout.

The coupon on page iii of cover must be attached to every query.

RADIO CLUBS & 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.

BRISTOL EXPERIMENTAL RADIO CLUB

Headquarters : 21, King's Corridor, Old Market Street, Bristol, 2.

Publicity Manager : D. J. James, 40, Robertson Road, Eastville, Bristol, 5.

THE meeting of this club, held on Tuesday, March 12th, was chiefly devoted to the official business of the club. Mr. C. R. Davis, the secretary, having volunteered for the radio operator section of the R.A.F., Mr. P. R. Dinham was elected to be his deputy until the end of the present financial year. D. James was elected to deputise for the chairman, Mr. A. A. Uppington, whenever his National Service duties prevent him from attending meetings.

It was decided that now evenings are lighter again, meetings should commence at 8 p.m. Mr. L. Toghill was requested to be responsible for the half-hour period of morse tuition at each meeting. Members' ideas for future agendas were discussed, and it was decided to adopt at least one of them.

THE CROYDON RADIO SOCIETY

Hon. Pub. Sec. : E. L. Cumbers, 14, Campden Road, South Croydon.

MR. NIXON, of the General Electric Co., Ltd., lectured to the Croydon Radio Society in St. Peter's Hut, Ledbury Road, S. Croydon, on Thursday, March 7th. His topic was "Valve Development," and he recalled the carbon lamp being the valve's forerunner, having its filament as one electrode.

It was not long, however, before objections to carrying accumulators to be charged were voiced, and so mains valves, firstly as a four-volt range, appeared. Then the triode led to the pentode, tetrode and screened grid, which meant that more tuned stages was better tuning. Finally Mr. Nixon's film of G.E.C. valve manufacture proved most interesting, containing as it did full explanations of every stage from glass blowing, exhausting and gettering, and elaborate testing before dispatch. The next monthly meeting is on Thursday, April 4th, with the annual general meeting at 7.30 p.m. The balance sheet will be presented and officers for 1940–41 will be elected. At 8 p.m. the popular ex-chairman, Mr. G. A. Hoskins, will give a musical programme on records with his new high quality apparatus. He has a selection of 200 records from which to choose, and PRACTICAL WIRELESS readers are invited to a most interesting evening's entertainment.

EXTERNAL AIDS

(*Continued from page 64.*)

and thus an additional socket or terminal will have to be mounted on the cabinet. The aerial is transferred to this new socket when the trap is required, and a lead then joined from the trap to the original aerial socket or terminal. By connecting a short, flexible lead to the trap and bringing this outside the cabinet the change, when desired, may be effected in a few seconds. The wave-trap consists merely of a condenser as already mentioned, having a maximum capacity not exceeding .0005 mfd.—preferably .0002 mfd. and a coil which will cover the medium-wave band. The trap is not generally needed on the long waves and therefore construction is simplified. If you make use of an old dual-wave broadcast coil the long-wave section may be short-circuited with a length of bare wire to avoid the complication of a switch, whilst if you wish to make up a coil you can use a former about 2½in. in diameter and wind on 45 or 50 turns of wire of about 22 to 26 d.c.c. A home-made coil lends itself more readily to experimental work, and by making tappings from the lower end at every 5 turns you can connect the trap in a number of different combinations, each of which will offer varying degrees of selectivity. The circuits are shown in Fig. 3.

No doubt other additional schemes will suggest themselves to keen constructors, such as an extra L.F. stage—preferably resistance-capacity coupled, or a small aperiodic H.F. stage, but as these will take up a fair amount of room, it may not be possible to add them conveniently to a receiver which is of the small table or self-contained type, and, accordingly, they are not described here.

(*Continued on page iii, col. 1.*)

RECEIVERS AND COMPONENTS

(*Continued from page 80, col. 3*).

24 MFD. can type, electrolytics, 450v. working, 1/- each.

B.I. wire-end type bias electrolytics. 50 mfd., 12v., 1/6 each; 50 mfd., 50v, 2/- each.

TUBULAR wire-end non-inductive paper condensers. All sizes up to 0.1, 5d. each, 4/9 dozen.

ENERGISED speakers, Plessey 6" cone, 1,500 ohms field. 5/11 each.

BATTERY output pentode valves. Well-known make. 3/11 each.

BATTERY double diode triode. Well-known make. 3/6 each.

ROTARY converters, 6v. and 12v., D.C. input, output 240v. 40 m.a. Complete with smoothing and suppression. State voltage when ordering. To clear 15/- each.

RAYTHEON first-grade valves. Largest stockists, all types in stock, including glass series, glass octal series, metal series, bantom series, single-ended series, and resistance tubes, all at most competitive prices; send for valve lists. All orders must include sufficient postage to cover. Hours of business: 9 a.m.-6 p.m. weekdays. Saturday, 9 a.m.-1 p.m. Please write your address in block letters.

RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE: HOLborn 4631.

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21/- Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.

5/- 100 Wire-end Resistances, assorted capacities. ½ and 1 watt, 5/- per 100.

ORMOND Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.

2/- Tool or Instrument Carrying Cases, ex Government Stock; Wood, 9" x 7" x 7", 2/-.

SOUTHERN Radio, 46, Lisle Street, London, W.C. Gerrard 6653.

VAUXHALL.—All goods previously advertised are still available; send now for latest price list, free.—Vauxhall Utilities, 163a, Strand, W.C.2.

COULPHONE Radio, Grimshaw Lane, Ormskirk. 1940 Collaro A.C. Gramophone Motors 12" turntable 27/6. Radiogram units 45/-. American Valves all types 4/6. Octal 5/6. Record F.W. Rectifiers 5/6. Stamp for list.

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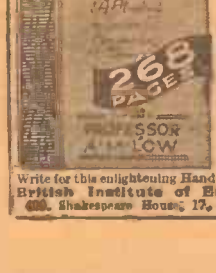

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Special Offer of Dual Range Screened Coils by well-known manufacturer. Aerial or H.F. coil. Accurately matched suitable Band-Pass. Medium- and long-wave operation. Complete with full diagrams, 2/9 each.

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Incorporating the Premier 3-Band S.W. Coil. 11-86 Metres without coil changing. Each Kit is complete with all components, diagrams, and 2-volt valves. **3-Band S.W. 1-Valve Kit, 14/9. 3-Band S.W. 2-Valve Kit, 22/6.**

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Complete to the last detail, including all Valves and coils, wiring diagrams and full instructions for building and working. Each Kit is supplied with a steel Chassis and Panel and uses plug-in Coils to tune from 13 to 170 metres.

1 Valve Short-Wave Receiver or Adaptor Kit	20/-
1 Valve Short-Wave Superhet Converter Kit	23/-
1 Valve Short-Wave A.C. Superhet Converter Kit	26/3
2 Valve Short-Wave Receiver Kit	29/-
3 Valve Short-Wave Screen Grid and Pentode Kit	68/-

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A NEWNES PUBLICATION

Edited by F. J. CAMM

Vol. 16. No. 395.

Practical Wireless and PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

April 13th, 1940.

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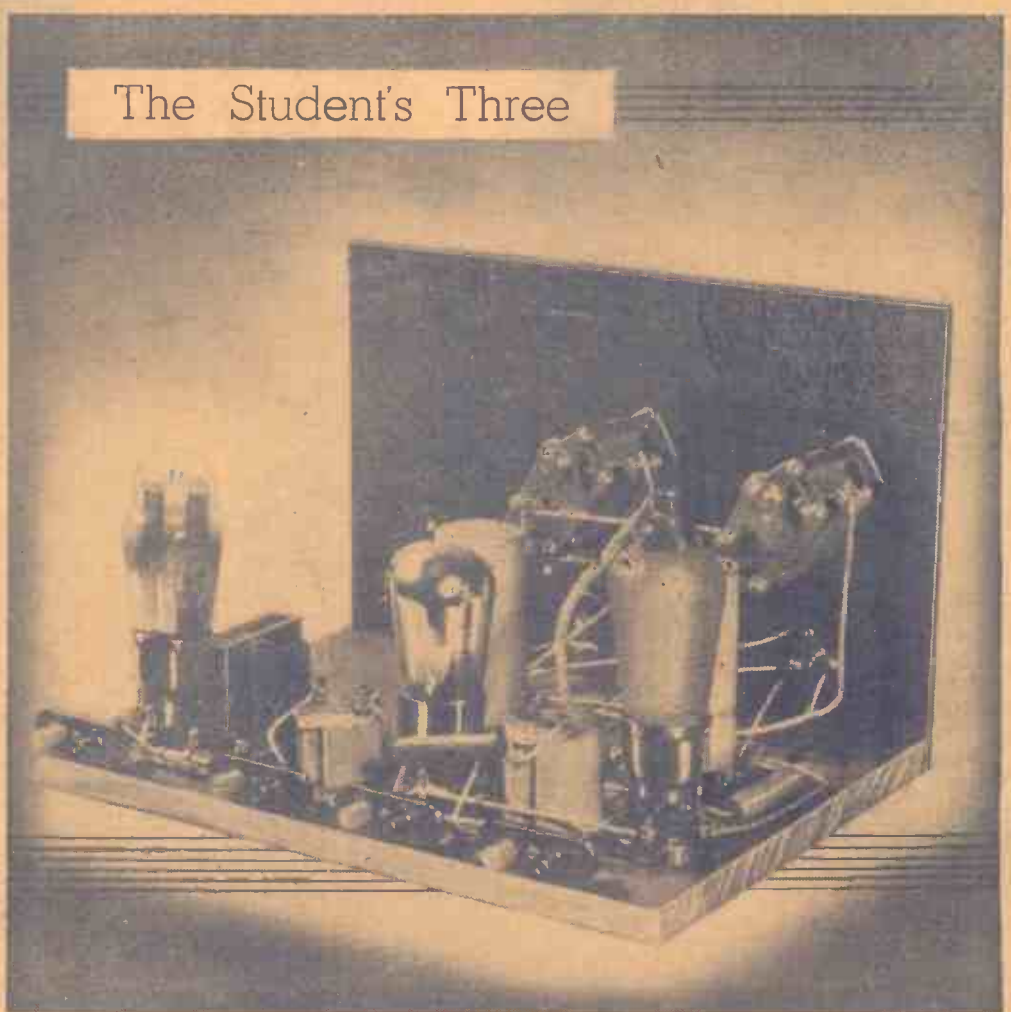

Practical and Wireless
★ PRACTICAL TELEVISION ★
EVERY WEDNESDAY
Vol. XVI. No. 395. April 13th, 1940.
EDITED BY F. J. CAMM
Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Presentation Offer of "The Radio Training Manual"

ON page 89 of this issue appear details of our latest book offer which will be of vital interest to all those who wish to enter radio as a career as well as to those who wish to obtain a sound knowledge of the fundamentals of radio. In spite of rising paper costs and increases in production costs generally, this new work is being offered at the extremely low price of 2s. and only 4 coupons cut from consecutive issues. Obviously, it is necessary for you to reserve a copy at once. Turn to page 108 and fill in and post the reservation form to us *now*.

Radio Careers

WE have been dealing recently with the question of radio as a career, and it is obvious that even more readers are now seriously considering taking up some form of employment in this direction. Unfortunately, it is not possible to give every detail regarding this subject, and such items as salaries to be expected, and prospects in various branches cannot be given. The main item is that of fitness for the branch of the occupation which it is decided to take up, and many readers find that they have forgotten some of the earlier principles which they may need should they have to pass a test. Accordingly, we give in this issue certain further data relative to the subject, and also deal with the question of taking up "free-lance" work as a career, whilst an announcement will be found concerning a useful book which has been prepared to deal more fully with the subject. "The Radio Engineer's Notebook" will be found of the utmost value in providing a readily available table of all the more essential data which is needed in radio research work, while for those who wish to build a simple set for the purpose of experimental work will find the "Student's Three" described in this issue a further valuable asset in this connection. In subsequent issues we shall cover further phases of the subject.

A Tribute to Leslie Heward

SIR ADRIAN BOULT is to go to Birmingham on April 14th to conduct the City of Birmingham Emergency Orchestra in a special concert organised as a tribute to Leslie Heward, who has been conductor of the City of Birmingham Orchestra for ten years. The first part—including the Brahms No. 4 Symphony—will be broadcast. Mr. Heward was a pupil of Dr. Boult at the Royal College of Music, and succeeded him as conductor of the City of Birmingham Orchestra. He conducted the Capetown Orchestra for three years.

Songs and Stories of the Scottish Clans

HELEN DREVER'S series of programmes for Children's Hour, recalling the stirring histories of the Scottish clans, brings on April 15th stories of Clan Douglas. The most famous of these is the story of the good Lord James, who set out with a silver casket bearing the heart of King Robert the Bruce to fight in the Holy Land against the Saracens. Wounded in battle and sore-pressed, he hurled the casket forward into the thickest of the fight, crying: "Lead on, brave heart, as thou wert wont! Douglas will follow thee or die!" There are also stories of the part played by the Douglas family at the Battle of Otterburn, which in England is called Chevy Chase. Among the songs connected with the name are the old Scottish tune, "Ca' the yowes to the knowes," and the Border ballad, "O waly, waly, up the bank."

Carl Carlisle, whose "Evening with the Stars" impressionist act is creating a sensation.

Radio Exports

THE General Electric Co., Ltd., reports that as radio receivers can now be exported without a special export licence, particularly profitable business is being obtained. The practice this company makes of ensuring that all the apparatus sent abroad is subjected to exhaustive tests under conditions reproducing those of the climate to which they are consigned is also beginning to bear fruit. The reliability and high performance of the sets are, in fact, establishing a valuable reputation.

Comforts for Members of His Majesty's Forces

THE Postmaster-General announces that persons wishing to post packets or parcels to the Committees arranging for the distribution of comforts to sailors, soldiers, or airmen must prepay postage at the ordinary inland rates. The Postmaster-General is not empowered to transmit them free of postage. The addresses of the Committees are as follow:

For sailors: The Royal Navy War Comforts' Committee, Admiralty, Whitehall, London, S.W.1.

For soldiers: Army Comforts, 12, St. Mary's Butts, Reading, Berks.

For airmen: The Royal Air Force Comforts Committee, Air Ministry, Berkeley Square House, Berkeley Square, London, W.1.

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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, *George Newnes, Ltd., Tower House, 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.

FOR THE NEW READER

Making a Start in Radio

An Outline of the Best Methods to Adopt in Taking Up Radio as a Serious Hobby

By L. O. SPARKS

IT would be difficult to find another industry the progress of which has been so closely connected with, and in fact dependent upon, the activities of the thousands of amateurs throughout the whole world as that concerned with the production of radio and allied apparatus. Keen experimenters in practically every nation have made some contribution to the development of the science or its practical application, and while America, by virtue of her great population, can most certainly claim to have the largest band of active amateurs, it must not be overlooked that Great Britain contributes, in no small way, valuable assistance to the general furtherance of the science by her smaller, but by no means less active, band of very keen amateurs.

It is quite possible that a casual reader of this journal would make some remark to the effect that he did not realise that such interest existed in constructional radio work these days. In fact, it is no uncommon thing to hear *non-readers* express their amazement that such activities do still flourish and invariably they ask "But what can the amateurs do? . . . etc., etc." This lack of understanding may seem very strange to those of us who are actively engaged with the hobby, but perhaps some allowance should be made, as I do not think it would be any exaggeration to say that quite a number of readers of PRACTICAL WIRELESS do not *realise to the full* the vast number of amateurs in this country alone, who are continuously seeking to improve existing designs and apparatus. In normal peace-time, each week brings fresh recruits to the army of enthusiasts, and strange as it will no doubt seem to many, during the last six months the numbers have increased by leaps and bounds.

Unlike many hobbies, radio can be truly said to be worldwide; frontiers and languages do not form any barriers to the activities and co-operation of those who enter into the great scheme with genuine interest, although, of course, during present conditions certain limitations have to be imposed.

How to Start

One thing which is continually arising in the many hundreds of letters received by the Editor from those taking up radio is the question "Which is the best way to start?" As it is not possible to give a general answer to that question, it is hoped that the remarks which follow will help all interested to obtain a reasonable idea of how to commence their activities.

The first point to be considered is whether one is contemplating taking up the subject purely as a hobby or whether they have in mind making it their livelihood. If it is to be for the former, then two queries arise: there is the constructional side and there is also the technical side to be considered. Although it is always desirable to try and combine both, within the limits which will allow the utmost satisfaction to be obtained from the subjects, it is not uncommon to find that some readers have a distinct fancy or tendency to one or the other, therefore it is best to try and map out the ground you wish to cover, making the plans sufficiently flexible to permit modification as time goes on.

As a hobby, and for the veriest beginner, I would strongly suggest a little reading about the fundamental principles of radio. There are many good textbooks on the market, as the advertisements in this journal will show, but it is not advisable to delve too deeply into matters theoretical without carrying out sufficient practical work to enable such theories to be put into practice. For example, before swatting up electrical laws, the function of valves and complicated circuits, get a sound idea of electro-magnetic waves, inductance, capacity, frequency and tuning and then make up, and experiment with, different types of simple crystal receivers. Several such circuits have been described in past issues, and as they are not costly to make, they provide fine material for initial experiments. Associated with such work will, of course, be the question of aerials and earths, and again quite a lot of time can be devoted to the former and some interesting experience gained.

After a reasonable amount of time with receivers of this type, during which further reading has been taking place, one can advance to circuits using a single valve, either in the form of an L.F. amplifier to increase the strength of the signals received by the crystal set or as a separate one-valve receiver. When the latter stage has been reached, endless experiments can be carried out; in fact, it is amazing the results which can be achieved with a good one-valver in conjunction with an aerial and earth system of reasonable efficiency and a reliable pair of headphones. Don't be too anxious to rush on to larger receivers; use the one-valver to its utmost so that you become *quite familiar* with different types of single-valve circuits, tuning, reaction, and all the many little—but important—items with which they are so closely associated. Remember, that it is a far greater achievement and, incidentally, a fine proof of the efficiency of a circuit, to get good results from remote stations with a one or a two-valver than with an elaborate multi-valve outfit. Twiddling a couple of knobs on a powerful commercial superhet receiver will not prove very instructive so far as the theory of radio is concerned.

With all the work undertaken, it is absolutely essential for one to observe and record the various things that happen which are not already familiar. If you cannot account for them, and if your reference books fail to make the matter clear, then get in touch with another enthusiast or, better still, your local radio club.

We publish an extensive range of tested blueprint designs, and to these fresh models are being continually added, so there is not the slightest reason why any constructor should be held up for reliable and accurate information to enable him to construct a receiver, amplifier or other radio apparatus.

Technically Inclined

For those whose interest is more in the technical side of radio, namely, design and research, more bookwork is absolutely essential, though a certain amount of practical work *must be undertaken*, if only to prove technical points.

The subjects to be covered will, of course, depend to a great extent upon the individual, but if a thorough knowledge of the science—so far as the amateur and his work are concerned—is required, then the following subjects should be covered. Electricity (D.C. and A.C.), electro-magnetism, high-frequency oscillatory currents and circuits, valve operation and characteristics. An elementary knowledge of mathematics will, of course, be very desirable. The list given above might seem rather stiff, but whether that is so or not depends on how far into the various subjects one explores. The true technically-minded person usually wants to go deeper and deeper into matters as his interest is aroused.

Livelihood

If one is about to take up radio as a career, then the subject must be approached from rather a different angle, *but* it should be appreciated that one's progress is bound to be much easier if the varied experience of a keen amateur experimenter has already been gained. An examination of the personnel of practically every branch of the radio industry will reveal the benefit of amateur training.

The various branches open to those interested in radio, and the necessary steps to take and the qualifications required, have been dealt with in detail in another issue, therefore a few words must suffice in this article.

First of all, secure a thorough working knowledge of the subject. If possible, undertake a recognised course of training, either in person or by correspondence, and at the same time gain as much knowledge as you can about various circuits and as many different types of receiver as facilities permit. Acquire a set of decent reference books and record your own observations, and above all, keep your knowledge right up to date by means of PRACTICAL WIRELESS and trade papers. Two or three meters and a small set of tools are, of course, absolutely essential, and when purchasing the meters do have sufficient patience to wait until funds permit obtaining really good instruments.

Careers in Radio

Further Details of Careers which are Open in the Radio Industry and in the Services

ALTHOUGH we have dealt in previous issues with the question of a career in radio, for the benefit of new readers it may briefly be repeated that there are dozens of different spheres which may be found in this particular branch of industry. The Services have, of course, in view of the present conditions, claimed first call on radio technicians, and the Royal Air Force is undoubtedly in the forefront in the employment of radiomen in all branches. Although the infantry and Navy also make use of radiomen, these are in the main not in the same categories as the R.A.F. men. In peace time the Air Force had a branch of radio and the men were either radio operators or simply servicemen. In many cases, and this applies also to the other branches of the Services, the operator was expected to keep his apparatus in good order, although major repairs might be attended to by specialists.

In view of the much wider use which is now being made of radio in the Royal Air Force, however, a special trade or branch has been developed known as Radio Mechanic. Men in this branch will be concerned solely with testing, assembly and servicing or allied work, and will not be expected to understand Morse or even to go into the air. They must, however, be specialists in so far as they must fully understand all the principles of modern apparatus.

Special Courses

In all branches of the Services it is not expected that a man will come fresh from civilian life and be able to service or maintain the apparatus which he will find in use. A course of instruction is one of the preliminaries so that he will become familiarised with the special apparatus which is called for under war conditions. Although the broad principles are identical in all radio equipment, it is obvious that apparatus required, for instance, for two-way communication in a modern fighter 'plane will not resemble the standard simple broadcast receiver. Neither will it be very similar to a modern superhet. But the circuit features will in the majority of cases be standard, and after a preliminary explanation of the equipment it will be just as simple to service and maintain as normal broadcast receivers. The main essential for all those who wish to enter this branch is a full understanding of all radio technique, plus initiative and ability to reason quickly.

In the case of those who wish to become operators, then a complete and thorough knowledge of the Morse code is absolutely essential, and although it may be possible to get in with only a knowledge plus slow-working speeds, it is much better if you are able to send and receive at least 15 words per minute. This means considerable practice if you have not been keeping up with sending and receiving code, but there are many useful methods of acquiring the necessary speed now available. Firstly, the gramophone records which we have mentioned before, supplied by the Columbia Company and by F. L. Masters, and secondly by means of the valuable Candler Course. Many ex-operators, who have not worried much about code since the last war, have found this course invaluable for brushing up and acquiring again the high speeds met with in Service messages or commercial traffic.

The Radio Trade

But apart from the Services, there are many branches now open in the trade for those who wish to change their occupation, or who are just starting out on a career. It must not be thought that due to the war radio factories have ceased to produce receivers. Many of the larger firms are making apparatus under Government contract, whilst others are still maintaining their ordinary broadcast receiver departments of research and production. A glance down the columns of Situations Vacant in many papers will show that there is a wide demand for many specialists, although it is admitted that in many cases the qualifications required are on the ambitious side. But it is to be remembered that the special training colleges,

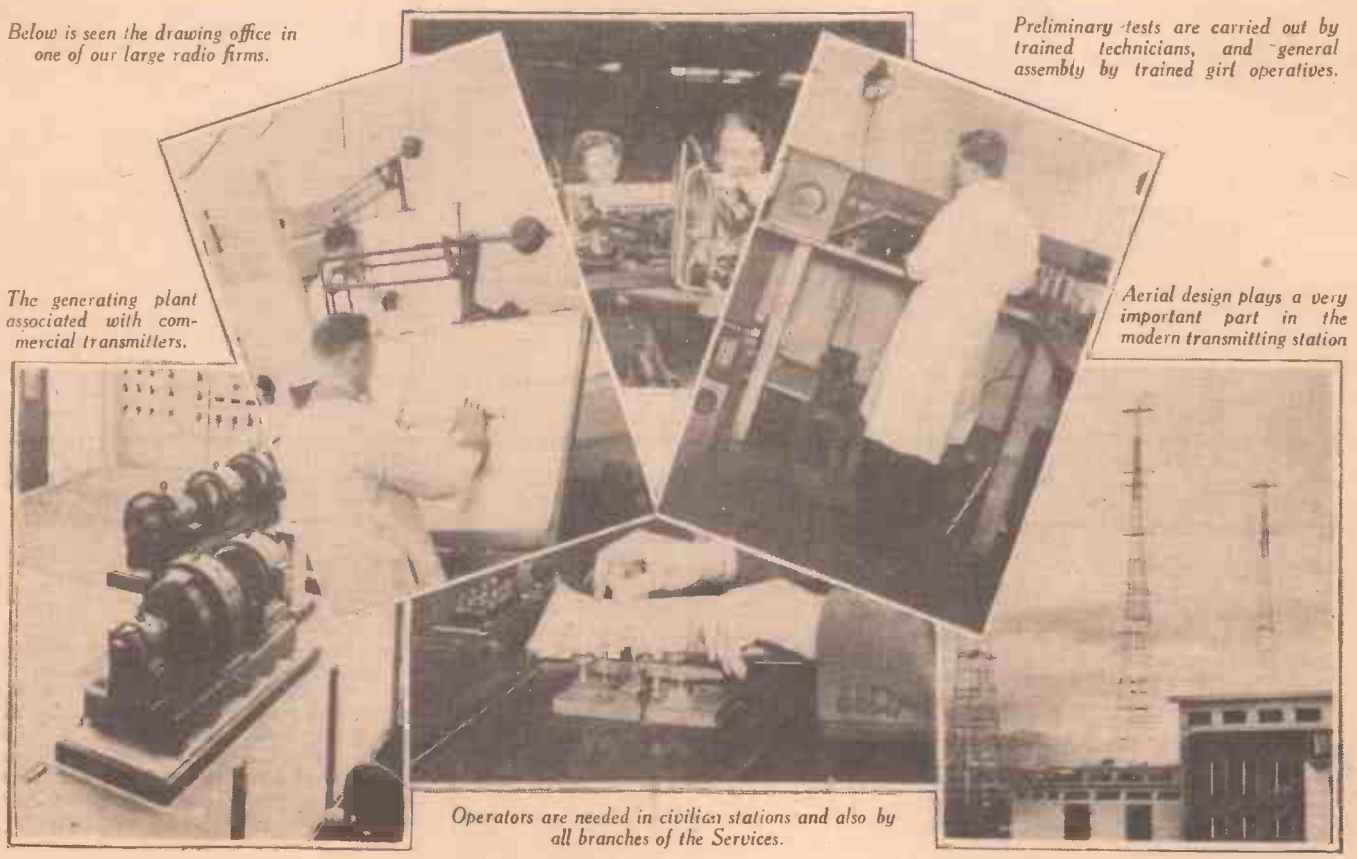
(Continued on page 96.)

Below is seen the drawing office in one of our large radio firms.

Preliminary tests are carried out by trained technicians, and general assembly by trained girl operatives.

The generating plant associated with commercial transmitters.

Aerial design plays a very important part in the modern transmitting station



Operators are needed in civilian stations and also by all branches of the Services.

Comment, Chat and Criticism

Biographies of Musicians

In this article our Music Critic, MAURICE REEVE, reviews the Life of SMETANA

FREDERICK SMETANA, Bohemia's foremost national musician, was born in 1824. I use that expression without qualification because few composers so completely symbolise their native land as this genial Czech did. His output is a microcosm of the national life just as Beethoven's was, or Liszt's; he never searched foreign parts for any of his inspiration but found the air he breathed and the soil he trod amply sufficient for the making of his music. As it was also very good music indeed, there is little wonder that in 1924 his enthusiastic countrymen made of his centenary a great national event.

He was in every way the founder of the modern school of national Czech music.

His father was the manager of a brewery on the estate of that same Count Waldstein who, as a young man, waved goodbye to the young Beethoven on his first departure from Bonn for Vienna in 1792. He, the father, was a good amateur musician.

As a child prodigy he would seem to have rivalled the deeds of the greatest of all prodigies, Mozart. He played in a Haydn quartet at five and gave his first pianoforte recital at six. No mention is made of any regular education but he seems to have been much sought by fashionable society and to have excelled in the playing of Liszt, with whom he formed a lifelong friendship.

His first ambitions were for virtuosity, but he turned his thoughts to composition during week-ends in the country when he made his first contacts with his native landscape, rural customs and the national folk dances and tunes, all of which pervade almost every page of his work.

Eighteen hundred and forty-eight has long been known as the year of revolution: almost every minority in Europe made sporadic and wholly unsuccessful efforts to throw off the tyrannical yoke of their imperial masters. In fact, they rather seized the opportunities afforded them by the revolutionary movements which caused almost every imperial government on the Continent to totter. So, whilst Wagner was behind the barricades in Munich and Chopin wrote to the tread of Russian infantry passing through Warsaw, Smetana helped the cause of his oppressed countrymen in Prague. These revolts were crushed with something of the technique and thoroughness we are so accustomed to to-day, and the oppressed nationalist minorities were whipped back to submission and to the further licking of their wounds.

Professor of Music

After these efforts had proved abortive, his friendship with Liszt grew and the great Hungarian—another subject race—helped him open a school in Prague. The same year he married a boyhood sweetheart, who succeeded him as teacher in the Thun family. Another close friendship was formed with Clara Schumann.

Smetana went as professor of music to Gothenburg, from 1856 to 1861, and during this period his nationalism was in complete abeyance. His wife died and he married again in '57. By this time the Hapsburg monarchy had slightly relaxed its oppressive rule in Bohemia and a re-awakening of the nation's artistic life at once made itself apparent. Smetana was in the van right from the start. All his energies were henceforth to be exclusively devoted to giving the Czech people a national music sufficiently rich and authentic to warrant their rallying round it for inspiration and guidance very much as the Russians used Moussorgsky and the Poles Chopin. Smetana started a renaissance in Czech life comparable to that resurgence we more usually deem the work of poets, Shakespeare and his contemporaries, for example. He founded many societies for the propagation and stimulation of national music, as well as the National Opera House in Prague.

His chief contributions to the national rebirth were a series of eight operas founded on patriotic subjects, and a cycle of symphonic poems styled Ma Vlast (my country). The first of the operas was called "The Brandenburgers in Bohemia," and was produced in 1863. Its story deals with the over-running of Bohemia by swarms of Teutons and the misadventures at their hands of a prince in his minority. Both the story and the title are very apposite in the light of recent events.

"The Bartered Bride"

Although received with great success, it was completely overshadowed by the second one, "The Bartered Bride," a work scintillating with the humours and characteristics of national peasant life, and overflowing with racy wit and good spirits. The public took it to its heart as something more than a merely fine work of art; whilst its celebrated overture has always been one of the first favourites in the concert room. It was staged in 1870.

Then came "Dalibor," the hero being the prototype of all good Czechs, whilst his friend, the minstrel Zdenek, is typical of the spirit of hope speaking his message through music. The public, still intoxicated by "The Bartered Bride," were a little disappointed with "Dalibor," but to-day it is revered as a dream of national regeneration come true.

Fourthly came "Libusa," to be followed by "The Two Widows," "The Kiss," "The Secret" and "The Devil's Wall." He commenced a dramatisation of Shakespeare's "Twelfth Night" by the name of "Viola," but the deafness and nerve trouble which finally hastened his end prevented his doing more than sketch out a first act.

The six works comprising "Ma Vlast" are "Vysehrad," "Vltava," "Sarka," "From the Fields and Groves of Bohemia," "Tabor," and "Blanik." Vltava is the river more familiarly known by its German name of Moldau, and after "The Bartered Bride" is perhaps Smetana's best known, and best, work. These works have been chiefly instrumental in perpetuating their composer's name and giving it lustre in foreign lands.

Liszt's Influence

Smetana was always a devotee of programme music, and even in his two string quartets is always definite and realistic. He came strongly under the influence of Liszt and got swept up in the romantic tide of the mid-nineteenth century. He wrote some piano music, too, which shows the Hungarian master's love of virtuosity. He did for the Czech national "Polka" what Chopin did for the Polish "Mazurka": he made of it an art form using the rhythm as one of the elements.

Smetana holds a unique position in his own country. Neither Grieg nor Chopin holds such a significant national position in their respective countries. Not a town or village failed to celebrate his centenary in 1924. But whilst his native land may slightly exaggerate his position in the musical hierarchy, the rest of the world, too, acclaims his music for its felicity in expressing the joy and abandon of a people at their best and liveliest. It is full of beautiful melody and subtle harmonisation, always fresh, clean and stimulating, and at times powerfully moving. A lot of it is most suited to home consumption, but works like "The Bartered Bride," "Tabor" and "Vltava" were written by a mind capable of crossing purely national boundaries to those wide enough to embrace all peoples.

NEW RECORDS

Vocal and Humorous

THE Decca lists reveal a nice balance of vocal and humorous records. There are Al and Bob Harvey with their sentimental "Sing me a Song of Home, Sweet Home" on *Decca F* 5623, and Bertha Wilmott with her boisterous "Beer Barrel Polka" on *Decca F* 7359. Tony Martin and The Street Singer have two romantic numbers with "Does Your Heart Beat" and "I shall be Waiting," on *Decca F* 7391 and *Decca F* 7394, respectively. The sophisticated will revel in the first record by London's favourite cabaret star, Inga Anderson. She is amusing in "Put it Down to Glands" on *Decca F* 7385.

For laughter lovers there is Carl Carlisle's impersonation record, "Private Robertson Hare's Predicament" on *Decca F* 7389. Neither must we forget Tommy Handley in "We Don't Want to be Jiggered About" on *Decca F* 7387. Other records which you should hear are The Merry Macs version of "Shoot the Sherbert to me, Herbert!" and "In the Mood"—*Decca F* 7392, Evelyn Dall singing "Mr. Jones (Are you Coming to Bed)," coupled with "My Wubba Dolly," *Decca F* 7410, and Vera Lynn's latest recording of "It's a Lovely Day To-morrow" and "Safe in my Heart" *Decca F* 7411.

Experimenting as a Career

How to Make Good Use of Spare Time as a Paying Radio Occupation

By W. J DELANEY

IN all the discussions on radio as a career the problem has been dealt with from the point of view of full-time occupation. But it is quite possible to play an important part in radio development whilst pursuing another occupation, although it is not intended by any means that employment should be undertaken in the category generally known as a "dabbler." There are many people who, after constructing a few receivers, feel that they know all there is to know about the subject and forthwith undertake to service receivers for others, undercutting the charges made for such work, doing regular dealers out of the work and in many cases injuring the profession on account of the bad quality of the work which is done. But by a systematic study of the subject, and with the use of suitable test apparatus, many really interesting experiments may be carried out and discoveries may result which will benefit the industry. It must not be imagined that as a fully-equipped laboratory is not available reliable experiments cannot be made. In the past developments in many industries have often resulted from experiments by "free lances." Often the fact that an experimenter has not available certain apparatus has resulted in the assembly of some make-shift material which has led to an invention or development which might otherwise never have come to light.

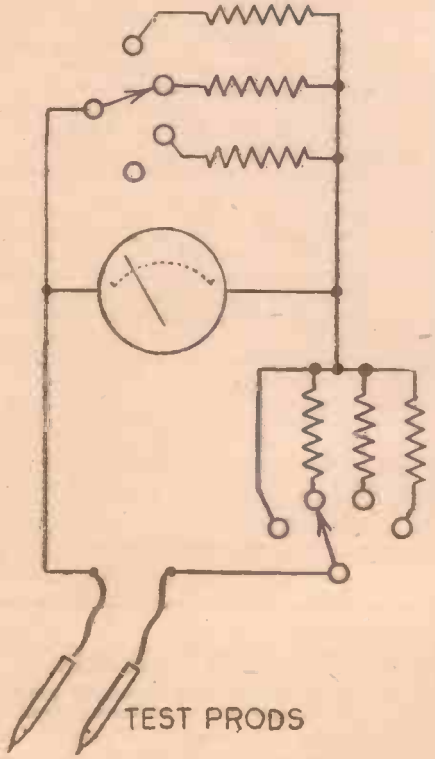


Fig. 1.—Basic principles of a general-purpose test meter.

Part Played by Amateurs

Proof of this is available anywhere. In radio, for instance, the first trans-atlantic short-wave transmission was effected by amateurs. An amateur picked up the first long-distance television picture (in South Africa), and in many other instances amateurs have been responsible for developments or the refutation of previously accepted facts. It is almost certain that the present wide use of short waves would not have been had not the amateur been forced to try some other channel for his experiments in the past, due to the restriction of commercial wavelengths allotted to him. It is not suggested that the kitchen-table workshop will bring in a fortune, but by following some systematic line of experiment, and by making use of suitable apparatus and at the same time going off into unusual channels, you may easily hit upon something which will prove of importance. But you cannot expect to do so with rough-and-ready apparatus. At the same time it is not necessary to launch out and purchase a wide range of equipment. The real experimenter will, of course, want to make his own material, and there is a very wide and interesting range of test equipment which may so be made up. Valve testers, circuit testers, multi-range meters, and even cathode-ray tube oscilloscopes may be constructed, in some cases from apparatus which may be found in every radio amateur's junk-box, but in any case from easily acquired components.

Test Equipment

As an indication we may mention the valve tester recently described in these pages. A collection of valve-holders, obtainable quite cheaply, terminals, a meter, and a few hours in construction and you have a piece of apparatus which carries out the same work as the most elaborate commercially produced article. A multi-purpose tester is another favourite item of the home-experimenter. All that is needed is a good milliammeter, a collection of resistances, and some plugs and sockets, and you can make all the tests needed in average experimental layouts. A good three- or four-valve set of the T.R.F. type may be modified to form a sound set-analyser, and so on. It would not be possible to describe in one article how all of these items may be made up but, as already mentioned, we have described most of them from time to time and will give others in future issues. Probably the most important item is the meter which is generally referred to as a "general purpose tester." The rough outline is indicated in Fig. 1. As will be seen, some form of selector is used to enable resistances to be connected in series or in parallel with the low-reading meter and this enables the meter to give the desired indications of voltage, current or to measure the values of resistance. The usual difficulty is in arranging the selector device to act as a safeguard and prevent damage to the meter due to the use of the wrong range—connecting it, for instance, to a high-voltage source when the meter is set for a low-current reading.

A valve-voltmeter is another very simple item which was described recently. This enables output voltages or other small voltages to be read and, in conjunction with the all-purpose tester, enables accurate

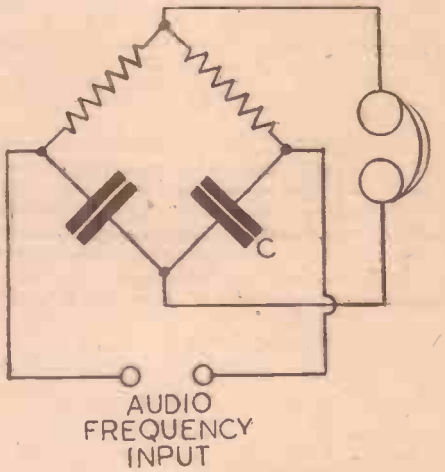


Fig. 2.—Main details of a capacity bridge, C being the capacity under test.

tests to be made when various circuits are tried out. The cathode-ray oscilloscope is not exactly a simple instrument, but small cathode-ray tubes are obtainable at a reasonable price, and when built up and the method of handling has been acquired they enable amplifiers or similar equipment to be analysed and distortion and other facts to be seen clearly.

Workshop Equipment

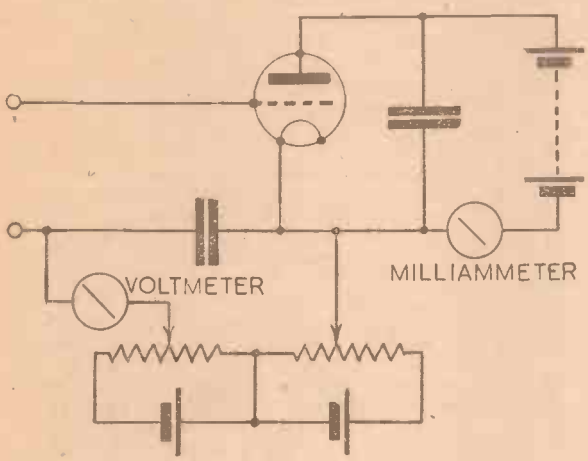
Tools are, of course, assumed to be in the possession of every reader of this paper, but too often they are not kept in a suitable manner. It is true that not many tools are needed for experimental work beyond, say, a screwdriver and pair of pliers, but if a really sound line of experiment is to be undertaken, some system must be adopted so that when a change in circuit, for example, is desired, time will not have to be wasted looking for a tool, during the course of which the thread of an experiment may be lost. A notebook is absolutely essential so that the results of various tests may be set out for ready reference and to avoid waste of time going over the same ground twice. Calculations may have to be carried out and, therefore, some source of information such as the "Radio Engineer's Notebook" or similar information should be available to avoid unnecessary work in this direction. Valves should be kept in a rack ready to hand so that when a change is required it may be carried out without looking round for the desired type of valve. Batteries, where they are used in preference

(Continued on next page.)

EXPERIMENTING AS A CAREER

(Continued from previous page)

to mains supplies, should be kept in such a manner that they do not rapidly deteriorate and thus give rise to false effects due to changes in voltage. A cool, dry place is indicated for them. Some type of switchboard is very desirable, with terminals marked clearly with various voltages, and each point verified from time to time with a good meter to ensure that it is up to the indicated rating. Small multi-drawer cabinets, with all drawers clearly marked, should be used to house terminals or other small parts; a really good bench light should be so fitted that it may be swung about to fall on any desired corner of the workroom, and similar items which should occur to the real handyman are only some of the points which should be given preliminary attention when taking up serious experimental work. Remember, finally, that success seldom comes at once. Hard work, much burning of the midnight oil, and probably many disappointments may be encountered, but revolutionary discoveries may be made by anyone who is prepared to devote his attention to the subject properly.



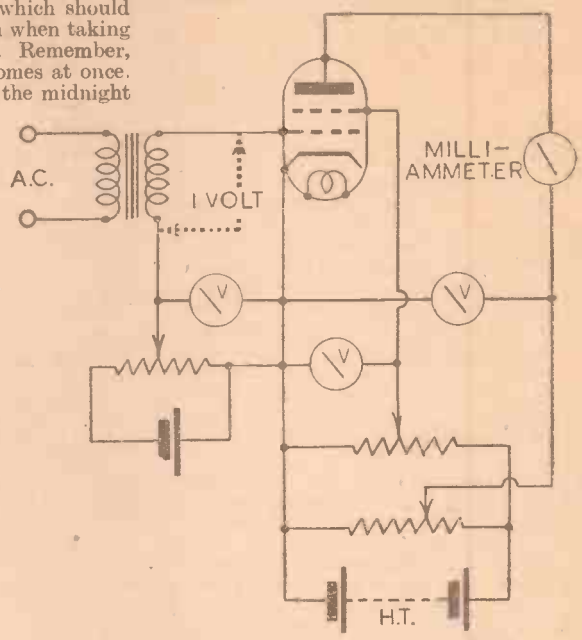


Fig. 3.—(Left) A simple valve voltmeter circuit, and Fig. 4 (right) An efficient valve testing circuit.

Pre-Amplification

IN those countries not in the throes of war, and therefore able to enjoy a public television service, every effort is being made by the manufacturers of home receivers to keep the prices of sets within the range of pockets of potential customers. One scheme to meet this point follows on similar lines to that adopted by some of the British radio manufacturers who marketed sets of identical external appearance but graded them at two selling prices according to the distance from the transmitting station that the set was to be employed. In other words, one receiver was made more sensitive than the other and required a weaker signal in millivolts per metre to make it operate with a fully modulated cathode-ray tube. This improvement in sensitivity can be carried into effect by having two distinct forms of vision chassis or using a standard chassis for both sets and adding a pre-amplifier to the set that is required to operate at a longer range. A good example of a compact pre-amplifier has been commercially produced in this country, and this unit is capable of providing an over-all gain of nearly ten decibels. In effect, it comprises two stages of high-frequency amplification and can be arranged to plug into the normal feeder terminals of the set, the feeder cable plugs then being inserted into the appropriate sockets of the unit. Made in this form, it can be screwed into any convenient clear space inside the receiver cabinet, while the necessary power supplies are derived from the main rectifier unit into which is inserted the six-pin plug. There is no doubt that a device of this character provides a convenient and economical method of extending the range of a good quality television set, but where signal strength is low it is necessary to ensure that the noise or interference level is very low, for the unit does not discriminate between the two forms of signal any more than the commercial set does.

TELENEWS

Getting Better Focus

THE maintenance of correct focus as evidenced by the area of the sharp spot of light on the cathode-ray tube screen under all conditions of beam current, is a problem not easy of solution. The simplest method appears to lie in the use of electromagnetically operated tubes, but there are many cases where electrostatically operated tubes have to be employed, and designers have therefore had to face up to the difficulties, and provide satisfactory working without resorting to ideas which for their successful application necessitate undue complexity in the electrode system. From time to time different ideas have been propounded in these columns, and all of these appear to achieve their purpose with varying degrees of success. One of the most up-to-date suggestions has the outstanding merit of apparent simplicity, and for this reason alone is worthy of careful consideration. The seat of many of the focusing troubles is located in the control electrode which is positioned close to the cathode, and to which is applied the signal variations up to 20 volts in order to change the intensity of the beam. To eliminate this dependence of spot size on modulating potential, as distinct from intrinsic brightness, it is proposed to introduce a very fine mesh grid which forms part of the modulating electrode, and is positioned between the cathode surface and the first apertured anode. This ensures that the equipotential surfaces close to the cathode surface are maintained flat, with the result that the focusing action of the tube remains constant irrespective of the modulating voltages fed to the control electrode within its normal working limits. This idea is claimed to have the further advantage that the range of volts necessary to change from black to full white on the fluorescent screen is reduced.

An Interim Period

IMPROVED interlacing to avoid line pairing which straightway halves the definition, better band widths for the vision circuits, improved cathode-ray tubes, more sensitive receivers, a reduction of background mush level, these and many other items are being delved into by the leading radio manufacturing concerns, so as to provide the public with better and better pictures without adding unduly to the cash price of the receiving set. It has even been suggested that some form of moratorium should be declared so that an acceptance of the present picture standards would be maintained for a period of years. This would remove from the American public mind any fear of early obsolescence and encourage a nation-wide buying campaign, so as to reimburse the manufacturers who so far have found sales returns reach a figure well below the sums involved in television development and production work. Another school of thought suggests that an interim period should be employed wherein a variety of standards would be tried so as to determine a flexible one which would permit changes to be made without involving costly alterations to those sets already on the market. In all these cases a really progressive programme campaign would operate side by side with the technical issues at stake, and once the public have been made really television minded, then progress would be so rapid that the industry would move forward to an era of commercial prosperity.

ON YOUR WAVELENGTH

By Thermion

Very Much Alive!

I HAD a letter the other day from a reader who has returned from abroad asking me whether this journal was still being published. This struck me as being such an astonishing question that I pressed the reader for further details. It turned out that he had been to the local newsagent, who had formerly supplied him with the paper, who told him that "it had ceased publication." Needless to say, we took strong action with the newsagent concerned. There is not the slightest truth in the suggestion, for it is our policy to carry on during the war as the only weekly journal devoted to the technical side of radio. If any of my readers find themselves in the same position as the reader I have quoted I hope they will let me know, stating in confidence the name of the newsagent. There is no reason why any reader should not be able to obtain his copy of this journal promptly on Wednesday morning. It helps, of course, if you place a regular order with your newsagent.

The Talking Organ

THE following interesting paragraph appeared in a recent issue of the *Daily Telegraph*:

"A church organ which 'talks' has been causing trouble at the Methodist Church in Pennsylvania. The organ, one of the new electrical type, has developed a distressing tendency to pick up short-wave broadcasts at the oddest moments.

"Such outbursts as 'Hello, PDQX, go ahead PDQX,' or 'It's snowing here, Joe, how's the weather in your territory?' coming from the organ have continually interrupted the sermons, said the pastor, Dr. H. D. Whitfield.

"Installed about a year ago, the organ first developed 'radio trouble' during choir rehearsal. Later it began 'sounding off' during Sunday services. Radio technicians blame the trouble on the similarity of the organ sound cabinet and a radio loudspeaker. It is believed a twisted wire is responsible. Until the wire is located the organ will continue to 'talk.'"

Careers in Radio

NEW industries steal upon us creating opportunities for interesting and well-paid posts. No one would have dreamed 25 years ago that wireless would have developed so rapidly, and thus created an urgent and at present unsatisfied demand for thousands of skilled men. The industry has, indeed, developed at a rate far in excess of the supply of skilled people to serve it. It was so in the motor trade, in the cycle trade, and a similar situation obtains to-day in the aircraft industry. Those considering taking up a profession or who are on the threshold of their careers, should carefully study the prospects which radio has to offer. We have in past issues dealt with a number of aspects of radio as a career. In this issue, however, we go more fully into the matter and offer a book specially designed to give those desirous of entering the trade a grounding in the knowledge essential for success.

The Student's Three has been specially designed so that you may learn as you build. It will help you to understand the principles of wireless reception and later articles will develop the theme covering such subjects as testing, measuring the values of different parts of the circuit; fault finding, and the addition of refinements to the circuit.

Readers on Active Service

I HAVE been successful in putting readers on active service, as well as those billeted in various parts of the country, in touch with enthusiasts in the particular districts. I have had many letters of appreciation for this small service I have been able to render, and I am pleased to note that real friendship has sprung up between the parties who have contacted. I was able to help Mr. A. G. Hobson some months ago. He is now stationed at Hoylake, Cheshire, and wishes to get into touch with any enthusiast in that salubrious district. Any letters sent to me will be forwarded to Mr. Hobson.

Gala Variety Broadcast

I HAVE been informed that although no Command Variety performance will be given this year, arrangements have been made to broadcast in the Forces programme most of a Gala Variety show from the London Palladium on May 5th. This is being organised by Mr. George Black, who is determined that the traditions shall be carried on and that the Variety Artists' Benevolent Fund shall not suffer through war-time conditions.

Schools Broadcast

I AM glad to hear that the second complete term of school broadcasting since the outbreak of war will open on April 15th. The programme of school broadcasts for the summer term, 1940, has been designed to meet, as far as possible, the special and difficult conditions imposed on schools and broadcasting by the war. The experience of the last months has proved the necessity of a modification of broadcasts both in content and presentation. Close co-operation has once more been established between the various education authorities and the Central and Scottish Councils for School Broadcasting, and such channels of communication between teachers and the councils as programme schedules and leaflets are once again functioning normally. But with the difficulty of arranging committee meetings, heads of schools could do most useful work by listening and reporting regularly on one or more series. The necessary reporting forms can be obtained immediately on application to Broadcasting House, London, or Broadcasting House, Glasgow.

A Service Problem

AS many readers of this issue will be interested in the service problem, there are one or two points which I have had brought to my notice recently which I think worth passing on. The first concerns the difficulty experienced in many quarters due to the shortage of servicemen, owing to the call of the Services. There is still considerable servicing work to be done, and thus delays are taking place. It has therefore been suggested, at a recent dealers' meeting, that some sort of ban should be placed on receivers over, say, five years of age. There are two angles to this question. Firstly, owing to the war many people are not purchasing new receivers, and thus sales of new models are falling off. This means that receivers are being kept in use longer than before with the result that servicing troubles are bound to increase. With the increase, plus the decrease in men (66.5 per cent. of service engineers being under 30 years of age, according to a recent census), it will be obvious that some restriction will have to be considered. At the meeting in question one dealer stated that he had no fewer than 93 sets waiting attention. There are, of course, two angles to this question, and it always seems bad policy to turn away custom. However, something will no doubt have to be done.

The replacement of servicemen called to the colours is not a simple problem. It is not possible to become a fully-qualified service engineer in a month. As mentioned on other pages, training is necessary.

Weather Effects

A RECENT letter in this paper drew attention to the peculiar effects of the weather on a receiver, and I was recently informed of a rather similar case, but one in which bad weather gave an improvement in performance due to a faulty component. It is well known that the capacity of a condenser is due to the dielectric to a very large extent. Many of the older types of condenser use a roll of non-impregnated paper with tin-foil or similar material interleaved. In a dry condition the capacity will be totally different from that found when the condenser is moist, due to the addition of moisture to the dielectric. In the case in question, the set had been left in an unoccupied house for some time due to evacuation. When the people returned the set was switched on and gave a much improved performance, the freedom from hum, which had been previously experienced, being one of the most noticeable effects. After a day or so it was noted that the set returned to its original poor performance, accompanied by the hum, and eventually it was found that as the house became warmed up, plus the effects of the fire in the room, the condenser had dried out again, and this reintroduced the trouble.

High-frequency Couplings

The Choice and Importance of Inter-valve Systems

MANY beginners, when designing their own receiver, find difficulty in deciding upon the circuit to be used between the H.F. and detector stages. There are at least three forms of coupling available and each of these has its own particular merits, and all are suitable for incorporation in a modern receiver. Perhaps the most usual form of coupling is that known as the tuned-grid, and shown in diagrammatic form in Fig. 1. In this arrangement an H.F. choke is included in

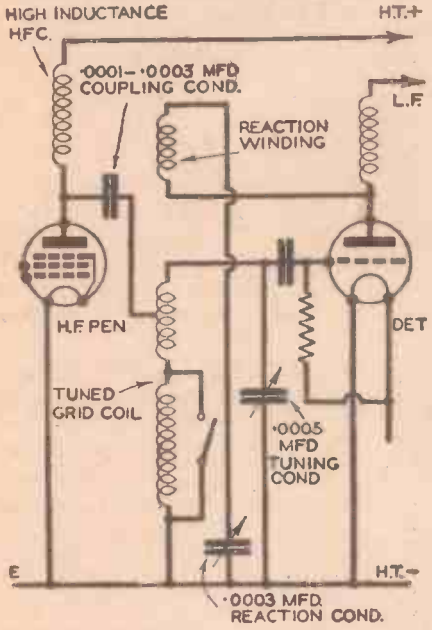


Fig. 1.—The simplest form of H.F. coupling—the tuned-grid circuit.

the anode circuit of the H.F. valve and a lead is taken from the lower end of this to one side of a fixed condenser, the other side of which is joined to the tuning coil in the grid circuit of the detector.

This circuit arrangement is very suitable when building an amplifier for adding to a normal detector-L.F. receiver, since the fixed condenser is then merely connected to the aerial terminal of the original receiver. It is evident that the high-frequency amplifier simply takes the place of the aerial, supplying the input to the detector—but after amplification. The tuned-grid coil calls for very little consideration, for it is simply a standard tuner of any type, although if a ganged condenser is to be employed it should have characteristics exactly similar to those of the tuning coil used in the grid circuit of the preceding valve. If the coil is of different type it is probable that it will be impossible properly to trim the sections of the gang condenser, with a result that there must be a tremendous loss in signal strength, especially at certain parts of the tuning scale. To prevent this trouble, the best course is to employ separate condensers for the two circuits or to use a two-gang condenser of the type having an external trimming adjustment capable of producing a fairly wide variation in capacity—.0001 mfd. for example.

The S.G. H.F. Choke

The H.F. choke is a very important link in the circuit, and has a considerable influence upon the efficiency of the finished set. First and foremost the choke should have an inductance of not less than 200,000 microhenries, whilst a value of twice this figure is to be preferred when using a high-frequency pentode, the A.C. resistance of which might easily be as high as 1,000,000 ohms. The choke should also have as low a self-capacity as possible consistent with the appropriate inductance, a value of 3 to 5 m.mfd. being sufficiently good for the purpose. It is also desirable that the choke should be of the screened type, since the screening assists very con-

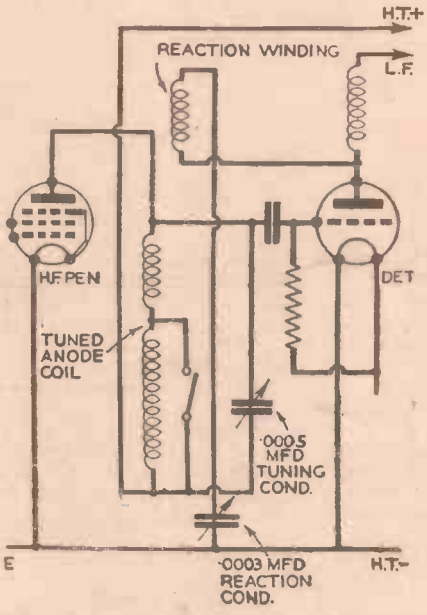


Fig. 2.—Tuned-anode coupling is a variation of the circuit of Fig. 1.

siderably in obtaining stable operation of the receiver when it is adjusted to give really high amplification. It is sometimes considered that if the coils are screened it is unnecessary to screen the chokes as well, but it must be remembered that the latter can create an extensive magnetic field which might easily "link" with nearby connecting leads and other necessarily unscreened components such as fixed condensers.

The fixed coupling condenser is not generally a critical component, and it is usual to choose a value of .0002 mfd. for it. This is, in fact, a good average, but a certain increase in selectivity can be obtained by reducing this value to .0001 mfd. and a little extra signal strength may be gained by using a capacity of .0003 mfd. This point will best be appreciated when it is remembered that the condenser acts in a very similar manner to that component frequently included between the aerial lead-in and the aerial terminal on the set; this being the case, many constructors may prefer to use a pre-set condenser, which can be modified until the most suitable capacity is found.

Tuned-anode Connections

A simpler circuit than the tuned-grid is the tuned-anode arrangement shown in Fig. 2. In this case the choke is not required, the tuned winding of the coil being wired directly in the anode circuit of the H.F. valve. Correctly used, this method of connection—in theory, at any rate—gives rather greater input to the detector than the tuned-grid circuit, although in practice this is not always realised. The reason for the greater efficiency is that the impedance in the anode circuit of the H.F. valve is infinite when the set is tuned to a signal, whereas the impedance of the choke must be appreciably lower. The chief practical advantage of tuned anode, however, is that it saves a choke and a fixed condenser. On the other hand, the circuit as shown has the definite disadvantage that the moving vanes of the tuning condenser are not connected to earth, but to H.T.+, which means that a gang condenser of normal type could not be used. This little difficulty can easily be overcome by using the connections as shown in Fig. 3, where a 1 mfd. fixed condenser is connected between that terminal of the coil which is joined to H.T.+ and earth, the variable tuning condenser being connected between the anode of the H.F. valve and earth.

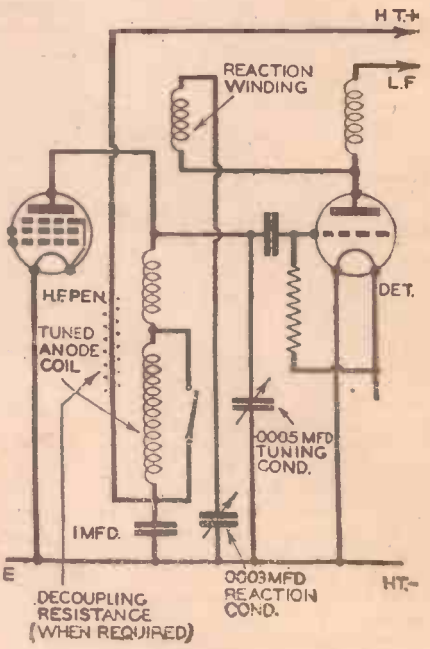


Fig. 3.—Parallel tuned-anode coupling.

It will be seen that in this case the tuning condenser is in series with the high-capacity condenser across the coil; this, however, produces the same effect as when the tuning condenser alone is in parallel with the windings. When it is necessary to decouple the anode circuit of the H.F. valve, or when the H.T. voltage to it has to be "dropped," the 1 mfd. condenser is required in any case, and so its cost need not be considered. A decoupling

(Continued on page 99.)

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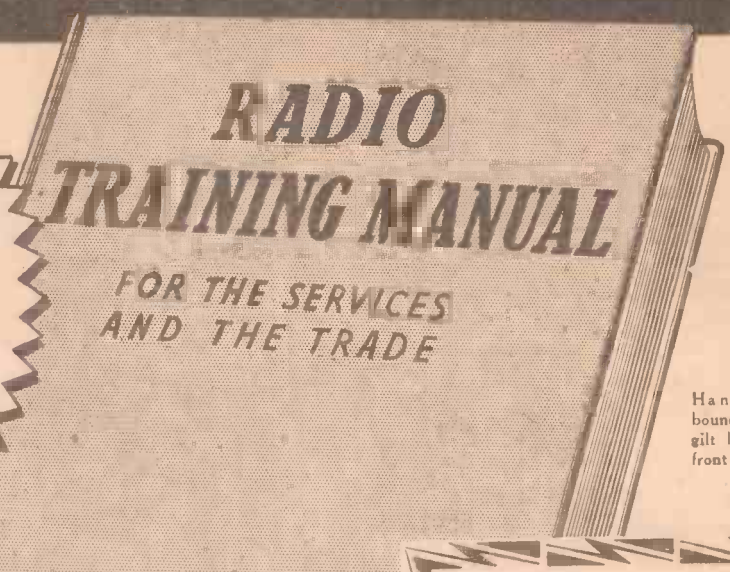

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The mass of vital information contained in this book is not obtainable in such handy form elsewhere, and there will be a huge demand for it. Be certain that there is a copy for you by filling up the forms on page 108 AT ONCE.

SIR KINGSLEY WOOD, the Air Minister, appealed recently for radio mechanics for the Royal Air Force. The rate of pay is exceptionally good. The need for radio technicians is equally urgent in other branches of the Services, whilst the servicing and repair of radio sets is one of the main activities of the radio industry to-day and is providing work for thousands.

Which branch of radio do you favour? This immensely helpful book will aid you in your choice of a radio career and solve all the difficulties on the way.

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Radio in the Services

A Refresher Course for the Radio Mechanic—5

By Frank Preston

Here is Another Selection of Questions of the Type which may be Anticipated by Applicants for Enrolment, together with Suitable Answers

WHAT is the difference between tone control and tone compensation?

In tone control the object is to provide a convenient means of varying the response of the receiver to the higher and lower audio frequencies, whereas in tone compensation the aim is to "correct" the reproduction to make good certain losses which may occur.

Tone control consists of providing a variable device by means of which it is possible to attenuate—or reduce the response to—low or high notes. By turning the control in one direction the higher notes are attenuated, giving the effect of increased bass response, whilst by turning it in the other direction an opposite effect is produced. It should be made quite clear that in most tone-control systems high-note and low-note response is not increased; in other words, extra amplification is not given to either end of the musical range.

Tone compensation, or tone correction, is used when, for example, a very selective tuning circuit is employed. This "cuts" the higher frequencies, so a means must be provided of reducing the lower frequencies to a similar extent if reproduction is to be natural. One method of doing this is simply to use a pentode in the output stage.

In most modern receivers tone control consists of wiring a fixing condenser and variable resistor in series between the anode of the output valve and earth. This is because a pentode valve is generally employed. By reducing the value of the resistor the higher notes are attenuated. To attenuate the low notes an iron-cored choke can be used in place of the condenser. It is possible to combine a resistor and a choke with a potentiometer to give "two-way" action.

How would you use a milliammeter as a voltmeter and as an ammeter?

It is a very simple matter to convert a milliammeter for use as a voltmeter, for it is necessary only to include a resistor in series with it. The value of the resistor can easily be found by applying Ohm's Law, which states that current (in amps.) is equal to the voltage divided by the resistance. A simple "rule-of-thumb" method is to have 1,000 ohms per volt. In other words, a meter reading up to 5 milliamps would read up to 5 volts if the series resistor were of 1,000 ohms; the reading would be up to 50 volts if the resistance were of 10,000 ohms, or up to 500 volts if the resistance were of 100,000 ohms. In doing this the resistance of the meter is ignored, but as it will rarely exceed about 100 volts the discrepancy is slight.

To increase the scale readings for current it is necessary to wire a resistor in parallel with the meter, its value being dependent upon the resistance of the meter. Thus, if the meter resistance were 100 ohms, all scale readings would be doubled by placing a resistor of 100 ohms in parallel; in this case one-half the current in the circuit would pass through the meter and one-half through the parallel resistor. To read up to .5 amp. with a meter designed for a maximum reading of 5 mA and having a resistance of 100 ohms, the parallel resistor would need to have a value of 1.01 ohms—one 99th of 100 ohms (See Fig. 1).

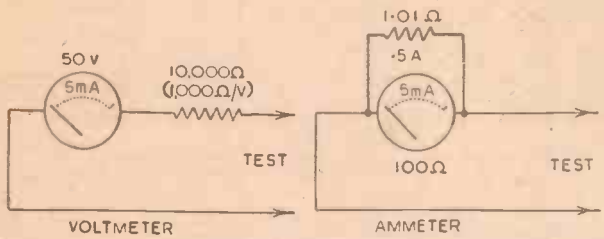


Fig. 1.—It is possible to use a milliammeter as a volt-meter by connecting a resistor in series with the meter. The current range of the meter is increased by using a shunt resistor.

If you were using two similar valves, each being rated at 3 watts maximum undistorted output, in push-pull what maximum undistorted output would you expect from the stage?

Provided that the valves were reasonably well matched, and the components of good quality and correctly chosen, the output should be approximately 7½ watts. This is because the output from two similar valves in push-pull is approximately equal to 2½ times the output of one of those valves. The higher output is due to the greater efficiency of the circuit and the reduced second-harmonic distortion.

When testing a mains receiver, which had suddenly become "silent," it was found that the mains transformer and rectifying valve were unusually hot, whilst the energised speaker was cold, and the receiving valves were cooler than usual. Where would you first look for faults?

A short-circuit in the H.T. supply, prior to the field winding of the speaker, would be expected. This is because the inference is that no H.T. is being applied to the anodes of the valves through the field winding, although it is being passed by the rectifying valve.

In the case quoted it was found that the electrolytic smoothing condenser between the filament winding of the mains transformer and the speaker field was short-circuited due to a blob of solder having been dropped between the condenser terminal and the metal chassis (See Fig. 2). If the fault had not been noticed quickly it is probable that the rectifying valve, and probably the mains transformer as well, would have been damaged. As it was, the rectifier had commenced to "blue-glow," this showing that the valve was grossly overloaded. Had the fault been similar, with the difference that the speaker field became warm, it would have been logical to suspect that the second smoothing condenser was shorting, or that there was a short elsewhere in the smoothed H.T. circuit.

What is the advantage of delayed A.V.C. over ordinary A.V.C.?

When employing the simplest form of automatic volume control the biasing voltage développed at the second detector is applied to the controlled valves as soon as a signal is tuned in, however weak that signal may be. As a result, the weaker signals would not be heard, or would be weaker than they need be.

By applying a delay, or small counteracting voltage the control bias is not applied to the frequency-changer and I.F. valves until signals attain a certain minimum strength. That means that the A.V.C. does not act on the weakest of the signals, but comes into action only on the

(Continued on next page.)

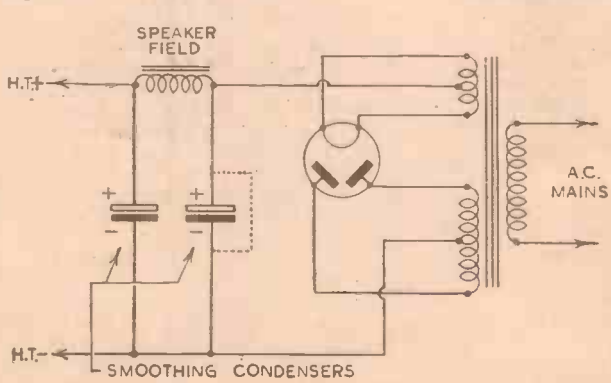


Fig. 2.—Overheating of the mains transformer and rectifying valve can be due to a short-circuit across a smoothing condenser, as shown by broken lines.

RADIO IN THE SERVICES

(Continued from previous page)

stronger ones. Simple methods of providing a delay voltage are indicated in Fig. 3, but there are many other more advanced arrangements.

If a faint shriek were heard as the tuning condenser of a superhet were tuned toward minimum capacity what fault would you suspect and how would you attempt to apply a remedy?

Assuming that the fault developed in a receiver which had previously been operating correctly, and adjustments had not recently been made, it would be fair to suspect the frequency-changer valve in the first place. If some adjustments had been made it is possible that re-setting the trimmers on the I.F. transformers would overcome the trouble.

It would also be logical in either case to suspect the by-pass condenser between the screening grids of the frequency-changer and earth, or even the corresponding condenser for the I.F. valve.

When the set was a newly-constructed one the faults already mentioned could be checked, but it might be found that the instability was due to insufficient screening or to the application of incorrect voltages. The usual tests for H.F. instability would be made, and it might be found worth while to include a small H.F. choke, consisting of about 50 turns on a ½in. diameter core, between the screening grids and the H.T. supply, or between the primary of the first I.F. transformer and the anode of the F.C. valve. As an alternative, the insertion of a 50-ohm resistor between the oscillator grid coil and the grid of the oscillator section is often useful in preventing this form of parasitic oscillation.

How do you account for the phenomenon of fading on short waves?

The phenomenon is in many ways complex, but it is mainly explained by the reflection of the waves from the Heaviside and Appleton layers. It is known that all radio waves are split up into two components, one of which follows the curvature of the earth, the other rising at a sharp angle and being reflected from the upper atmosphere. On long waves the ground wave is that which travels from transmitter to receiver, the upward ray being largely absorbed. The reverse is the case on short waves, since the reflected ray is generally the only one which reaches the receiver (incidentally, this accounts in large measure for what are known as "skip-distance" effects). Since the more useful ray is reflected from the upper atmosphere, the condition of the reflecting surface is of great importance. It can be assumed that this surface is constantly changing; it may be compared with ripples on a stream. Due to the changes the upward ray is reflected unevenly, this accounting for the high-speed fading.

This is the generally-accepted theory, but there are others and absolute proof is difficult.

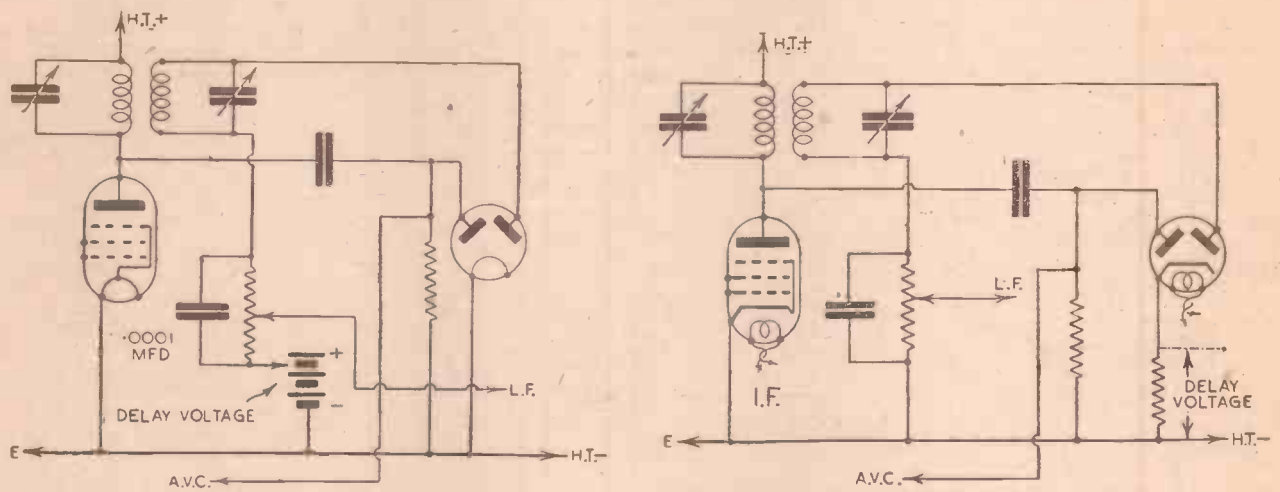


Fig. 3.—These skeleton diagrams show two simple methods of providing delayed A.V.C. action.

SHORT-WAVE SUGGESTIONS

THERE are many amateurs who, although keenly interested in short-wave technique, are not actively engaged in short-wave constructional work and receiver operation. Probably they imagine that extensive technical knowledge, tuning skill, and trouble-tracking abilities are necessary in order to obtain satisfactory results.

These ideas are, of course, erroneous, because a carefully-built receiver will prove to be both reliable and efficient. Short-wave and broadcast receivers respectively have much in common fundamentally. Differences there are, of course, all of which are most desirable and necessary, taking into account the exacting requirements of high-frequency reception.

Troubles Easily Overcome

The troubles associated with short-wave receivers are few and may be overcome. A little common-sense reasoning and experiment usually proves that things are not so bad as they at first appeared to be. Some common short-wave receiver troubles are now explained:

Body capacity effects are not so prevalent nowadays, owing to improved mechanical and electrical methods of construction, and the use of specially-designed low-loss components. Chassis construction and under-chassis wiring are undoubtedly most suitable to short-wave requirements.

Metallised Chassis

The foil-lined and metallised wooden chassis are deservedly popular: many constructors think, however, that when this form of chassis is used a metal panel or back screen is unnecessary. In a well-tried and efficiently-designed receiver this is sometimes correct, but not always.

In order to cut down expenses, metal-shielded slow-motion dials are used, the screen of shield being earthed. Whilst this type is highly satisfactory, other things being equal, it should not be forgotten that when the lay-out is bad, the hands of the operator near the dials, even with screens earthed, will produce instability and very bad B.C. effects, which can only be minimised by unearthing the dial screens. Interaction between magnetic fields due to faulty lay-out and wiring are, of course, the basis of the trouble.

The most satisfactory procedure is to use a screened chassis, panel, and cabinet. Screened dials may then be earthed to the panel; the moving vanes and frames of tuning condensers, if of metal frame construction, will be automatically at earth potential when mounted directly to the metal panel, and the latter earthed to the foil at two widely-separated points in order to take full advantage of potential differences.

The metal or foil-lined cabinet is a disadvantage unless properly and completely earthed. The most satisfactory method to assure this is to make four or more copper angle-pieces about a half-inch wide and fasten them to chassis, cabinet, and panel by means of 6 B.A. bolts.

Coil Construction

Short-wave coil construction is within the capabilities of the average constructor. There is, however, a vast difference between constructing and designing a set of coils, and the home constructor is advised to copy as accurately as possible coil data available or to use commercial products.

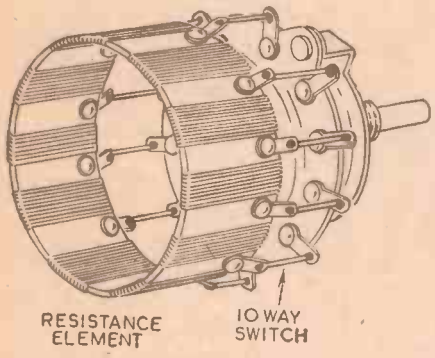
The number of turns, spacing of turns, distance between windings and gauge of wire used are most important factors, which do not appear to be realised to the extent they should be. In some instances, the opinion seems to be that formers of larger or smaller dimensions may be used with more or less turns, and different spacing between turns and complete windings and other variations will make absolutely no difference whatsoever. Practical tests, however, remove any doubts, and drastically adjust wrong ideas.

Practical Hints

Variable Resistance

THE following is a useful method of making a variable resistance which will dissipate a considerable amount of power. The fact that the resistance can only be varied in steps is seldom a disadvantage in a resistance of this type, which can be used for voltage control, etc. The great advantage is that the sliding contact is eliminated, thus making the resistance practically everlasting.

The resistance is built around a Bulgin 10-way switch, type S160. A strip of paxolin, approximately 1in. by 5ins., forms the resistance element, and on it is wound



Making a variable resistance from a selector switch.

the required quantity of resistance wire, 10 equally spaced tapping points being provided. The strip is then carefully bent into a circle and the tapping points soldered to the switch contacts with small lengths of wire.

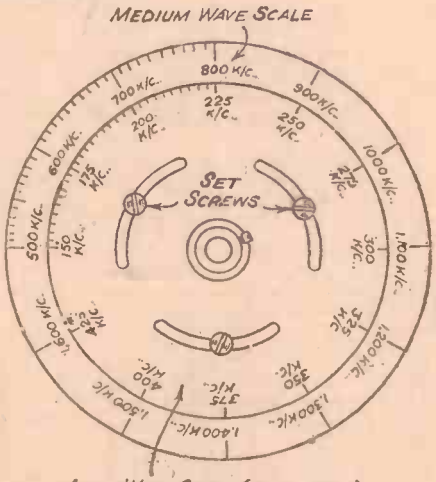
If a high value of resistance is required a better method is to solder 10 half-watt resistances between the switch contacts, each being one-tenth of the total required resistance. This arrangement makes an excellent potential divider for power supplies, etc.—B. H. BRIGGS (Gt. Horton).

Needle Scratch Filter

MANY constructors need a scratch filter and here is a simple one you can make from spare parts. In addition to a standard .1 megohm volume control and .001 mfd. condenser, you need a choke and this can be made by making up a bobbin from two 2½in. discs of thin wood or paxolin mounted on a ⅝in. length of ¼in. diameter rod. On this bobbin wind 10,000 turns of 38-gauge enamelled wire and take tappings at 5,000 and 8,000 turns. Adjustment of the volume control, which is connected as a variable resistance, and the choke, will enable the desired scratch elimination to be obtained with almost any type of pick-up.—D. LANE (Enfield).

An Adjustable Scale

I USE an S.L.F. tuning condenser and I think the following idea for a scale will appeal to other experimenters. The main point is in obtaining an initially correct setting, after which, as the dial is calibrated in frequencies equally for this type of condenser, all further readings will be automatically correct. As may be seen from the illustration, the dial, which in my case is of thin brass, is carefully marked off (I etched my dial with a coating of soap and acid) and slots are cut so that the final position of the dial may be accurately obtained. The large part of the dial is, of course, provided with tapped holes and the ordinary grub screw enables this to be set, the front section being the part which has finally to be adjusted to obtain the desired completion of the range.—R. FRANK (Preston).

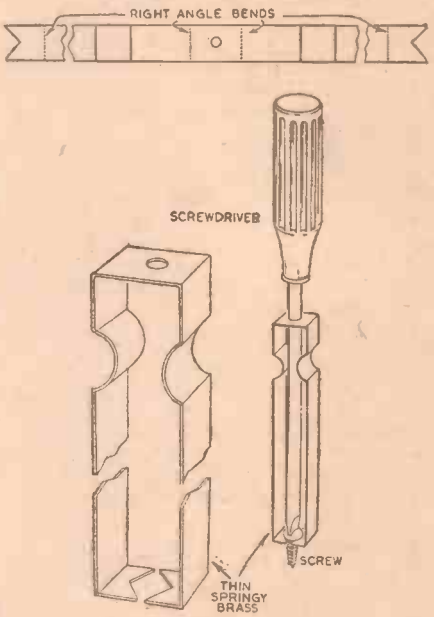


An adjustable S.L.F. dial.

Screw Holder

A VERY useful addition to an ordinary screwdriver can be fashioned from a strip of thin springy brass, bent as shown in the sketch. When in use the screw is placed in the lower jaws formed by the ends of the strip in which V-shapes are cut, and the screwdriver blade pressed down into the screwhead slot. The springy brass presses against the screwdriver stem and is thus held in position.

The screw can be lifted as if in one piece with the screwdriver. This is particularly useful when fixing a screw in an awkward position where the fingers cannot reach to hold it in position.—RONALD ILES (Knowle West).



Mr. Iles's suggestion for a useful screw holder.

Combined Batteries

A LARGE number of modern receivers are provided with a combined H.T. and G.B. battery, generally on account of space saving. Owing to battery shortage some users of these receivers are finding difficulty in obtaining a replacement of these special batteries, although standard H.T. and G.B. batteries are fairly easy to obtain. There is no need to go without your radio in such a case, as it is possible to use the two separate batteries until such time as the correct type of battery may be obtained. The only difficulty is that there is no G.B. positive lead fitted to this type of receiver, but in all standard circuits G.B. positive is joined to H.T.— and therefore the single H.T. negative lead in the combined type of circuit automatically picks up the positive G.B. connection as the H.T. negative point is situated a few cells along the battery. Therefore, to use the separate batteries attach a short length of flex to the H.T. negative plug and to this flex fit a red plug marked G.B. +. This should be inserted into the G.B. positive socket.

THE "STUDENT

(First of a Series)

Constructional Details of a Designed for Instruction

MANY amateurs are anxious to know what difference a certain circuit change will make, or wish to experiment with different circuit combinations. For such purposes they generally construct a special receiver, or if circumstances do not permit, they modify an existing broadcast receiver. The latter may be quite a good practice in some cases, but there is always the risk that in making changes the original high performance of the receiver may be modified. The newcomer to radio may also find himself in the same predicament, and wish to have some type of receiver which will lend itself to experiment or to a kind of instructional arrangement which will enable him more readily to follow various circuit schemes. The "Student's" Three has been designed to cover both of the above cases, and although a perfectly straightforward battery three-valve arrangement, it has been built on slightly different lines from those usually found in a normal broadcast receiver. The theoretical circuit which is given below shows that the valve sequence is H.F., detector and output, the detector being a normal triode and the other two being pentodes. Transformer coupling is employed between H.F. and detector, and detector and output stages, and in all other respects perfectly standard practice has been followed.

Split Circuits

In order to enable the receiver to be used for the experimental work above mentioned, however, the following special arrangements have been made. First, the receiver has been built on the older baseboard lines, thus permitting all components and wiring to be fully accessible at all times without the need of turning over the receiver to obtain access to parts which would in other cases be found under the chassis or baseboard. Secondly, in place of a ganged tuning condenser for the two tuned circuits, separate condensers have been incorporated. Thirdly, the separate stages have been kept slightly isolated so that they may more readily be identified, and finally, separate terminals have been provided in the detector stage so that 'phones and aerial and earth connections may be adopted on the detector stage. The uses of these will be detailed later. It will thus be seen that the receiver is an ideal design for beginners or experimenters and many hours of interesting work may be carried out with a set of this type, whilst it is always ready for standard broadcast reception and may be built also by those who need a standard receiver yet who do not wish to experiment. It might also be mentioned at this stage that the receiver has been built with a strict regard to economy and the use of all standard parts which are readily obtainable.

Construction

Dealing first with construction, the entire receiver is built on a wooden baseboard and panel, the former being either a plain piece of ½in. or ¾in. board or a plywood panel, measuring 12in. by 9in., and the panel being of ¼in. material measuring 12in. by 8in. There is very little weight on the panel, therefore, brackets have not been used for support, the panel being attached by screws driven into the thickness of the baseboard. The small terminal socket strips are obtained with terminals ready mounted and there is a small bracket on the strip which enables it to be mounted on the baseboard with a minimum of trouble. All other components are mounted by means of ordinary screws and the only drilling work required is five ¾in. diameter holes in the panel for the panel controls. This should be the first part of the constructional work, cutting and drilling the panel and then staining or otherwise finishing it according to your individual preference. In the original model, the panel was stained black on both sides and finished with ordinary wax floor polish which gives a semi-gloss or egg-shell finish and is quite durable.

Next, place the various components on the baseboard, locating their position from the wiring diagram, which is drawn to scale. If desired, the baseboard may be scored across lightly into three equal divisions to indicate the separate circuit sections. When all parts have been located an awl or similar sharp-pointed tool should be inserted into all the component fixing holes to provide a start for the fixing screws, and then the parts may be screwed down. (Do not attach the panel until the majority of the wiring has been completed.) Make certain that everything is properly and securely fixed and then commence the wiring. This may be carried out in any desired manner, the original model being

LIST OF CO

Two coils, type BP.80. (Varley).

Two .0005 mfd. variable condensers, popular log type, with two large control knobs (J.B.).

One differential reaction condenser, .0003 mfd. (J.B.).

Three baseboard-mounting valveholders, two 4-pin and one 5-pin (Bulgin).

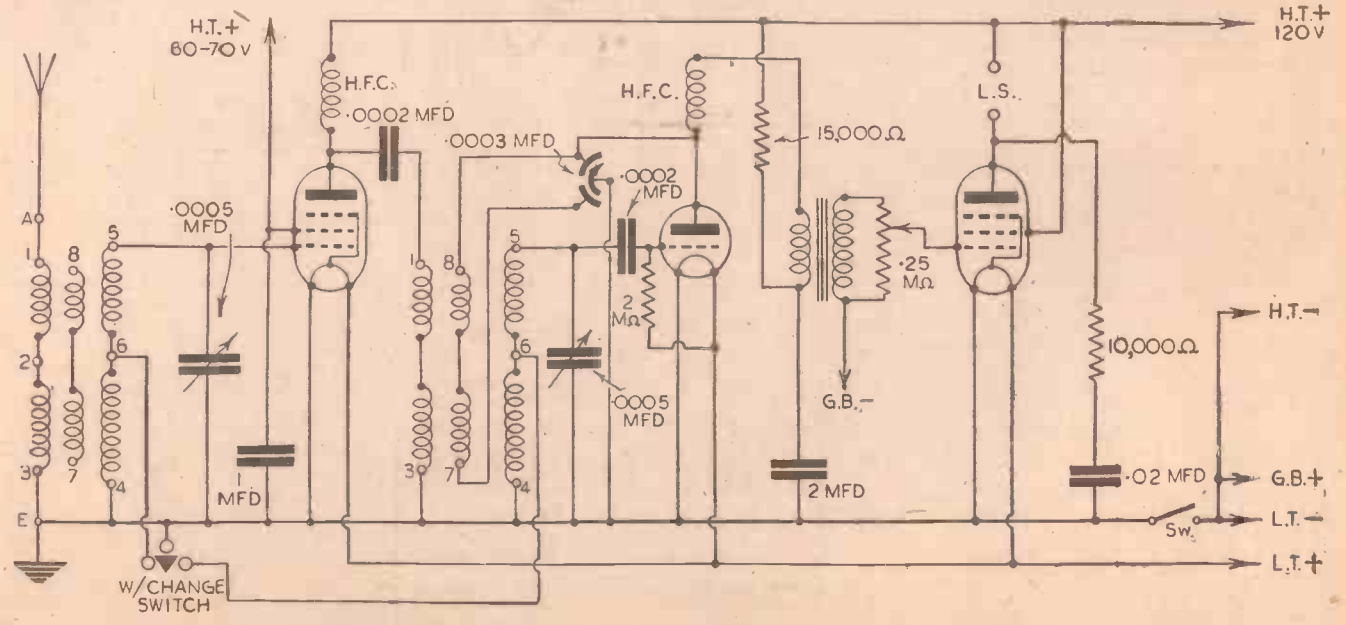
One type H.F.8 H.F. choke (Bulgin).

One type H.F.9 ditto (Bulgin).

One 3-point switch, type S.36 (Bulgin).

One 4 to 1 L.F. transformer (B.T.S.).

Five fixed condensers:
One .1 mfd. type 4603/S. Two .0002 mfd. type 4601/S. One 2 mfd. type 3016. One .02 mfd. type 4601/S (Dubilier).



Theoretical circuit of the receiver—not indicating the separate terminal arrangement.

T'S" THREE

Battery Receiver
nal Purposes

wired with 22 tinned copper wire and standard insulated sleeving slipped over to provide a neat appearance. Any of the proprietary screened connecting wires may, of course, be used, provided that it is remembered that the ends are properly bared and cleaned where they are attached to terminals. The resistors and fixed condensers may be attached direct by means of their wired ends, but on the combined volume control-on-off switch, soldering will have to be resorted to.

If the receiver is to be built as a normal broadcast set without the scope for experiment the two centre terminal socket strips may be omitted and the wiring to them also left out. Incidentally it will be noted in the wiring diagram, upon comparing this with the panel seen in the illustration at the top of the page, that the reaction condenser and wave-change switch are not shown. The latter illustration shows that these two components are situated immediately below the two tuning condensers, and they have been omitted to avoid making the wiring diagram difficult to follow. Having completed the wiring, the receiver is now ready for test, and this may be carried out either in the form of the complete three-valver, as a two-valver (H.F. and detector or detector-L.F.) or as a single valver. Connect the L.T., G.B. and H.T. batteries, and then preferably test the receiver as a simple single-valver. Connect aerial and earth to the second terminal strip and the phones to the next strip. Switch on and pull out the wavechange switch. As the right-hand condenser is now rotated towards the upper part of the scale, the Home Service programmes should be heard. If oscillation is present, turn the lower centre knob in an anti-clockwise direction until oscillation ceases. This is a normal reaction control and should be used to augment signal strength and selectivity as required. The uses of this will be explained more fully later. When signals have been heard and it is found that the reaction control gives an increase in volume, proving that the wiring of the detector stage is more or less in order, the aerial and earth leads may be transferred to the end pair of sockets, thus converting the receiver into an H.F. detector combination. As soon as the left-hand tuning control is rotated so that it is in step with the other condenser there should be a good increase in volume of the station, except perhaps in cases where the local station is very close and the H.F. stage may be overloaded. Other stations may now be tuned-in by turning both condenser controls together, keeping them in step by noting the level of the background (rushing) noise. It may be possible in some locations to connect a loudspeaker in place of the phones and obtain reasonable volume from this combination, although some L.F. amplification is generally desirable in order to obtain good loudspeaker results. Therefore, the next step is to add the output stage, by transferring the speaker to the end pair of sockets and bridging the sockets from which the speaker or phones have been removed. Any ordinary piece of wire may be used for this purpose. When the output stage has been included, the right-hand control also comes into action. This is a volume-control, and regulates the signal passed on to the output valve from the detector stage. When turned to its maximum position in an anti-clockwise direction signals are at a minimum, and rotation in a clockwise direction gradually increases signal strength. The two controls—reaction and volume, may be used together in certain circumstances to provide varying degrees of selectivity, but these arrangements, and other facts concerning the receiver, will be dealt with in later articles.

OMPONENTS

Three fixed resistances, ½ watt type: One 10,000 ohms. One 15,000 ohms. One 2 megohms (Dubilier).

One .25 meg. volume control with 3 pt. switch, type VM.62 (Bulgin).

Four terminal mounts and terminals, type P.30 (Bulgin).

Three valves: type Z.21 (4-pin), HL.2 and KT.2 (Osram).

One wooden baseboard, 12in. by 9in. One panel 12in. by 8in. Wire for connection, flex for leads, screws, etc. (Peto-Scott).

One pair 2,000 ohm headphones (Ericsson).

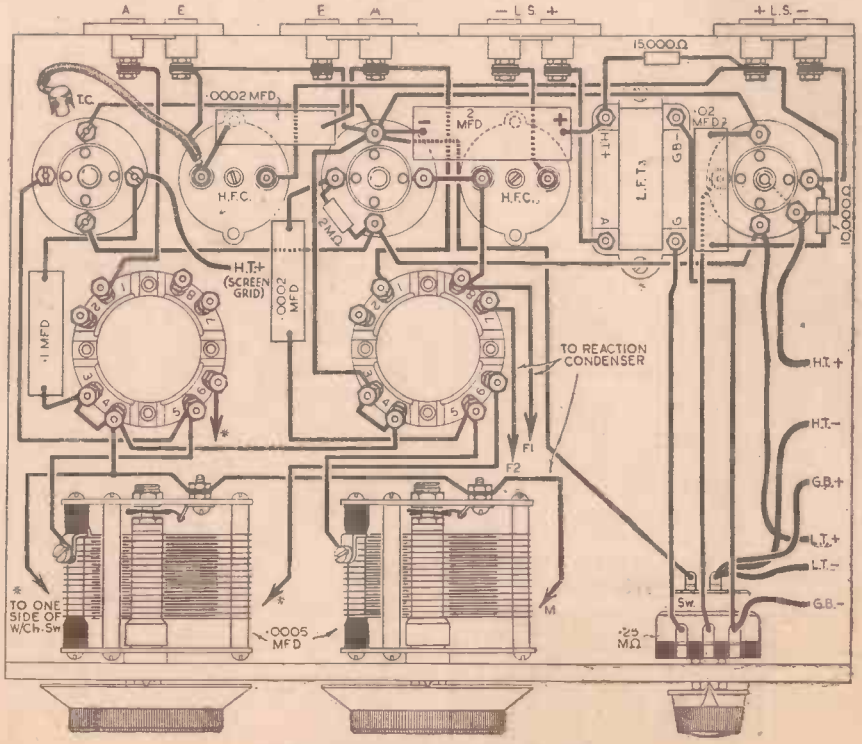
One W.B. Stentorian Junior loudspeaker (W.B.).

One 2-volt accumulator (Exide).

One 120-volt H.T. battery (Drydex).

One 9-volt G.B. battery (Drydex).

On the right is the receiver, three-quarter front view, showing the control layout.



Wiring diagram of the Student's Three

CAREERS IN RADIO

(*Continued from page 83*)

both personal and by post, cater for some of the highest standards, and it is possible to obtain many academic degrees even through a correspondence course. Mathematics is one of the main features and is applied widely in radio design, whilst the complete industry employs chemists, metallurgists and physicists in addition to electricians and the purely manual worker.

In addition there are, of course, the draughtsmen who are engaged in preparing the blueprints of receivers, cabinets and other apparatus used in modern radio equipment.

Making Preparations

The obvious first difficulty of those who are thinking of taking up one of these trades is how to make a start. If your education has only just finished and you have included some of the subjects mentioned above you may be able to obtain a post right away. On the other hand, you may wish to brush up certain subjects, or even to take up an entirely new subject, and therefore one of the specialised training colleges will prove of the greatest value. From our library of books, a copy of which will be found on this page, you will be able to select volumes which will solve any problems which you may have, and they will enable many to take up radio for the first time. The Encyclopaedia, for instance, explains clearly all the terms met with in modern radio apparatus, and is fully illustrated. The Service Manual explains clearly the procedures adopted in servicing modern apparatus, with especial reference to the superhet, which is probably the widest used receiver to-day, both in the Services and in civil life.

Sound Engineers

A branch of the industry which has not to-day been given the prominence it deserves in this country is that generally known as Sound Engineering. It embraces mainly those engaged in public address work, and although in the past much of this work has been carried out by small radio firms who have simply made do with odd equipment which was handy, it is actually a very specialised branch of the radio trade. For instance, suppose a large open-air meeting is to be held, and some form of redistribution is needed to cover the area over which it is likely that the public will be spread. A radio technician or sound engineer who has studied his subject will be able to select speakers suitable for covering the area in the most effective manner with the minimum of power; will be able to place them effectively, and the result will be that everyone will be able to hear clearly the words of the speaker. Contrast this with the effects seen at some meetings where unqualified men have erected the equipment. Deep boomy tones come from unsuitable speakers and it is almost, if not completely, impossible to understand a word of what is being said. The same thing applies inside a building. Badly arranged speakers will result in echoes or distortion which will prevent good sound radiation, or feedback may occur which will result in the amplifier gain being reduced to such a level that insufficient power will be fed to the speakers and the sound will thus be inaudible in many parts of the hall.

In America this work has been developed in a very extensive field, owing, of course, to the much wider scope offered in that country, and special training centres are available for sound engineers. The work includes, of course, design and maintenance of amplifiers and microphones and these alone are a complete source of study for the would-be technician. Also included in the field would be recording, as many public meetings or similar functions are of such an importance that a record of certain speeches or performances in the case of entertainment are needed. If not, the engineer may desire to make a record with a view to a subsequent sale to the performer or speaker. This is a profitable business, and many good radio dealers now include a private recording studio on their premises. The quality of a properly "home-recorded" disc should be indistinguishable from that of the commercial record, and it is possible to use portable apparatus and still obtain the same high degree of reproduction. It will thus be seen that there is an extremely wide and varied field available for those who are keen to take up some form of radio as a career, and we shall be pleased to answer any questions relative to the matter which have not been covered in this article or in our Gift Book which is announced on another page.

PRACTICAL TELEVISION

April 13th, 1940. Vol. 4. No. 198.

Looking Ahead

IT is somewhat refreshing to learn that in spite of the difficult situation now existing in Europe because of the war, all the original preparations for the World's Fair to be held in Rome in 1942 are being adhered to. As would be expected, not the least interesting section of the Fair will be that devoted to radio in all its many manifestations.

Bearing in mind that Marconi was an Italian, it is quite fitting that Italy should undertake this work, for a debt of gratitude is owed by the whole world to this engineer and scientist who made commercial wireless possible and assisted so materially in the development of television. In this radio section a first class historial assembly of apparatus is being organised, and if circumstances permit it is hoped to include original television and radio equipment from all the important countries of the world. It is not always realised how much work has been done in Italy with the object of providing a satisfactory television service, and one of the leading manufacturers to help in this connection is Safar. The Telepantoscope invented by Castellani is used in the television camera, and has been described before in these columns, the principle of working for converting the optical image into a television signal differs from the Iconoscope. As far as the ultra-short-wave radio transmitter at Rome is concerned, the vision signals are radiated on a wavelength of 6.8 metres and the sound on 7.4 metres. Picture dissection is one of 441 lines interlaced, while the aerial power is rated at 5 kilowatts for full white in the picture, the frequency characteristic allowing for a maximum modulation frequency of 3 megacycles without distortion. In Milan, facilities are provided for television demonstrations on closed circuit, and here again the Telepantoscope is employed in the television cameras. It is as well to remember that with this device the signal mosaic is built up in such a way that it possesses a luminous inertia of the same duration as the frame frequency. It is claimed that in this way better sensitivity is secured and less flicker. Focusing is carried out electrostatically, but the line and frame deflection circuits operate electromagnetically. The demonstration receivers employed for public viewing of the studio programmes enacted in the same building incorporate 16in. cathode-ray tubes of a relatively short length and having a front screen face of the latest flat type. Since electromagnetic operation is employed the controls of these sets are very simple and compare favourably in performance with British sets in use last year.

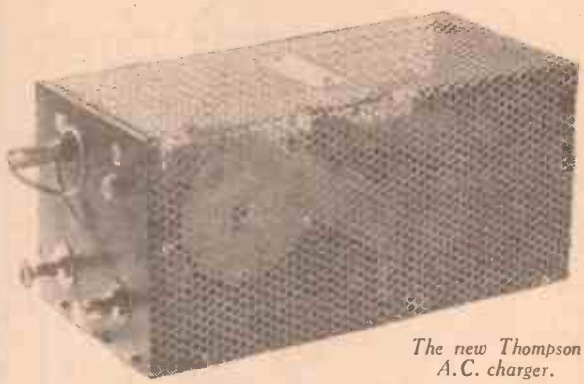
Electron Multiplier Modulator

THE photo-electric cell, complete with electron multiplier, has been employed for a variety of purposes in modern industrial science, and it is now suggested that it can function in such a way that full modulation can be derived from it in a television transmitter. Between the photo-electric cathode and main anode are interposed the usual secondary emissive electrodes, these being of open grid type. Appropriate positive potentials are applied to these via potentiometer, so that the voltage increases in magnitude as the electrodes become nearer to the anode. Between the final multiplying electrode and the anode a constant voltage is applied and a voltage of the same frequency as the vision carrier wave is magnetically coupled to this section of the circuit.

LATEST TRADE NEWS

An Efficient L.T. Charger

IT would appear that during the last six months, the demand for reliable low-tension chargers has shown a marked increase, and this is, no doubt, due to the more extensive use of low-tension emergency lighting systems and the necessity of keeping car accumulators in a fully charged condition. The demand has introduced several new types and this week we have received for test purposes a newly introduced model from Messrs. T. W. Thompson, of 176, Greenwich High Road, Greenwich, S.E.10. In all fairness to the makers, it should be noted that although the model in question is a new addition to their range of products, the makers are by no means new to the market as they have been producing similar equipment for the last twenty-five years.



The new Thompson A.C. charger.

The unit, as the illustration shows, is neat in appearance, sturdy in construction and, owing to the perforated metal container, provides adequate cooling facilities for the mains transformer and metal rectifier. The output is designed for 6-volt and 12-volt cells, the change-over being made by plugs and sockets. The mains transformer is substantially designed, and will deliver an output far in excess of that needed in the unit so that there is little risk of damage due to an accidental overload. The latest type of non-valve rectifier is incorporated and will supply a generous 1-amp on load. The price of the unit is 35s., and it is guaranteed for 12 months. The overall dimensions are 9ins. by 4ins. by 4ins.

New Osram Valves

Although not strictly valves in the accepted sense, the Tuneray Indicators recently introduced by the G.E.C. may be classed in the valve group. These are similar to existing models but have small tubular bulbs to facilitate mounting in radio receivers and obviate the necessity of using a rigidly held valveholder. Comparisons in size may be made by reference to the dimensioned diagrams on right. The type numbers are Y61 and Y62, and they may be used to replace the Y63 and Y64 types in all sets already using the latter. The prices of these two indicators are 8s. 6d. each. In addition the G.E.C. announce that they are replacing the Mercury Rectifier Type GU5, with a valve of a new design to be known as the GU50.

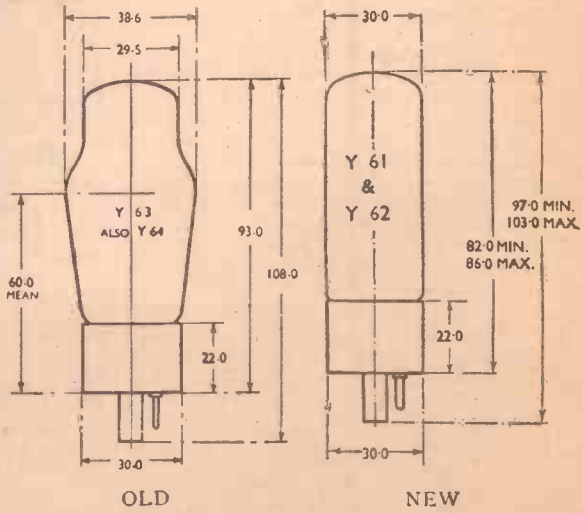
The Osram GU50 has characteristics identical to its predecessor, and can be employed in all apparatus for which the GU5 has been specified. As a result of considerable research, it incorporates many modifications in design however, which will improve the reliability factor under maximum conditions of operation.

This new valve can be recommended with confidence as a reliable rectifier where an output up to 250 milliamps per valve (with delayed switching) is required. It is rated up to 1,500 volts R.M.S., and priced at 25s.

Osram VMP4G Replaces VMP4

The G.E.C. also states that valve type VMP4, the 4-volt indirectly-heated variable-mu H.F. Pentode, is now obsolete. To meet the requirements of servicing for receivers in which this valve was used, the more recent VMP4G will now be supplied fitted either with a 5-pin or 7-pin base as required. It has been proved in tests that the VMP4G will replace the VMP4 with perfectly satisfactory results, and the removal of the VMP4 from the market has, therefore, been deemed quite justifiable.

Owing to pressure on space, several regular features have been held over.



Dimensioned drawings for comparison purposes, of the old and new Osram Tuneray indicators.

HIGH-FREQUENCY COUPLINGS

(Continued from page 88)

resistance is indicated in Fig. 3 by broken lines. There is one other slight disadvantage of the tuned-anode circuit, even when it is arranged as shown in Fig. 3, which is that the full voltage of the H.T. supply is applied between its terminals, so that if the vanes were to touch a short-circuit would result. Provided that a good-class condenser is used, however, this can be ignored.

H.F.-Transformer Coupling

The third form of inter-valve coupling is that shown in Fig. 4, and this is in reality a combination of the other two arrangements. The coupling provided is by means of an H.F. transformer, the secondary winding of which is tuned, the primary being aperiodic, and it is identical in principle with a standard aerial tuner. In the present instance it is not possible to use a three-point wave-change switch, and two separate on-off switches or a four-point switch must be used instead, unless a by-pass condenser is used in the same manner as in the tuned-anode circuit described above. The tuned-transformer method of coupling combines the advantages of both of the systems previously considered, besides which, theoretically, it provides a certain amount of voltage step-up, due to the secondary winding having a greater number of turns than the primary. This additional amplification is not always realised in practice but the method of coupling is extremely good when a well-designed coil is employed. But if a poor coil is employed it is usual to find that the receiver is very inefficient at various wavelength settings, or that reaction control is very "unsteady."

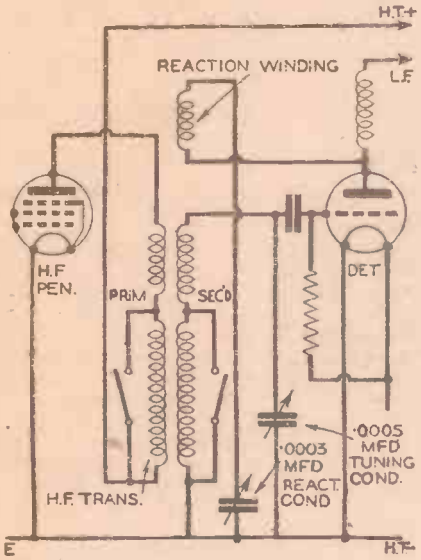


Fig. 4.—H.F. transformer coupling is shown here.

As far as the single-valve, high-frequency amplifier which we are considering is concerned, it does not matter very much which of the three types of coupling is used, provided that the disadvantages and special points dealt with are borne in mind. On the other hand, when we come to consider a receiver having two H.F. stages, the position is rather different, and it is best for the amateur to avoid using a pair of tuned-anode circuits, because it is then usually rather difficult entirely to avoid self-oscillation, due to the fact that the circuits are *too* efficient.

SCHOOL BROADCASTING IN WAR-TIME

IN presenting the programme of School Broadcasts for the Summer Term, 1940, the Central and Scottish Councils for School Broadcasting hope that the various series will be found of special value in the difficult conditions which have been imposed on schools by the war.

Broadcasts have been modified where necessary both in their content and their presentation to suit war-time conditions. For instance, there is now only one Home Service programme for the whole of Great Britain, and certain series of particular interest to Scotland and Wales have had to be abandoned, but the essential quality and purpose of School Broadcasting remain—to provide something which the teacher himself cannot give, and to supplement the work of the school on the imaginative side. In addition, for many children living in strange surroundings away from their parents, it has provided a reassuring link with the outside world. It may not be out of place to quote the following statement on the contribution of School Broadcasting which appears in the English Programme of Broadcasts to Schools 1939-40, and which remains true to-day in war-time as it was in peace time:

> School Broadcasting should not be viewed in isolation. On the one hand it is a section of general broadcasting; on the other it is one of the elements in modern education. Education is passing through a stage of rapid development; the boundaries of the school are receding and, as they recede, the responsibilities of the teacher increase. It is the avowed object of the educator to-day to prepare children for life, both in work and play; in fact, the school is or should be part of life. The teacher has no longer to be content to instruct his pupils in classroom subjects; he is all the time seeking ways in which he can link up classroom teaching with life outside the school. Broadcasting is an important outside influence on the development of the child. The teacher who brings it into the school is drawing into his service something which is part of the normal experience of home life to-day. Moreover, apart from what the child learns from the broadcasts, he has his first experience of listening under guidance. He is likely to spend many hours of his adolescent and adult life listening to the radio. The teacher has a chance of doing something to train his powers of selection and concentration.

During the first term of war-time School Broadcasting, the B.B.C. Central Council were trying to interpret the needs of an audience which as to perhaps 75 per cent. of its total number was listening under abnormal conditions, and the B.B.C. Schools Department, evacuated to a country house and working under equally abnormal conditions, executed the Council's commission with indomitable efficiency. Gradually normality returned on both sides. By the end of the autumn term fewer schools were working in shifts or in strange buildings and more Heads of schools were in a position to find out what the Council were doing and to tell them what would help them. At the same time the difficulties of production became less and the new technique of presentation (the children lacking illustrated pamphlets to refer to) more assured.

Commercial Coil Connections

Details of Terminal Indications for Certain Popular Coils

WE are continually receiving inquiries from readers for details of connections of coils which are not now in normal circulation, and as we have repeatedly pointed out it is not advisable to try out modern circuits with old parts. We have given certain details previously, but as all issues are out of print we are reprinting this data. It must be pointed out that coil connections have never been standardised, as have certain other components, and thus the fact that a certain coil may have six terminals does not mean anything. Even the numbering of these terminals bears no indication to its type or the method of using it, and thus we may find that one coil will have terminal number 1 joined to the grid, whilst another will have terminal 6 taken to the same point.

All-wave Coils

In 1933 the Lissen Four-range coil and the British General All-wave Tuner were in common use, and these are very popular with home constructors. The circuit of the Lissen coil is given in Fig. 1, and it will be seen that in this component the various sections are short-circuited by means of the self-contained wave-change switch as the ranges are lowered. The four bands covered are from 12 to 38, from 22 to 90, from 190 to 555, and from 800 to 2,000

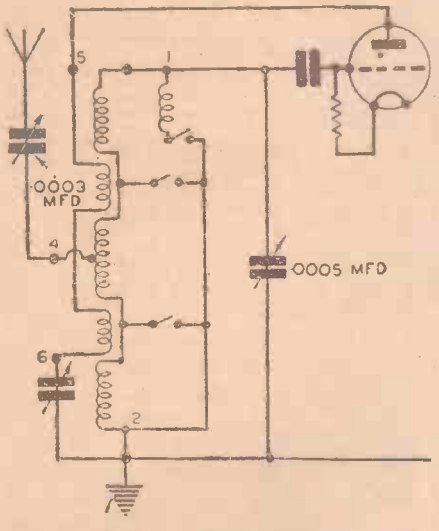


Fig. 1.—Circuit of the Lissen 4-range tuner.

metres, and the coil may be used in a simple detector stage or as an H.F. coupling coil—in this case taking the preceding anode to the coupling condenser in place of the series aerial condenser. The efficiency of this coil will not be found so high as modern all-wave coils, and it is, of course, of much larger dimensions.

The British General Tuner is of a different type, having a transfer aerial tapping for each range, and incorporating the circuit shown in Fig. 2. In this case the ranges are 14.5 to 40, 32 to 90, 200 to 550, and 900 to 2,000 metres, and for this, as well as the Lissen coil already mentioned, a standard .0005 mfd. tuning condenser should be used. It must be pointed out that several different types of British General Tuner were produced and the reference-letters given in Fig. 2 may not apply to all of them. The coil illustrated was used in our All-wave Unipen receiver described in 1933.

Telsen Variable Selectivity Coil

Another very popular coil of its time, and one which is still in common use, is the

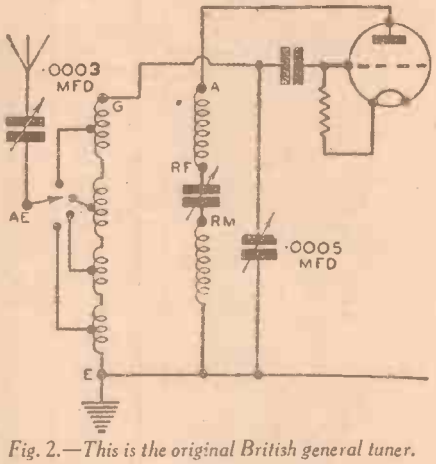


Fig. 2.—This is the original British general tuner.

Telsen component which had a small self-contained condenser mounted on top of it for aerial tuning purposes. It was known as a variable selectivity coil, and the circuit and connection numbers are shown in Fig. 3. In some cases it may be found desirable with this particular coil to include a fixed condenser having a maximum capacity of .0003 mfd. across points 4 and 6 to prevent medium-wave breakthrough. With this coil a separate wave-change switch has to be employed, and this should be of the three-point type.

Another Telsen coil about which we still receive requests is the Type 349—one of the first miniature screened iron-core coils to be produced. This has six terminals only, and they are wired, as shown in Fig. 4. With this, as with most other coils described, it is possible to employ a simple

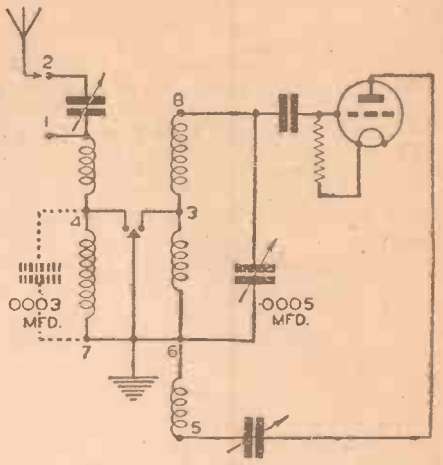


Fig. 3.—The popular Telsen variable selectivity coil.

detector stage or to use them in an H.F. stage as H.F. coupling components. In each case the anode takes the place of the aerial lead.

Band-pass Coils

An early Lewcos coil of interest was the unscreened bandpass filter, built up round two small formers mounted on a base in a "V" formation. This coil also contained a switch in the base, and the terminals, instead of being numbered, bear reference-letters. These are shown in the circuit in Fig. 5, and it will be seen that a coupling condenser has to be employed. This should be of the non-inductive type having a maximum capacity of .02 mfd., and if possible a mica condenser should be employed. In this particular coil unit the series aerial condenser is included in the coil mount and thus, when used as an inter-valve coil, the anode would be joined to terminal A direct. This coil is not ideal for modern conditions owing to the fact that the wave-range on the medium band is from 235 to 550 metres, and thus it is not possible to tune down to a large number of popular stations. Turns can be stripped from the former, but some difficulty may be experienced in balancing the two windings, and if this is done then a separate panel-trimmer should be connected across one of the condensers to enable the two circuits to be balanced for distant station work.

Lissen Type LN5101

A screened coil in the Lissen range which is still popular is type LN5101, but it must be remembered that this firm has produced dozens of screened coils and unless the type number is given on the coil-

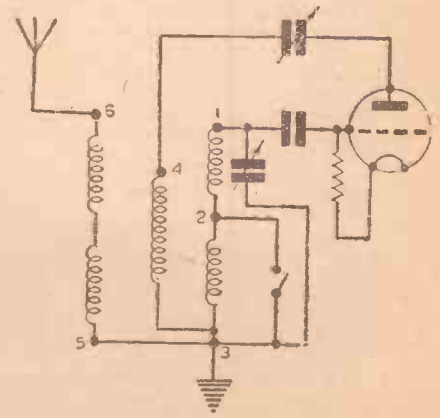


Fig. 4.—This is the Telsen type 349 coil.

COMMERCIAL COIL CONNECTIONS

screening can these reference numbers cannot be followed. The circuit is shown in Fig. 6, and the wave-range covered is from 200 to 550 and from 800 to 2,100 metres. It will be noticed in the circuit that the reaction condenser is shown jointed between the anode and the terminal 5, or between terminal 6 and earth, and this enables a metal panel or an insulated panel to be used at will. The latter connection is preferable as it puts the reaction condenser

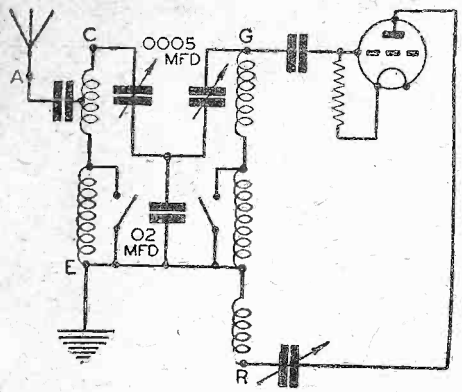


Fig. 5.—The Lewcos bandpass coil.

moving vanes direct at earth potential and this avoids tuning difficulties when critical reaction adjustments are being made. If a metal panel is employed and the condenser is joined between the anode and the reaction winding, in any type of coil, the condenser must be insulated from the panel (if this is earthed in the usual way), otherwise the reaction coil is short-circuited.

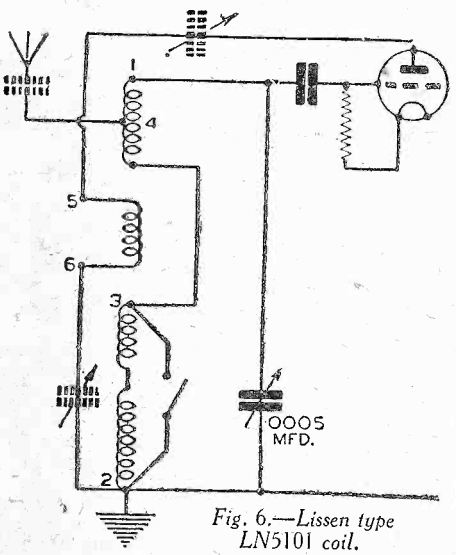


Fig. 6.—Lissen type LN5101 coil.

RADIO ENGINEER'S POCKET-BOOK

LOGARITHMS—(*continued*)

No. 47.

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	4	4

ANTILOGARITHMS—(*continued*).

No. 50.

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12

ANTILOGARITHMS

No. 48.

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2
.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	3
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	3
.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	3
.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	3	3
.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2	2	2	3	3
.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2	2	2	3	3
.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2	2	2	3	3
.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2	2	2	3	3
.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2	2	2	3	3
.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2	2	2	3	3
.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2	2	3	3	3
.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4

ANTILOGARITHMS—(*continued*).

No. 51.

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	4	5	7	9	10	12	14	16
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20

ANTILOGARITHMS—(*continued*).

No. 49.

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2	2	3	3	4
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	2	3	3	4	4
.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	2	3	3	4	4
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	2	3	3	4	4
.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	2	3	3	4	4
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	2	3	3	4	4
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	2	3	3	4	5
.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	2	3	4	4	5
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	2	3	4	4	5
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	3	4	4	5
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	4	5	6
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	4	5	6
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	6	6
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	6	6

NATURAL SINES, COSINES, AND TANGENTS

No. 52.

Degrees.	Sine.	Cosine.	Tangent.	Degrees.	Sine.	Cosine.	Tangent.
30′	0.0087	.9999	0.0087	8° 0′	0.1392	.9903	0.1405
1° 0′	0.0174	.9998	0.0174	30′	0.1478	.9890	0.1495
30′	0.0262	.9997	0.0262	9° 0′	0.1564	.9877	0.1584
2° 0′	0.0349	.9994	0.0349	30′	0.1650	.9863	0.1673
30′	0.0436	.9991	0.0437	10° 0′	0.1737	.9848	0.1763
3° 0′	0.0523	.9986	0.0524	30′	0.1822	.9833	0.1853
30′	0.0610	.9981	0.0612	11° 0′	0.1908	.9816	0.1944
4° 0′	0.0698	.9976	0.0699	30′	0.1994	.9800	0.2035
30′	0.0785	.9969	0.0787	12° 0′	0.2079	.9782	0.2126
5° 0′	0.0872	.9962	0.0875	30′	0.2164	.9763	0.2217
30′	0.0959	.9954	0.0963	13° 0′	0.2249	.9744	0.2309
6° 0′	0.1045	.9945	0.1051	30′	0.2334	.9724	0.2401
30′	0.1132	.9936	0.1139	14° 0′	0.2419	.9703	0.2493
7° 0′	0.1219	.9926	0.1228	30′	0.2504	.9682	0.2586
30′	0.1305	.9914	0.1317	15° 0′	0.2588	.9659	0.2679

How Old are Your Valves?

QUERIES regularly received from readers very forcibly bring home the fact that many listeners fail to realise that the valve is not a permanent part of a radio receiver, and that, apart from the fact that it gradually deteriorates, accidents in connecting up or testing a receiver may very seriously impair the efficiency and shorten the life of a valve. The queries in question are:

1. "My output pentode glows with a blue incandescence which varies with the music. . . ."

2. "I switched on but no signals or hum came from the loudspeaker. After a few minutes I raised the lid of the cabinet and was surprised to see that the pentode was red-hot. . . ."

The solution to the first query is generally the fact that the receiver is being operated without H.T. for a considerable period of the testing-time whilst the set is being installed, and the result is that the output valve has become "soft." In the second case it eventually transpired in one instance that no loudspeaker was connected to the set, and thus there was no load for the output valve (a mains pentode). Consequently, owing to the considerable wattage dissipation from the screen which resulted, the entire electrode assembly had become red-hot and the life of the valve was not only considerably reduced, but less than half the normal output was obtainable when the receiver was subsequently correctly connected up.

A Story and a Moral

Most valve manufacturers give a guarantee of a definite life to a valve, and this means that when used under correct operating conditions it should provide for that period, the anode current, wattage dissipation, and other characteristics which the makers state for that particular valve. The care which is taken at the factory, not only in assembly but in testing, prevents all but a very few defective valves from finding their way into the hands of the listener. Now and again, unfortunately, a peculiar defect does enable a valve to pass its factory tests in spite of some fault, and after only a short period of use it breaks down. In such cases, however, the valve makers will exchange the valve and will examine the faulty one in order to take precautions against a similar defect again arising.

Therefore, the listener may be reasonably certain that when the valve is plugged into his receiver it will give good service for a definite period of time. Owing to the method by which a valve functions, however, there is a gradual deterioration, or falling-off in performance. This is so slight that it is not noticeable and after, say, six months' use the receiver appears to give exactly the same performance as when first installed. The same remarks apply at the end of the year's use, but by that time, if a set of brand-new valves of exactly similar characteristics is used in place of the old ones, a remarkable improvement in performance will be noticed. We do hear of cases where a constructor proudly boasts that he has had the same set of valves for three years, "and they are still as good as when I first bought them." Unfortunately, this cannot be true, as the valve is what might be called a "perishable" article, that is to say, from the moment the filament or cathode is heated something is being used, and this is not put back in any way, so that in time they must become "worn-out."

The moral of this is to replace your valves after the period of life given by the makers, and you will be richly rewarded, not only in improved quality, but also in greater "reach" or, in other words, improved reception from all stations.

Points to Guard Against

The useful period of life above referred to may be very considerably shortened if the valve has become damaged due to wrong connection, mechanical shock, etc. Some of the points, although at first sight do not appear to have any effect on the life of a valve but which may prove of great importance, are now given.

In a battery receiver it is essential that the H.T. be applied whilst the filament is alight. When trying out a new circuit, therefore, make quite certain that the anode circuits are complete if the L.T. is switched on. Although running the filaments alone for a few minutes only may not make much difference, if allowed to glow for a long time the valve may become soft. This is because when the normal anode current is flowing there is a kind of "cleaning-up" effect which acts on the residual gases in the valve envelope, and without this useful effect the degree of vacuum is modified, with the result that softening takes place, and in the output valve in particular it is denoted by the blue glow referred to in the opening paragraphs.

In a mains receiver it is not usually possible to run one supply without the other, but in the event of a broken H.T. supply circuit the same remarks apply.

When first installing a mains receiver, or when carrying out experiments, take particular care to plug the valves into the correct holder. At first it may not appear to be a very serious matter if the wrong holder is employed, but a moment's thought will show that in some cases serious damage can be done. Take, for instance, the case of an A.C. receiver employing a directly-heated pentode. If an ordinary triode is plugged into this holder there will be a positive voltage of about 150 to 200 applied to the cathode (the centre pin) with disastrous results.

Another little-known point relates to overloading a modern high-slope valve. In the case of an output pentode of this type the application of a very large signal will cause considerable transient anode-voltage surges, and if an inductive anode load is being employed these may rise to as much as five times the steady anode feed voltage. This may cause what is known as a "flash-over" inside the actual valve, breaking down insulation, impairing the vacuum, and in an extreme case actually causing the glass envelope to fracture.

Other points, such as incorrect voltages caused by wrong connection or broken-down resistances and condensers, will, of course, occur to the average constructor, and it should be unnecessary to point out that short-circuits, either accidental or intentional, can result in irreparable damage, both to valves and other components.

Open to Discussion

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

Steps to Quality—1

SIR,—Several points seem to require explanation in the article on a new receiver by Mr. Hunt in your issue of March 16th. The third valve is stated to have an anode voltage of 120. As the cathode is about 35 volts above earth there is an effective anode voltage between anode and cathode of 85. As the grid of this valve is 25 volts positive to earth, the cathode being 35 volts positive, there is a grid-bias of 10 volts negative. But the makers' curve for the MHL4, the valve specified, show the anode current, with 85 volts H.T., as dropping to nil at about 6 volts grid-bias. How will there then be appreciable anode current with 10 volts bias ?

Allowing for normal losses, the peak audio-frequency volts required to load fully the output valve, necessary on the grid of the third valve, will be two or less. This being so, it is difficult to see any necessity for 10 volts grid-bias. Also, as the output valve is evidently to work normally, and not as part of a Class B or Q.P.P. arrangement, why should the receipt of a signal increase its anode current ?—A. O. GRIFFITHS (Hope).

Steps to Quality—2

SIR,—I have built up the amplifier described in your March 16th issue by Mr. N. A. B. Hunt, exactly in accordance with the circuit there specified, and feel sure your readers will like to know how pleased I am with the results, both on radio and on records.

As a seeker after quality reproduction, I have tried every other form of quality circuit and can state that this latest form of direct-coupled amplifier is easily the best. The most striking feature, in my opinion, is the response to the upper audio-frequencies while retaining the smoothness and beauty of the original performance. The speaker I am using reproduces frequencies up to 15,000 cycles, so that there is no question as to the frequency-range I am getting. Bass notes are also exactly in proportion, and transients are simply amazing.

As regards the detector stage, I am using a Tungsram D.418 diode in place of the crystal and valve arrangement mentioned in the article, and can confidently recommend this to anyone who contemplates making up the amplifier, as it will take a smaller input than the usual type of diode.—J. CLARKE (Worcester).

Amateur Co-operation

SIR,—Other readers may be interested in my 9 mc/s log of stations recently received on an 0-v-2, home-built, with an antenna 44ft. long and 17ft. high, running W. to E. :

TAP, PCJ, CSW7 (Lisbon), YUC, EAQ, CR7BE (Lourenço Marques), VLQ, VUD2, KZRH (Manila), JZL (Tokio), OFD (Lahti), HAT4, TPB11, and several Americans, including WGEO, WGEA, WCAB, WBOS, and WRCA.

I am 16 years of age and have been a reader of your interesting and helpful paper for the past six months. I should very much like to correspond with any S.W.L. in England or U.S.A.—DENNIS HOWARD (Dorking, Surrey).

The Radio Engineer's Notebook

SIR,—It's a few weeks since I wrote to you but would like to thank you now for helping me to get into touch with my friends whose addresses I didn't know. With the help of "Thermion's" column I did indirectly hear from them. As usual, every week my wife forwards me my copy of PRACTICAL WIRELESS, which is always a godsend, being out of touch with the practical side, but with the help of "P.W." the theory still continues. I, like many more, I hope, are delighted with your new series of "Radio Engineer's Handbook." I have got all my pages up to date and am sure it's going to be the finest scrapbook I ever made up. I look forward every week to sticking the new issue in. In the Services now I'm hoping to become a signaller and find the pages, as well as "P.W.," very helpful. My morse is coming on splendid, and the metre and frequency chart are very helpful, so you can guess how I enjoy working out the formulæ with its help.—G. HAZLEWOOD (R.A. Barracks, Somewhere in England).

Prize Problems

PROBLEM No. 395

PURVIS had a four-valve battery receiver which gave very good results. One night whilst listening to a distant station it suddenly grew weaker, and in spite of retuning he found he could not obtain any signals. He decided to examine the set on the following day, and when he switched on to do so, he was surprised to find that the set worked quite well again. After about half an hour, however, signals again faded away into inaudibility. What was wrong ? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 395 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, April 15th, 1940.

Solution to Problem No. 394

Barlow overlooked the fact that without an output filter circuit the H.T. would have to flow through the extension wires, and thus the voltage eventually reaching the anode was too low to permit the output valve to operate properly.

The following three readers successfully solved Problem No. 393 and books have accordingly been forwarded to them : R. Poole, 47, Russell Road, Gravesend, Kent : C. Scott, 48, Springfield Road, St. Leonards-on-Sea, Sussex : C. A. Russell, 30, Mill Street, Maidstone, Kent.

Midget Receivers

SIR,—A short time ago reference was made in your columns to the question of designs for "pocket" receivers. Now that 1.4 volt valves—which can be operated from dry cells instead of an accumulator—are being manufactured by British firms, the design of small battery sets should be a practical proposition. Previously, the accumulator and H.T. battery occupied more space than the receiver itself, but with midget batteries available for both H.T. and L.T. this is no longer the case. An interesting portable set (the "Pocket Two") was described in your issue of December 23rd last, and many readers might like to see a re-designed version of this set, using 1.4 volt valves such as the 1E4G and 1G6G. As there would be two low-frequency stages ample headphone volume would be available.

Small air-spaced condensers and plug-in coils could be incorporated to make the set suitable for short-wave and medium-wave reception. The receiver, headphones, batteries and a throw-out aerial might easily be fitted in a case about the size of a gas-mask box.

If a midget portable could be produced and sold by some firm, both in kit form and ready for use, it would appeal not only to the home-constructor but to many of those who, especially in war-time, have no facilities for building their own apparatus. In the United States several companies advertise kits of parts for experimental receivers and offer to supply the sets wired and tested for a small additional charge. Services of this kind might prove popular in this country.

The midget portable could also be supplied in a special tropical finish for use abroad or at sea. In this connection it is interesting to note that some months ago a Chicago firm commenced production of a portable superhet "Communications" receiver, using 1.4 volt tubes, and intended to provide headphone or loudspeaker reception with only 90 volts H.T. The receiver is described as being suitable for amateur transmitters, short-wave listeners, and Army/Navy/Air Force communications. It would seem that if our British manufacturers could produce a set of this kind it would meet with a satisfactory response in home and Empire markets. Providing the price was competitive, a receiver of this type should be an important factor in the present drive for increased exports of electrical and radio apparatus.—ALAN CLARKE (Rossendale).

Correspondents Wanted

THE following readers are desirous of corresponding with others on the subjects mentioned :

C. MERRETT, of 26, Port Street, Evesham, Worcester—in connection with the comparison of results obtained on a home assembled New Times Sales "S.G. Band spread 4."

A. C. POLLARD, Ships Hotel, East Grinstead, Sussex—with a reader of about his own age (16) who is interested in all wave work. He will reply to any letter sent from any part of the world.

D. CLIFF, 41, Woodfield Avenue, Penn, Wolverhampton—a member of the B.L.D.L.C., who wishes to contact another member in his district.

G. BUTLER, Trent Farm, Newton Solney, Burton-on-Trent—who wishes to exchange short-wave logs with other readers.

PRACTICAL POINTERS

Improving Reaction Control

IT is often rather annoying when operating a not-too-powerful receiver to find that if the set is to be kept in its most sensitive condition the reaction knob must be used practically simultaneously with the tuning condenser. This state of affairs generally points to a badly-arranged reaction circuit—wrong size or position of windings, unsuitable capacity in reaction condenser, etc., but in most cases a cure can be effected very easily. All that one need do is to connect a resistance in series with the reaction winding. The resistance must be non-inductive, of course (a metallised one is most convenient) and its value will lie between 100 and 500 ohms. The best value will depend upon the characteristics of the receiver and must be found by trial. When a resistance in excess of about 250 ohms is used it might be necessary to employ a reaction condenser of higher capacity than before.

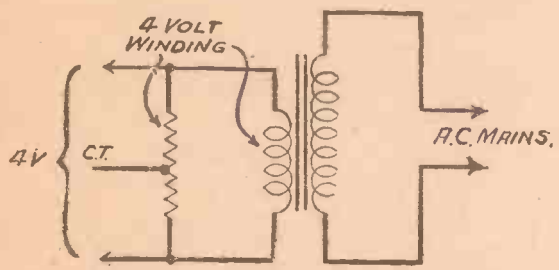


Fig. 1.—Providing an artificial centre-tap on the heater winding of a mains transformer.

A Mains Transformer Tip

A non-technical reader was in difficulties the other day because he wished to build a mains receiver from certain components which he had. Most of these were perfectly suitable, but he was very perturbed to find that the 4-volt winding of his mains transformer was not centre-tapped. He was considering the possibilities of dismantling and rewinding it, but wrote to us first. We explained to him that exactly the same effect as centre-tapping would be obtained by connecting a potentiometer or centre-tapped resistance across the 4-volt terminals as shown diagrammatically in Fig. 1. In the end he made a centre-tapped resistance from a strip of fibre and 3 yds. of 26 gauge Eureka resistance wire. As the wire was bare it was wound on the fibre along with a length of thread to insulate the turns one from the other. A tapping was taken after winding on half the wire by making a small loop. The resistance was 8 ohms and so only consumed the negligible current of half an ampere. The constructional details are given in Fig. 2.

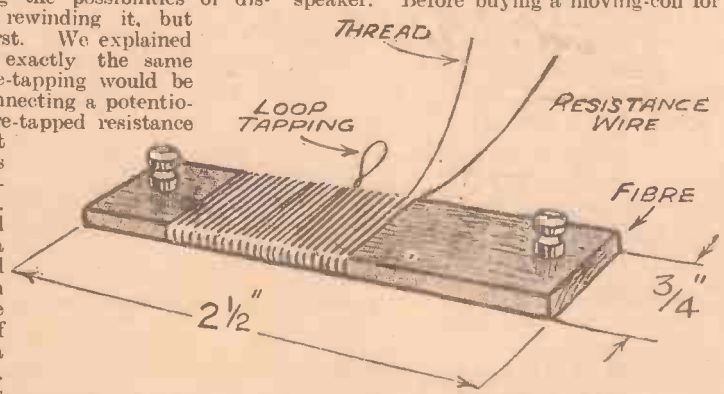


Fig. 2.—The construction of the resistance used in Fig. 1 is shown here.

Tuning Condensers

The best capacity for aerial tuning condensers depends to a certain extent on the wavelength range required from any one coil, but it should be emphasised that the ratio of maximum to minimum capacity is more important than the maximum capacity alone. For instance, a .0001 mfd. (maximum) condenser with a very low minimum in the region of, say, 2 micro-microfarads, will cover a wider wavelength range than a .00015 mfd. condenser with a high minimum capacity. The former condenser will also prove to be much more efficient than the latter, because efficiency is always highest on any wavelength when the tuning circuit is made up of the greatest possible inductance and the least amount of capacity. It is therefore always advisable, when buying a variable condenser for short-wave work, to choose it not only by its maximum capacity, but also by its minimum. The latter figure is not stated by makers of poor quality components, but these should be avoided at all costs, for they are definitely not worth while.

When an M.C. Speaker is an Advantage

Most radio amateurs are under the impression that the reproduction from their sets is bound to be improved by using a moving-coil speaker in place of one of the older "cone" type. Whilst this is true when the set is a really good one designed on modern lines and having a fairly generous output, it is often very wide of the mark where an old receiver is still in use. The fact is that the moving-coil speaker is much more sensitive to certain notes and gives a far more correct impression of the set's performance. On the other hand, the core or balanced armature speaker often tends to "correct" the set and gloss over its defects. This explains why many listeners consider that a moving-coil is not so good as their old speaker. Before buying a moving-coil for an oldish set it is therefore advisable to try it on the set to make sure that the latter can do justice to it.

Practical Wireless
BLUEPRINT SERVICE

These Blueprints are drawn full size.
Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices *which are additional to the cost of the Blueprint*. A dash before the Blueprint Number indicates that the issue is out of print.

Issues of Practical Wireless ... 4d. Post Paid
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The index letters which precede the Blueprint Number indicates the periodical in which the description appears : Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS	*Date of Issue.*	*No. of Blueprint*
CRYSTAL SETS		
Blueprints 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
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Two-valve : Blueprint, 1s.		
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Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three ((SG, D, Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen)	—	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-Valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	—	PW52
Mains Sets : Blueprints, 1s. each.		
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D.C. £5 Superhet (Three-valve)	—	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. Superhet 4	31.7.37	PW59
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"Qualitone" Universal Four	16.1.37	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
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One-valve : Blueprint, 1s.		
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Two-valve : Blueprints, 1s. each.		
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Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	1.10.38	PW68
PORTABLES.		
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS		
Blueprint, 1s.		
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150-mile Crystal Set	—	AW450
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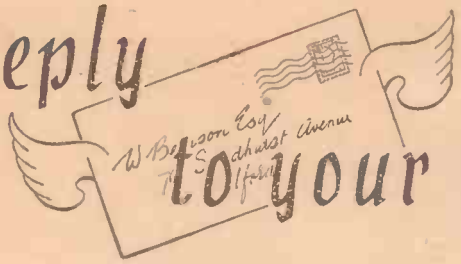
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
£5 5s. S.G.3 (SG, D, Trans)	—	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three : De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen)	—	WM384
The Auto Straight Four (HF Pen, HF, Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340

Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home Lover's New All-Electric Three (SG, D, Trans) A.C.	—	AW383
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM329
Harris' Jubilee Radiogram (HF Pen, D, LF, P)	*May* '35	WM386
SUPERHETS.		
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four	*Oct.* '35	WM395
The Request All-Waver	*June* '36	WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
Rome Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-Short Battery Two (SG, det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	—	WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	*Mar.* '36	WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

In reply to your letter



Using Headphones

"Is it possible to use a pair of earphones of the value of 50 or 60 ohms with a one-valve set, without spoiling the earphones?"—D. W. H. D. (Downderry, Cornwall).

THE low-resistance phones would be wound with fairly heavy gauge wire, and thus there would be less risk of spoiling them than there would be of spoiling normal high-resistance models. The main point, however, is that the low-resistance windings will not offer sufficient load to the single valve to enable an appreciable output to be obtained. You should remember that the signal is developed across the load which is included in the anode circuit, and 2,000 ohms should be considered the minimum resistance for satisfactory signal strength. You can use your phones, however, by obtaining an output transformer of the step-down type, having a ratio of about 10 to 25 or 1.

Magic-eye Tuner

"I have a commercial superhet, which although not of recent make, works very well and I am quite satisfied with it. I should like, however, to provide one of the magic-eye tuners and I understand that these may be bought separately and fitted to any set. Could you give me a diagram showing how to wire the device in my particular model? I suppose a special mount may be obtained for the tuner."—G. T. (Reigate).

THE magic-eye is a small device exactly similar to an ordinary valve and may be mounted in a standard valveholder. This will have to be mounted on a metal bracket so that the valve is disposed horizontally, as the tuning device is viewed on the end or top of the valve. The anode and target are fed from the H.T. positive line (which you will have to find in the receiver) and the grid is fed through a decoupling resistance from the A.V.C. line, which you will also have to locate. There is a question as to whether the mains transformer in the set will deliver sufficient extra current for the heater circuit, and if not, a separate heater transformer would have to be provided.

Cutting Out a Stage

"I have a four-valve battery short-wave set with H.F., Detector, L.F. and pentode stages. I find that when wearing phones the signals are far too loud for comfort and I should like to make arrangements to include the phones in the L.F. stage without seriously upsetting the wiring as I have never made a set and am not keen on starting in case I upset the performance. What do you suggest?"—L. C. W. (Larne).

IF the receiver is a standard transformer-coupled arrangement you could quite easily add phone connections by connecting a 1 mfd. fixed condenser to the anode of the L.F. valve and then connecting phones between the other side of this condenser and the earth terminal. The only point is that there may still be signals audible if a speaker is left connected to the output stage, but this could be avoided by inserting a simple on/off switch in the filament circuit of the output valve.

RULES

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.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Push-pull Detector

"I am interested in Circuit No. 16 in your book 'Sixty Tested Wireless Circuits,' but do not wish to make my own coil. Could you recommend any good make of commercial coil which I could use for the purpose?"—S. D. (Warrington).

UNFORTUNATELY the special arrangement employed in the circuit in question calls for a centre-tapped reaction winding which may be varied in its position relative to the grid winding. There is no such coil commercially produced and you must therefore in this case make up the coil yourself. It is not possible to make use of a differential reaction condenser or any similar split component as the anodes must be fed with H.T.

Needle Scratch Filter

"I have converted my set into a radio-gram which gives quite good results except for a rather prominent emphasis of the scratch of the needle. Is there any way of eliminating this without affecting quality of musical reproduction?"—D. R. (Melton Mowbray).

IT is a simple matter to fit a tone-control in the form of a scratch filter to eliminate the noise. It is important to bear in mind, however, that this will affect all frequencies at the resonant point cut off by the filter. There are various types cutting off at frequencies from 3,500 up to 5,000 cycles or so. Generally speaking, they consist of a choke and condenser, or combination of these parts and suitable components may be obtained from Messrs. Bulgin. (See also page 96).

Reflex Circuit

"I have been talking to one of the old experimenters, and he has told me that I should try a reflex circuit if I want something to experiment with, and I should be glad if you could tell me exactly what this is and if you have a blueprint of one, as I am just taking up radio as a hobby."—H. Y. (Lower Edmonton).

THE arrangement is that whereby a valve is used in a dual capacity as H.F. and L.F. amplifier. In the older types of reflex a valve was used in this manner with a crystal detector, but it is possible to use a valve detector, thus obtaining with two valves results equivalent almost to those normally obtained by three. You will find a two-valve circuit of this type in our issue dated January 6th last, and this will form an interesting basis for experiment.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

M. G. (Leicester). We cannot recommend individual models, but suggest that you hear them under your own conditions with your own receiver. Remember the question of the load you intend to supply.

E. D. A. (Birmingham, 15). The details have been given before and will be found in practically all of our handbooks. The first figure indicates the number of H.F. stages, v. indicates valve detector (as distinct from crystal), and the last figure indicates the number of L.F. stages. 0-v-1 is therefore a simple two-valver, consisting of detector and L.F.

L. M. D. (N. 19). We have not tried the component but see no reason why it should not prove satisfactory in the circuit in question.

K. M. C. (Bristol). So far as we can trace, the firm is no longer in business.

H. W. F. (S.W.13). As the set is a modified model we regret that we cannot make any useful suggestion. There may be many faults present in a converted battery set, such as wrong type of wiring, incorrect type of components, etc.

D. F. McL. (Balintore). The cells are treated exactly as accumulators.

J. D. G. (Warwick). 120 volts would be quite satisfactory.

H. R. E. P. (Bitterne). There are various methods, depending upon the coils. Some have their own coupling winding, others require top-capacity coupling, whilst others are intended for mixed couplings.

C. E. B. (Lincoln). The unit in last week's issue would be quite satisfactory for your purpose.

T. R. E. (Welling). If you use a push-pull input transformer you do not need a phase-inverter. Add your D.D.T. for detector and A.V.C. and follow this by a single low-gain triode to feed the push-pull stage.

K. R. G. (Lincoln). As there is no television now we cannot advise the construction of apparatus. In any case, the disc scheme is now obsolescent.

The coupon on page 105 must be attached to every query

Classified Advertisements

CABINETS

A CABINET for Every Radio Purpose. Surplus Cabinets from noted makers under cost of manufacture. Radiogram Cabinets from 30/-. Undrilled table, console and loudspeaker cabinets from 4/6. Inspection invited.
H. L. SMITH AND CO., LTD., 289, Edgware Road, W.2. Tel: Pad. 5891.

LITERATURE

NEW Edition. American Amateur Relay League Handbook. 500 pages of up-to-the-minute technical information, 7/- post free. 1940 Jones Handbook; approximately 700 pages dealing with every aspect of Short-wave Radio, 8/6, post free.—Webb's Radio, 14, Soho St., London, W.1. 'Phone: Gerrard 2089.

LOUDSPEAKER REPAIRS

LOUDSPEAKER repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

REPAIRS to moving coil speakers. Cones/coils fitted or rewound. Fields altered or wound. Prices quoted, including eliminators. Pick-ups and speaker transformers rewound, 4/6. Trade invited. Guaranteed satisfaction. Prompt service.
L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

MISCELLANEOUS

BE TALLER!! Inches put you Miles Ahead!! Details 6d. stamp:—Malcolm Ross, Height Specialist, BM/HYTE, London, W.C.1.

MORSE EQUIPMENT

FULL range of Transmitting Keys, Practice Sets, Oscillators, Recorders and other Radio Telegraph Apparatus, designed and manufactured by T. R. McElroy, World's Champion Telegraphist. Sole distributors: Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

MORSE TRAINING

WIRELESS Code Courses. "Book of Facts" Free.—Candler System Co. (L.O.), 121, Kingsway, Loudon, W.C.2.

NEW LOUDSPEAKERS

3,000 Speakers, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers Pulteney Terrace, Copenhagen Street, London, N.1

PUBLIC APPOINTMENTS

AIR MINISTRY.
AERONAUTICAL INSPECTION DIRECTORATE. Vacancies exist for unestablished appointments as Examiners in the General Engineering, W/T and Instrument Branches.
QUALIFICATIONS.
All candidates must have good general education, be able to read drawings, understand specifications, use micrometers and other measuring instruments.
(a) Applicants for the General Engineering Branch must have had practical experience in an engineering works. An elementary knowledge of materials testing is desirable.
(b) Applicants for the Instrument Branch must have knowledge of physics and training in light engineering or instrument making. Candidates with knowledge of optical instruments are also required.
(c) Applicants for the W/T Branch must have practical knowledge of W/T and electrical equipment with technical training in radio communication equal to City and Guilds final examination standard.
ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three calendar months, and will be paid £3 10s. 0d. weekly during training. Subsistence allowance of £1 5s. 0d. weekly during training is payable to married men normally residing outside the training area. On successful completion of training, candidates will be appointed as Examiners at a salary of £246, if 25 years of age or over, with a corresponding reduction of £12 per annum for each year under 25 on joining (payable monthly in arrear) if service is satisfactory, and must be prepared to serve in any part of the United Kingdom.
NORMAL age limits 23 to 60.
CANDIDATES should indicate on their applications for which vacancy they wish to be considered—a, b or c.
APPLICATIONS must be made on Form 786, copies of which can be obtained on application, *by postcard only*, to: The Inspector-in-Charge, A.I.D. Training School (I.C.S./REC. 53), Brandon Steep, Bristol, 1.

HOW TO SECURE THE RADIO TRAINING MANUAL

(See Special Offer on Page 89)

First place a standing order with your newsagent to-day on the form below for the supply of PRACTICAL WIRELESS for four weeks and until further notice.

Next, fill up the Reservation Form and the Address-label beneath, and post both to the address given on the Reservation Form.

When we receive the Reservation Form and the Address-label from you, we will at once reserve a copy of the RADIO TRAINING MANUAL in your name, and immediately send you a Voucher. On this you affix 4 Tokens cut from the bottom left-hand corner of the back cover of PRACTICAL WIRELESS for 4 consecutive weeks. Commence with Token No. 1 given this week.

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Please deliver or reserve PRACTICAL WIRELESS each week for me for 4 weeks and until further notice.

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(Presentation Dept.),
Holford Square, London, W.C.1. (Pref.)

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Fill in this form and the Address-Label below in Block Letters. Stamp the label as directed and post with this form in an unsealed envelope (½d. stamp only required).

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Practical Wireless (Manual)

PUBLIC APPOINTMENTS

Wireless Technical Instructors required in Army units
EMOLUMENTS.
Pay, 8s. 3d. per day (7 days a week). Clothing, rations and accommodation, or if this cannot be provided, allowances at authorised rates. If married and otherwise eligible family allowances payable in respect of wife and children, subject to allotment from pay.
Candidates should preferably be under 35 and over 24 and (a) Hold one of the following qualifications: Graduateship of the Institution of Electrical Engineers. Final (Grade III) Certificate of City and Guilds of London Institute Examination in Radio Communication.
Higher National Certificate in Electrical Engineering. Certificate of City and Guilds of London Institute in Radio Service work.
Or similar qualifications, or (b) Be able to pass an examination on the following syllabus:
CURRENT ELECTRICITY.—Properties of an electric current. Ohm's Law and its applications. Galvanometers and Measuring Instruments. Electro-magnetism. Magnetic materials. Conductors, Insulators and Dielectrics.
ALTERNATING CURRENTS.—General principles. Effects of Resistance, Inductance and Capacity. Resonance.
RADIO.—General character of a radio signal. Knowledge of valves and their simple applications. General knowledge of tuning both transmitters and receivers.
MATHEMATICS.—Knowledge of Algebra and simple Trigonometry.
Suitable candidates will be interviewed at local centres, and, if successful, will be appointed Acting-Sergeant-Tradesman. For those who are on the Schedule of Reserved Occupations special arrangements will be made to enable them to be enlisted.
Application forms, obtainable by postcard from The Under Secretary of State, War Office (A.G.6.c), Hobart House, Grosvenor Place, London, S.W.1, to be lodged by 30th April, 1940.

RADIO MAP AND GLOBE

WEBB'S Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6. Limited supply on Linen, 10/6. **WEBB'S** Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post Paid, 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

RECEIVERS AND COMPONENTS

COULPHONE Radio, Grimshaw Lane, Ormskirk. 1940 Collaro A.C. Gramophone Motors 12" turntable, 27/6. Radiogram units, 45/-. American Valves, all types, 4/6. Octal, 5/6. Record F.W. Rectifiers, 5/6. Stamp for list.

5/- BARGAIN PARCEL comprising Speaker Cabinet, 2 Drilled Chassis, condensers, resistances and many other useful components. Worth £2. Limited number. Postage 1/-.—Bakers Selhurst Radio, 75, Sussex Road, South Croydon.

SCRAP your H.T. battery with Mallory vibrator converter, 12v., 150v., 30 m.a., 18/9; listed £5/5/0. Or Genemotor, 12v., 250v., 50 m.a., 25/-. Postage 1/3.—Aeronautical Radio, 47, River Road, Littlehamptou.

SOUTHERN Radio's Bargains.
ALL Guaranteed. Postage Extra.
5/- Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.
15/- Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7", 15/- the Kit.
21/- Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.
5/- 100 Wire-end Resistances, assorted capacities. ½ and 1 watt, 5/- per 100.
ORMOND Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.
2/- Tool or Instrument Carrying Cases, ex Government Stock; Wood, 9" x 7" x 7", 2/-.
SOUTHERN Radio, 46, Lisle Street, London, W.C. Gerrard 6653.

VAUXHALL.—All goods previously advertised are still available; send now for latest price list, free.—Vauxhall Utilities, 163a, Strand, W.C.2.

BANKRUPT Bargains. Brand new 1939/40 models, makers' sealed cartons, with guarantees, at less 40% below listed prices; also Midgets, portables, car radio. Send 2½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

RECEIVERS AND COMPONENTS

RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE : HOLborn 4631.

COMPLETE KIT of parts to build Lissen Hi Q Battery Short-wave receiver. 5-91 metres switched. Brand new goods boxed, with circuit and instructions. Listed, £4/15/-. Our price, £1/19/11 less valves.

ALL-WAVE super-het. chassis, 5 valve A.C. Latest Mullard valves: T.H.4.B., V.P.4.B., T.D.D.4, Pen A.4, L.W. 4/350v. Ranges: Short-wave, 16-48 metres. Med.-wave, 200-500 metres. Long-wave, 800-2,200 metres. Size of Chassis: 14½" long, 7½" deep. Height overall, 8¾". Controls tuning at side, volume on/off at side, wave change. Provision for pick-up. Complete with valves and knobs, £4/17/6. Special speaker, 1,500 ohms field, 10/6 each.

L.F. transformer. Lissen Hi Q. Ratio 3-1. High grade, boxed. List 6/-. Our price, 2/3 each.

H.F. choke. Lissen Hi Q. Compact disc type with feet. Boxed. List, 2/6. Our price, 6d. each.

ULTRA-SHORT and short-wave choke. Lissen Hi Q. Inductance 100 microhenries. Boxed. List, 2/-. Our price, 1/- each.

ULTRA-SHORT and short-wave double-wound low-resistance choke. Lissen Hi Q. Resistance less than .05 ohms. Boxed, List, 2/6. Our price, 1/3 each.

LOW-LOSS Ceramic valve-holders. Lissen Hi Q. Base-board and chassis. 5- and 7-pin., 10d. and 1/- each.

MANSBRIDGE type condensers. Lissen Hi Q. 250 D.C. working. Moulded case with feet. .1 mfd. and 1 mfd., 6d. each.

ROTARY coil unit. Lissen Hi Q. Four-band from 4.8-91 metres, can be selected by a turn of the knob. With circuit. Boxed. List, 15/6. Our price, 6/11.

LOW-LOSS short-wave variable condensers. Ceramic insulation. Brass vanes. Lissen Hi Q. Minimum capacity 5 micro-micro farads. Two types. Boxed, with knobs. 160 m.mfd. List, 7/6. Our price, 3/6 each. 20 m.mfd. List, 5/6. Our price, 2/11 each.

MICA condensers, Lissen. New. Boxed. All useful sizes, OUR selection. 1/3 per dozen.

SPEAKER cabinets, finished black rexine. Circular face. Metal grille. Size 8½" x 9½" x 4½", 4/6 each.

SCREENED 3-way flexible, ¼ yards for 1/6.

MEDIUM- and long-wave coil units, with valve-holders and sundry resistances, 9d. each. (No circuit.)

MIXED tubulars, wire-ends. OUR selection, 2/6 per dozen.

4-PIN base-board valve-holders. Lissen. 2 for 3d.

4-1 L.F. transformers. Lissen. Boxed. 2/6 each.

CONE speaker unit. Lissen. Complete with reed and chuck. Boxed. 1/- each.

SPAGHETTI resistances. Lissen. Many useful sizes. OUR selection, 1/3 doz.

4-PIN valve adapters. Lissen. 6d. each.

PUSH-PULL switches. Lissen. 2-point, 4d. each. 3-point, 6d. each.

RICE-KELLOGG SENIOR 12" moving-coil speakers, 20 watts. Field 1,000 ohms. 11 ohms speech coil. Without speech transformer, 32/6 each. With transformer tapped 3,000 ohms and 7,000 ohms, 35/- each.

GRAMPIAN 10" 10-watt, 2,500 ohms energised speakers. Heavy cast frame, 15/- each. With heavy-duty pentode speech transformer, 17/6 each.

HEAVY-DUTY speech transformers. Pentode matching, 2/11 each.

2-GANG straight condensers. Plessey. 1/6 each. Ditto, 3-gang, 2/- each.

ROLA P.M. speakers. Latest type 7½" cone with pentode transformer. Boxed. 14/6 each.

CLOCK-FACED dials. 5" x 3½". With printed 3-wave scale. Ox-copper escutcheons and glass, 3/6 each. Ditto, less escutcheon, 2/6 each.

HORIZONTAL dials, with plain scale. 7½" x 3½" and pointer, 1/- each.

FILAMENT transformers, input 200-250v., output 4v. 4 amps., 4v. 6 amps., 4/11 each.

MAINS transformers, Plessey, 350-0-350v., 90 m.a., 4v., 2.5 amps., 4v., 6 amps., 8/6 each.

MAINS transformers. G.E.C. American windings, 350-0-350v., 65 m.a., 5v. 2 amps., 6.3v. 2.5 amps. Suitable for replacements in G.E.C. models, 5/6 each.

MAINS transformers. Wearite. Type R.C.1, 250-0-250v., 80 m.a., 4v. 2.5 amps., 4v. 4 amps., 9/11 each. Type R.C.2, 350-0-350v., 120 m.a., 4v. 2.5 amps., 4v. 4 amps., 12/6 each. Type R.C.3, 350-0-350v. 150 m.a., 4v. 2.5 amps., 4v. 2 amps., 4v. 5 amps., 15/- each. Type R.C.4, 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.6 amps., 21/- each. All the above centre-tapped windings. Type R.C.5, 100-watt auto transformer, 100-110v., 200-250v., reversible, 12/6 each. Type R.C.B., 350-0-350v. 80 m.a., 5v. 2 amps., 6.3v. 5 amps., 6/11 each. All transformers 200-250v. tapped primaries.

CHASSIS mounting valve-holders, American 4-5-6- and 7-pin. 4d. each. Octals, 6d. each. Loctals, 10d. each. 7-pin English type, 3d. each.

1 WATT resistances, Polar N.S.F. 4d. each, 3/9 dozen. All sizes up to 2 meg.

WEARITE 110 k/c I.F. transformers, 1/- each.

VOLUME controls. American C.T.S., finestmade, divided spindles. Length 2½". With switch, 2,000, 5,000, 10,000, 25,000, 100,000, 250,000, 500,000, and 1 meg., 2/6 each. Wire wound, 5 watt (less switch), 2,000, 5,000, 10,000, 20,000, and 25,000 ohms, 2/- each.

24 MFD. can type, electrolytics, 450v. working, 1/- each.

B.I. wire-end type bias electrolytics. 50 mfd., 12v., 1/6 each; 50 mfd., 50v., 2/- each.

TUBULAR wire-end non-inductive paper condensers. All sizes up to 0.1, 5d. each, 4/9 dozen.

(Continued in column 3.)

PREMIER RADIO

Special Offer of Record Auto-Changer Units for A.C. Mains by famous manufacturer. Play 8 records. Latest type Magnetic Pick-up, Auto-stop, Start and Rejector.—Limited number only at £4/19/6, Carriage Paid.

Special Offer of Dual Range Screened Coils by well-known manufacturer. Aerial or H.F. coil. Accurately matched suitable Band-Pass. Medium- and long-wave operation. Complete with full diagrams, 2/9 each.

PREMIER SHORT-WAVE KITS for OVERSEAS NEWS

Incorporating the Premier 3-Band S.W. Coil. 11-86 Metres without coil changing. Each Kit is complete with all components, diagrams, and 2-volt valves. **3-Band S.W. 1-Valve Kit, 14/9. 3-Band S.W. 2-Valve Kit, 22/6.**

DE LUXE S.W. KITS

Complete to the last detail, including all Valves and coils, wiring diagrams and, incid Instructions for building and working. Each Kit is supplied with a steel Chassis and Panel and uses plug-in Coils to tune from 13 to 170 metres.

1 Valve Short-Wave Receiver or Adaptor Kit	20/-
1 Valve Short-Wave Superhet Converter Kit	23/-
1 Valve Short-Wave A.C. Superhet Converter Kit	26/3
2 Valve Short-Wave Receiver Kit	29/-
3 Valve Short-Wave Screen Grid and Pentode Kit	68/-

REPLACEMENT VALVES FOR ALL SETS

EUROPA MAINS VALVES. 4 v., A.C. Types, A.C./H.L., A.C. L., A.C./S.G., A.C./V.-M.S.G., A.C./H.P., A.C. V.H.P. (5-pin), all 5/3 each. A.C./H.P., A.C./V.H.P. (7-pin), 7/6; A.C./Pens-I.H., 7/6; A.C./P.X.4, 7/3; Oct. Freq. Changers, 8/6; Double Diode Triodes, 7/6; 350 v. F.W. Rect., 5/6; 500 v. F. W. Rect., 6/6; 13 v. .2 amps. Gen. Purpose Triodes, 5/6; H.F. Pens and Var.-Mu H.F. Pen., Double Diode Triodes, Oct. Freq. Changers, 7/6 each. Full and Half-wave Rectifiers, 6/6 each.

TRIAD HIGH-GRADE U.S.A. VALVES, all types in stock. Standard tubes, 5/6 each. Octal Base tubes, 6/6 each.

HUGE PURCHASE OF U.S.A. MAINS TRANSFORMERS at Pre-War Prices. Manufacturers' surplus. All brand new and Guaranteed. **Input 110 v. and 220 v. A.C. Output 325-325 v., 120 m.a. 6.3 v., 2-3 amps., 5 v. 2 amps., C.T., 7/6 each. Input 230 v. A.C. Output 325-325 v., 75 m.a., 5 v. 2 amps., 6.3 v. 2-3 amps. C.T., 6/6 each. Input 100-250 v., 300-300 v. 60 m.a. 4 v. 5 a. C.T., 4 v., 1 a., 6/11.**

PREMIER BATTERY CHARGERS for A.C. Mains. Westinghouse Rectification complete and ready for use. To charge 2 volts at ½ amp., 11/9; 6 volts at ½ amp., 19/-; 6 volts at 1 amp., 22/6; 12 volts at 1 amp., 24/6; 6 volts at 2 amps., 37/6.

GRAMOPHONE MOTORS and PICK-UPS

Collaro A.C. Gramophone Motors. 100-250 v. 12in. turntable. Auto-stop. Hum-free. .. 35/-
A.C./D.C. Model 52/6
Collaro A.C. Gramophone Unit. Complete motor and pick-up. Auto-stop and start 52/6
A.C./D.C. Model 77/6
Premier Pick-up Heads. Will fit any tone-arm 5/3
ANOTHER SPECIAL OFFER. Piezo Xtal Pick-ups. With arm. Famous make. Output 1.7 v. Response 40-8,000 cycles. .. 35/-
MOVING COIL SPEAKERS. All complete with Output Transformer. Rola 3in. P.M.'s, 12/6; 8in. P.M.'s, 16/6; 10in. P.M.'s, 22/6; G12 P.M.'s, 66/-. Energised Models. Plessey, 8in., 2,500 or 7,500 ohm field, 7/6; 750 ohm field, 7/6; G12 Energised, 59/6.
PREMIER Short-Wave Condensers all-brass construction, with Trolitul insulation. 15 mmf., 1/9; 25 mmf., 1/10; 40 mmf., 2/-; 100 mmf., 2/3; 160 mmf., 2/7; 250 mmf., 2/11.
PREMIER SHORT-WAVE COILS, 4- and 6-pin types, 13-26, 22-47, 41-49, 78-170 metres, 2/- each, with circuit. Special set of S.W. Coils, 14-150 metres, 4/9 set, with circuit. Premier 3-band S.W. coil, 11-25, 19-43, 38-86 metres. Suitable any type circuit, 2/11.
Coil Formers, 4- and 6-pin, plain or threaded, 1/2 each.
UTILITY Micro Cursor Dials. Direct and 100 : 1 Ratios, 4/3.
NEW PREMIER 2-Gang S.W. Condenser 2 x .00015 mfd. with integral slow-motion, 5/9.
Orders 5/- and over sent Post Free. Under 5/- please add 6d. postage.

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or 50, High Street, Clapham, S.W.4. *Macaulay* 2381

RECEIVERS AND COMPONENTS

(Continued from column 1.)

ENERGISED speakers, Plessey 6" cone, 1,500 ohms field, 5/11 each.

BATTERY output pentode valves. Well-known make, 3/11 each.

BATTERY double diode triode. Well-known make. 3/6 each.

RAYTHEON first-grade valves. Largest stockists, all types in stock, including glass series, glass octal series, metal series, bantam series, single-ended series, and resistance tubes, all at most competitive prices; send for valve lists. All orders must include sufficient postage to cover. Hours of business: 9 a.m.-6 p.m. weekdays Saturday, 9 a.m.-1 p.m. Please write your address in block letters.

RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE : HOLborn 4631.

WESTON (501) and **E. Turner** (909) 2in. Dial Moving-Coil Milliampmeters, as new. 0 to 5 m/a., 17/6; 0 to 25 m/a., 16/6; 0 to 50 m/a., 15/-; 0 to 250 m/a., 15/- each.

MULTI-CONTACT Relays, Ex-G.P.O., as used in automatic exchange, condition as new, small size, suitable for automatic tuning for press-button control, heavy platinoid contacts, 2/6, post 3d.; 2 for 4/-, post 6d.: 3 for 6/-, post 6d.

VOLTAGE Changing Transformers (Auto. wound), 12 months' guarantee, 100/110 to 200/240 v. or vice versa, 250 watts, 21/-; 500 watts, 26/-; 750 watts, 32/6; 1,000 watts, 37/6; 1,500 watts, 50/-; 2,000 watts, 62/6.

HIGH Voltage Transformers for Television, Neon, etc., 200/240v. 50 cy. 1-ph. primary 5,000 and 7,000 v. secondary, enclosed in petroleum jelly. Size: 5½in. x 4½in. x 4½in., 7/6 each, post 1/-. Ditto, skeleton type, 5/6, post 9d. All brand new.

MOVING Coil Movements, complete in case with pointer, very low m/a., full deflections, 2½in. dia., 5/-, post 6d.; 4in. dia., 6/-, post 9d.; and 6in. scale, 7/- each, post 9d.

EVERETT Edgcumbe Electrostatic Voltmeter, 3in. dial, 0 to 6,000 volts, in good condition, 55/-, post 2/-.

ELECTRIC Light Check Meters, for sub-lettings, garages, etc. 200/250v., 50 cy. 1-ph., supply 5, 10 or 20 amps., 6/- each, post 1/-.

Terms : Cash with Order.
ALL GOODS SENT ON THREE DAYS' APPROVAL AGAINST CASH.
GALPIN'S ELECTRICAL STORES, 75, Lee High Rd., Lewisham, London, S.E.13. Telephone : Lee Green 5240

B.I. 4 mfd. Resin Oil-filled Condensers, 450v. working, 2/3 each; .1 mfd., .25 mfd. 1,000v. working, 2/3 each.
NEW 1/16 h.p. Induction Motors, 220 A.C., 1,430 Revs., Ball Bearings, 25/-; Townsend Buzzers, H.F. Buzzers, 4½v. to 10v., 3/6; Cossor Valves, 210 H.F., 210 Detector, 2/3; Microphone Carbon Inserts, 1/3, Microphone 80-1 Transformers 1/9. Tapped Resistance 550 ohms 2/9. 350 ohms 2/3.
London Central Radio, 23, Lisle Street, W.C.2, Gerrard 2969.

TRANSFORMERS for L.T. Rectifiers for charging and safety, 12v. lighting, from 12/6.—Thompsons, 170, Greenwich High Road, S.E.10.

BANKRUPT - Bargains. Ten-valve all-wave 4-band chassis, complete speaker, valves, £6/17/6. Truphonic 11 gn. A.C. and A.C./D.C. all-wave superhets, 5v. 7gns. Portadyne 4v., A.C./D.C. all-wave 1940 superhets, £6/17/6. Portables, midgets and semi-midgets. Valves all types. Service parts. Please state requirements. Butlin, 6, Stanford Avenue, Brighton.

SCIENTIFIC SOCIETIES

R.S.G.B. reduced war-time subscriptions. Details and current issue "T. and R. Bulletin," 1s.—16, Ashridge Gardens, London, N.13.

SHORT-WAVE EQUIPMENT

"H.A.C." one-valve Short-wave Receiver, famous for over 5 years, now available in kit form; complete kit of precision components, accessories, full instructions, 12/6, post 6d., no soldering necessary; descriptive folder free on request.—A. L. Bacchus, 109, Hartington Road, S.W.8.

TUITION

PRACTICAL Postal Courses, radio television, test equipment design, trade-test coaching for R.A.F. posts, I.P.R.E. and I.W.T. exams.; booklet free.—Secretary, I.P.R.E., 3, Shirley Road, London, W.4.

SPECIAL OFFER

SPARTAN 5-Valve Press Button Radio

Any 7 stations on Press Button. Walnut Cabinet. Provision for Pick-up and Extension Speaker. 4 watts Output with negative feed back. Multi-stage Superhet. A.V.C. For A.C. mains only. Guaranteed Perfect Reception. 60 only. Original Price £9.19.6. Our Price £4.5.0. Carriage paid.

LONDON CENTRAL RADIO STORES, 23 Lisle Street, W.C.2. Gerrard 2969

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THE ONLY WIRELESS WEEKLY

A NEWNES PUBLICATION

Practical Wireless and PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

Vol. 16. No. 396.

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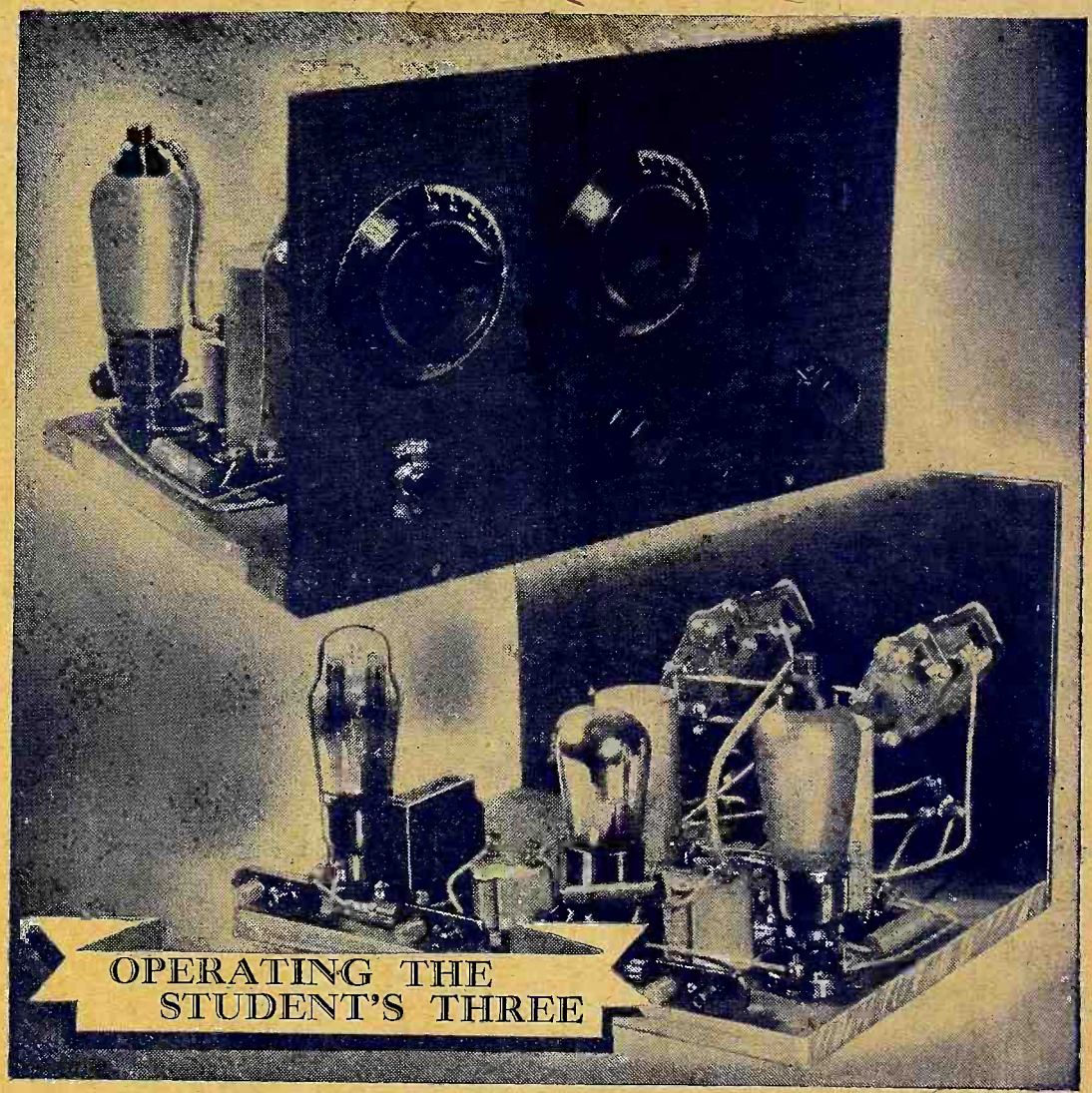

OPERATING THE STUDENT'S THREE

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 59

ACCUMULATOR PASTES.—The following ingredients are required: 4 parts by weight redlead (Pb_3O_4), 1 part by weight litharge (PbO), 1 part by weight sulphuric acid (1.12 specific gravity). Add the acid gradually to the mixture of redlead and litharge, stirring well until a fairly stiff paste has been formed. Thorough mixing is essential, and care must be taken not to make the paste too thin.

How to Apply. Place the grid on a flat board and use a scoop to place the paste in the grid. A wooden spreader should then be used to force the paste into the pockets of the grid. A piece of newspaper is then placed on top of the plate, and another flat board on top of that. This enables the plate to be turned over so that it can be pasted on the opposite side.

Drying. Stack the plates carefully in a warm room to dry. After three or four days dip the plates in sulphuric acid (1.25 specific gravity) and re-dry.

Paste for Negative Plates. Use the following ingredients: 5 parts by weight litharge, 1 part by weight of 1.10 specific gravity sulphuric acid. Mix, apply, and dry as for positive plates.

For a high-rate discharge cell, the paste for the negative plates can be varied as below:

Litharge, 99.96 per cent.; lamp-black, .03 per cent.; wood flour, .01 per cent. One-sixth of the total weight of the above of 1.10 specific gravity sulphuric acid.

Use acid of 1.12 specific gravity, charge at the rate of about .02 amp. per square inch of the plate area, counting both sides of the plate.

No. 60

Neutralising Spilled Electrolyte. If electrolyte is spilled, it should be immediately treated with a neutralising solution, such as sodium carbonate (soda) and water, or ammonia and water. Either of these liquids is excellent for checking the effects of acid on clothing. Benches, trays, and other fittings which have become acid-sodden should be treated with a solution of 1lb. of soda to 1 gallon of water, and then dried before coating with acid-proof paint.

JELLY ELECTROLYTE.—Jelly electrolyte consists of sulphuric acid to which a given proportion of sodium silicate has been added. Jellification takes place at varying speeds according to the proportions in which the two chemicals are mixed. A suitable mixture which jellifies in five or six minutes is—1 part of pure sodium silicate (1.200 specific gravity) to 3 parts of cold sulphuric acid (1.400 specific gravity).

As jellification takes place fairly rapidly it is essential to arrange that the entire operation may be carried through without any hitch or delay. The cell to be filled with jelly acid should be given a first charge, using ordinary free sulphuric acid. This acid should then be poured off, and the cell inverted and allowed to drain for about half an hour.

No. 61

AERIAL DATA

NATURAL WAVELENGTH. — The natural wavelength of an aerial is approximately four and a half times its electrical length (length between insulators plus length of lead-in). Standard aerial of 100ft. has a natural wavelength of about 120 metres. If connected direct to the grid of the detector valve, it would receive transmissions on this wavelength.

The maximum length of aerial, inclusive of lead-in, permitted by the Postmaster-General is 100ft.

REFLECTOR.—An arrangement generally employing a dipole aerial, for preventing a signal from being radiated in all directions, or for ensuring maximum reception in a given direction. It consists of a vertical or horizontal aerial behind which is erected a similar aerial (not connected to anything), the spacing between these being adjusted according to the frequency of the signals. A multi-reflector system will generally have the reflectors arranged in the form of a parabola with the aerial at the focal point.

Stranded 7/22 insulated copper wire is best for both aerial and lead-in.

No. 62

FRAME AERIAL DATA

Length of Side of Square Frame.	*No. of Turns.*	*Space between Wires.*	*Inductance. (Micro-henries).*	*Self-capacity. (Micro-farads.*	*Natural Wavelength in Metres.*
8 ft.	3	½ in.	96	75	160
6 ,,	4	½ ,,	124	66	170
4 ,,	6	½ ,,	154	55	175
3 ,,	8	½ ,,	193	49	185

The Wire for the Aerial. The wire for these aerials consists of thin flex, usually 14/36, that is, fourteen strands of No. 36-gauge wire, covered with art. silk in various colours. For the normal broadcast band 75 ft. should be sufficient, although the exact length will depend upon the shape of the aerial, the size of the condenser used for tuning, and the spacing between the turns. As a rule, the wire should be wound on with a space of about 1/10in. between each turn.

No. 63

MUSICAL NOTES FREQUENCY.—The frequency of the notes of the pianoforte covers the band from 26 to 4,096 vibrations per second. The lowest note, A, has a frequency of 26, middle C (the centre note of the standard piano keyboard) a frequency of 256, and the top note of the standard piano has a frequency of 4,096. The following table shows the piano notes and their frequencies:

A 26	G 96	F 341	E 1,280
B 30	A 106	G 384	F 1,365
C 32	B 120	A 426	G 1,536
D 36	C 128	B 480	A 1,706
E 40	D 144	C 512	B 1,920
F 42	E 160	D 576	C 2,048
G 48	F 170	E 640	D 2,304
A 53	G 192	F 682	E 2,560
B 60	A 213	G 768	F 2,730
C 64	B 240	A 853	G 3,072
D 72	C 256	B 960	A 3,413
E 80	D 288	C 1,024	B 3,840
F 85	E 320	D 1,152	C 4,096

No. 64

STANDARD UNITS

UNIT B.O.T.—The Board of Trade Unit is 1,000 watt-hours.

UNIT CHARGE.—Any charge which repels an equal and like charge with a force of 1 dyne when they are 1 centimetre apart.

UNIT MAGNETIC POLE.—That pole which, if situated in a vacuum at a distance of one centimetre from a similar pole, would give rise to a mechanical force of repulsion of one dyne. The total number of lines of force which pass through a unit magnetic pole $= 4\pi$.

UNIT OF CAPACITY.—The farad. A conductor has a capacity of 1 farad when a charge of 1 coulomb raises the potential 1 volt. In wireless practice the practical unit is the micro-farad.

UNIT OF CONDUCTANCE is the mho, which is the reciprocal of the ohm.

UNIT OF CURRENT is the ampere. It is a flow of 1 coulomb per second. A pressure of 1 volt will pass a current of 1 ampere through a resistance of 1 ohm.

UNIT OF INDUCTANCE is the henry. It is the amount of inductance in a circuit which will produce a difference in potential of 1 volt when the amperage is changing at the rate of 1 ampere per second.

UNIT OF POTENTIAL is the volt. It is the pressure required to pass a current of 1 amp. through a resistance of 1 ohm.

UNIT OF POWER is the power required to perform 1 foot-pound of work per second. It is referred to as F.P.S.

UNIT OF RESISTANCE.—The unit of resistance is the ohm. It is the resistance which will permit the flow of 1 amp. when a pressure of 1 volt is applied.

(See also page 124)

Practical and Wireless
★ PRACTICAL TELEVISION ★
EVERY WEDNESDAY
Vol. XVI. No. 398. April 20th, 1940.
EDITED BY F. J. CAMM
Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Learn as You Go

THE difficulty which many beginners experience is in obtaining a full knowledge of some particular point, in spite of elaborate explanations. It is generally found that such difficulties are cleared up very quickly if some actual demonstration can be made of the point in question, and it is in this connection that practical experience is of such great importance. For instance, the effects of oscillation in a valve may be explained in a very detailed manner, covering involved matter such as negative resistance, etc., but if a milliammeter is included in the anode circuit of a valve, and reaction is then applied, the sudden drop in anode current will show instantly that something important has taken place in the valve, and in conjunction with a description of the subject it is then more obvious just what has happened. The same thing applies to distortion in an L.F. or output valve, and thus some ready means of carrying out such tests will prove of the greatest value to those who are making a study of radio rather than merely using the receiver for the reception of entertaining programmes. The "Student's" Three, described last week, has been designed for the purpose of teaching various facts relative to modern equipment, and in this issue we give details of one or two tests which may easily be carried out with this particular receiver.

Mr. S. J. de Lotbinière

THE B.B.C. announces that Mr. S. J. de Lotbinière has been appointed an acting Assistant Controller of Programmes, as a result of the recent secondment of Mr. R. E. L. Wellington, Assistant Controller of Programmes, to the Ministry of Information.

A Dog's Life

DENIS CONSTANDUROS has written a new comedy for broadcasting called "A Dog's Life," which will be heard on April 20th. This treats the question of evacuees from a new angle and also deals with the type of young woman who is so fond of her dog that every other interest in life is made subservient to its welfare. The play will be produced by M. H. Allen.

Double Alibi

ADAPTED by L. J. Ludovici from a short story by Harold Weston, "Double Alibi," to be broadcast on April 19th, deals with a safe-breaker and his mates who attempt to rob a factory safe containing a week's wages. The safe breaker, Sam Crayshaw, has a cast-iron alibi, which eventually involves him in worse trouble than if he had had no alibi at all. The play is full of breathless suspense, which should be given its full value by the producer, John Cheatle.

Jack Leon, who broadcast from the London Casino last week in the Services programme.

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Boy Scouts' Programme

AS St. George's Day has been adopted by Scouts all over the world as a day of reunion and for the renewal of the Scout promise, it is fitting that it should be chosen for a feature programme about this great movement and that a message from the Chief Scout, Lord Baden-Powell, should be included in such a programme. This message was recorded in South Africa and will form the finale. Robin Whitworth will produce the feature, which has been arranged by Beresford Webb, of the Boy Scouts London Headquarters.

After a brief introduction indicating the spirit behind the movement, the programme will give some account of its spread to America and to other continents. The main section will consist of talks linked by national songs. This will include reference to such events as the floods at the Jamboree in Denmark, the World Jamborees in Holland and Hungary, the help given to earthquake victims in Bulgaria, and the time when Scouting in Finland was begun as a secret movement. Scouts in exile will be represented by a Polish Scout. An Indian Scout will speak for Asia, a Canadian Scout for North America, and Lord Hampton for Australasia. It is hoped also to have a Chilean Scout, as Chile had the first troop after England.

The Arabic Listener

THE B.B.C. announces that the first number of the *Arabic Listener*, the new B.B.C. publication which will be issued twice monthly, is now on sale. It will circulate in all parts of the Arabic-speaking world: including North Africa, Egypt, Syria, Palestine, Iraq, Arabia, and the Persian Gulf, as well as among the Arab communities in such widely separated places as Singapore, Zanzibar, and North and South America.

The chief object of the journal will be to reprint talks already broadcast in Arabic, but, in addition, it will include special articles on life and activities in Britain, summaries of British comment on Arab affairs and other matter of general interest. It is hoped that the new publication will contribute to the friendly relations existing between this country and the Arab world.

The *Arabic Listener* may be had on application to the British Broadcasting Corporation, London, England, for 4s. for six months, or 8s. for 12 months, including postage to any part of the world.

Tracking in Superhet Circuits

The Principles and Methods of Keeping the First Detector and Oscillator Circuits in Track are Explained, while Practical Notes on Aligning the Circuits Are Given.

By FRANK PRESTON

IT is well known that special gang condensers are made for use in superhet receivers, and that the vanes of the section intended for tuning the oscillator circuit are of different shape from those of the other section, or sections. The reason for this is that the rate of capacity variation must be different in the oscillator circuit to ensure that the beat note is of constant frequency. Many experimenters find difficulty in appreciating this point, and argue that both oscillator and signal-frequency circuits have to cover a similar band-width and therefore that specially shaped oscillator vanes should not be necessary. That is, if the wavelength range on one band is, say, 200 to 600 metres, the range of the oscillator circuit must be from 200, plus or minus the I.F., to 600 metres, again plus or minus the I.F.

Ratio of Frequencies

To understand the matter it is necessary to think entirely in terms of frequency. Thus, assuming that the tuning range on one waveband is 200 to 600 metres, the frequency range is 1,500 to 500 kc/s. The oscillator is almost invariably tuned to a higher frequency than the first detector, and therefore if the I.F. in use were the usual one of 465 kc/s, the range of the oscillator tuning circuit would have to be 1,965 to 965 kc/s. It will be seen that in the first case the ratio of maximum to minimum frequency is 3 : 1, whereas in the second it is approximately 2 : 1. In other words, the oscillator frequency varies less rapidly than the signal frequency during tuning.

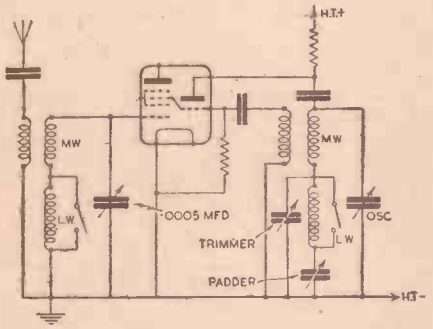


Fig. 1.—The simple method of padding in the long-wave section of the oscillator tuning circuit; there is both a trimmer and a padder for the long-wave winding and a superhet-type gang condenser is used. Although a triode-hexode is shown the arrangement would be the same for a pentagrid.

To obtain a clear idea of this point we might take the half-way point between maximum and minimum frequency on the waveband referred to above. Half-way between 200 and 600 metres is 400 metres. This is equivalent to a frequency of 750 kc/s, and when the input circuit is tuned to this frequency the oscillator must be tuned to 1,215 kc/s. Thus, although the signal frequency has been halved, the oscillator frequency has been reduced by only about one-third.

On long waves the variation is even more marked. Assume, for example, that the long-wave band extends from 1,000 to 2,000 metres (a fairly average range), the frequency range is from 300 to 150 kc/s; a ratio of 2 : 1. Corresponding oscillator frequencies are 765 and 615 kc/s; a ratio of about 1¼ : 1.

On short waves the variation is far less marked, because of the higher frequencies. If it were assumed that a particular S.W. range were from 20 to 30 metres, the corresponding frequency range would be 15,000 to 10,000 kc/s—exactly 3 : 2. The oscillator range would be 15,465 to 10,465 kc/s—approximately 2.955 : 2, or near enough to 3 : 2.

Coil Inductance

This will make it clear why tracking condensers are often used for long-wave tuning only, it being sufficient to use a gang condenser with shaped oscillator vanes, and a suitable oscillator coil, for medium waves. Incidentally, the oscillator coil is invariably of lower inductance than the aerial coil. For 465 kc/s the medium-wave winding of an aerial coil has an inductance of 157 microhenries; the corresponding winding of an oscillator coil has an inductance of only about 70 microhenries. The exact value depends upon whether the coil is intended for use with a special superhet condenser or a "plain" gang condenser.

It has become usual, in the case of home-constructor sets at least, to employ gang condensers with a special oscillator section, but it is debatable whether or not this is a good thing. The trouble is that if this gives accurate tracking on medium waves it will not necessarily do so on long waves, and therefore it will be necessary to use a padding condenser for long-wave tuning. There is a good deal to be said in favour of using a plain condenser for superhet tuning, and having a separate padding condenser for each waveband. This makes necessary some additional preliminary adjustment, but gives greater certainty of the tracking being accurate, and holding more closely over the whole of each waveband.

Tracking Systems

Fig. 1 shows the tuning connections for a triode-hexode frequency changer where a superhet type two-gang condenser is employed. In this case, of course, the oscillator section has specially shaped vanes and has a capacity appreciably lower than .0005 mfd., which is used for first-detector tuning. On medium waves it is sufficient to adjust the trimmers on the gang condenser (if fitted), but before the receiver can operate efficiently on long waves, the additional trimmer, wired in parallel with the long-wave section, and also the padding condenser, wired in series with this section, must be set to their optimum positions.

This is a fairly usual arrangement, but there is much to be said in favour of that indicated in Fig. 2. Here, use is made of an oscillator coil with two separate tuning windings—one for medium-wave and one for long-wave. In addition, a padding condenser is used for each winding. Thus, each of these must be adjusted in turn when aligning the receiver prior to putting it into use. Some manufacturers make coils of this type with built-in padders of a capacity suitable for the particular windings.

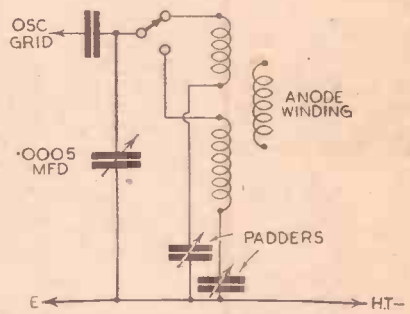


Fig. 2.—Some oscillator coils are enclosed in a can which also contains two padders. Connections are as shown here. A "plain" two-gang condenser is used.

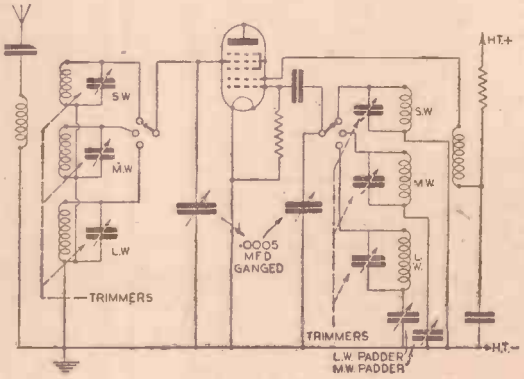


Fig. 3.—How trimming and padding are usually provided for with three-range tuners. In many cases the tuners are designed for use with a "plain" gang condenser.

The coils resemble I.F. coils in appearance, and the padders are adjusted by means of a screwdriver.

The most usual arrangement of trimmers and padders for multi-range tuners is shown in Fig. 3. It will be seen that in this case there is a trimmer across each section of both first-detector and oscillator coils, and that padding condensers are provided for all except the short-wave section of the oscillator coil; the reason for not having a padding condenser for short waves will be understood from what has already been written. By combining adjustment of trimmers and padders, it is possible to ensure exceedingly good tracking on all wavebands. Unfortunately for the home constructor, however, it is very desirable that a modulated oscillator be available when carrying out the alignment.

(Continued on page 120.)

For the Beginner

VALVE TYPES EXPLAINED

A Non-technical Article to Help Beginners Understand and Select Valves from the Numerous Types Now Available - - - By L. O. SPARKS

IT is not very difficult for a beginner to construct his first receiver and obtain very pleasing results, if he follows reliable advice and works to a diagram or blueprint which is accurate in all details. The trouble usually starts when he desires to either modify the initial attempt or start to build something more ambitious, say, for example, a set using more valves or those of different types.

At this stage it cannot be expected that the beginner will know everything about valves. Therefore, bearing in mind the numerous types now available, it is not surprising that some little difficulty and confusion is experienced when it comes to the question of which to use for the new circuit.

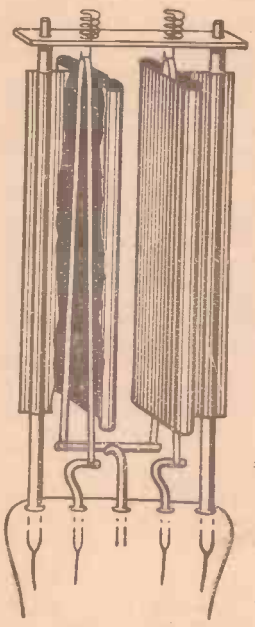
To one not well versed in such matters, a valvemaker's booklet does not always make the common or garden points too clear, and, in fact, a beginner need not be surprised if he finds himself more confused than ever after studying one of these booklets, as such an occurrence is not unknown and, strangely enough, this is invariably due not to the absence of details but rather to the number provided. It is the purpose of this article, therefore, to explain, without delving into technical matters, why so many types of valve are produced, their purposes and how to select the right one for any given circuit. You will note I say "without delving into technical matters." To some readers, this might savour of avoiding the issue and not giving information which will, or should be, required eventually by all newcomers to radio. Well, that is not the case; a beginner will take some little time to acquire sufficient theoretical knowledge to enable him to study the complete theory of the thermionic valve in all its varied forms, and as it would be very detrimental to his progress if he had to hold up his constructional and elementary work until he had reached the desired technical stage, it is far better for sufficient practical knowledge of valves to be gained so that the active side of the hobby can be continued *while* the technical subjects are being studied.

The Diode and Triode

If the glass bulb is removed from a valve, it will be seen that several distinct parts are assembled within the space enclosed by the bulb, and connected to the valve-pins or legs by means of fine wires passing through the base. These parts are known as *electrodes* and the number in any one valve is governed by its type. With diode and triode valves, as their names imply, two and three electrodes, respectively, are employed. The electrodes enclosed in a diode valve are filament, or heater, and anode, and this arrangement forms the *most simple* type of valve.

They are used chiefly as detectors and rectifiers, the former for the detection or, more correctly speaking, the *rectification* of the minute alternating currents produced by the radio signal, and the latter, i.e., rectifiers, for converting A.C. mains supplies to direct current, as in the case of mains-operated receivers or amplifiers.

In addition to the simple diode, there are double-diodes, which have two anodes, double-diode-triodes, which means that two anodes and a triode section are all enclosed within one bulb, and other even more complicated combinations, but we need not worry about those at this stage. A double-diode is often used as a detector (one diode) and a means of providing automatic volume control, by means of the other diode. In the case of A.C. mains rectifying



The construction of a valve using two diode sections is shown here. The valve is, in this case, a mains full-wave rectifier and the filament and anode of one section can be seen.

valves, a single diode would be used for *half-wave* rectification and a double-diode for the more normal *full-wave* system.

The triode has three electrodes; these take the form of anode and filament (heater) as in the diode *but*, between these, is fixed the third electrode in the form of a fine wire mesh or *grid*; in fact, it is known as the *grid*. This type of valve is, undoubtedly, the most widely used, as its range of application is very wide, but before discussing it, it becomes necessary to introduce one or two more items which play very important parts in most valves.

Every valve has a certain *internal* resistance which tends to affect the flow of current from the *filament* (or cathode in the case of mains valves) *to the anode*. This resistance is known as the *impedance* or A.C. resistance of the valve, and the value, which varies according to the type of valve, is always quoted by the valve-makers in *ohms*.

Another important item or *characteristic* of a valve is its *amplification factor*, which denotes how much amplification, or, if you like, magnification, will be obtained when it is handling a signal. This factor is also quoted by the valve-makers, thus helping one to choose a suitable valve for a given circuit. It should be noted at this stage that there appears to be some link between *impedance* and *amplification factor*; if a valve list is examined it will be seen that the *higher* the impedance of a valve the *higher* will be its amplification and, conversely, the *lower* will be its anode current consumption, i.e., the less current it will take from the source of high-tension. For example, refer to the valve list again—if you don't possess one or more, then I would advise you to get hold of one from, say, each valve-maker—and compare the valves recommended for use as a detector against those specified as being suitable for L.F. (low-frequency) use. The former will have an impedance in the neighbourhood of, say, 20,000 ohms, with an anode current of about 2 milliamps, while the latter might have an impedance in the region of 5,000 ohms, with an average current consumption of 5 mAs. The example can be taken a step farther by making comparisons between the S.G. and output power valves, when the difference will be more strikingly illustrated.

Triodes

Now to get back to the triode; its range of application is very wide and this is made possible owing to the fact that it is made in several types as regards its impedance and amplification factor, therefore, it is these two items which govern the selection. *Generally* speaking, if it is to be used as a detector it should have a reasonably high impedance, but a certain latitude is, of course, permissible, according to the complete circuit. For L.F. amplification, i.e., after the signal has been rectified, it becomes necessary to use a valve of lower impedance, as a valve of this type—and this should be noted—can handle a much larger signal without the risk of introducing distortion which would be created if it were overloaded. The lower impedance valve, remembering previous remarks, and the fact that it will be doing more work than the detector, will, naturally, consume more current in its anode circuit. This is unavoidable, as it must be appreciated that even with electricity, one cannot get something for nothing. Supposing that two valves were used between the detector and the final output valve, then the second would have to have suitable characteristics, i.e., even lower impedance, to allow it to cope with the work passed from the detector and the first L.F. valve. Similarly, the output valve must be chosen to suit the signal which will be delivered to its grid from the preceding stages.

One slip which most beginners make is to attempt to obtain too much amplification with too little thought for the valves which have to do all the work. A given type of valve can only handle a certain maximum signal strength without being overloaded, therefore, like most things, if it is overloaded, something has to suffer, and in this case it is the faithfulness of reproduction of the original signal.

Comment, Chat and Criticism

Biographies of Musicians

MAURICE REEVE, our Music Critic, Reviews in This Article the Life of DVORAK

ANTON DVORAK, the greatest Czech musician and unquestionably one of the master musicians of the nineteenth century, was born near Prague, on the Vltava river in 1841. Coming of a sturdy peasant trading stock, he worked for a time in his father's butcher's business. He had many teachers, of the schoolmaster-musician type then so prevalent in Central Europe. He made a particular study of church music and, through voluntarily playing the viola in the orchestra of the Society of St. Cecilia and other bodies, became familiar with the great German romantics of that period, notably Schumann and Wagner.

Being compelled to find means of subsistence, however, he entered a Prague concert band and later the orchestra at the National Theatre in Prague. There is no finer training in the world for an intending composer than orchestral playing, it enables him to hear the polyphony and instrumentation of great works in an incomparable way. Beethoven's youthful experiences in the Elector's private orchestra bear ample witness.

Dvorak was evidently a reticent and bashful young man, for all this time he was assiduously composing, a fact only known at the time to a few intimate friends. Much of this work was chamber music, and excellent, too; but he did not succeed in investing it with that wonderful idiom which shortly blossomed out, and it was far too much influenced by others' music that he was evidently studying and playing. It was, however, sufficiently meritorious to warrant his resigning his orchestral desks and devoting himself to composition as a means of livelihood.

Recognising the lead that Smetana was giving to the national self-consciousness through his music, Dvorak decided to follow this lead and elaborate on it to the limits of his powers. He placed himself more and more under the influence of the classics, and thus gave to his work a perfection of form and architectural detail which it had hitherto lacked. He also dived deep into the wells of Czech national music and folk lore.

Chamber Music

The chief works of this period, 1874-5, were numerous chamber compositions, usually including a piano: a serenade for strings, the First Symphony and an early opera, "King and Collier," entirely reset. Faithful to his national folk verse, there followed the first cycle of songs and the first Moravian duets. He made every effort to infuse the melodic zone of his work with ideas grown and cultured in the soil of Czech national art. From his earliest days he cultivated a movement of his own design which he called a Dumka, after the Russian word meaning "passionately sad." Many of these are extremely beautiful and one entire work at least, the celebrated Dumky pianoforte trio, takes its name from the Dumka movement in it.

Then came the "Stabat Mater." All these works yielded him but a poor return and he successfully appealed for a State grant. In 1877 he met Brahms and his publisher Hanslick. Brahms was very struck with his gifts and a letter to Simrock concludes: "Decidedly he is a very talented man. Besides, he is poor. Please take this into consideration."

Simrock published the Duets, which achieved an immediate success. Dvorak never looked back and his friendship for Brahms grew and grew with the passing years. The two men had much in common.

In the works that followed Dvorak clung closely to the rich sources of Czech folk music. The first series of the famous Slavonic dances appeared for two pianos, four hands, in 1878 and was a huge success. Richter, Bulow, Manns and many other famous conductors commissioned him to write them works. Many visits to foreign countries followed and that to England was particularly successful. The "Stabat Mater" took the town by storm. He visited all our leading festivals.

He wrote the Second Symphony for the Royal Philharmonic Society and although the Fifth, "From the New World" completely overshadows everything else he ever wrote in fame and popularity, Sir Donald Tovey has "no hesitation" in ranking the Second side by side with Schubert's in C and Brahms's four as the greatest symphonies since Beethoven's.

American Visit

In 1892 Dvorak accepted the Directorship of the New York Conservatoire, which he held for three years. He was accorded a splendid reception. This visit would be memorable for the creation of the "New World" Symphony, if for nothing else. Based on some Negro and native Indian melodies and themes given him by students and friends, this splendid and justly famous work is a first favourite with concert audiences throughout the world, and is probably only rivalled in the public's affections by Beethoven's Fifth.

On his approaching return home, he wrote one or two trifles, inspired by nostalgia. Amongst these was the renowned "Humoresque." This is one of those sad and wistfully appealing little numbers the reasons for whose well-nigh devastating popularity I enquired into a few weeks ago. "Humoresque" has been arranged for every instrument and conceivable combination of instruments under the sun, and has unquestionably taken its place amongst the first dozen or so favourite short pieces.

Another immensely popular work is the brilliant "Carnival" overture, one of three, the others being styled "Amid Nature" and "Othello." It is impossible to deal in any detail with Dvorak's many great works, but the two concertos for violin and 'cello respectively must not be omitted. The latter is one of the very few really first-class works that that instrument possesses. Also a Scherzo Capriccioso and a Theme and Variations.

Dvorak died in 1904.

Brilliant Piano Scores

A great master of instrumentation and of orchestral colouring, and a sincere devotee of the highest ideals of his art, Dvorak must be ranked high amongst the world's musicians. He was an inspired creative artist and his intuition may be said to have risen superior to his intellect. In an age which was fast deeming it fashionable or smart to despise ancient glories and the gods of their fathers, he proved that sonata form did not perish with Beethoven. Brahms, of course, was also proving the same thing.

He possessed a complete mastery over the orchestral palette and scored some marvellous effects. He was not one of the great piano composers but he wrote some brilliant scores for that instrument in those chamber works in which he employed it, notably the Dumky Trio and the A major Quintet.

Whilst Smetana grasped and evoked the whole spirit of Czech music and made himself the singer of their past and the prophet of their future, Dvorak is simple, kindly and human. Smetana was the superior in the fusion of intellect and intuition, but Dvorak had a far greater wealth of inspiration and creative versatility. Looked at as a pair, they might be thought to bear resemblances to Haydn and Mozart; the one prospecting and pioneering for the other to build an empire.

A musician who handles the symphonic form with the mastery and originality that Dvorak displayed must take precedence over him who works in smaller media, but taken singly or together, Smetana and Dvorak make a great pair, pioneer and leader, of whom any nation might well be proud.

ON YOUR WAVELENGTH

By Thermion

The Gadgets Racket

I THOUGHT the gadgets racket had come to a timely or untimely end—I hoped the latter. Just as a reminder that firms believe that there are still mugs to be found, I saw a gadget advertised in two of our nationals recently by two separate firms. Each advertisement made the same claim for the gadget, and the two advertisements were contiguous in the columns. The price of the first was 2s. 6d., and the second 9d.

The Old Tunes

ALTHOUGH all musical compositions are based upon the diatonic scale, the permutation of notes provided by the compass of the piano is such that it would be impossible (especially when we consider time, the sharps and flats, and repetition), ever to exhaust the possibilities of musical composition. You have been hearing a great deal recently of a piece entitled "Eighteenth-century Drawing-room." This makes use of the famous Mozart Sonata No. 15, or at least a few bars of the first, or allegro, movement. I do not like to see vintage music spoliated by the comic bands which draw large screws for making banal noises. There should be some law to stop plagiarism. The full Mozart's Sonata No. 15 takes about a quarter of an hour to play, and occupies over twelve sheets of music score. It commences with the allegro, and the andante and rondo movements follow.

"Eighteenth-century Drawing-room" makes use of the first few bars of the opening theme. Tuneful though it is, the bars used do not give you sufficient idea of the development. The complete piece is a really beautiful work, much used by music masters as an exercise. It makes use of considerable single-hand fast runs, and finally winds up in the somewhat exultant rondo. Those who hear "Eighteenth-century Drawing-room" should certainly purchase the two Parlophone records which give the complete Mozart rendering. Their numbers are E.1142 and E.1143; 12in. records, of course.

"The Radio Training Manual"

I HOPE that every reader has reserved a copy of "The Radio Training Manual" offered on presentation terms in last week's issue. I have been privileged to see an advance copy of it, and consider it to be a most useful book for the purpose in view. I am amazed that in these days of paper shortage and rising production costs it has been possible to offer it for the money. It is not only a training manual—it anticipates the questions likely to be set to examinees, and really provides the answers to them.

The Constructor Comes Back

ONE of the most pleasing features of my correspondence during the past few months has been the letters I have received from old constructors who, for one reason or another, had deserted our ranks. I do not know whether it is the shortage of commercial receivers, or the fact that the black-out keeps people in o' nights, but these early constructors are building sets again. Many of them are raking over their junk boxes and asking for circuits and blueprints which we published years ago. Alas, many of our early issues are now entirely out of print. We have, however, one or two bound volumes of Vols. 1, 2 and 3 of P.W. available at 12s. 6d. each. Readers will find our handbook "Sixty Tested Wireless Circuits" contains details of most of the popular circuit arrangements, and I recommend those who have returned to the fold to obtain a copy.

A number of readers are building sets for their A.R.P. Depots, and others on volunteer or military service are rigging up their shacks with receivers.

The Neutrodyne Circuit

THE neutrodyne circuit is not so popular as it used to be, for the very good reason that modern component design has reached such a stage that the factors which needed neutralising are no longer there. However, one or two readers have asked queries about it in recent weeks, so I suppose it is not entirely dead.

The whole secret of obtaining successful H.F. amplification is the prevention of feed-back from the plate circuit of the H.F. valve to its grid circuit. In the modern S.G. scheme, this is achieved by very complete screening, not only between external circuits but between the actual electrodes in the valve itself. With an ordinary three-electrode valve the outside screening may be arranged in just the same way, but obviously, a certain amount of "feed-back" will take place in the valve itself.

The well-known Hazeltine "neutrodyne" circuit very ingeniously got round this difficulty by arranging that energy should be intentionally fed back from the anode circuit to the grid circuit in such a way as to cancel out the amount of unwanted feed-back. This was done by extending the anode coil; the H.T. was tapped on to the centre of the tuned circuit so that both ends of the coil were "live" and at opposite phase. From the end remote from the plate a very small adjustable condenser was used to couple back directly on to the grid of the same valve. When the value of this condenser was exactly right, the circuit was perfectly stable—an unheard of state in those days. A really high amount of amplification could be obtained, and the only drawback was the fact that very complete screening was necessary, although it always is, and that the actual "neutralising" process—the adjustment of the condenser—was often rather tricky to the unskilled hand.

It is well known that a screened-grid valve will overload very easily, and that the signal straight off the aerial from a nearby station is quite capable of exceeding the legitimate grid swing. In cases where people want a receiver with rather better distance-getting properties than the conventional "detector and two L.F.," and happen to be situated so near a broadcasting station that a screened-grid valve in the first stage will overload, the neutralised triode forms an excellent substitute for the S.G.

Little need be said about operation, except for a description of the actual process of neutralising. Without trying to find the correct position, tune the set to a local, bringing it up to maximum volume.

Now remove one filament lead from the terminal on the H.F. valveholder. Leave the valve in position, of course, but with its filament switched off. The local will probably be heard at quite good strength if the neutralising condenser is either "all in" or "all out." Adjust the neutralising condenser until the signal from the local disappears altogether. Having obtained it, move the tuning condensers slightly to make sure that it does not come in again.

When the ideal state of affairs has been found, the filament of the H.F. valve should be switched on again, and the set should operate in a stable condition.

Electronic Pianos

APROPOS my recent remarks re electrical-musical instruments, I see that pianos that perform like organs, and yet result in greatly decreased expense of construction, are predicted by B. F. Miessner, electronic musical-instrument pioneer of Milburn, N.J.

"We have new designs in progress which will greatly reduce the cost, weight, and bulk of the mechanical proportions of electronic pianos. Where now three strings per note at, say, 160 pounds tension are used, we can use one string per note at 20 pounds tension, and much shorter; as a result the iron string-plate and its reinforcing wood structure need only be designed for one instead of 20 tons of string tension. Also the key action for these strings can be made very much cheaper, simpler, and lighter, and no soundboard is needed," says Mr. Miessner.

"These cheaper pianos, by some additional electrical complications, can be made to perform like organs as well as pianos, and in many tone qualities.

"We are convinced that the music-instrument business is going to be completely changed by all these developments and that the radio industry is going to take over this business, just as it has with phonographs and as it is now doing with organs, guitars, etc.

"The electronic-music art," concludes Mr. Miessner, "is now out of the normal, expensive, 50-year incubation period, and is rapidly emerging into commercial form. Those with foresight and courage will be the new leaders in this renaissance of an industry which has lain technically stagnant for hundreds of years."

Automatic Gain Control

Details of a New Circuit Designed Round a New American Valve

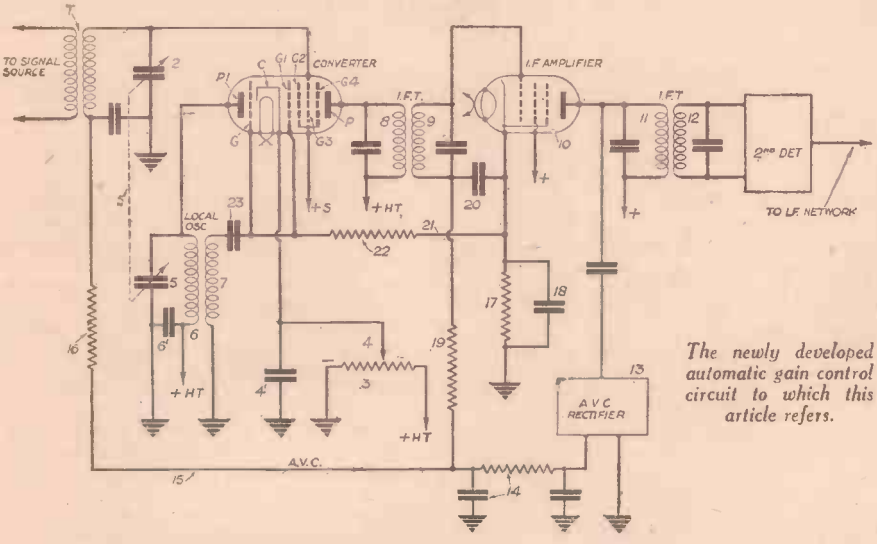
THE following is a description of a superheterodyne circuit developed by R.C.A. engineers in which a new type of mixer or converter valve, known as the 6K8, is employed. The converter valve is essentially a triode-hexode, in which the oscillator and mixer elements are disposed in separate electron streams. The 6K8 valve gives improved performance in all frequency bands, but its performance is most spectacular in the high-frequency regions above 15 mc/s. In these regions interlock is very greatly reduced, and loading of the signal input circuit is not only reduced, but by the proper choice of operating conditions may be made negative in sign.

The reason for the negative input conductance of the signal input circuit in a 6K8 valve may be explained as follows. The space current between G_1 and G_2 is relatively independent of the bias on signal grid G_3, due to the interposed screen G_2 (see figure). In other words, the sum of the currents in the mixer plate P and the screens G_2 and G_4 is relatively constant. The electrons passing through G_2 will be subject to the influence of G_3 and at some high negative bias on G_3 will be completely prevented from passing through this grid, resulting in mixer plate current cut-off as in the case of the ordinary triode. However, as the negative bias on G_3 is decreased from some high value the mixer plate current will not increase linearly, because the supply of electrons going through G_2 is limited. This limitation is brought about because the potential on the mixer grid G_1 exerts the primary influence for determining how many electrons shall be available for the remainder of the mixer section.

The grid G_2, by virtue of its potential and its location, will draw some value of current, which current will be relatively independent of the potential of G_3, with the remainder of the mixer section current passing to plate P. Therefore, by a proper choice of potentials in G_1 and G_2 there will be a scarcity of electrons on the G_3 side of G_2 for some range of potential on G_3 (low values of negative bias). Then, with electrode potentials selected to cause an electron deficiency in the G_2-G_3 space over a certain range of bias values on G_3, it may be said to a first approximation that the current passing through G_2 is constant with respect to the potential of G_3 over that restricted range of operation. If the signal grid potential increases, the velocity of the electrons in the space between G_2-G_3 will increase and the charge will decrease. This decrease in charge in the G_2-G_3 space will cause electrons to flow into the signal grid, or current to flow out; thus, an increase in potential of signal grid G_3 is accompanied by a change of opposite sense in the current in that electrode, which condition is the criterion of negative conductance.

H.F. Gain Increase

The net input circuit conductance of the 6K8 valve will depend in sign and in magnitude upon the relative importance of the two effects operating simultaneously within the G_2-G_3 space. When the 6K8 is operated with a high value of negative bias on G_3, the mixer plate current will decrease and the screen grid current will rise. These effects will be accompanied by the building up of a space charge in the G_2-G_3 region. Hence, at high values of negative bias on the signal grid the signal input circuit has a positive, or comparatively low negative, input conductance. It can also be shown that maximum negative conductance is attained in the signal input circuit when the valve is operating at a low signal grid bias and at a low oscillating strength. Since the radio-frequency gain and the image ratio are greatly improved with maximum negative input conductance for the 6K8 valve, it will be appreciated that it is highly desirable to maintain the conductance value during operation.



The newly developed automatic gain control circuit to which this article refers.

However, when utilising the A.V.C. circuit for automatically increasing the negative bias on signal grid G_3 as the I.F. carrier amplitude increases, so as to maintain the carrier amplitude at the detector input circuit 12 substantially uniform, the negative input conductance of the converter tube actually decreases as explained previously. Hence with increase of A.V.C. bias, the gain and image ratio of input circuit 1-2 are seriously impaired. Now, as explained previously, a reduction in the oscillator strength to a low value has the effect of increasing the negative input conductance of the valve, and if the oscillator strength is decreased to a magnitude less than a certain value, the conversion gain is also decreased. Hence, the oscillator grid G, as well as the mixer grid G_1, is connected by lead 21 to a circuit which functions automatically to increase the oscillator grid bias as the carrier amplitude increases. If resistor 22 is the oscillator grid leak resistor connected to the bias resistor 17, the A.V.C. bias applied to the signal grid of valve 10 causes the voltage drop across resistor 17 to decrease.

A.V.C. Effect

The oscillator grid G will become more negative, in this case, with respect to cathode K, which is biased by the portion of the bleeder resistor 3 between point 4 and earth. In other words, as the A.V.C. bias increases, the oscillator grid G becomes biased in a negative polarity sense with respect to point 4 on bleeder resistor 3. This increase in bias of oscillator grid G reduces oscillation amplitude, and causes an increase in the negative input circuit conductance. Hence, it will be seen that as the A.V.C. bias increases, the input conductance of circuit 1-2 will tend to remain substantially constant at a predetermined low, or negative, value by virtue of the opposing effects of the biasing of grids G_3 and G. Therefore, the gain and image ratio remain uniform over the entire range of A.V.C. bias variation. Additionally, it is to be noted that the increase in A.V.C. bias on the signal and oscillator grids causes a decrease in conversion gain, thereby improving the A.V.C. action. The bias, from the bleeder 3 and the amplified A.V.C. voltage developed across resistor 17, and the magnitude of D.C. built up by oscillator action across resistors 22 and 17 in series, are to be proportioned so that the input conductance is maintained substantially constant despite A.V.C. This cannot be done over the entire characteristic of G_3, but operation should preferably be confined to that operating region where the input conductance can be maintained substantially constant. There is a sufficient number of variables, namely, oscillator amplitude (by coupling between 7 and 6), a bleeder voltage, magnitude of resistor 22 and resistor 17, to be able to obtain the desired result.

THE "STUDENT'S" THREE

(Second of a Series)

In this Article Further Constructional and Operating Notes are Given, Together with Some Preliminary Experimental Notes

ALTHOUGH complete constructional details of this new receiver have been given, there are one or two small points which it would perhaps be desirable to explain for the benefit of beginners or those who have not previously constructed a broadcast receiver. Firstly, with regard to the lead which is connected to the anode of the H.F. valve. This is a screened wire, the screening being intended to prevent instability which might be caused by radiations from the wire. The screening also prevents the lead from acting as a small aerial and picking up energy which would result in poor selectivity, but more of this later. The method of screening is the first point which might need explaining, and it should be carried out with the special braided screening sleeving sold for the purpose. A length is cut off sufficiently long to permit of the metal braiding being turned back at each end to prevent it from coming into contact with the wire which is passed through the insulated sleeving inside it. The ends may then be wrapped or soldered to prevent accidental short-circuits, and a wire twisted once or twice round the lower end and soldered. This wire is joined to the earth terminal as shown in the wiring diagram given last week. The ends of the actual lead are joined to the H.F. choke and to the anode, a cap connector being joined to the lead if a top-cap type of valve is used, and the wire being connected under the terminal if a terminal type of valve is obtained.

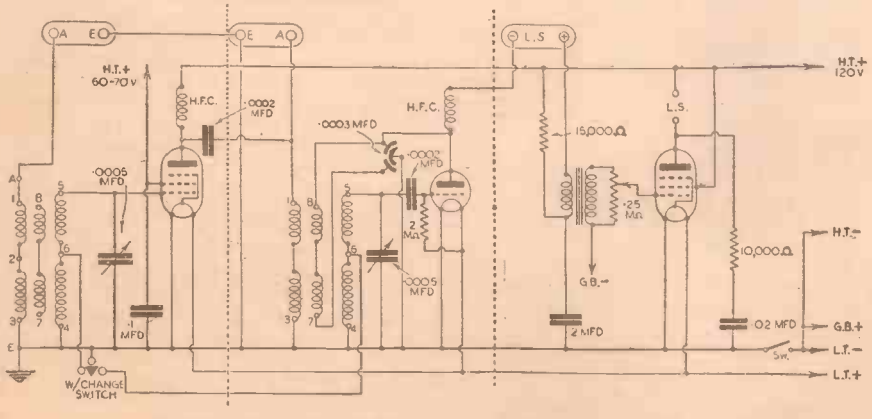
Screening

It will be found at a later stage that although the valve is metallised (that is, screened), and the lead to the anode is also screened, the actual anode connector is not protected in this manner and this can give rise to trouble which can only be overcome by using a screen over the valve. The two H.F. chokes are both mounted in screening cases and when mounted on the baseboard they will not be earthed. Therefore, a wire may be joined from the holding-down screws of these two components to the nearest earthed point —actually the filament wiring nearest to the panel. The chokes, incidentally, are of two different types, that next to the H.F. valve being type H.F.9, and that next to the L.F. transformer being type H.F.8. The two coils, although enclosed in metal screening cases, will not be actually screened until the screens are connected to earth and, therefore, the same procedure should be adopted here as in the case of the H.F. chokes, a bare wire being connected beneath the holding-down screw nearest the filament wiring already mentioned, and connected to that wiring.

The completed "Student's" Three —ready for insertion in a cabinet.

The First Experiment

By way of an initial experiment and to see how a valve functions under varying conditions, a good milliammeter of the low-reading type should be connected to the pair of sockets joined in the detector anode circuit. The illustration on this page shows actually how these sockets are connected to the circuit and it will be seen from this illustration that the meter will be in series with the anode circuit and consequently when the set is switched on the anode current of the valve in the detector stage will be seen on the meter. It will only be a very low value, about 1 mA, and, therefore, a meter with a full-scale reading of 2 mA, or a multi-meter with the range-setter at 2 mA should be used. Without connecting aerial or earth, set the centre tuning condenser to a mid-way position and then slowly advance the reaction control, watching the meter needle as you do so. Suddenly the needle will be seen to dip and if the reaction control is advanced further there will be a slight rise in the reading, not reaching the original setting. Turn back the reaction control until the maximum dip or deflection is obtained on the needle, and this will indicate the fact that the valve is oscillating. Now, in order to confirm the oscillating condition, carry out one of the tests which is used when a superhet is being tested and it is desired to know whether or not the oscillator valve is functioning properly. That is to say, stop the valve oscillating, the easiest way being to earth the grid. To do this, moisten your finger and touch the grid terminal of the detector valve and when you do so you will see the meter needle rise to its original setting, removal of your finger immediately causing the needle to drop back to the low setting. Thus by quickly touching the grid terminal in a series of "flicks" the meter needle will follow the movements by a series of dips, thus giving a very visual indication that the valve is oscillating effectively. If a really sensitive meter is employed it will be possible to see the needle movement which is obtained as a signal is tuned in, although, of course, the application of reaction will also affect the needle setting.

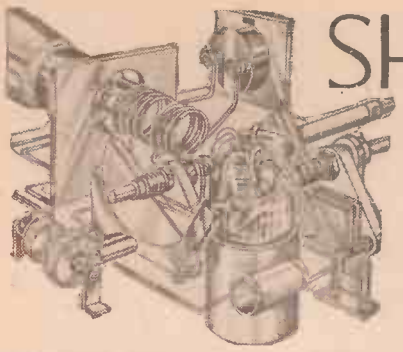


This circuit diagram shows how the terminal sockets are included.

H.F. Stability

Taking next the H.F. stage, let us see what we can learn from the screening point of view. First of all, erect a very short temporary aerial, and with the 'phones in the detector stage tune in a station which is fairly loud normally. Try to use an aerial of such a size that the volume is reduced to a very low level and preferably is only just audible. Tune in the station very critically on both dials,

(Continued on page 121).



SHORT-WAVE SECTION

S.W. NEWS TWO

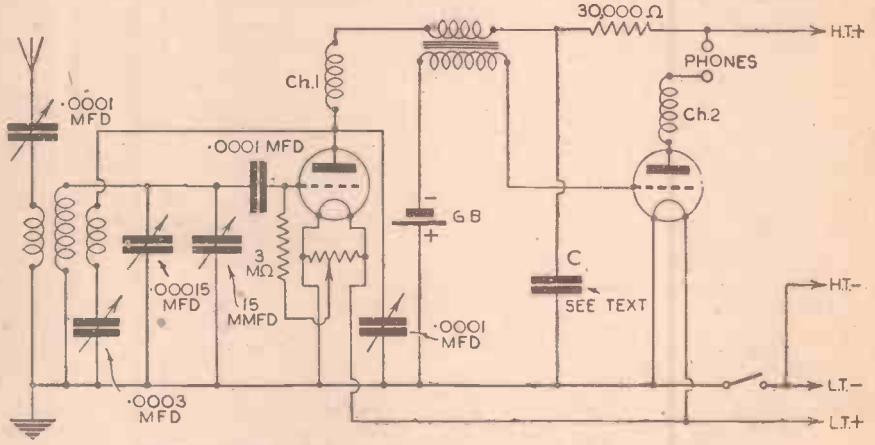
A battery two-valver designed to offer maximum results for headphone reception.

By W. J. DELANEY

ALTHOUGH we have given many constructional details of short-wave receivers for headphone or loud-speaker reception, we still receive requests for receivers designed for specific purposes. It should be unnecessary to point out that a receiver designed for general reception may be used for either headphone or speaker work, and in the general features of design there is no difference. When, however, as is the case at the present time, many listeners desire to make exclusive use of headphones, there are one or two features which may be incorporated so as to offer a maximum performance in this particular connection. News is very prominent to-day, and in America there are certain stations which are using directional aerials beamed on Europe. Thus quite a modest type of receiver will be capable of picking up these stations on the 'phones. The only point is that there must be no hand-capacity (or more correctly, head-capacity effects) which will result in erratic reaction control. A list of the main stations offering these "beamed" news broadcasts, with times and wavelengths, is given on this page, and a theoretical circuit of a suitable two-valver is also included. Such a set may be built from spare parts, provided that they are of reasonably good design and in good condition.

The Circuit

Taking the circuit from aerial to 'phones, the main details which will be seen are the inclusion of a pre-set condenser to enable the aerial damping to be regulated; band-spread tuning for certainty in obtaining the correct setting, and an output choke to keep H.F. out of the 'phones and thus remove head-capacity effects. In all other respects the circuit is standard, and two triodes are recommended. A pentode or tetrode could be used in the output stage if desired and would not affect the general features of the design. Transformer coupling is employed between detector and output stages to give maximum gain and with reasonably good valves, say a general purpose or H.F. type for the detector and a L.F. for the output, quite good signal strength should be obtained from the stations in question. A single H.T. feed is employed, the necessary voltage drop for the detector stage being obtained by means of a decoupling circuit, this giving greater stability and also preventing an uneven discharge of the H.T. battery. A standard 6-pin coil may be used for tuning, and it will be seen that the reaction condenser is on the earth side of the reaction winding, thus permitting the moving vanes of the condenser to be earthed, and facilitating the use of a metal panel if desired. A refinement, which is found desirable where reaction is a critical point (as it must be in a simple receiver without H.F. amplification) is the inclusion of a potential divider in the grid circuit of the detector valve and a pre-set condenser for by-pass purposes in this stage. It has been pointed out in previous articles on reaction that the by-pass capacity is an important item in a detector stage, although it is often excluded in short-wave receivers. The potential applied to the detector grid is also of some consequence, and although it is usual to connect the grid-leak to the positive side of the detector filament, it is often found that the bias obtained is slightly too much for the valve. The tapped potential divider specified will enable different values to be obtained, and if necessary the grid-leak may still be joined to the positive side of the filament without difficulty—the potential divider being left in circuit.



Theoretical circuit of the 2-valve short-wave for headphone reception.

Layout

The layout is not critical, and a base-board scheme may conveniently be employed. No screening or other elaborations are needed, and the parts may be laid out in almost the same positions as they occupy in the theoretical circuit. Wiring should, however, be carried out with stiff wire, and if the ordinary thin tinned copper wire is used it should be stiffened by cutting off about three feet and clamping it in some way and then carefully stretching it until it is felt to give. Although this is not usually recommended as it fractures the surface, it will be found that it will provide sufficient rigidity to the wire to enable the set to be efficiently wired. Battery leads of the four-way type may be employed, or lengths of flex may be cut off and provided with plugs. Condenser C may be of 1 or 2 mfd., or preferably may be of the electrolytic type. Both chokes should be of the standard short-wave type, whilst the transformer may have a ratio up to 5 to 1. If desired, the special Eddystone band-spread assembly may be used for tuning, or a standard .00015 mfd. tuning condenser may be used for the band-setter with a small, say 15 mmfd., condenser for the band-spreader. The aerial series condenser need not be mounted on the panel, as it is generally found that it may be set when the set is installed initially and then requires no further adjustment unless the aerial is modified. If it is panel mounted it will probably be found that the adjustments made will so affect the main tuning settings that it will not be a simple matter to log stations at given settings.

Operation

When the receiver has been completed, it may be connected for preliminary trials to a good outdoor aerial. When found to work satisfactorily it is advised that different aerials and positions be tried, as the beamed transmissions may be found to be heard better when the aerial is pointed in some directions than others. The earth also may be found worthy of experiment, and in many cases it may be found that it can be dispensed with entirely. A great deal depends upon the aerial and the actual position of the receiver. A capacity between batteries and receiver and earth will often act as a counterpoise and give as good results as an orthodox earth connection. H.T. should be 120 or 150 volts, and the G.B. adjusted according to the makers' requirements for the particular valve in use. Remember that results cannot always be obtained from America, in spite of the directional aerial system, and therefore if you are unsuccessful at the first attempt in hearing the signals, try on another night, in case conditions are not suitable. Results from other parts of the world may be no criterion as to the conditions.

U.S.A. BEAMED NEWS TRANSMISSIONS

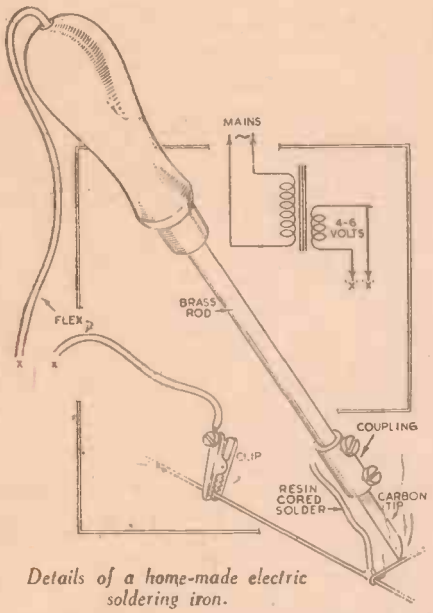
12 m'n't WRUW 25.58 metres (Except Mondays)

A.M.				
12.30	WCAB	31.28	,,	Tues., Fri.
		49.5	,,	Wed., Thur., Sat.
12.45	WCAB	49.5	,,	Sun., Wed., Thur., Sat.
		31.28	,,	Sun., Tues., Fri.
1.0	WCAB	49.5	,,	Mon.
2.55	WCAB	49.5	,,	Mon., Wed., Sat.
		31.28	,,	Sun., Tues., Fri.
5.0	WCAB	31.28	,,	Sun., Tues., Thur., Fri.
P.M.				
2.0	WGEA	19.56	,,	Daily.
	WCBX	16.83	,,	Daily.
3.0	WCBX	16.83	,,	Sunday.
5.0	WCBX	16.83	,,	Sunday.
6.0	WNBI	16.87	,,	Daily.
7.30	WCBX	25.36	,,	Monday to Friday.
9.30	WGEO	31.48	,,	Sunday.
	WRUL	25.45	,,	Mon., Wed., Thur., Frid.
	WCBX	25.36	,,	Mon. to Fri.
	WRUW	19.83	,,	Mon., Wed., Thur., Fri.
	WGEA	19.56	,,	Daily.
10.55	WGEO	31.48	,,	Mon. to Fri.
	WGEA	19.56	,,	Mon. to Fri.
11.15	WGEA	19.56	,,	Sunday.
11.50	WCBX	25.36	,,	Mon. to Fri.

Practical Hints

Electric Soldering Iron

THE following is a description of an easily constructed electric soldering "iron," which I have found invaluable in radio work. The essential items are a mains transformer from a "scrap" radio set, with a 4 or 6-volt secondary having



Details of a home-made electric soldering iron.

as high a current capacity as possible, and a carbon rod obtained from a dry cell. The diagram and circuit are self-explanatory, although it is advisable that the carbon holder should be of fairly heavy construction to prevent undue resistance and heating.

To use, the clip is placed on the wire to be soldered, at any convenient spot (as near to the actual joint as possible, of course), and the carbon tip touched to the jointing position along with the tip of a piece of flux-cored solder. A second or two is sufficient for a good joint to be made.

With this method, dry joints are eliminated, as the wire itself is heated to melt the solder.—W. NEWBOULD (Middlesbrough).

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 hint 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., Tower House, 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 "Practical Hints." DO NOT enclose Queries with your hints.

SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page 126.

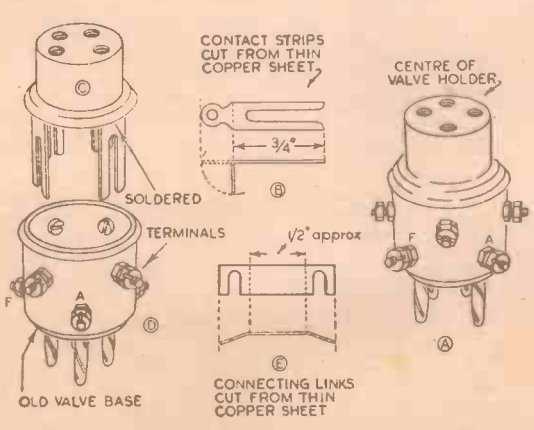
diameter as the top of the valve base and copper strips cut to the shape shown in diagram B must be soldered to each contact. In some types of valveholder the original copper strips used as contacts and springs may be left and suitable slots cut in them. Four more holes should be drilled near the top of the valve base and between the other terminals. Four terminals fitted with washers are inserted loosely, and the adapter assembled so that the terminals engage in the slots in the copper strips. The terminals may then be tightened up, and after testing for continuity the parts can be glued together. All terminals should be small, as otherwise it may be found impossible to insert the adapter in closely placed sets. Three copper links should be made as shown in diagram E to connect the corresponding terminals, which should be marked as shown in diagram A.

This adapter may also be used to connect a pick-up to a battery set, the leads being taken to the top grid terminal and a filament; all corresponding terminals being bridged with connecting links, except the grids and the adapter, which are inserted in the detector valveholder. Another use is for testing each stage of a faulty battery set. The phone leads should be connected to the two anode terminals, the other three sets of terminals being bridged.

A Simple Adapter

THE accompanying illustration shows an adapter which may be inserted in a valveholder of a battery set, and the valve plugged in on top of it. Current readings in the grid, anode and filament can be taken by connecting a milliammeter to the appropriate terminals, the other corresponding terminals being connected by copper strips.

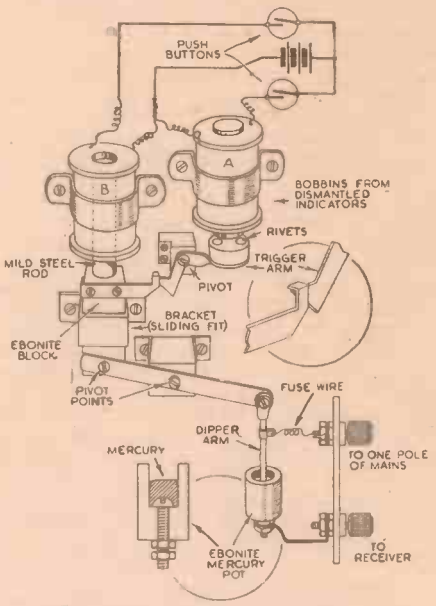
A large valve base must be obtained and holes bored low in the sides above each pin. Terminals are then screwed in and connected to the pins with wire. Next the centre piece of an anti-microphonic type valveholder must be obtained. The centre piece must be roughly the same



Details of a simple adapter for testing purposes.

Remote-control Relay

I HAVE made up a remote-control relay for switching off a mains set, together with a press switch for use with relay. The switch, together with batteries, fits in a box 7½ins. by 4ins. by 3ins., which is screwed to the underside of table on which



A remote-control relay system for switching off a mains set.

receiver stands—the leads to extension speaker are two bell wires and a light 3-core flex. Five-pin wafer valve sockets are mounted on skirting board in rooms required to use extension speaker. A 5-core bell flex with a 5-pin base of an old valve at its end is used as a wander lead for extension speaker so that it is a very simple matter to use both extension speaker and operate relay from any room. The diagram should make everything clear.—R. D. WILLIAMS (Newport, Mon).

The British Long-Distance Listeners' Club

ALTHOUGH the details of this club, which is sponsored by PRACTICAL WIRELESS, have been published from time to time in past issues, we are repeating the information for the benefit of the many new readers.

The purpose of the club is solely to bring together all those listeners who specialise in the reception of stations situated in distant parts of the world. It is intended to form a community of kindred minds and its aims are encouragement of DX reception, mutual help and comradeship.

It should be noted that the club has no commercial aims. Membership is absolutely free, and all members can, therefore, still belong to other similar clubs without further incurring any additional financial responsibility.

In a club of this type it is absolutely essential for every member to take an active part by communicating periodically with headquarters, passing on ideas and details of their own experiments, and to further this, the services of the entire staff of PRACTICAL WIRELESS are placed at the disposal of every member, while space will be set aside in this journal for reports, constructive articles, information, and any details relating to the welfare of the club.

To enable members to keep accurate records of their own activities, certain stationery is available at reasonable prices, while for identification purposes, very neat, well-finished enamelled badges can also be obtained.

The A.C.R.

To encourage long-distance reception, which naturally means maintaining a reasonable degree of efficiency of the receiving station, a very fine certificate, known as the A.C.R., or All Continents Received, is available for those members who can forward QSL cards from transmitting stations situated in the five continents, namely, Europe, Asia, Africa, Australia, and America. It should be noted that North and South America are treated as one continent, and that QSL cards from stations transmitting within the British Isles cannot, of course, be accepted for Europe.

This QSL Racket

While speaking of QSL cards, there is one point we would like to stress. It has always been the object of the B.L.D.L.C. to further in every way possible the interests and progress of their members in all matters relating to radio. Owing to the very nature of the club, no hard and fast rules or stern dictates have been imposed upon its members; no regulations have been issued to attempt to control the activities of those whose names appear on the ever-growing list of members. When one is connected with a large band of enthusiastic radio amateurs, such restrictions would appear irksome, and should be quite unnecessary, as the radio ham world has its own unwritten page of, call it what you will, but the word etiquette seems the most applicable. Perhaps it would be better described as the true spirit of amateur radio, and when it is appreciated that this spirit, or etiquette, is not in force in one county, country, or continent, but throughout the whole world, it must be realised by all who enter the amateur ranks that they undertake to uphold in every respect these unwritten laws.

One of the most flagrant violations of the true amateur spirit is this "racket" of obtaining QSL cards from any source other than the transmitting stations. Considerable publicity has already been given in these pages to the practice adopted by certain people of exchanging and bartering QSL cards, thus making it possible for anyone to acquire the most imposing display of verifications from stations which they themselves have never received and ones quite possibly well out of their scope and ability to contact with their own equipment. This system has to be killed, and it is up to every member of the B.L.D.L.C. to do his utmost to prevent the trafficking of such cards.

Correspondence

We have stressed many times before that we welcome letters; in fact, we expect them, from all members, as it is impossible for us to further the activities of the club unless we are in a position to know members' requirements and to hear of their individual work. As far back as September 2nd, the Editor was kind enough to offer 10s. 6d. each fortnight to the sender of the most interesting letter, provided it was of general interest and described such things as the writer's experiments, constructional work, or station operations. The letters should not be longer than, say, 300 words, and photos or drawings will, of course, add additional interest to the written matter.

It must not be thought from the above remarks that we do not hear from our members, but, generally speaking, the letters are too brief and do not give sufficient material of general interest, so it is up to everyone to get busy in this respect and communicate with us from time to time.

Member 6480 (Bala)

Many thanks for your interesting letter. Your log is certainly very good, and it is apparent that your station must be quite efficient in spite of your Heath Robinson aerial. How about the A.C.R. mentioned above? We are pleased to note your remarks concerning QSL cards, but there is a vast difference between the racket and getting genuine veri's from worthwhile stations.

Member 6320 (Wisbech)

We hope that the A.C.R. adds to the appearance of your shack, and would like to thank you for the remarks contained in your letter which we were very pleased to receive. We thoroughly agree with the points you raise, but unless members take a more active interest it is impossible for us to cover all the ground you mention. How about starting the ball rolling from your area?

Contacts

While it is part of the object of the club to enable members to get in touch with each other, especially those in the same district, we must request members to state whether they are agreeable for their name to be published in these columns, or whether only their membership number. If no definite instructions are given, then the number only will be used.

Will all members note that member 6331 has changed his address, and contacts can now be made with him at Mr. T. H. Plater, 341, Milligan Road, Leicester.

Member 6415, of 35, Greenfield Road, Smethwick, Staffs, would like to get in touch with any other members in his district. He is 15½ years old and very keen on S.W. work.

Member 6529, of 533, Southport Road, Orrell, Liverpool, 20, who is apparently a very keen enthusiast and a morse fan, would like to make contact with any other members.

Member 6364. Cheering news from this member, who also sends in details of his latest log to prove that conditions are not too bad; 41 stations were received during 28 days in last month. He goes on to say: "My Rx is home built, 0-v-2, working from a battery eliminator and using 'phones. Aerial is 50 degrees east-west with a 45 degree slope. I would also like to second Mr. G. F. Swaysland's remarks regarding a DX contest. I think it would be a good idea for the B.L.D.L.C. to arrange something like this."

Well, concerning the contest, what is the general opinion? Let us have your views and suggestions, but remember that it is rather more difficult to obtain veri's now than in normal times.

AIMS OF THE B.L.D.L.C.

THE purpose of the club is solely to bring together all those listeners who specialise in the reception of stations situated in distant parts of the world. It is intended to form a community of kindred minds, and its aims are encouragement of DX reception, mutual help and comradeship.

The B.L.D.L.C. has no commercial aims. Membership is free. Members can, therefore, still belong to all other similar clubs with similar aims without further incurring any additional financial responsibility through their membership of the B.L.D.L.C.

In order to give members the opportunity of exchanging ideas, the services of the entire technical staff of PRACTICAL WIRELESS are placed at the disposal of every member.

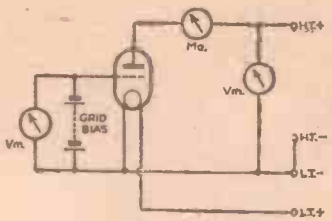
PRACTICAL WIRELESS, furthermore, will set aside a special section in which reports of reception, constructive articles, information, etc., and the internal affairs of the club will be discussed.

ADVANTAGES OF MEMBERSHIP

1. No enrolment or membership fees.
2. Organisation centred in Great Britain.
3. Standardised log-books and verification sheets and badges available for members at reasonable prices.
4. Regular reports in PRACTICAL WIRELESS.
5. Interchange of ideas with fellow members.
6. Members in same district placed in touch with one another when desired.
7. Special meetings and visits to be arranged.
8. Regular problems for short-wave listeners.
9. Members' competitions and numerous other advantages to be announced.
10. Members are expected to show an active support of the Club by communicating with Headquarters periodically, concerning their experiments, logs or general radio work. They are also expected to co-operate with other members in their area to the extent of furthering the progress of their common interests in radio matters.

POWER OUTPUT

A Comprehensive Account of the Speech or Audio Component of a Receiver



A theoretical representation of the arrangement shown in Fig. 1.

THERE are four important units of measurement with which every wireless enthusiast is familiar. He knows to what they refer, and they are always cropping up in everyday conversation between radio enthusiasts. They are volts, ohms, amperes and watts. For the present, however, we are interested in the last unit—watts, with particular reference to output valves. How often have you heard a friend say his power output was two, five, or even twenty-five watts? Now be very careful. There is a distinct difference between anode dissipation in watts and power output in watts, so you must be sure that you are both talking about the same thing. We will discuss anode dissipation in connection with power output later, for sometimes, when dealing with the latter, anode dissipation has to be taken into consideration.

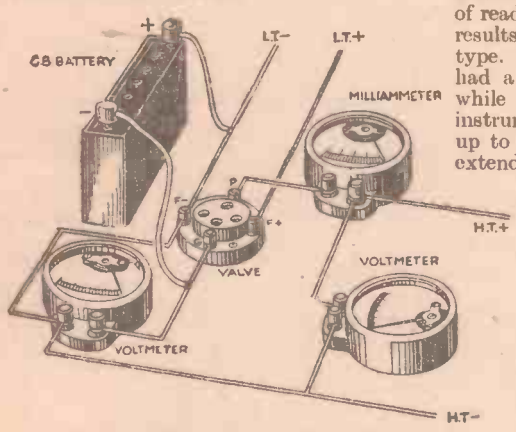


Fig. 1.—Pictorial lay-out of parts for taking valve characteristics.

Now, what is this power output, and how is it calculated? Is it just one of those common, everyday calculations such as amperes × volts equals watts, or is it something a little more complicated? Yes, it is! But if you follow this explanation carefully you will have at your finger-tips a method of approximately calculating the power output of a valve, and, therefore, be enabled to select the most suitable valve for your particular purpose. For instance, if you wish to operate a mains receiver at reasonable volume in a medium-sized room, about 2 to 2½ watts output is generally considered quite ample. If you want something still nearer realism, and have no neighbours who would object, employ a 5-watt output valve. After all, many constructors like that extra reserve of power even if not constantly employed. If you are interested in public-address work, then you can go higher still and use an output valve giving 10 or 25 watts, or even greater power output. However, our chief interest at the moment lies in ascertaining how this power output is calculated.

Necessary Factors

In order to make the necessary calculations, all that is necessary is the anode volts/anode current curves of the output valve, together with the load impedance in ohms. These curves are obtainable for the majority of output valves, and are supplied by the valve manufacturers in their catalogues.

The writer happened to have a spare 2-volt power valve, so decided to take the necessary curves himself, and calculate the power output in order that readers might have an opportunity of following through the whole process from a concrete example. Take a glance at the circuit shown in Fig. 1. This will show you the circuit of the hook-up required in order to obtain the necessary data.

You will notice that this is quite a simple arrangement, and for ease of operating it was assembled on a small baseboard. All that was necessary was a valveholder and a few terminals, and every wireless man usually has these at hand. The necessary connections can then be made to the batteries and meters. The volt-meter should be capable of reading up to 250 volts, and for accurate results should be of the high-resistance type. Actually, the voltmeter employed had a resistance of 1,000 ohms per volt, while the milliammeter was a first-grade instrument. If the milliammeter only reads up to 10 milliamps it will be necessary to extend the range, and this can be carried out quite easily by following the instructions given in earlier articles on increasing the range of meters.

Taking a Reading

Having fixed your valve in the holder and connected up your batteries and meters, arrange the first set of readings with zero grid-bias. This can be done by connecting the grid and filament together, or, preferably, by disconnecting the grid-bias battery, and connecting a piece of wire across the battery terminals. Now arrange to adjust your anode voltage in steps of 20 volts or thereabouts, and make a note each time of the anode current readings obtained. Next, connect your grid-bias battery in circuit, and arrange for 3 volts negative bias to be applied to the grid of the valve (this can be checked by means of the low-reading voltmeter connected in parallel with it). Repeat the process outlined above and again jot down the readings: this will give you data somewhat similar to that in the table of meter readings. Of course, different types of valves will give different readings. Continue increasing the grid-bias potential until you have applied approximately twice that recommended by the valve manufacturers.

The writer completed the series of readings up to 14 volts negative grid-bias, but only two sets of the readings are shown in the table mentioned.

Our next step is to plot these readings on square paper, and the graph reproduced in Fig. 2 shows the resultant anode current and voltage curves, which is what we require.

The Load Line

We now have the anode volts-anode current curves, and our third requirement is the load line. It is well known that in order to obtain any amplification a valve must be operated with a load in its anode circuit. In the case of an output valve, the most suitable load is recommended by the manufacturers, and in this particular instance was 7,000 ohms. Knowing the optimum load, it is fairly easy to arrange our load line. First of all assume that 7,000 ohms resistance be placed in series with the anode of the valve. Then, if the grid voltage recommended by the manufacturers be 7 volts at a maximum anode voltage of 150, and the anode current be 6 milliamps, there will be a voltage drop across the load of 42 volts; add this voltage to the maximum anode voltage, making the total 192 volts. This will compensate for the drop in voltage across the load resistance. Now, any change in anode voltage will be accompanied by a corresponding change in anode current; this would not be the case if there was no load in the anode circuit of the valve.

Next calculate the various voltages for variations in anode current. At 2 milliamperes 14 volts will be dropped, which, subtracted from 192 volts, will leave 178 volts. Mark this point on the graph. At 6 milliamperes 42 volts will be dropped, leaving 150 volts, and at 12 milliamperes 84 volts, leaving 108 volts. These points should be marked on the graph as indicated by the letters X, Y, Z. Draw a line passing through these points and this will represent our load line, when the optimum load is 7,000 ohms.

The next thing is to assume a signal of 14 volts peak value being applied to the grid of the valve when it is biased, say, 7 volts negative. The grid will then swing backwards and forwards from zero to 14 volts negative, between the points A-B, which are marked on the load line where it cuts the grid-bias curves at zero and 14 volts respectively. At these points ascertain the anode current and voltage,

(Continued on next page)

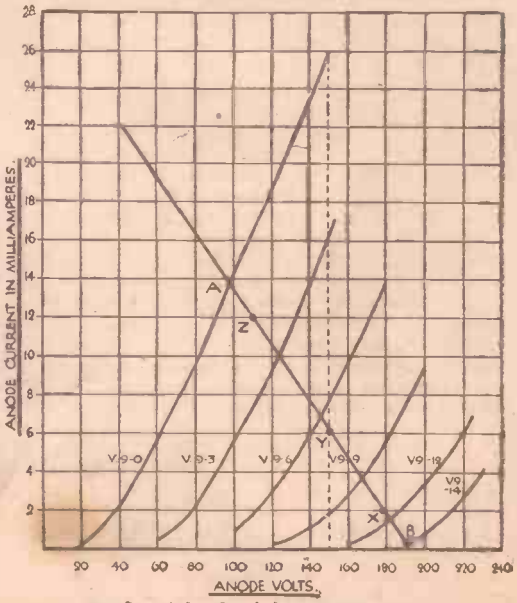


Fig. 2.—A family of characteristic curves.

POWER OUTPUT

(Continued from previous page)

which in this case will be: At zero grid volts 13.6 milliamps 98 volts and at 14 volts grid-bias 0.4 milliamps 188 volts. Subtract the smaller figures from the larger and this will give us 13 milliamps and 90 volts.

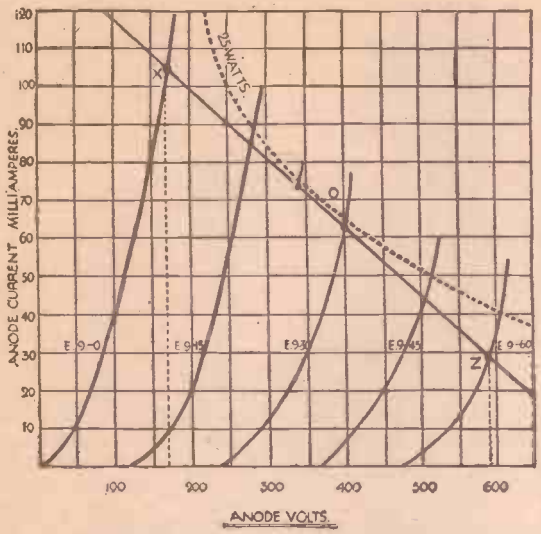


Fig. 3.—The load-line plotted, together with the line indicating maximum anode dissipation.

Our next step is to multiply these together and divide by 8, and the result will give us the power output in milliwatts.

$$\frac{13.2 \times 90}{8} = 148.5 \text{ milliwatts.}$$

Therefore the undistorted output of this particular valve is roughly 150 milliwatts, not very great, but quite suitable for use as an output valve in a portable receiver.

"Yes, all very simple," you exclaim; "but where do you get the figure eight from, and why should we divide by this particular number?"

It has to be borne in mind that the values of anode current and voltage with which we have been dealing are maximum values, and what we require is the R.M.S. values. To obtain these we divide both current and voltage by $\sqrt{2}$. Now $2\sqrt{2}$ multiplied by itself will give us 8, which is, of course, so much simpler to employ and gives precisely the same results.

Anode Dissipation

In order to appreciate the importance of anode dissipation and how it differs from power output, although both are expressed in watts, we will examine the curves of a large output valve with an undistorted output of about 4 or 5 watts. This is shown in Fig. 3. You will notice the curved dotted line which at one point touches the load line, but never crosses it. If the slope of the load line were such that it cut the dotted line, greater power output might be obtained, but the life of the valve would be endangered, as the anode dissipation limit fixed by the valve manufacturers would be exceeded. Therefore a compromise has often to be made in order to keep below the anode dissipation line. This, then, is the relationship between power output and anode dissipation, both calculated in watts, mentioned earlier in this article.

The anode dissipation in watts is the product of anode voltage and anode current at any particular operating point on the anode volts-anode current curve, and in the example given in Fig. 3 the maximum is 25 watts, which must not be exceeded. If we calculate this at the maximum anode voltage and anode current recommended by the manufacturers our results will be as follows:

Anode current 63 milliamps, anode voltage 400 volts $= \frac{63}{1,000} \times \frac{400}{1} = 25$ w.

At the point O, therefore, the maximum anode dissipation in watts is reached. In determining the position of the load line in Fig. 3 the maximum anode dissipation has to be considered.

Distortion

If load lines were drawn through the working point O (Fig. 3) at different slopes assuming for a moment no limit due to maximum anode dissipation, OX and OZ would become more nearly equal as the load line becomes nearly vertical, but the power output would fall off rather rapidly. If, however, the load line were made more nearly horizontal there would be an increase of power output, resulting in increased distortion. Theoretically, distortionless output is only obtainable when OX equals OZ, but in actual practice a certain amount of distortion can be tolerated, as it is not aurally appreciable. In deciding the best position for the load line, not only has the maximum undistorted output to be obtained, but the load line must not cut the anode dissipation curve. In calculating the amount of distortion which is permissible it is laid down that the distance between OX and OZ should not exceed the ratio of 11 to 9. If the ratio should exceed this amount the quality of reproduction will suffer. The valve manufacturers, therefore, fixed the load line so that the above conditions are complied with.

Now take a family of curves of an output valve, and calculate the undistorted output for yourself. It is extremely interesting, and you will gain a lot of useful information on the operation of your output valve.

GRID VOLTAGE ZERO	
Anode voltage.	Anode current milliamps.
20	0.4
40	2.3
60	5.6
80	9.6
100	14.0
125	21.0
150	26.0
GRID VOLTAGE 3 VOLTS NEGATIVE.	
Anode voltage.	Anode current milliamps.
20	0
40	0
60	0.6
80	2.3
100	5.6
125	10.5
150	16.5

TRACKING IN SUPERHET CIRCUITS

(Continued from page 110)

It might be asked what is the precise function of the padder; it is the same in all cases, notwithstanding the precise position which it occupies in the circuit. By being in series with the oscillator tuning condenser, it lowers the effective capacity of the latter. The capacity of two condensers in series can be found from the simple formula: $C = \frac{c1 \times c2}{c1 + c2}$. From this it can easily be seen that if a .0005-mfd. variable condenser is wired in parallel with a .0005-mfd. fixed condenser the maximum capacity is .00025 mfd. When the capacity of the variable condenser is halved, the capacity of the fixed condenser remaining unchanged, of course, the effective capacity is .000166 mfd. In other words, although the condenser has been moved through half its range the effective capacity has been reduced by only one-third. This is precisely what is required as we have already seen. In practice, the padding condenser is generally of the pre-set type.

Padder Adjustment

When aligning a superhet of the type with separate padders for medium and long-wave bands, the procedure is, very briefly, as follows: Tune the receiver to a steady, weak signal on the medium-wave band and adjust the trimmers of the I.F. transformers. Then tune to a station near the lower end of the medium-wave band and adjust the trimmers of the gang condenser for maximum volume and to bring in the station at the correct setting of the condenser scale. Next tune to a station near the top of the medium-wave band and set the padding condenser, meanwhile slowly "rocking" the tuning knob. Go back to the lower wavelength station and re-check the setting of the trimmers; revert to the higher wavelength and once again test the adjustment of the padding condenser. This process might seem rather laborious, but it is necessary if the ganging is to be accurate.

A similar procedure should next be carried out on the long-wave band, first setting the trimmer in parallel with the long-wave winding, on a station at the lower end of the band, and then dealing with the padder after tuning to a station near the top of the band; do not alter the previous settings of the trimmers on the gang condenser.

On short waves it is often sufficient to set the trimmers which are in parallel with the short-wave sections of both input and oscillator windings.

In all trimming and tracking operations, start with a weak signal—preferably by substituting a short length of wire for the aerial—and turn down the volume control after each adjustment which increases signal strength. When A.V.C. is provided, and this is not delayed, the A.V.C. line should be put out of action prior to carrying out the adjustments.

THE "STUDENT'S" THREE

(*Continued from page 115*)

using a minimum of reaction. Now, when properly tuned, slip off the screened sleeving for the anode lead and note whether there is any alteration in the signal strength. If the station is what might be termed a "local" there will probably be an increase in strength, due to the lead picking up some of the signal energy. The tuning may shift and you may find a slight readjustment of one or both of the condensers is now necessary to obtain maximum strength, and, what is more important, you will probably find that tuning will be flatter or broader, that is, occupying a wider spread on the tuning scale. There may also be a high-pitched whistle accompanying the signal, due to H.F. instability. Similarly, if the lead is screened, and one of the top-cap screened connectors is employed, as well as the metallised valve, you may find that the signal which you found originally at a very low level will be completely inaudible, showing that the anode cap itself was also picking up energy. It is this stray wiring effect which is so important in powerful receivers where there is a great deal of amplification, many of the complaints of poor selectivity which are often made against such a receiver being attributable to the effects of the signal pick-up on the wiring. In cases where the receiver is situated very close to a powerful station, it may even be necessary to enclose the set in a metal box, with the casing effectively earthed to overcome this trouble.

LIST OF COMPONENTS

Two coils, type BP.80. (Varley).

Two .0005 mfd. variable condensers, popular log type, with two large control knobs (J.B.).

One differential reaction condenser, .0003 mfd. (J.B.).

Three baseboard-mounting valveholders, two 4-pin and one 5-pin (Bulgin).

One type H.F.8 H.F. choke (Bulgin).

One type H.F.9 ditto (Bulgin).

One 3-point switch, type S.36 (Bulgin).

One 4 to 1 L.F. transformer (B.T.S.).

Five fixed condensers: One .1 mfd. type 4603/S. Two .0002 mfd. type 4601/S. One 2 mfd. type 3016. One .02 mfd. type 4601/S (Dubilier).

Three fixed resistances, ½ watt type: One 10,000 ohms. One 15,000 ohms. One 2 megohms (Dubilier).

One .25 meg. volume control with 3 pt. switch, type VM.62 (Bulgin).

Four terminal mounts and terminals, type P.30 (Bulgin).

Three valves: type Z.21 (4-pin), HL.2 and KT.2 (Osram).

One wooden baseboard, 12in. by 9in. One panel 12in. by 8in. Wire for connection, flex for leads, screws, etc. (Peto-Scott).

One pair 2,000 ohm headphones (Ericsson).

One W.B. Stentorian Junior loudspeaker (W.B.).

One 2-volt accumulator (Exide).

One 120-volt H.T. battery (Drydex).

One 9-volt G.B. battery (Drydex).

PRACTICAL NOTES

Reaction Effects

SOMETIMES when testing out a new receiver, reaction is fierce. After slacking back the reaction to zero code signals are heard. The reason is, of course, that at the zero dial reading zero reaction effect is not in evidence, and the detector valve is still in oscillation due to excessive plate voltage.

H.T. voltage to the detector plate should be reduced. It is not unknown for inexperienced short-wave constructors to remove reaction turns and ruin a set of commercial coils, finding later that reaction is still fierce or has entirely ceased, according to the number of turns removed. A higher capacity reaction condenser is sometimes fitted, and patchy reaction or one big dead spot results.

Sometimes reaction turns are increased and oscillation is damped entirely, especially within the fundamental and harmonic tuning ranges of the aerial system, individual coils, and tuned circuits.

Dead Spots

Thus we move from instability and parasitic oscillation effects to dead spots. Dead spots may be cured if the fundamental phenomena relative to them are understood. Briefly, dead spots are due to absorption or cancellation, and may be experienced with straight, high-frequency, and superheterodyne circuits. In the latter instance both absorption and cancellation types may be met with, but in straight circuits the absorption type is most common.

Careful attention to the aerial length, and also to the earth lead will generally enable absorption dead-spots to be avoided, as it may be regarded in the light of an absorption wave-trap, preventing the passage of signals at certain frequencies—those of the combined aerial-earth system or harmonics of it.

A Camera Improvement

WHEN an electron camera of the storage type is being used with a signal mosaic which is scanned by a beam of electrons, an important point to study is what occurs during the flyback period of the beam after it has completed either its line or frame scan. Unless suitable steps are taken there is always the possibility that the beam on its return journey may pass over one or more sections of the mosaic not yet scanned and so partially neutralise the signal charge which has been built up in those sections. In some cases the beam is completely suppressed during its return flight, this being carried into effect by applying suitable voltages to the modulator electrode of the neck assembly. This has been found to produce high signal potentials which evidence themselves by picture margins either too dark or too bright. One proposal which has been put forward to overcome this defect, is to force the beam of electrons during its return flight to pass over a section of the mosaic signal plate which has already been subjected to the signal generation process. This can be undertaken very readily by applying specially shaped pulses to the deflector system and that section of the screen which has still to be picture scanned is in no way impaired in so far as its acquired electrostatic potentions are concerned.

PRACTICAL TELEVISION

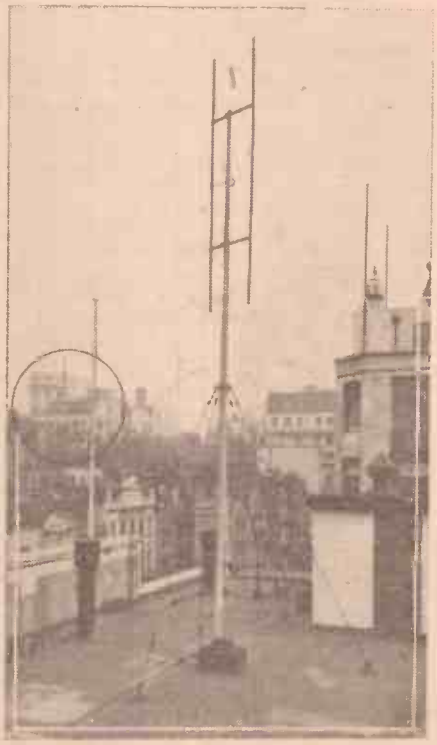
April 20th, 1940. Vol. 4. No. 199.

Spot-light Scanning

IN spite of the intensive development of the various forms of electron cameras for producing a television signal in the studio or out of doors, it has been proved very conclusively that for certain forms of transmission within a relatively limited scope, the spot-light method presents several advantages. The modern equipment used for this purpose does not employ the old mechanical method, however, in order to produce and control the movement of the rapidly moving intrinsic light area which scans the subject to be televised, but relies on the projection type cathode-ray tube. These have been brought to such a high degree of efficiency that with a suitable high-value anode voltage and a screen capable of withstanding the resultant very intense electronic bombardment, the tiny area of light on the screen is sufficiently bright to be projected by a lens on to a back screen a few feet wide so that any person or object placed before the screen is suitably scanned. The resultant varying light reflections from the surface are made to activate the cathodes of photo-electric cells generally of the multiplier type and in this way a clean, strong, mush-free television signal is generated. This is not a development which has been confined to the laboratory, for several examples of commercial equipment built on these lines have been satisfactorily demonstrated. During the course of several lectures by members of the B.B.C. engineering staff a portable representation of this apparatus was used. Built up in unit form, the demonstrator was able to televise various objects and show the resultant picture on a monitor cathode-ray tube receiver, cable linked to the transmitter. At about the period that war broke out cathode-ray tube light spot scanning was being demonstrated at the Swiss National Exhibition and the resultant signals were made to modulate ultra-short-wave carriers which were picked up by several receivers on view to the visiting public. Then, again, in several of the television telephone booths used so successfully on the European continent cathode-ray tube scanning was used, often with infra-red filters, to reduce the disturbance on the person who was being televised and who, of course, was anxious to concentrate on the picture of the person to whom he was speaking at the other end of the telephone line. It is to be hoped that the various television firms will continue their development in this quarter, for there is no doubt that the light spot scanner, conceived originally by Baird for his early experiments, has a function to fulfil in many specialised directions.

A Question of Aerials

THE large number of people who purchased television receiving sets prior to the closing down of the B.B.C. service at the outbreak of war are no doubt wondering how their aerials are faring after the abnormal weather conditions experienced during part of the winter. On two or three occasions in these columns hints have been given to readers in connection with the care of the sets themselves so as to ensure that at the cessation of hostilities, or earlier if the Postmater-General can be persuaded to change his mind in regard to a resumption of television entertainment, satisfactory results will once more be obtained on the cathode-ray tube screen. The efficiency of the set itself, however, is naturally dependent on the nature of the input signal passed by the aerial and feeder system to the appropriate receiver connections. With the seasonal improvement in outdoor weather conditions the time is now



A typical short-wave aerial, used for television, with reflector. This picture also shows, in the circle, the tower from which our editorial offices take their name. The aerial mast is on the top of the tower immediately above our research laboratories.

opportune for an examination of the aerial to ensure that it is in a sound condition, both electrically and mechanically. In the majority of cases the television aerial consists of a simple vertical rod broken at the centre for feeder connection, the length of the rod being approximately 10ft. This is used either with or without a reflector, and since its length corresponds approximately to half the wavelength of the transmissions from the signal station it is designed to receive, it is generally referred to as a dipole. A proper explanation of the functioning of this relatively simple aerial would necessitate an excursion into the realms of mathematics so it is sufficient to remember that the aerial in this form resonates to the carrier wave for which it has been designed. It is important to note also that the frequency response of this aerial does not take the form of a sharp curve and only shows approximately a one decibel loss at five megacycles either side of resonance. This is valuable, as it ensures that the higher modulation frequencies of the television signal will not be seriously attenuated and furthermore, since the sound signals accompanying the vision radiation were sent out on a carrier 3.5 megacycles remote from the vision carrier, then a single aerial will suffice for the reception of the dual signals.

Usual Practice

AS a rule the aerial is erected on the roof in a clear space and a careful examination should be carried out to ensure that during its non-use for the past six or seven months no damage has occurred. Most of the aerials are mounted on a mast and when this was accommodated on a flat roof the work is simplified. A good example of this method of erection is furnished by the accompanying illustration. First of all, any guys with their insulators inserted should be run over to see that no wire strands are broken and after this, when such a course can be resorted to, the mast should be lowered carefully, taking care not to break or damage in any way the feeder cable which may be of the twin or co-axial type. The dipole elements of the aerial mounted on a wooden strip or held in free space, if of stout metal, should be cleaned, and where connection is made at the centre to the feeder cable the joints be examined for corrosion, and if electrically poor should be re-soldered carefully and bound with fresh insulating tape. In the accompanying photograph a reflector is shown positioned a quarter of a wavelength behind the dipole aerial. No electrical connection is made to this section of the assembly, its function being to induce a voltage in the receiving dipole in phase with and almost equal to the signal induced voltage of the dipole. For this to occur, that is, maximum reception conditions, the reflector should be behind the dipole in a line with the dipole and the television transmitting station. When replacing the pole and aerial system this point should be watched carefully and the bearing checked on the station with a compass if one is available. The feeder cable should be checked for electrical continuity and insulation and, as shown in the photograph, the feeder cable must be taken at right angles to the dipole for a distance of at least a foot. It is generally convenient to attach this cable to the mast, as this will prevent the dead weight of the cable from causing any strain to the connections.

LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes, price 2s. each.

NEW PATENTS

These particulars of New Patents of interest to readers have been selected from the Official Journal of Patents and are published by permission of the Controller of H.M. Stationery Office. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription, £2 10s.).

Latest Patent Applications.

5119.—Chakravarti, S. P.—Band-pass filters for radio and television systems. March 19th.

5213.—General Electric Co., Ltd., and Biggs, A. J.—Wireless receiving-sets comprising dial lamps. March 20th.

4930.—Hamilton, C. G. Cole, and Morris, T. C.—Radio receivers and installations. March 16th.

5228.—Philips Lamps, Ltd.—Adjustable electric resistances. March 20th.

5230.—Philips Lamps, Ltd.—Superheterodyne wireless receivers. March 20th.

Specifications Published.

519110.—Marconi's Wireless Telegraph Co., Ltd.—Ultra short-wave circuits.

519111.—Pye, Ltd., and Liebmann, G.—Cathode-ray tubes.

518969.—Marconi's Wireless Telegraph Co., Ltd., and Brailsford, J. D.—Electrical tuned circuit.

518979.—General Electric Co., Ltd., Rose, W. R., Clark, F., and Forbes, A. D.—Tuning devices for radio receivers and the like. (Cognate Application, 369/39.)

518991.—General Electric Co., Ltd., and Peters, W. H.—Wireless-receiving apparatus.

519051.—Rantzen, H. B.—Transmission of television signals over cables.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

TELENEWS

Mobile Units

THE entertainment and interest value associated with outside television broadcasts is one of the items which is readily being realised by those companies in the United States who are devoting so much of their energy into the transmitting side of this subject. To carry this into effect in a thoroughly efficient manner steps are being taken to construct mobile television units on lines resembling those which were adopted originally in this country. The signals generated from this unit can then be fed to the main broadcasting station through the medium of a network of coaxial cable lines, a good deal of which has already been laid in America, or when this is not possible, advantage is taken of a beamed ultra-short-wave transmission picked up by a delicate receiving set located in an area completely free from interference so that the clean signal can then be relayed to the main rediffusing transmitter. It is customary to split the functions of the complete mobile unit into four separate sections for convenience, for many occasions arise when only one section has to proceed to a site in order to carry out the television programme. The first section is, therefore, made up as the camera control and monitoring van. In this is accommodated all the television cameras, signal generator control and monitoring equipment, together with the associated sound pick-up control and amplifier. With a view to an adequate coverage of the event the Americans now seem to favour the use of two or three camera units of the mosaic signal plate type, with various forms of lenses so that this entails a mixing control, power supplies, pre-fade and transmitted picture monitors, synchronising pulse generator and picture channel distribution amplifier. In practice this apparatus is very similar to studio equipment, but is of a more compact type since it has to be housed in a van of convenient dimensions capable of proceeding to the scene of action under its own motive power.

A Master Frequency Generator

IN any complete television system it is essential, if satisfactory results are to be obtained, to have a master frequency generator located at the transmitting end. This equipment is then called upon to furnish the fundamental line and frame synchronising frequencies to all parts of the station. It is well known that the success which attends any interlaced system of scanning in television depends upon the rigidity of the lock, or the accuracy of the time relation between the frame and line frequencies, and it is for this reason that various types of designs have been developed to ensure that this factor is met under the widest variety of practical conditions. The normal practice is for the frame frequency to be derived from the time controlled alternating current mains. It is then necessary to make some provision so that an electrical inertia is introduced, and thereby prevent the transmitted signal from following any sudden changes in the phase of the electrical mains supply. These changes, if inherent in the built-up equipment, are very detrimental to the achievement of perfect interlacing, and must be counteracted by patented methods in the circuit design. In its completed form the apparatus is then called upon to furnish synchronising pulses to the cameras in the studios, the telecine scanners and the radio transmitters. In addition to this, the equipment should also be capable of providing electrically-generated test signals for checking up the degree of linearity, contrast and adjustment, which is a daily routine test in any modern high-definition television transmitting station. This is carried out on special internal circuits, and then again at the commencement of any broadcast this same master frequency signal generator is called upon to supply the tuning signal in bar form for radiation from the transmitting aerials. This enables the viewer or service engineer to ascertain whether the receiving set is functioning normally at the receiving site.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

(See also page ii of cover.)

No. 53

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

Degrees.	Sine.	Cosine.	Tangent.	Degrees.	Sine.	Cosine.	Tangent.
15°30′	0.2672	.9636	0.2773	23° 0′	0.3907	.9205	0.4245
16° 0′	0.2756	.9613	0.2867	30′	0.3987	.9170	0.4348
30′	0.2840	.9588	0.2962	24° 0′	0.4067	.9136	0.4452
17° 0′	0.2924	.9563	0.3057	30′	0.4147	.9099	0.4557
30′	0.3007	.9537	0.3153	25° 0′	0.4226	.9063	0.4663
18° 0′	0.3090	.9510	0.3249	30′	0.4305	.9025	0.4770
30′	0.3173	.9483	0.3346	26° 0′	0.4384	.8988	0.4877
19° 0′	.03256	.9455	0.3443	30′	0.4462	.8949	0.4986
30′	0.3338	.9426	0.3541	27° 0′	0.4540	.8910	0.5095
20° 0′	0.3420	.9397	0.3640	30′	0.4617	.8870	0.5206
30′	0.3502	.9367	0.3739	28° 0′	0.4695	.8829	0.5317
21° 0′	0.3584	.9336	0.3839	30′	0.4772	.8788	0.5430
30′	0.3665	.9304	0.3939	29° 0′	0.4818	.8746	0.5543
22° 0′	0.3746	.9272	0.4040	30′	0.4929	.8704	0.5658
30′	0.3827	.9239	0.4142	30° 0′	0.5000	.8660	0.5774

No. 54

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

Degrees.	Sine.	Cosine.	Tangent.	Degrees.	Sine.	Cosine.	Tangent.
30°30′	0.5075	.8616	0.5891	38° 0′	0.6157	.7880	0.7813
31° 0′	0.5150	.8572	0.6009	30′	0.6225	.7826	0.7954
30′	0.5225	.8526	0.6128	39° 0′	0.6293	.7772	0.8098
32° 0′	0.5299	.8480	0.6249	30′	0.6361	.7716	0.8243
30′	0.5373	.8434	0.6371	40° 0′	0.6428	.7660	0.8391
33° 0′	0.5446	.8387	0.6494	30′	0.6494	.7604	0.8541
30′	0.5519	.8339	0.6619	41° 0′	0.6561	.7547	0.8693
34° 0′	0.5592	.8290	0.6745	30′	0.6626	.7490	0.8847
30′	0.5664	.8241	0.6873	42° 0′	0.6691	.7431	0.9004
35° 0′	0.5736	.8192	0.7002	30′	0.6756	.7373	0.9163
30′	0.5807	.8142	0.7133	43° 0′	0.6820	.7314	0.9325
36° 0′	0.5878	.8090	0.7265	30′	0.6884	.7254	0.9489
30′	0.5948	.8039	0.7400	44° 0′	0.6947	.7193	0.9657
37° 0′	0.6018	.7986	0.7536	30′	0.7009	.7132	0.9827
30′	0.6088	.7934	0.7673	45° 0′	0.7071	.7071	1.0000

No. 55

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

Degrees.	Sine.	Cosine.	Tangent.	Degrees.	Sine.	Cosine.	Tangent.
45°30′	0.7133	.7009	1.0176	53° 0′	0.7986	.6018	1.3270
46° 0′	0.7193	.6947	1.0355	30′	0.8039	.5948	1.3514
30′	0.7254	.6884	1.0538	54° 0′	0.8090	.5878	1.3764
47° 0′	0.7314	.6820	1.0724	30′	0.8141	.5807	1.4020
30′	0.7373	.6756	1.0913	55° 0′	0.8192	.5736	1.4282
48° 0′	0.7431	.6691	1.1106	30′	0.8241	.5664	1.4550
30′	0.7490	.6626	1.1303	56° 0′	0.8290	.5592	1.4826
49° 0′	0.7547	.6561	1.1504	30′	0.8339	.5519	1.5108
30′	0.7604	.6495	1.1709	57° 0′	0.8387	.5446	1.5399
50° 0′	0.7660	.6428	1.1918	30′	0.8434	.5373	1.5697
30′	0.7716	.6361	1.2131	58° 0′	0.8480	.5299	1.6003
51° 0′	0.7771	.6293	1.2349	30′	0.8526	.5225	1.6319
30′	0.7826	.6225	1.2572	59° 0′	0.8572	.5150	1.6643
52° 0′	0.7880	.6157	1.2799	30′	0.8616	.5075	1.6977
30′	0.7934	.6088	1.3032	60° 0′	0.8660	.5000	1.7321

No. 56

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

Degrees.	Sine.	Cosine.	Tangent.	Degrees.	Sine.	Cosine.	Tangent.
60°30′	0.8704	.4924	1.7675	68° 0′	0.9272	.3746	2.4751
61° 0′	0.8746	.4848	1.8041	30′	0.9304	.3665	2.5387
30′	0.8788	.4772	1.8418	69° 0′	0.9336	.3584	2.6051
62° 0′	0.8830	.4695	1.8807	30′	0.9367	.3502	2.6746
30′	0.8870	.4618	1.9210	70° 0′	0.9397	.3420	2.7475
63° 0′	0.8910	.4540	1.9626	30′	0.9426	.3338	2.8239
30′	0.8949	.4462	2.0057	71° 0′	0.9455	.3256	2.9042
64° 0′	0.8988	.4384	2.0503	30′	0.9483	.3173	2.9887
30′	0.9026	.4305	2.0965	72° 0′	0.9510	.3090	3.0777
65° 0′	0.9063	.4226	2.1445	30′	0.9537	.3007	3.1716
30′	0.9100	.4147	2.1943	73° 0′	0.9563	.2924	3.2907
66° 0′	0.9135	.4067	2.2460	30′	0.9588	.2840	3.3759
30′	0.9171	.3988	2.2998	74° 0′	0.9613	.2756	3.4874
67° 0′	0.9205	.3907	2.3559	30′	0.9636	.2672	3.6059
30′	0.9239	.3827	2.4142	75° 0′	0.9659	.2588	3.7321

No. 57

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

Degrees.	Sine.	Cosine.	Tangent.	Degrees.	Sine.	Cosine.	Tangent.
75°30′	0.9682	.2504	3.8667	83° 0′	0.9926	.1219	8.1444
76° 0′	0.9703	.2419	4.0108	30′	0.9936	.1132	8.7769
30′	0.9724	.2335	4.1653	84° 0′	0.9945	.1045	9.5144
77° 0′	0.9744	.2249	4.3315	30′	0.9954	.0959	10.3854
30′	0.9763	.2164	4.5107	85° 0′	0.9962	.0872	11.4301
78° 0′	0.9782	.2079	4.7046	30′	0.9969	.0785	12.7062
30′	0.9800	.1994	4.9152	86° 0′	0.9976	.0698	14.3007
79° 0′	0.9816	.1908	5.1446	30′	0.9981	.0610	16.3499
30′	0.9833	.1822	5.3955	87° 0′	0.9986	.0523	19.0811
80° 0′	0.9848	.1737	5.6713	30′	0.9990	.0436	22.9038
30′	0.9863	.1650	5.9758	88° 0′	0.9994	.0349	28.6363
81° 0′	0.9877	.1564	6.3138	30′	0.9997	.0262	38.1885
30′	0.9890	.1478	6.6912	89° 0′	0.9998	.0174	57.2900
82° 0′	0.9903	.1392	7.1154	30′	0.9999	.0087	114.5887
30′	0.9914	.1305	7.5958	90° 0′	1.0000	.0000	∞

ACCUMULATOR DATA. No. 58.

ACID OF 1.840 SPECIFIC GRAVITY

Required Specific Gravity at 70°F.	Water — Parts by Volume.	Acid, 1.840 Specific Gravity. — Parts by Volume.
1.400	14	10
1.350	18	10
1.300	21	10
1.250	27	10
1.225	29	10

ACID OF 1.400 SPECIFIC GRAVITY

Required Specific Gravity at 70° F.	Water. — Parts by Volume.	Acid, 1.400 Specific Gravity. — Parts by Volume.
1.300	4.5	10
1.280	5.5	10
1.275	6.25	10
1.265	6.4	10
1.255	6.65	10
1.250	6.75	10

CURRENT-CARRYING CAPACITY OF LAMPS FOR CHARGING PURPOSES

Carbon-filament Lamps

Candle-power.	Voltage.	Current passed.
8	110	.254
16	110	.509
32	110	1.018
8	220	.127
16	220	.209
32	220	.509

Metal-filament Lamps

Candle-power.	Voltage.	Current passed.
8	110	.09
16	110	.18
32	110	.36
8	220	.049
16	220	.09
32	220	.18

Condition of Cells.	Actual Hydrometer Readings at Temperatures shown below to give 1.280 at 60° F.						
	40°F.	50°F.	60°F.	70°F.	80°F.	90°F.	100°F.
Fully charged	1.288	1.284	1.280	1.276	1.272	1.268	1.264
Half discharged	1.207	1.204	1.200	1.196	1.193	1.189	1.186
Fully discharged	1.115	1.113	1.110	1.107	1.104	1.101	1.098

Open to Discussion

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

Full-wave Detection

SIR,—I should like to sincerely thank your correspondents for their most interesting replies to my letter on the above subject.

"Empiricist," in your issue dated March 23rd, says that Mr. Ford will have his little joke! I have spent much hard work, hard thought and hard-earned money on the subject of detection, but now I am enjoying the discussions. I have no objection to calling it push-pull detection, but this does not offer a solution. I think it is possible to detect (rectify) the "full" radio-frequency wave—but not by full-wave detection.

The letter from Mr. Taylor in your issue dated March 30th is also much appreciated. Although advantages may be obtained from the use of what is apparently a full-wave detector circuit, it does not follow that full-wave detection is obtained; and although a copper oxide rectifier may be designed expressly for this purpose, it also does not follow that full-wave detection (rectification) is obtained. Mr. Taylor also says that no theoretical grounds could be stated for the impossibility of H.F. full-wave detection. It is agreed that no grounds can be found in accepted theory, but according to the new theory, which I had the privilege of publishing some years ago, detection of radio frequencies simply means the displacement of the base line so that the positive amplitude of the rectified output is generally greater than the negative. I have naturally not had the time to work out the theory in all its details, but it could be stated in more detail as follows: Detection (rectification) of radio frequencies is a displacement of the base or zero voltage line so that generally the positive amplitude is increased, and the negative amplitude is decreased, and the positive amplitude of the output is permanently greater than the negative. This does not take into consideration any question of detector amplification or losses, which would either increase or decrease both the positive and negative portion of the wave, and would be relatively in proportion.

Half-wave and full-wave rectification of low-frequency alternating current, as given in theoretical diagrams, bears no relation (in the new theory) to the detection of radio frequencies—hence the full-wave detection of radio frequencies is (in the new theory) apparently theoretically impossible. With a "perfect" crystal it may be possible to displace the base or zero voltage line so completely that the whole of the rectified output rises and falls in an increasing positive and decreasing positive direction, with no negative amplitude. Detection would then be "complete" from the point of view of volume of output, but the question of quality of output is another matter. The volume of output at audio frequency will depend upon the *difference* between the voltages above and below the base or zero voltage line. Different methods of detection and different conditions in the detector circuit produce an output which may have a different positive/negative ratio. In some forms of detection in general use the rectified output may consist of a wave which falls 75 per cent. below the base or zero voltage line, and rises 100 per cent. above it, so that the negative amplitude is 75 per cent. of the positive—which means that, broadly speaking, only 25 per cent. of the wave can be used as an audio-frequency output. If the negative amplitude were 90 per cent. of the positive, there would be only 10 per cent. effective audio output, with considerably reduced volume. After amplification in the L.F. amplifier there should still be 10 per cent. of the wave as effective audio output. The negative portion of the wave cancels out a proportion of the positive voltage.—D'ARCY FORD (Exeter).

TAP, Ankara

SIR,—I should like to take this opportunity of thanking you for your very interesting paper, and I am glad to see that it has not changed owing to the war. I am much relieved to see that you have discontinued to print letters in which the writers request to swap their QSLs.

I find conditions have been poor lately, but I should like to report a very interesting programme given by TAP (Ankara), on Saturdays, at 21.30 B.S.T. in English. The station invites English listeners to send in reports, and to ask any questions concerning Turkey, its towns or any other relevant question. The writer is asked to state the date in his letter on which it is most suitable for him to listen in to TAP, and the announcer will give him a call over the air, and answer his questions. TAP'S QRA, "Correspondence Dept.," Radio Ankara, Ankara, Turkey.—E. G. GRAY (Abergavenny).

Comradeship!

SIR,—I feel I ought to write and thank you for publishing my request for back numbers in this week's issue.

As a matter of interest and as examples of the good spirit amongst radio amateurs, I would like to inform you that as early as Wednesday evening a local ham left me a large pile of back numbers and on Thursday I received an offer from Wakefield (all free and post paid), followed by another caller from two miles away. Friday brought a card from Wirral and a 7d. post paid parcel from Sussex. I have replied to every one of these.—W. G. ANDREWS (Liverpool, 14).

Dead Spots

SIR,—I was very interested in Mr. J. Kidd's (Melton Mowbray) letter, in the current issue of your paper. His problem of not receiving signals from Canada or South Africa is exactly the same as mine. Even during the weeks before the "great Easter electrical storm," when DX conditions were very good, I could not find a single Canadian or South African station. I have used two aerials. The first is an inverted L, 30ft. high and 30ft. long, running due east and west, the second is an indoor one, approximately the same height, 25ft. long and running in *three* directions, which rather spoils the idea of directional effect. The receivers have been varied, too. I have used from a simple one-valve right up to my Trophy "V," and get the same results with all the sets. I wonder if any other readers have had similar experiences, and whether Melton Mowbray and Wallasey are "dead spot" areas for reception from certain parts of the world.

Anyway, this has made me start experimenting with aerials, and I had no idea how interesting this branch of my hobby could be. Most of my knowledge of radio has come from your valuable paper—carry on the good work, PRACTICAL WIRELESS!—ERIC H. WILLIAMS (Wallasey).

Prize Problems

PROBLEM No. 396

MANNING decided that he could improve his three-valve battery receiver from the point of view of volume and quality. For this purpose he obtained another L.F. valve and L.F. transformer, which he included between his existing detector stage and the output valve. He experienced very bad distortion and thinking that overloading was responsible he connected a volume control across the secondary of the transformer feeding the output valve. He still experienced distortion, even at minimum settings of the control. What was wrong? Three books will be awarded for the first three correct solutions opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 396 and must be posted to reach this office not later than the first post on Monday, April 22nd, 1940.

Solution to Problem No. 395

The accumulator Purvis was using was in need of recharging, and when it stood unused over-night it regained a certain amount of power, which enabled it to work the set satisfactorily when next switched on for a short time.

The following three readers successfully solved Problem No. 394 and books have accordingly been forwarded to them: F. D. Collen, 130, St. John's Road, Tunbridge Wells, Kent; R. Alland, 12, Gamble Lane, Farnley, Leeds; C. W. Hildersley, 43, Litchfield Gardens, Willesden Green, N.W.10.

Correspondents Wanted

The following readers are desirous of corresponding with others on the subjects mentioned:

D. King, of The Hall, Stalham, Norfolk, with a view to learning the Morse Code.

F. Lamsley, 64, Canning Road, Wealdstone, Harrow. Wishes to receive correspondence from anyone on short-wave reception. All letters will be answered.

W. H. Reid, 98, High Street, Easton, Bristol, 5, wishes to contact anyone in his district interested in short-wave listening.

R. E. G. Durham, 25, New Inn Hall Street, Oxford—with any reader who has constructed the "Mite Two"—preferably in his district.

H. G. Vale, 18, Coalway Road, Wolverhampton, with a short-wave enthusiast about 17 years of age. He promises to reply to all letters.

K. J. Blight, Cromie Street, Murton, Victoria, Australia, with any S.W. enthusiast.

L. Woodcock, "Norwood," 110, Amington Road, Tamworth, Staffs, with a short-wave enthusiast of about his own age—16.

E. Wilson, 3, Bk. Meal Street, New Mills, Derbyshire, with a young reader, about 15, interested in medium-wave DX.

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS	Date of Issue.	No. of Blueprint.
CRYSTAL SETS		
Blueprints 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve: Blueprint, 1s.		
The Signet Two (D & LF)	24.9.38	PW76
Three-valve: Blueprints, 1s. each		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three ((SG, D, Pen), Pen)	30.4.38	PW80
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve: Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve: Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen)	—	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-Valve: Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47

These Blueprints are drawn full size.

Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices *which are additional to the cost of the Blueprint*. A dash before the Blueprint Number indicates that the issue is out of print.

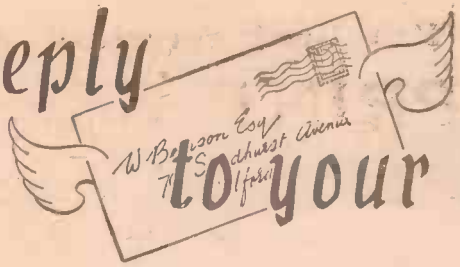
Issues of Practical Wireless... 4d. Post Paid
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/3 " "

The index letters which precede the Blueprint Number indicate the periodical in which the description appears: Thus P.W. refers to PRACTICAL WIRELESS. A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

SUPERHETS.		
Battery Sets: Blueprints, 1s. each.		
£5 Superhet (Three-Valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	—	PW52
Mains Sets: Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	—	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73
Four-valve: Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model / Push Button 4, A.C. Mains Model	22.10.38	PW95
SHORT-WAVE SETS. Battery Operated.		
One-valve: Blueprint, 1s.		
Simple S.W. One-valver	23.12.39	PW88
Two-valve: Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve: Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	1.10.38	PW68
PORTABLES.		
Three-valve: Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve: Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS		
Blueprint, 1s.		
S.W. Converter-Adapter (1 valve)	—	PW48A
AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated		
One-valve: Blueprint, 1s.		
B.B.C. Special One-valver	—	AW387
Two-valve: Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve: Blueprints, 1s. each.		
£5 5s. S.G.3 (SG, D, Trans)	—	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400

In reply to your letter



Eliminator Output

"I have an eliminator which should give a maximum of 120-150 volts, but I only get 60 volts. Can you tell me what is wrong, and, if possible, suggest a remedy?"—J. S. (Plaistow).

THIS is a very common query and we presume that you are a new reader, or you would have seen the comments which have been repeatedly made in regard to this matter. In the majority of cases such a query is the result of a test being made with an unsuitable type of voltmeter. The output of an eliminator is what might be termed "floating," that is to say, the current and voltage are closely related, and an increase in current results in a decrease in voltage. A cheap type of meter will take a high current and give a low voltage reading, especially if there are "Detector" and "S.G." tappings which are intended only to supply 2 or 3 mA at the most. Your meter may take 20 mA or even more. Therefore, to measure the output from an eliminator accurately you need a high-resistance voltmeter, or alternatively should take the voltage readings with that type of meter when the receiver is being operated. If, however, the rectifier has been damaged this would account for a reduced output and a replacement of the rectifier is then necessary.

Electrolytic Block Condenser

"I wish to obtain a 6 plus 6 plus 1 mfd. cardboard container 230-volt electrolytic condenser. I require this to repair an A.C. mains receiver and I was wondering if you could advise me where I could obtain one which would serve the purpose."—W. E. M. (Whitehaven).

YOU have indicated the type as being 6 plus 6 plus 1 mfd. and we would point out that the sign between values in block units usually indicates the polarity of the common lead. Thus 6 plus 6 plus 1 would mean that there are three condensers with a common positive lead to each. There are few receivers which would employ such a block unit and we think you require a 6–6–1 block which is three condensers with a common negative lead. This would be more usual and in the Dubilier range is a block of this type, No. 319, working voltage 220 volts. The pre-war price was 5s.

Cabinet and Aerial

"Could you tell me where to get a metal cabinet? Also with a doublet aerial for reception, where do the two lead-in wires go to? Are they connected to a transformer, or are they twisted together and plugged into the one aerial terminal on the set? If the former, what transformer is necessary?"—T. W. (S.W.1).

WRITE to E. Paroussi regarding the metal cabinet, or to Peto-Scott. With regard to the doublet lead-in the usual arrangement is to connect the two leads to the primary of an aerial transformer. This is the standard type of aerial coil, such as the 4-pin or 6-pin plug-in variety, and if your receiver incorporates this type of aerial circuit you can insert the two leads into the aerial and earth sockets. Better results are obtained, however, if you disconnect the primary winding of the aerial coil from the earth line, and then connect an earth to the receiver, with the lead-in wires taken to the aerial terminal and the now free end of the primary winding.

Long-wave Stations

"I should be glad if you could let me have the wavelengths of Tiflis, Minsk, Kiev, Leningrad and Kaunas stations on the long waves."—D. H. (Aston, Birmingham).

THE wavelengths of the stations in question are as follows: Kaunas, 1,961 metres, 153 kc/s; Minsk, 1,442 metres, 208 kc/s; Kiev, 1,210 metres, 248 kc/s; Leningrad, 1,107 metres, 271 kc/s; and Tiflis, 1,060 metres, 283 kc/s.

RULES

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.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Superhet Tone

"I have a commercial receiver, rather old, which is of the superhet type. I find now, on experimenting, that I can improve the tone and make it much more natural by slightly putting the pointer off the tune point. When it is loudest, however, the tone is rather deep. I have been told that I am getting bad quality by off-tuning, but it seems to me to be better. Can you answer this point for me?"—J. R. C. (Beith).

WHEN a superhet is properly tuned, provided that all circuits are correctly aligned, the tone should be properly balanced, that is, all side bands should be equally reproduced. When off-tune, however, there will be some side-band cutting, and this normally results in distortion. Incidentally, this is the reason for the introduction of the visual tuning indicator which permits the user to see when the set is dead on tune and thus reproduction is properly balanced. If, in your case, the tone is too deep, the effect of modifying the tuning is to introduce a form of distortion which probably approaches a whistle and this apparent raising of the tone is apparently more pleasant to your ear than the correct reproduction given by the set in question. As it is an old receiver the reproduction may not be so brilliant as that obtained in modern sets.

Variable Resistance

"I have a volume control in my set which is apparently giving trouble. It is very erratic in action and before buying a new one I should like to try to mend it. I have taken off the cover and there appears to be a disc of metal inside over which the arm moves. It does not appear possible to me for a disc to vary the resistance, and I wonder if something has worn off or become lost and should like your opinion on this matter before taking it any further to pieces."—L. E. R. (Watford).

THERE is a type of variable resistance in which the variation is effected by what is known as a "swash-plate." This is a springy disc which, as the arm is rotated, is pressed into contact with either a chemical element or a wire-wound element. If the springiness has gone out of the plate then it would fail to act properly, but it is more likely that some grease or oil has got into the component and is preventing good contact between the plate and the element. In some cases a chemical element can become worn, but there is very little wear with a good swash-plate movement and we therefore suggest that you dismantle the component and clean away any dirt or grease which you find on the plate.

Reaction Efficiency

"I am making a small short-wave set and am interested in several designs which you have published. I am not quite clear regarding the difference between the so-called electron-coupled arrangement and the ordinary reaction circuit, and should be glad if you could explain this and advise me which to adopt. I shall use about three valves and am keen on some really effective long-distance logs on short and medium waves."—J. E. H. (Matlock).

WITH a simple set, as we have before pointed out, the reaction circuit is of the utmost importance and the main efficiency of the set is dependent upon this part of the circuit. You therefore need a very carefully chosen arrangement which can be handled easily and will produce its maximum effect. We therefore advise the electron-coupled circuit, with potentiometer control for the screen voltage of a good H.F. pentode. Pay careful attention to the layout and use good quality parts, and you will find that the arrangement will give you all you desire.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

J. A. B. (W.2). The value depends upon the bias voltage required, and on the type of valve, i.e., short-base or long-base.

A. T. (Todmorden). The details will all be found in our Encyclopædia.

A. D. B. (Coventry). We regret that we do not now have details of the valves in question. They do not appear in current lists.

A. T. H. (Margate). We cannot give details in the absence of full data concerning the amplifier and connections.

S. A. W. (S.E.15). The transformers are not suitable. You need a special transformer with a low-resistance secondary.

W. C. (Warrington). Premier Radio can supply the meter.

C. W. B. (Ashbourne). You should communicate with the makers of your receiver.

The coupon on page 126 must be attached to every query.

Classified Advertisements

ADVERTISEMENTS are accepted for these columns at the rate of 2d. per word (minimum charge 2/- each paragraph). Series discounts of 5 per cent. for 13, 10 per cent. for 26 and 15 per cent. for 52 insertions are allowed. All advertisements must be prepaid.
EACH paragraph will commence with the first word printed in bold face capitals. Additional words in bold face capitals are charged at 4d. per word.
ALL communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, London, W.C.2.

CABINETS

A CABINET for Every Radio Purpose. Surplus Cabinets from noted makers under cost of manufacture. Radiogram Cabinets from 30/-. Undrilled table, console and loudspeaker cabinets from 4/6. Inspection invited.
H. L. SMITH AND CO., LTD., 289, Edgware Road, W.2. Tel: Pad. 5891.

FOR SALE

SALE.—S.T.600 with speaker. 150 volt Milnes unit. Offers.—Haines, Chute, Andover, Hants.

LITERATURE

NEW Edition. American Amateur Relay League Handbook. 500 pages of up-to-the-minute technical information, 7/- post free. 1940 Jones Handbook; approximately 700 pages dealing with every aspect of Short-wave Radio, 8/6, post free.—Webb's Radio, 14, Soho St., London, W.1. 'Phone: Gerrard 2089.

LOUDSPEAKER REPAIRS

LOUDSPEAKER repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

REPAIRS to moving coil speakers. Cones/coils fitted or rewound. Fields altered or wound. Prices quoted, including eliminators. Pick-ups and speaker transformers rewound, 4/6. Trade invited. Guaranteed satisfaction. Prompt service.
L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

MISCELLANEOUS

S.W.Ls., Q.S.Ls., any design, samples free.—East, 44, Devon Ave., Twickenham.

BE TALLER!!—Inches put you miles ahead!! Increased my height to 6ft. 3¾ins. Details 6d. stamp.—Malcolm Ross, Height-Specialist, BM/HYTE, London, W.C.1.

MORSE EQUIPMENT

FULL range of Transmitting Keys, Practice Sets, Oscillators, Recorders and other Radio Telegraph Apparatus, designed and manufactured by T. R. McElroy, World's Champion Telegraphist. Sole distributors: Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

MORSE TRAINING

WIRELESS Code Courses. "Book of Facts" Free.—Candler System Co. (L.O.), 121, Kingsway, London, W.C.2.

MORSE easily learnt by gramophone records by ex-Service Instructor. Speeds from 2 words per minute. Also private tuition in London.—Masters, Pound Hill, Crawley, Sussex.

NEW CHASSIS

ARMSTRONG CO. recommending the following economically priced Radio Chassis for good quality reproduction.
ARMSTRONG Model AW38.—8-valve All-wave Radio-gram chassis, incorporating the latest circuit, including 6 watts push-pull output. Price £8/8/0 + 5% war increase.
Armstrong Co. have many other models of equal interest, please write for catalogue.
Armstrong Manufacturing Co., Warliters Rd., Holloway, Loudon, N.5.

NEW LOUDSPEAKERS

3,000 Speakers, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

RADIO CLUBS & 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.

ASHTON-UNDER-LYNE AND DISTRICT AMATEUR RADIO SOCIETY

Headquarters: 17a, Oldham Road, Ashton-under-Lyne.
Hon. Sec.: K. Gooding (G3PM), 7, Broadbent Avenue, Smallshaw, Ashton-under-Lyne.
Meetings: Wednesdays, 8 p.m., and Sundays, 2.30 p.m.

THERE was quite a good rally of members and friends at a recent meeting when the R.S.G.B. National Field Day Film was shown. The arrangements for the projection were ably carried out by a real old-timer in Mr. Leslie Gordon (ex G6ZY) who now devotes his spare time to photography. Later in the evening Mr. Gordon gave an entertaining impromptu talk when he compared the modern amateur equipment with that of 20 years ago. Appropriate "cine" music was provided by an audio-amplifier and records loaned by Mr. C. Noke (G6DV).

At the same meeting Mr. J. Partington (G5PX), the President, outlined the society's future programme which includes the construction of a Steel-wire Audio Recorder.

In view of the fact that most of the members are now building superhet receivers, Messrs. W. P. Green (Chairman) and J. Cropper (G3BY—Treasurer), have arranged to collaborate in a series of lectures dealing with superhet principles and design.

SLOUGH AND DISTRICT SHORT-WAVE CLUB

Headquarters: Toc H Headquarters, High Street, Slough (above Messrs. Lilley and Skinner's Shop).
Hon. Sec.: K. A. Sly, 16, Buckland Avenue, Slough.
Meetings: Alternate Thursdays at 7.30 p.m.

THE last meeting was held at the club's new headquarters at the address given above.

The meeting opened with a discussion of short-wave conditions, particularly the recent sun-spot activity and its effects upon reception. Mr. Hine, research group organiser, presented a selection of very interesting graphs which he had drawn to show the signal strengths and fading times on WGEA and WGEO for the same time G.M.T. each evening for several months past. The co-relation shown between the curves was examined by all the members and they remarked upon the similarity between readings taken on signal strength and fading. Mr. K. Sly also showed some highly interesting graphs on the same two stations and these compared very favourably with those of Mr. Hine.

Mr. Baldwin (2BWV) demonstrated the new superhet which he has just built and many stations were received at good volume; members suggested alterations and improvements for which Mr. Baldwin thanked them.

Morse practice was then held with Mr. J. Gilbert (2DDG) at the key. Mr. Gilbert is one of the many members with the Forces and received a particular welcome since he was the founder-of the club.

The more members we can obtain the greater shall we be able to enlarge the scope of our meetings. Members of His Majesty's Forces will be welcome at all times, and will be enrolled as honorary members. The subscription is 2s. 6d. annually and 3d. per meeting to cover the cost of hire of room.

ROBERT BLAIR RADIO SOCIETY

Headquarters: L.C.C. Evening Institute, Blundell Street, Islington, N.7.
Hon. Sec.: W. Jennings, 82, Craven Park Road, London, N.15.

THE above society met again on April 4th, and a series of interesting lectures on the Outline of Wireless has been planned by Mr. E. W. A. de Kretser, our technical instructor. An up-to-date test bench which includes a cathode-ray oscillograph is available for the full use of its members.

A morse code section, which proved very successful last term, will also be carried on, and beginners are especially welcome.

All inquiries should be addressed to Mr. H. Shelton, 5, Gordon House, King's Cross, N.1.

ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Assist. Sec.: H. G. Holt, M.P.S., 5, Butts Green Road, Hornchurch.

THE Romford and District Radio Society resumed Tuesday evening meetings as before at the Red Triangle Club, on April 2nd, 1940, at 7.45 p.m.

This was the annual general meeting and all the retiring members were re-elected unanimously.

New members are welcome and any inquiries should be addressed to Mr. H. G. Holt, 2DXI, at the above address, who as assistant secretary for the duration will give any help that may be required.

PUBLIC APPOINTMENTS

AIR MINISTRY.
AERONAUTICAL INSPECTION DIRECTORATE. Vacancies exist for unestablished appointments as Examiners in the General Engineering, W/T and Instrument Branches.
QUALIFICATIONS.
All candidates must have good general education, be able to read drawings, understand specifications, use micrometers and other measuring instruments.
(a) Applicants for the General Engineering Branch must have had practical experience in an engineering works. An elementary knowledge of materials testing is desirable.
(b) Applicants for the Instrument Branch must have knowledge of physics and training in light engineering or instrument making. Candidates with knowledge of optical instruments are also required.
(c) Applicants for the W/T Branch must have practical knowledge of W/T and electrical equipment with technical training in radio communication equal to City and Guilds final examination standard.
ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three calendar months, and will be paid £3 10s. 0d. weekly during training. Subsistence allowance of £1 5s. 0d. weekly during training is payable to married men normally residing outside the training area. On successful completion of training, candidates will be appointed as Examiners at a salary of £246, if 25 years of age or over, with a corresponding reduction of £12 per annum for each year under 25 on joining (payable monthly in arrear) if service is satisfactory, and must be prepared to serve in any part of the United Kingdom.
NORMAL age limits 23 to 60.
CANDIDATES should indicate on their applications for which vacancy they wish to be considered—a, b or c.
APPLICATIONS must be made on Form 786, copies of which can be obtained on application, *by postcard only*, to: The Inspector-in-Charge, A.I.D. Training School (I.G.S./REC. 53), Brandon Steep, Bristol, 1.

RADIO MAP AND GLOBE

WEBB'S Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6. Limited supply on Linen, 10/6. WEBB'S Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post Paid, 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

RECEIVERS AND COMPONENTS

COULPHONE Radio, Grimshaw Lane, Ormskirk. 1940 Collaro A.C. Gramophone Motors 12" turntable, 27/6. Radiogram units, 45/-. American Valves, all types, 4/6. Octal, 5/6. Record F.W. Rectifiers, 5/6. Stamp for list.

5/- BARGAIN PARCEL comprising Speaker Cabinet, 2 Drilled Chassis, condensers, resistances and many other useful components. Worth £2. Limited number. Postage 1/-.—Bakers Selhurst Radio, 75, Sussex Road, South Croydon.

VAUXHALL.—All goods previously advertised are still available; send now for latest price list, free.—Vauxhall Utilities, 163a, Strand, W.C.2.

BANKRUPT Bargains. Brand new 1939/40 models, makers' sealed cartons, with guarantees, at less 40% below listed prices; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 201-3, Lichfield Road, Aston, Birmingham.

TRANSFORMERS for L.T. Rectifiers for charging and safety, 12v. lighting, from 12/6.—Thompsons, 176, Greenwich High Road, S.E.10.

SOUTHERN Radio's Bargains.
ALL Guaranteed. Postage Extra.
5/- Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.
15/- Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7", 15/- the Kit.
21/- Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.
5/- 100 Wire-end Resistances, assorted capacities. ½ and 1 watt, 5/- per 100.
ORMOND Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.
2/- Tool or Instrument Carrying Cases, ex Government Stock; Wood, 9" x 7" x 7", 2/-.
SOUTHERN Radio, 46, Lisle Street, London, W.C. Gerrard 6653.

RECEIVERS AND COMPONENTS

RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE : HOLborn 4631.

COMPLETE KIT of parts to build Lissen Hi Q Battery Short-wave receiver. 5-91 metres switched. Brand new goods boxed, with circuit and instructions. Listed, £4/15/-. Our price, **£1/19/11** less valves.

ALL-WAVE super-het. chassis, 5 valve A.C. Latest Mullard valves: T.H.4.B., V.P.4.B., T.D.D.4, Pen A.4, L.W. 4/350v. Ranges: Short-wave, 16-48 metres. Med.-wave, 200-560 metres. Long-wave, 800-2,200 metres. Size of Chassis: 14½" long, 7½" deep. Height overall, 8½". Controls tuning at side, volume on/off at side, wave change. Provision for pick-up. Complete with valves and knobs, **£4/17/6.** Special speaker, 1,500 ohms field, **10/6** each.

L.F. transformer. Lissen Hi Q. Ratio .3-1. High grade, boxed. List 6/-. Our price, **2/3** each.

H.F. choke. Lissen Hi Q. Compact disc type with feet. Boxed. List, 2/6. Our price, **6d.** each.

ULTRA-SHORT and short-wave choke. Lissen Hi Q. Inductance 100 microhenries. Boxed. List, 2/-. Our price, **1/-** each.

ULTRA-SHORT and short-wave double-wound low-resistance choke. Lissen Hi Q. Resistance less than .05 ohms. Boxed. List, 2/6. Our price, **1/3** each.

LOW-LOSS Ceramic valve-holders. Lissen Hi Q. Base-board and chassis. 5- and 7-pin., **10d.** and **1/-** each.

MANSBRIDGE type condensers. Lissen Hi Q. 250 D.C. working. Moulded case with feet. .1 mfd. and 1 mfd., **6d.** each.

ROTARY coil unit. Lissen Hi Q. Four-band from 4.8-91 metres, can be selected by a turn of the knob. With circuit. Boxed. List, 15/6. Our price, **6/11.**

LOW-LOSS short-wave variable condensers. Ceramic insulation. Brass vanes. Lissen Hi Q. Minimum capacity 5 micro-micro farads. Two types. Boxed, with knobs. 160 m.mfd. List, 7/6. Our price, 3/6 each. 20 m.mfd. List, 5/6. Our price, **2/11** each.

MICA condensers, Lissen. New. Boxed. All useful sizes, OUR selection. **1/3** per dozen.

SPEAKER cabinets, finished black rexine. Circular face. Metal grille. Size 8½" x 9½" x 4½", **4/6** each.

SCREENED 3-way flexible, 4 yards for **1/6.**

MEDIUM- and long-wave coil units, with valve-holders and sundry resistances, **9d.** each. (No circuit.)

MIXED tubulars, wire-ends. OUR selection, **2/6** per dozen.

4-PIN base-board valve-holders. Lissen. 2 for **3d.**

4-1 L.F. transformers. Lissen. Boxed. **2/6** each.

CONE speaker unit. Lissen. Complete with reed and chuck. Boxed. **1/-** each.

SPAGHETTI resistances. Lissen. Many useful sizes. OUR selection, **1/3** doz.

4-PIN valve adapters. Lissen. **6d.** each.

PUSH-PULL switches. Lissen. 2-point, **4d.** each. 3-point, **6d.** each.

RICE-KELLOGG SENIOR 12" moving-coil speakers, 20 watts. Field 1,000 ohms. 11 ohms speech coil. Without speech transformer, **32/6** each. With transformer tapped 3,000 ohms and 7,000 ohms, **35/-** each.

GRAMPIAN 10" 10-watt, 2,500 ohms energised speakers. Heavy cast frame, **15/-** each. With heavy-duty pentode speech transformer, **17/6** each.

HEAVY-DUTY speech transformers. Pentode matching, **2/11** each.

2-GANG straight condensers. Plessey. **1/6** each. Ditto, 3-gang, **2/-** each.

ROLA P.M. speakers. Latest type 7½" cone with pentode transformer. Boxed. **14/6** each.

CLOCK-FACED dials. 5" x 3½". With printed 3-wave scale. Ox-copper escutcheons and glass, **3/6** each. Ditto, less escutcheon, 2/6 each.

HORIZONTAL dials, with plain scale. 7½" x 3½" and pointer, **1/-** each.

FILAMENT transformers, input 200-250v., output 4v. 4 amps., 4v. 6 amps., **4/11** each.

MAINS transformers, Plessey, 350-0-350v., 90 m.a., 4v., 2.5 amps., 4v., 6 amps., **8/6** each.

MAINS transformers. G.E.C. American windings, 350-0-350v., 65 m.a., 5v. 2 amps., 6.3v. 2.5 amps. Suitable for replacements in G.E.C. models, **5/6** each.

MAINS transformers. Wearite. Type R.C.1, 250-0-250v., 80 m.a., 4v. 2.5 amps., 4v. 4 amps., **9/11** each. Type R.C.2, 350-0-350v., 120 m.a., 4v. 2.5 amps., 4v. 4 amps., **12/6** each. Type R.C.3, 350-0-350v. 150 m.a., 4v. 2.5 amps., 4v. 2 amps., 4v. 5 amps., **15/-** each. Type R.C.4, 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.6 amps., **21/-** each. All the above centre-tapped windings. Type R.C.5, 100-watt auto transformer, 100-110v., 200-250v., reversible, **12/6** each. Type R.C.B., 350-0-350v. 80 m.a., 5v. 2 amps., 6.3v. 5 amps., **8/11** each. All transformers 200-250v. tapped primaries.

(Continued in column 3.)

PREMIER RADIO

MORSE PRACTICE KEYS.—Brass movement on Bakelite base, **3,3.** General purpose Morse keys, smooth action, heavy contacts, **5/10.**

HEAVY DUTY TX KEYS.—Tungsten contacts, heavy cast base with brass movement, **10/-.**

BUZZERS, high-pitched, in Bakelite Base, **1/9.**

Special Offer of Record Auto-Changer Units for A.C. Mains by famous manufacturer. Play 8 records. Latest type Magnetic Pick-up, Auto-stop, Start and Rejector. Limited number only at **£4/19/6,** Carriage Paid.

PREMIER SHORT-WAVE KITS for OVERSEAS NEWS

Incorporating the Premier 3-Band S.W. Coil. 11-86 Metres without coil changing. Each Kit is complete with all components, diagrams, and 2-volt valves. **3-Band S.W. 1-Valve Kit, 14/9. 3-Band S.W. 2-Valve Kit, 22/6.**

DE LUXE S.W. KITS

Complete to the last detail, including all Valves and coils, wiring diagrams and lucid instructions for building and working. Each Kit is supplied with a steel Chassis and Panel and uses plug-in Coils to tune from 13 to 170 metres.

1 Valve Short-Wave Receiver or Adaptor Kit	**20/-**
1 Valve Short-Wave Superhet Converter Kit	**23/-**
1 Valve Short-Wave A.C. Superhet Converter Kit	**26/3**
2 Valve Short-Wave Receiver Kit	**29/-**
3 Valve Short-Wave Screen Grid and Pentode Kit	**68/-**

REPLACEMENT VALVES FOR ALL-SETS

EUROPA MAINS VALVES. 4 v., A.C. Types, **A.C./H.L., A.C./L., A.C./S.G., A.C./V.-M.S.G., A.C./H.P., A.C./V.H.P. (5-pin),** all 5/3 each. **A.C./H.P., A.C./V.H.P. (7-pin), 7/6 ; A.C./Pens-I.H., 7/6 ; A.C./P.X.4, 7/3 ; Oct. Freq. Changers, 8/6 ; Double Diode Triodes, 7/6 ; 350 v. F.W. Rect., 5/6 ; 500 v. F. W. Rect., 6/6 ; 13 v. .2 amps. Gen. Purpose Triodes, 5/6 ; H.F. Pens and Var.-Mu H.F. Pen., Double Diode Triodes, Oct. Freq. Changers, 7/6 each. Full and Half-Wave Rectifiers, 6/6 each.**

TRIAD HIGH-GRADE U.S.A. VALVES, all types in stock. Standard tubes, 5/6 each. Octal Base tubes, 6/6 each.

HUGE PURCHASE OF U.S.A. MAINS TRANS-FORMERS at Pre-War Prices. Manufacturers' surplus. All brand new and Guaranteed. **Input 110 v. and 220 v. A.C. Output 325-325 v., 120 m.a. 6.3 v., 2-3 amps., 5 v. 2 amps., C.T., 7/6 each. Input 230 v. A.C. Output 325-325 v., 75 m.a., 5 v. 2 amps., 6.3 v. 2-3 amps. C.T., 6/6 each. Input 100-250 v., 300-300 v. 60 m.a. 4 v. 5 a. C.T., 4 v., 1 a., 6/11.**

PREMIER BATTERY CHARGERS for A.C. Mains. Westinghouse Rectification complete and ready for use. To charge 2 volts at ½ amp., **11/9** ; 6 volts at ¼ amp., **12/-** ; 6 volts at 1 amp., 22/6 : 12 volts at 1 amp., **24/6** ; 6 volts at 2 amps., **37/6.**

Class B Kits, comprising Driver Transformer, Class B Valve and Holder. Complete with circuit, **11/6.**

Premier Pick-up Heads. Will fit any tone-arm, **5/3.**

ANOTHER SPECIAL OFFER. Piezo Xtal Pick-ups. With arm. Famous make. Output 1.7 v. Response 40-8,000 cycles, **35/-.**

MOVING COIL SPEAKERS. All complete with Output Transformer. Rola 6in. P.M.'s, **12/6** ; 8in. P.M.'s, **16/6** ; 10in. P.M.'s, **22/6** ; G12 P.M.'s, **66/-.** Energised Models. Plessey, 8in., 2,500 or 7,500 ohm field, **7/6** ; 750 ohm field, **7/6** ; G12 Energised, **59/6.**

PREMIER Short-Wave Condensers all-brass construction, with **Trolitul** insulation. 15 mmf., **1/9** ; 25 mmf., **1/10** ; 40 mmf., **2/-** ; 100 mmf., **2/3** ; 160 mmf., **2/7** ; 250 mmf., **2/11.**

PREMIER SHORT-WAVE COILS, 4- and 6-pin types, 13-26, 22-47, 41-49, 78-170 metres, **2/-** each, with circuit. Special set of S.W. Coils, 14-150 metres, **4/9** set, with circuit. Premier 3-band S.W. coil, 11-25, 19-43, 38-86 metres. Suitable any type circuit, **2/11.**

Coil Formers, 4- and 6-pin, plain or threaded, **1/2** each.

UTILITY Micro Cursor Dials. Direct and 100 : 1 Ratios, **4/3.**

LISSEN Dual Range Screened Coils, medium and long waves, **2/9** each.

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RECEIVERS AND COMPONENTS

(Continued from column 1.)

CHASSIS mounting valve-holders, American 4-5-6- and 7-pin. 4d. each. Octals, 6d. each. Loctals, 10d. each. 7-pin English type, 3d. each.

1 WATT resistances, Polar N.S.F. 4d. each, 3/9 dozen. All sizes up to 2 meg.

WEARITE 110 k/c I.F. transformers, **1/-** each.

VOLUME controls. American C.T.S., finest made, divided spindles. Length 2½". With switch, 2,000, 5,000, 10,000, 25,000, 100,000, 250,000, 500,000, and 1 meg., 2/6 each. Wire wound, 5 watt (less switch), 2,000, 5,000, 10,000, 20,000, and 25,000 ohms, 2/- each.

24 MFD. can type, electrolytics, 450v. working, **1/-** each.

B.I. wire-end type bias electrolytics. 50 mfd., 12v., 1/6 each ; 50 mfd., 50v., 2/- each.

TUBULAR wire-end non-inductive paper condensers. All sizes up to 0.1, 5d. each, 4/9 dozen.

ENERGISED speakers, Plessey 6" cone, 1,500 ohms field, **5/11** each.

BATTERY output pentode valves. Well-known make, **3/11** each.

BATTERY double diode triode. Well-known make. **3/6** each.

RAYTHEON first-grade valves. Largest stockists, all types in stock, including glass series, glass octal series, metal series, bantam series, single-ended series, and resistance tubes, all at most competitive prices; send for valve lists. All orders must include sufficient postage to cover. Hours of business: 9 a.m.-6 p.m. weekdays. Saturday, 9 a.m.-1 p.m. Please write your address in block letters.

RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE : HOLborn 4631.

B.I. 4 mfd. Resin Oil-filled Condensers, 450v. working, 2/3 each ; .1 mfd., .25 mfd. 1,000v. working, 2/3 each.

NEW 1/16 h.p. Induction Motors, 220 A.C., 1,430 Revs., Ball Bearings, 25/- ; Townsend Buzzers, H.F. Buzzers, 4½v. to 10v., 3/6 ; Cossor Valves, 210 H.F., 210 Detector, 2/3 ; Microphone Carbon Inserts, 1/3. Microphone 80-1 Transformers 1/9. Tapped Resistance 550 ohms 2/9. 350 ohms 2/3.
London Central Radio 23, Lisle Street, W.C.2. Gerrard 2969.

TECHNICAL PUBLICATIONS

R.S.G.B. AMATEUR RADIO HANDBOOK, 300 pages, 3s., by post.—16, Ashridge Gardens, London, N.13.

SHORT-WAVE EQUIPMENT

"H.A.C." one-valve Short-wave Receiver, famous for over 5 years, now available in kit form ; complete kit of precision components, accessories, full instructions, 12/6, post 6d., no soldering necessary ; descriptive folder free on request.—A. L. Bacchus, 109, Hartington Road, S.W.8.

BULGIN AC/DC S.W. Converter, 10 to 240 metres Complete valves £3 10 0 ; bargain.—Coates, 5, Park Terrace, Whitby, Yorkshire.

TUITION

PRACTICAL Postal Courses, radio television, test equipment design, trade-test coaching for R.A.F. posts, I.P.R.E. and I.W.T. exams. ; booklet free.—Secretary, I.P.R.E., 3, Shirley Road, London, W.4.

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Practical Wireless and PRACTICAL TELEVISION

3D.

EVERY WEDNESDAY

April 27th, 1940.

Edited by F. J. CAMM

Vol. 16. No. 397.

Contents

THE SHORT-WAVE FOUR

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 65

AMPERE-HOUR.—This unit, chiefly used in connection with accumulators, is equal to 1 coulomb per second for 3,600 seconds, or 3,600 coulombs.

AMPERE TURNS.—The number of turns in the coils of an electromagnet, multiplied by the current flowing through them.

INTERNATIONAL AMPERE.—The current which, when passed through a solution of nitrate of silver in water, deposits silver at the rate of .00111800 gramme per second.

INTERNATIONAL OHM.—The resistance offered to a current by a column of mercury at the temperature of melting ice, 14.4521 grammes in mass, of a constant cross-sectional area, and of a length of 106.3 centimetres.

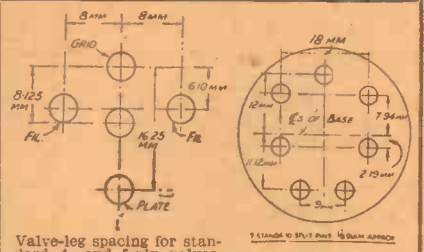
INTERNATIONAL VOLT.—The electrical pressure which causes 1 international amp. of current to flow when applied to a conductor having a resistance of 1 international ohm.

INTERNATIONAL WATT.—The energy used in 1 second by an international ampere when flowing at a pressure of 1 international volt.

LIGHT, SPEED OF.—Light waves travel at 186,000 miles per second. This speed is also that of wireless waves.

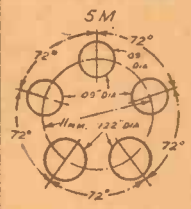
SOUND, SPEED OF.—Sound waves travel 1,142 feet per second.

No. 66

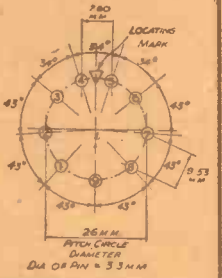


Valve-leg spacing for standard 4- and 5-pin valves. The diameter of the valve pins is 3.2 mm.

Valve-leg spacing for 7-pin valves.



The two diagrams above show the valve-leg spacing for the Hivac Midget valves.



Valve-leg spacing for 9-pin valves.

No. 67

POWERS AND ROOTS

No.	Squares.	Cubes.	Square Roots.	Cube Roots.
1	1	1	1.000	1.000
2	4	8	1.414	1.260
3	9	27	1.732	1.442
4	16	64	2.000	1.587
5	25	125	2.236	1.710
6	36	216	2.449	1.817
7	49	343	2.646	1.913
8	64	512	2.828	2.000
9	81	729	3.000	2.080
10	100	1 000	3.162	2.154
11	121	1 331	3.317	2.224
12	144	1 728	3.464	2.289
13	169	2 197	3.606	2.351
14	196	2 744	3.742	2.410
15	225	3 375	3.873	2.466
16	256	4 096	4.000	2.520
17	289	4 913	4.123	2.571
18	324	5 832	4.243	2.621
19	361	6 859	4.359	2.668
20	400	8 000	4.472	2.714
21	441	9 261	4.583	2.759
22	484	10 648	4.690	2.802
23	529	12 167	4.796	2.844
24	576	13 824	4.899	2.884
25	625	15 625	5.000	2.924
26	676	17 576	5.099	2.962
27	729	19 683	5.196	3.000
28	784	21 952	5.292	3.037
29	841	24 389	5.385	3.072
30	900	27 000	5.477	3.107
31	961	29 791	5.568	3.141
32	1 024	32 768	5.657	3.175
33	1 089	35 937	5.745	3.208
34	1 156	39 304	5.831	3.240
35	1 225	42 875	5.916	3.271

No. 68

POWERS AND ROOTS (*continued*)

No.	Squares.	Cubes	Square Roots.	Cube Roots.
36	1 296	46 656	6.000	3.302
37	1 369	50 653	6.083	3.332
38	1 444	54 872	6.164	3.362
39	1 521	59 319	6.245	3.391
40	1 600	64 000	6.325	3.420
41	1 681	68 921	6.403	3.448
42	1 764	74 088	6.481	3.476
43	1 849	79 507	6.557	3.503
44	1 936	85 184	6.633	3.530
45	2 025	91 125	6.708	3.557
46	2 116	97 336	6.782	3.583
47	2 209	103 823	6.856	3.609
48	2 304	110 592	6.928	3.634
49	2 401	117 649	7.000	3.659
50	2 500	125 000	7.071	3.684
51	2 601	132 651	7.141	3.708
52	2 704	140 608	7.211	3.733
53	2 809	148 877	7.280	3.756
54	2 916	157 464	7.348	3.780
55	3 025	166 375	7.416	3.803
56	3 136	175 616	7.483	3.826
57	3 249	185 193	7.550	3.849
58	3 364	195 112	7.616	3.871
59	3 481	205 379	7.681	3.893
60	3 600	216 000	7.746	3.915
61	3 721	226 981	7.810	3.936
62	3 844	238 328	7.874	3.958
63	3 969	250 047	7.937	3.979
64	4 096	262 144	8.000	4.000
65	4 225	274 625	8.062	4.021
66	4 356	287 496	8.124	4.041
67	4 489	300 763	8.185	4.062
68	4 624	314 432	8.246	4.082
69	4 761	328 509	8.307	4.102

No. 69

POWERS AND ROOTS (*continued*)

No.	Squares.	Cubes.	Square Roots.	Cube Roots.
70	4 900	343 000	8.367	4.121
71	5 041	357 911	8.426	4.141
72	5 184	373 248	8.485	4.160
73	5 329	389 017	8.544	4.179
74	5 476	405 224	8.602	4.198
75	5 625	421 875	8.660	4.217
76	5 776	438 976	8.718	4.236
77	5 929	456 533	8.775	4.254
78	6 084	474 552	8.832	4.273
79	6 241	493 039	8.888	4.291
80	6 400	512 000	8.944	4.309
81	6 561	531 441	9.000	4.327
82	6 724	551 368	9.055	4.344
83	6 889	571 787	9.110	4.362
84	7 056	592 704	9.165	4.380
85	7 225	614 125	9.220	4.397
86	7 396	636 056	9.274	4.414
87	7 569	658 503	9.327	4.431
88	7 744	681 472	9.381	4.448
89	7 921	704 969	9.434	4.465
90	8 100	729 000	9.487	4.481
91	8 281	753 571	9.539	4.498
92	8 464	778 688	9.592	4.514
93	8 649	804 357	9.644	4.531
94	8 836	830 584	9.695	4.547
95	9 025	857 375	9.747	4.563
96	9 216	884 736	9.798	4.579
97	9 409	912 673	9.849	4.595
98	9 604	941 192	9.899	4.610
99	9 801	970 299	9.950	4.626
100	10 000	1 000 000	10.000	4.642

No. 70

TRIGONOMETRICAL EQUIVALENTS

Sine = $\sqrt{1 - \text{Cos}^2}$ — Cosecant = 1 ÷ Sin.
Sine = 1 ÷ Cosec. — Tangent = 1 ÷ Cotan.
Sine = Cos ÷ Cotan. — Tangent = Sin ÷ Cos.
Sine = Tan ÷ Sec. — Cotangent = 1 ÷ Tan.
Cosine = $\sqrt{1 - \text{Sin}^2}$ — Cotangent = Cos ÷ Sin.
Cosine = 1 ÷ Sec. — Versine = 1 — Cos.
Cosine = Sin × Cotan. — Coversine = 1 — Sin.
Cosine = Sin ÷ Tan. — 1 = Tan × Cotan.
Secant = 1 ÷ Cos. — 1 = $\text{Sin}^2 + \text{Cos}^2$.
Secant = Tan ÷ Sin. — Secant^2 = $1 + \text{Tan}^2$.

TRIGONOMETRICAL FUNCTIONS

RIGHT-ANGLED TRIANGLES
(See Fig. 2.)

Sec A = $\frac{b}{c}$ = $\frac{c}{a}$ — Tan A = $\frac{a}{c}$ = $\frac{c}{a}$
Cosec A = $\frac{b}{a}$ — Cotan A = $\frac{a}{c}$ = $\frac{c}{a}$
Sin A = $\frac{a}{b}$ — Coversin A = $\frac{b - c}{b}$ = $\frac{a}{b}$
Cos A = $\frac{c}{b}$
Versin A = $\frac{b - c}{b}$

(See also page 144)

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Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Short-wave Efficiency

AS most short-wave enthusiasts will have found, a simple receiver depends for its efficiency upon the effectiveness of the reaction control. Many long-distance stations are only heard after reaction has been carefully adjusted, and in many receivers this may take a little time, the control being advanced, retarded, the set re-tuned and reaction again adjusted. Backlash and other troubles are often found to be the cause of complaints that short-wave working is not worth while, and therefore listeners who have experienced the above troubles should try suppressor-grid reaction on the lines recently mentioned in these pages. In this issue we give constructional details of a 4-valve receiver built round this type of circuit, and those readers who want a 4-valve set of the "straight" type for short-wave work will find many points of interest in it. When once the preliminary adjustments have been made, the receiver will be found to handle extremely well and will give results somewhat similar to a superhet. Of course, the power available and the range will not be comparable with a superhet, but the ease of control and the effectiveness of signal build-up will certainly make this a very useful receiver for all-round short-wave work.

Norwegian News

A SERVICE of news in Norwegian is now being broadcast from 6.30 to 6.45 p.m., B.S.T., until further notice. The service is given on the Home Service wavelengths of 391.1 and 449.1 metres, and is also broadcast regularly on the short waves normally used in the B.B.C.'s European Service as follows:

GSA—49.59 metres.
GSW—41.49 metres.
GRX—30.96 metres.

The programme for the Forces is unaffected.

Mr. Michael Standing

THE B.B.C. announces that Mr. Michael Standing has been appointed to take charge of the Outside Broadcasts Department in Mr. de Lotbinière's absence. As already announced, Mr. de Lotbinière has been appointed an acting Assistant Controller of Programmes. Mr. John Snagge, Assistant Director of Outside Broadcasts, who took charge of the B.B.C. Announcers' staff at the beginning of the war, will continue this work.

More Tricks of Dr. Goebbels

W. A. SINCLAIR'S sixth talk in the "Voice of the Nazi" series, in which he lays bare some tricks of the trade of the Nazi propagandists, will be repeated on April 27th. He will deal particularly with distortions of history by which Dr. Goebbels attempts to prove that British rule in Africa, India, Ireland and other parts of the world is, or has been, harsh and extortionate.

Josef Cherniavsky, WLW Musical Director, who is responsible for many interesting programmes heard over the N.B.C. network.

Symphonists' Holiday

THE Romantic Rhythmists, a combination gathered from members of the B.B.C. Scottish Orchestra who wish to take a "holiday" from symphony music, will be broadcasting a programme of their dainty arrangements of jazz and novelty numbers on April 25th. Among their items will be "Harlem," which the composer, Eddie Carroll, uses as his signature tune; a new number by Whitley, "Parakeet's Picnic"; and "Chinatown."

"Stage Door"—1

ERNEST LONGSTAFFE is to present the first of a new series of slapstick shows called "Stage Door" on May 8th, which will feature the famous crazy act, the O'Gorman Brothers. The production, which will be in the "Keystone" tradition, will be concerned with the precarious fortunes of a highly improbable music-hall. During the course of the series, the O'Gorman Brothers will be goaded by a truculent and absurdly ignorant manager to run the place, more or less. In fact, they will do everything from appearing at the top of the bill to scene-shifting and sweeping the auditorium. The O'Gorman Brothers, one of the best-known acts of their kind on the halls, are at present appearing with Arthur Askey and Billy Bennett in "Jack and Jill," at Birmingham.

"Night Workers"

THE war has been responsible for a great increase in the number of night workers, and on April 30th, Nan Davies will produce a feature programme which will give listeners an idea of the manifold activities which go on in the cities and villages by night. The programme, which will be partly recorded, will cover town and country and seaport.

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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, *George Newnes, Ltd., Tower House, 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.

For the Beginner

VALVE TYPES EXPLAINED—2

Further Notes to Assist Beginners to Understand the Function of Various Types of Valves

By L. O. SPARKS

IN addition to impedance and amplification factor, which were dealt with in the issue of last week, there is another governing item, namely *grid bias*, with which the beginner must become familiar as it forms an essential part of valve operation. At a later date, when the reader has acquired more technical knowledge, the question of characteristic curves can be discussed, and the function of applying additional negative bias to the grid depicted in graphical form, but as these articles are avoiding all technicalities as far as possible, a more practical explanation will be given. It must be appreciated, however, that with such an explanation a certain latitude has to be allowed: the details are not necessarily accurate in all the finer technical points, but if a working knowledge of the idea is obtained, then the liberty taken in the comparisons or descriptions will be warranted.

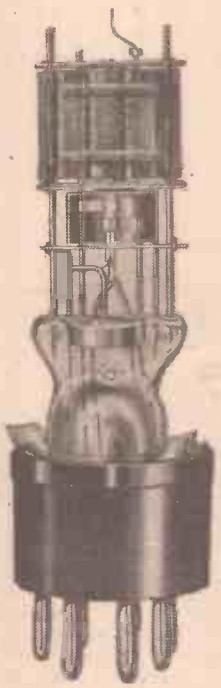
When reading the specification of a valve, especially those designed for L.F. work, it will be seen that certain values are given for *grid volts* or *grid bias*. "What do these figures indicate and why must bias be applied?" is quite a common question.

An Analogy

Supposing two people of equal weight are sitting on the ends of an ordinary see-saw. Assuming everything to be in order, they will have to expend very little energy to maintain a smooth up and down motion. If they do not put too much energy into it no violent bumps or jars will be experienced by either of the persons, but if they suddenly decide to do more work by putting more power into their legs, then things will become very unsettled. The movement will no longer be smooth and pleasant. It will become rather erratic and violent bumps will be experienced which, in turn, will tend to increase the unevenness of the movement until things become unbearable.

Let us now replace the see-saw with a valve, the smooth movement with faithful reproduction of a signal, and, finally, the very unpleasant bumpy movement with distortion. A valve, like the see-saw, has to operate about a certain point, that is, above and below some point which is predetermined by operating conditions. In the case of the see-saw, the point is the support over which the board is rested, and the operating conditions can be the height of the point above ground level, the energy the persons put into the game, and the distance they are from the supporting point. With a valve, you must at this stage imagine that this point exists. It does, as you will find out; in fact, it is referred to as the *operating point* of a valve. The up and down is accounted for when it is realised that the signal passing through the valve is of an *alternating current* nature or, in other words, a current which changes its direction of flow alternatively for a given period of time, but more about that later.

To maintain suitable conditions which will allow a valve to operate about this point, certain factors have to be observed. For example, the type of valve, i.e., its characteristics, the value of the positive voltage applied to its anode, the strength of the incoming signal, and, finally, the potential (voltage) of the grid. For the simplest form of L.F. amplification, it is desirable that the movement or operation above the point should equal the movement below the point, but if operating conditions are not just so, then it is possible for the movements to be unequal, and when this happens, then the signal is no longer reproduced in a faithful manner and distortion is introduced. It will be obvious



A very good example of the precision work involved in the design and assembly of a modern multi-electrode type of valve.

that the movement will depend on the strength of the signal; the movement—which I think we could now give its more correct name, namely, *swing* or *grid swing*—will be far greater in the output valve of, say, a three-valver than in the detector valve. From these details it becomes apparent that the operating point must be adjustable if distortion is to be avoided, and in actual operation this is made possible by altering the grid voltage or, in other words, the *grid bias*.

As the biasing controls the position of the operating point, and in view of the up and down process, it can be taken that the *signal voltage* the valve will handle will be equal to twice the applied bias voltage, it also follows that the more powerful the signal the greater will have to be the value of the bias, other conditions being correct for the type of valve concerned. The anode current of a valve, and this is a point which interests all those who have to use dry batteries for high-tension purposes, is also governed by grid bias, which, it should be remembered, is negative in the majority of valve circuits. The following brief explanation will make this statement more clear. When the filament of a valve is heated, due to the current passing through it from a suitable low-tension accumulator, it emits what are known as *electrons*. If the electrons remain in a state of rest, then they are nothing more than electrons, but if they can be set on the *move*, then they constitute what everyone now knows as an *electric current*. In a valve, where a partial vacuum exists, the electrons fly off the filament into space. Fortunately, however, there is a little law which tends to govern their activities and it can be best put in this manner. "An electron is *negative* by nature or characteristic, and does not experience any attraction from other electrons, but it is violently attracted to any body which is of *unlike* characteristic, namely, *positive*." This weakness is exploited in a valve by providing an anode which is maintained at a *positive potential* with respect to the filament by means of a suitable source of high-tension. This can be checked by examination of any valve circuit diagram. The fact that the anode is positive attracts the electrons as they leave the filament, causing them to flow between the two parts in the valve and thus cause an electric current, the presence of which can be proved by connecting a milliammeter in series with the anode.

Grid Bias

With a triode valve, it will be remembered that a third electrode was introduced, in the form of the grid between the filament and the anode. Now the current just explained will have to flow through the grid on its way to the anode, so if the grid is made negative by means of the grid voltage, then it will have the effect of *retarding* the flow of electrons and consequently reduce the total number which reach the anode, which, in turn, will lower the resultant anode current.

This effect of grid-bias voltage on the anode current should be noted and remembered, as it is absolutely essential for the beginner to appreciate that unless the grid of a valve is maintained at its *correct grid voltage* for a given anode high-tension value, excessive anode current will flow which will tend to *reduce* the *life* of the valve and the H.T. battery. It is for this reason that no adjustments should be made to the G.B. tappings or connections, without first disconnecting the H.T. supply.

Extra L.F. Gain

Details as to Suitable Means for Improving the Output from an Existing Receiver

By W. J. DELANEY

ONE of the most often-repeated requests which are received by our Query Department is for details as to the simplest method of obtaining additional volume from an existing receiver. Unfortunately, it is not a simple matter to state definitely just what should be done in such circumstances, as there are several points to be considered. First, it is possible in most cases to add a single stage of L.F. amplification, but there are one or two points which have to be considered in this connection and which will determine the type of amplifier to add and what alterations, if any, must be made to the existing receiver. Secondly, it may be possible merely to replace an existing valve by one of another type and thereby obtain the desired improvement.

Take the case of a simple battery two-valver. This will undoubtedly utilise a standard L.F. valve in the output stage in order that maximum gain may be obtained with a triode. Therefore, if this is the case, the substitution of a pentode will no doubt deliver sufficient extra power in many cases. If, however, a pentode is employed, then it will not be desirable to add a further stage in the usual way, and a change-round will have to be undertaken.

Simplest Change

In the first case, the method of substituting a pentode is merely to replace an existing 4-pin valveholder by one of the 5-pin type, connect the extra terminal to H.T. positive maximum and plug in the pentode valve. It *may* be necessary to modify the grid-bias applied, but this may be seen by consulting the maker's data sheet for the valve in use. It *will* be necessary, however, if distortion is to be avoided and maximum output is to be obtained, to make a change in the connections to the loud-speaker, as a pentode requires a higher anode load than the standard L.F. or small-power valve, and therefore, if the speaker has a tapped transformer fitted to it, the connections should be changed so that "pentode" load is applied. If, however, the speaker does not have such a transformer, it may be desirable to obtain a new transformer so that the correct load may be applied.

If a pentode is already being used, the output should be sufficient to overload any other type of valve added *after* it, and, therefore, in that case if an additional valve is needed it must be placed between the existing detector and output stage. However, a simple L.F. amplifier may be built as described later and the desired position obtained by plugging into the existing output valve a small L.F. valve and then placing the pentode valve in the new amplifier.

L.F. Stage

There are two ways of building the L.F. extra stage. First, it may be made up as a small complete unit and connected to the existing 'phone or L.S. terminals, or it may be made on a small strip of wood or ebonite, fitted with a single plug and inserted into the existing output valveholder. This arrangement is much more compact and simple to add, but can only be effected if there is sufficient room available in the receiver for the additional unit. This latter scheme is illustrated in Fig. 2, and it will be seen that the strip of material must be large enough to accommodate two valveholders side by side, with space between them for small items such as R.C. components or a midget transformer. In most cases we recommend the R.C. components as these will avoid overloading difficulties and, if two transformers are employed, there is also a risk of some interaction resulting in distortion or other troubles. A plug should be mounted on the bottom of the strip and the position carefully worked out so that when inserted it will clear all other parts. The two valveholders should then be mounted side by side, and one of these may be a 5-pin type for a pentode if desired. The extra point is indicated by the broken lines. It will be noted that the filament terminals are linked together and the grid pin of the plug is joined to the 4-pin holder, or the first L.F. valve. The anode pin of the output valveholder is connected to the anode pin of the plug and the remaining connections are as shown. Thus when this small unit is plugged-in in place of the existing output valve, and the latter is inserted in one holder and a new valve in the output valveholder, the extra stage is automatically added. The advantage of this arrangement is that it is only the work of a second to remove the unit and replace the valve to restore the receiver to its original condition.

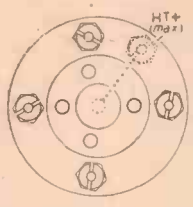


Fig. 1.—Most battery pentodes have the extra electrode joined to a centre pin. Thus only the change of a valveholder and the additional terminal joined to H.T.+ effects the necessary modifications when changing over to pentode.

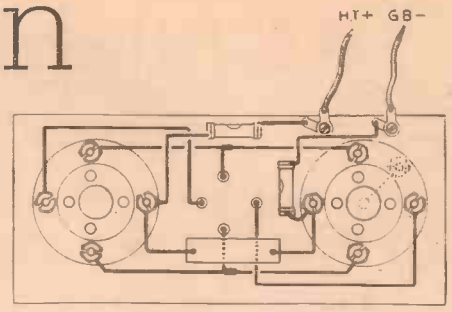


Fig. 2.—An add-on plug-in unit, giving additional amplification.

Extra Amplifier

If it is desired to build a small separate amplifier, the parts should be laid out as shown in Fig. 3. The baseboard need only be large enough to accommodate the valveholder and other parts, and although a small cabinet would be desirable to keep out dust, etc., it may be found possible to house the unit in some part of a cabinet if this is sufficiently large. The connections are clearly indicated, the input terminals being joined to the 'phone or L.S. terminals on the present receiver, and the speaker or 'phones transferred to the output terminals on the unit. The question of the H.T. and G.B. are dependent upon the valve in use, but in general the maximum H.T. should be applied to the unit, and a slightly lower voltage may be applied to the original output stage, that is, the positive terminal of the input pair. The question of the type of coupling is important. In most cases the existing receiver will incorporate a transformer, and therefore it is generally preferable to make the additional stage R.C. coupled

Changing the Couplings

If thought worth while the couplings may be changed round. If there are H.F. stages to the receiver it is generally desirable to make the R.C. coupling first so that the signal fed to the first L.F. valve, which will be of a small type not capable of handling too large a grid swing, will not be overloaded. It should be appreciated that any overloading in that stage will be amplified and fed to the output stage, thus giving rise to trouble which can only be cured by modifying the first stage.

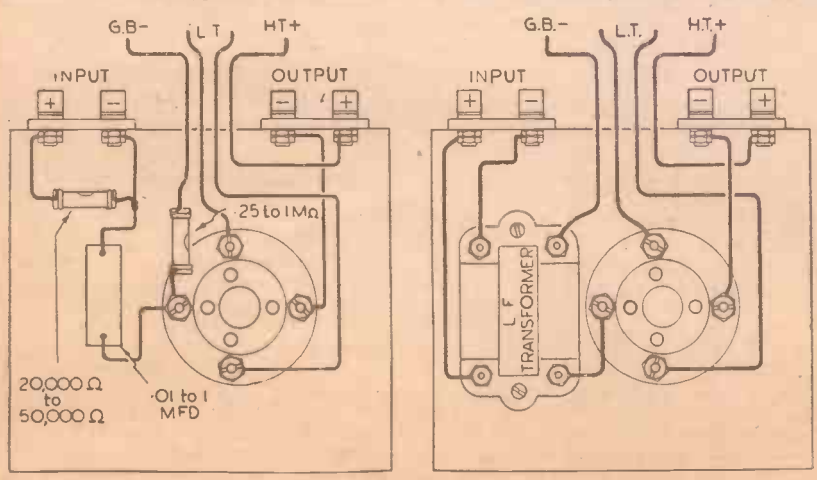


Fig. 3.—Two L.F. units—R.C. and transformer coupled. These are for battery operation.

Comment, Chat and Criticism

A Notable Centenary

Our Music Critic, MAURICE REEVE, Reviews the Life and Work of the Great Russian Composer Tschaikowsky

ON reading the critics of a recent concert I was recalled to the present topsy-turvydom of things by the announcement in one of them that Tschaikowsky was born exactly one hundred years ago. But for the war, the event would have been commemorated up and down the land, for no composer is listened to with greater rapture than this exotic Russian, and certain of his works have acquired a place in the concert repertoire second to none. Therefore it may not be inappropriate if I deal briefly with the facts of his life this week, and with his music next.

Peter Ilyich Tschaikowsky was born at Kamsko-Votinsk, in the then government of Vyatka, near Kazan, on May 7th, 1840. His father held a lucrative post as Inspector of Mines. His grandfather was a nobleman, whilst his great-grandfather fought at Poltawa, under Peter the Great. But Peter probably owes his music to his mother, who was French, and whose family emigrated to Russia after the French Revolution, and who would seem to have been the more artistically cultured of the two parents.

The family must have been pretty well off, as we learn that they had a large house, many servants, and a hundred Cossacks at their command. They moved to St. Petersburg in 1849, where the young master started lessons with one Philipow, though he had had his first lesson before he was five. A serious attack of measles left him so weak and with such grave nervous disorders that he was profoundly affected for the rest of his life.

Law Studies

A first intention to send him to the School of Mines was changed, and he went to the College of Jurisprudence instead. This entailed a separation from his family which he felt very keenly, and which his extreme nervous derangement accentuated. He was always passionately fond of his mother, and her death from cholera in 1854 filled him with a grief which he never really overcame. In fact, the inclusion in his last and greatest work, the Pathétique Symphony, of a fragment of the Russian Requiem is said to be autobiographical, in memory of her.

In 1859 his father for the second time lost his fortune through a too naïve trust in friends, but soon gained another good post as Director of the Technical Institute. Peter always found his law studies irksome and uncongenial, but graduated in spite of this handicap. He entered the Ministry of Justice as an official in 1859. He didn't display much originality or initiative in his job, and would seem to have spent his time chiefly in avoiding pitfalls and mistakes rather than exercising acumen and seeking advancement. He possessed a curious habit of chewing pieces of paper, and on one occasion swallowed a State document, which he somehow managed to get replaced. He appears to have had plenty of fun at this time, and not to have taken his job too seriously.

He had many masters, none of whom seem to have scented his genius for music in any way. The opportunities for studying the classics were very few in the Russia of that day. No Russian editions of them had yet been made, and most of the foreign ones were of a prohibitive price. Consequently it may not seem so incredible as it might sound at first hearing that young Tschaikowsky had never heard of Schumann, and that he was not supposed to have known exactly how many symphonies Beethoven actually wrote; however, he had a lifelong passion for Mozart, and he frequented the Italian opera, which was then very fashionable in St. Petersburg.

At St. Petersburg

In 1861 he entered the St. Petersburg Conservatoire, and he wrote to his brother Nicholas: "I may not be another Glinka, but I promise you that some day you will be proud to own me for a brother." He visited some foreign countries the following year and met the famous critic Laroche, who became a lifelong friend. His teacher of composition was the renowned pianist Anton Rubinstein, the Dean of the Faculty. Although, with a few exceptions, Rubinstein's compositions are "on the shelf" to-day, Tschaikowsky thought so highly of them as to actually prefer his "Ocean" symphony to Beethoven's ninth! The great pianist showed unlimited kindness to the young student, and the two were close friends for a few years.

Always a modernist, in spite of a lifelong worship of Mozart, Tschaikowsky never wrote for the classical orchestra. His conducting of Wagner, Liszt and Berlioz left little doubt where his tastes lay. But his likes and dislikes were weird and changed rapidly. His first work was called "The Storm," and was written for such things as tuba, harps, cor anglais, and divided strings, etc. He was far too nervous to show it to Rubinstein, and it only posthumously saw the light.

He always vowed he would never write certain classes of works against which he had youthful aversions. These included concertos for piano and orchestra, string quartets, and the type of small piece of which such writers as Chopin and Schumann were such consummate masters. But he only kept his word in one instance, sonatas for piano and violin.

After some "Peasant Girls" Dances he wrote a setting of Schiller's "Ode to Joy" for his passing-out examination. With greater prescience than most, Laroche expressed the opinion that "Tschaikowsky was the only hope of Russian music."

Professor of Theory

At this time Anton Rubinstein's brother, Nicholas, founded the Moscow Conservatoire, and Tschaikowsky moved there to take up a professorship of theory at a salary of 50 roubles per month. He was treated by Nicholas Rubinstein with the greatest kindness, and he even found such things as his laundry attended to. He entered an interesting circle which included the publisher Gurgensen, who brought out the first cheap edition of the great German classics, and who later acquired the copyright of most of his works.

He soon settled down in Moscow, and completed his first symphony, "Winter Dreams," 1866. This probably gave him more trouble than any other of his works, and it led to a serious nervous disorder. "Hammerings in the head," especially in the evenings, were followed by hallucinations. He could never work again at late hours. A holiday in Miatlew, with his sister and relatives, helped him to a partial recovery.

His work never met with the approval of Anton Rubinstein and the St. Petersburg critics, and the breach widened as his personal idiom grew with the first symphony and following works. Finally, it became irreparable, and the two men never reformed their first intimacies. It was the old story of a pupil proving greater than a master, and of progress fighting reaction in the imperative interests of musical culture.

His First Opera

In 1867 he completed his first opera, "The Voyevoda," and on its production in 1869, the composer was recalled fifteen times. But even Laroche criticised it in severe terms, and as he eventually destroyed the score all but the overture, an entr'acte and an air de ballet, he must have realised the justness of the censure.

Also, in 1867, Anton Rubinstein resigned from the St. Petersburg Conservatoire, and was succeeded by Balakirew. Now Balakirew was the recognised leader of a remarkable coterie of musicians that called themselves the Kutchka. Their avowed aim was the cultivation of an ardent nationalism in music. Among the most famous names on its roll were Rimsky-Korsakow, Moussorgsky, Borodin, and Cui. The latter acted as spokesman. One of Balakirew's first acts was to send for Tschaikowsky's Voyevoda dances. Owing, however, to the severe criticism they had met with, including Cui's, Tschaikowsky's vanity compelled him to ask for the signed request of each member of the Kutchka before he would send them. This was eventually forthcoming, and they were accompanied by a letter saying that their performance would be deeply appreciated.

The divergencies which eventually split Russian music into two camps occurred later.

Whilst on this visit he met the actress, Desirée Artot, with whom he had a tempestuous and ardent romance. But, without any warning, she married the tenor Padilla. That she afterwards occupied a foremost place in his life is probably proved by the fact that when they next met, more than twenty years later, it was as the best of friends.

In 1870 came the symphonic poem "Romeo and Juliet," and with this luscious, intoxicating and passionate work, so eloquent of the immortal plot it set out to paint in tone colours, Tschaikowsky never looked back. He had arrived, as the saying goes, and henceforth took his place among the nineteenth-century masters.

ON YOUR WAVELENGTH

By Thermion

Those Magnetic Storms

A JOURNALISTIC friend of mine who ought to know better came to me the other day, and I could see at once from the sparkle in his eye that he was bursting to tell me something. There is a vain desire in all of us to claim the possession of a piece of knowledge which others have not. It leads us to adopt the attitude epitomised in the song: "I Know Something but I Won't Tell You." This journalist furtively gazed round my office to make quite sure that none of the Hitlerian characters shown in those waste-of-public-money Fougasse posters were eavesdropping. He came to me to tell me one fine result of the so-called magnetic storms from which we have been suffering recently. Wireless fans, of course, have already noticed them, especially those interested in short-wave work. The phenomenon and its manifestations are well known. This journalist, however, after binding me to the strictest confidence, said that he had it on the authority of one of His Majesty's Ministers that one fine effect had been that these storms had brought all the magnetic mines to the surface.

He genuinely believed this, and it was some time before I could convince him that such a story was a fantastic dream. He seemed quite unaware of the weight of these magnetic mines, and to suggest that some magnetic storm could make them lighter than water so that they floated, to me was just too funny. I was convulsed with a paroxysm of cachinnation, and then pointed out that if the storms were so powerful they would have destroyed every instrument on board ship and on land, put every watch and clock out of action, caused cutlery to dance from the shops and tango down the street, and in general magnetised everything.

Which reminds me of the stupid story which was published in some of the less knowledgeable periodicals a few years ago concerning safety-razor blades. This story stated that if you left razor blades with their edges pointing north and south they automatically sharpened themselves! Yes, the layman is prepared to believe everything, and I suppose it is due to his ignorance that propaganda succeeds. As Adolph Schicklgruber, who later changed his name to Hitler, states, the bigger the lie the more the public will believe it.

The Minister of Information

WHEN Sir John Reith was Director-General of the B.B.C. he made it clear that he held journalists in extreme Scottish contempt—and that means something. In this Scot-ridden country of ours, however, it was unthinkable that he would not be found another job when he vacated his job at the B.B.C. The programmes have not suffered in consequence. I know that I am in the minority, but I never regarded Sir John Reith as an extremely popular man. He was too much of a strutting pocket Napoleon for my liking, and too proud of his Scottish ancestry for another. That being so, I was interested to read the views of Oliver Stewart, who is the editor of *Aeronautics*. This paragraph appears in the May issue of this important monthly journal: It is headed "Gairmany Calling" and runs: "Religious people are sometimes fierce fighters. They find no contradiction in carrying a Bible in one hand and a bomb in the other, and it is recorded of the Presbyterian Ministers of Perth that they rushed into the battle of Tippermuir with the cry: 'Jesus Christ and no quarter!'" No wonder the Germans fear the Scottish regiments! Now, Sir John Reith's friends are never tired of telling us that he is a son of the manse, and so we must expect him to be a bonny fighter. His activities at the Ministry of Information, unfortunately, contradict that view. In the Sylt raid just before Easter the Royal Air Force scored a success; but the Ministry of Information scored a failure. The bombing squadrons did fine work; but the Germans were quicker and better with their subsequent propaganda, with the result that the damage was minimised. The Ministry of Information's incompetence permitted the Germans to take the gloss off a fine feat. What air had won, propaganda failed to hold.

Both sides always do their best to cast doubt on the claims made by the enemy. When the Germans attack us we say that they hit a rabbit, and a disused cowshed. When we attack the Germans they say that the bombs fell in the sea. The converse is that the entire Royal Air Force has been shot down and, on the other side, all the German air bases destroyed.

For arriving at the facts this formula seems to be useful:

$$\frac{a + b}{2} = T$$

where a is the British report, b the German, and T the truth. That British reports get no more credence than German is the fault of the Ministry of Information. Gangling religion-ridden Sir John Reith, who bolstered up the business side of Imperial Airways and let down the aviation side, is now dabbling with the ministerial side of the Ministry of Information and neglecting the information side.

Training, imagination and ability are needed to compete with the expert propaganda methods of Germany. Power politics cannot be countered with a prayer book and a plate of porridge!"

I do not think that Sir John Reith has the necessary qualifications to make a good Minister of Information. In the first place, he has made himself unpopular with the Press, in the second he knows little of journalistic methods, in the third his well-known religious views conflict with the requirements of such a job, and in the fourth he lacks experience. I have not the slightest doubt, of course, as to his sincerity.

A Suggestion for the Trade

HERE is an interesting suggestion put forward by an Irish reader who is anxious to get into the radio industry:

"It is in the interest of the radio *manufacturers*, to a large extent, that their customers get proper service, so if there is a scarcity of servicemen, what is to prevent the manufacturers and large service firms seeing that suitable men who are over 'calling up' age, or unfit for service, are given additional practical training as required, and, when qualified, recommending them to their agents who are short of mechanics. The training in some cases would only involve a week or two to get used to modern service equipment which most of us only know from photos.

"Of course, there would need to be some sort of examination to select suitable men and protect the trade from 'duds,' also some form of payment during training for men who gave up jobs, and some guarantee of a job at a decent wage when trained.

"I for one would jump at a proposition like this if it could be arranged, and if the need is as great as you say, something of the sort will have to be done sooner or later."

Composer Cavalcade

IN the Home Service programme for the Forces it was only to be expected that sooner or later George Gershwin, perhaps the greatest musician of his genre, would appear in the popular series called "Composer Cavalcade—Famous Song-writers on Parade." Forty minutes will be devoted to his work on May 1st; and no doubt those responsible will have the greatest difficulty in deciding what to leave out, although in the end, as in the case of Irving Berlin, he may be awarded a second programme later. Gershwin was equally famous as a song-writer and a composer of the more serious form of jazz which tried to combine two different worlds of music. In this latter category, it is hardly necessary to remind listeners of the celebrated "Rhapsody in Blue," "An American in Paris," and other works. George Gershwin's first song-hit was "Swanee," a tune which swept the world in 1919, and is still popular now. Most of his songs come from musical comedies, or film musicals like "Lady, Be Good!", "Funny Face," "Shall We Dance?" or "The Goldwyn Follies of 1938"—in which occurred what was perhaps the last song he wrote before he died in Hollywood in 1937—"Love Walked In." Musical arrangements will again be by Phil Cardew, and the programme is being compiled by Joe Murrells and presented by Ronald Waldman.

PRACTICAL TELEVISION

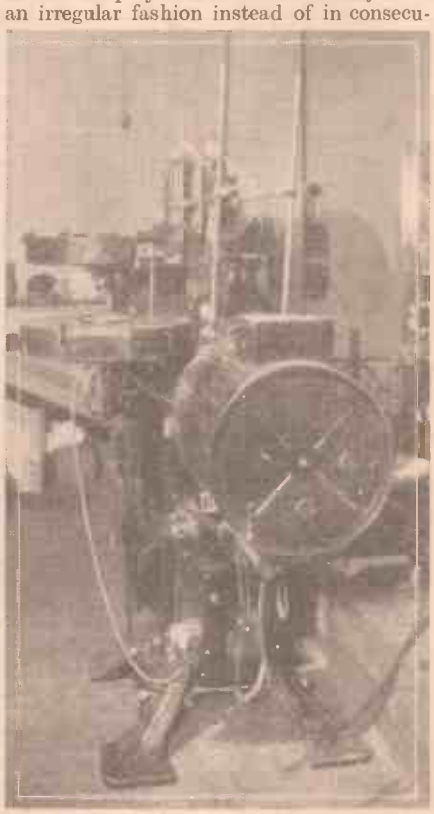
April 27th, 1940. Vol. 4. No. 200.

Television in the Air

IT is reported that a fair measure of success is being obtained by engineers in America, in their efforts to perfect a system of television which provides good pictures in ground receiving stations, when the picture signals are radiated from aeroplanes in flight. Developments of this character are by no means new, for several reports have been published during the last year or so on work of a similar nature, carried out in various parts of the world, England being no exception to the rule. The countries now at war are shrouding all their experiments of this nature in a cloak of secrecy, but it is certain that applications for both peace and war can be found for a satisfactory air television service. In the case of the former, the initial surveys of different areas could be undertaken with an aeroplane television transmitter, and two schemes find favour in this connection. Either an electron camera can be employed in which case the signal, once transmitted, is lost, or if preferred, a compact version of intermediate film television can be used so that a permanent record of all the camera has "seen" is retained for future use, after the picture signals have been radiated. In either case, one of the prime factors to be settled is one of weight and size, for there is not unlimited weight-lifting power or much spare space in a machine which is normally used for other purposes as well. Furthermore, the question of a suitable lens is also important, for unless flying low, and this would be fatal in a war-time application, long-range lenses would be necessary, suitably corrected for all the usual defects, before the resultant television pictures would really be acceptable for careful observation purposes. Associated with the television equipment and its operator must be a suitable ultra-short-wave radio transmitter and engineer, so that the problem is not easy of solution if the stringent requirements of both the ground and air organisations are to be completely satisfied.

An Interesting Film

THE ingenuity and up-to-date outlook of film producers has been exemplified in a recent film which has been made in America dealing with television. Obviously, the plot had to be developed on lines which had definite public appeal and included such subjects as espionage, struggling inventors, and an element of love interest, but the main theme dealt with the progress made in making television transmissions travel over long distances in spite of the generally-accepted ultra-short-wave service limitations due to the very high frequency carrier employed. Important technical matters had to be discussed, but it says much for the authors that they kept fairly close to facts as at present known. A compact inter-departmental television transmitter and receiver was featured to enable the head of a firm to see and talk to his other executives. This, of course, is very feasible, but how the electron television camera was reduced to such small dimensions was left to the imagination. Large screen television was shown, it being inferred that the size of the received picture had a direct bearing on the nature of the screen employed, this being one of inter-cellular structure which permitted intensity multiplication so as to furnish both size and brightness. To provide secrecy of communication the scrambling of signals was resorted to, a feat which has already been accomplished under practical conditions, and the fundamentals of which are common knowledge. The most usual method employed is to scan the subject in an irregular fashion instead of in consecutive or alternate lines, depending upon whether sequential or interlaced scanning is used. Provided the receiving end has the key to the scrambled line selection a correct picture will be reproduced, but without this the result is an unintelligible blur. Finally, the picture portrayed the successful development of long-distance television communication over hundreds of miles. This was certainly delving into the future, but inferred that just as short waves pass round the world by reflection from the upper ionised layers, so means had been discovered to allow the ultra-short-wave carriers to perform the same feat. That this will not be impossible has evidence lent to it by the reports of received signals in America, and South Africa, when the B.B.C. were radiating daily programmes, and once the propagation characteristics of these very high frequency waves have been studied carefully in the light of modern knowledge we can expect the scientists' hopes becoming hard, everyday facts.



A continuous motion film projector as used in America is favoured by television engineers for providing good quality high-definition television film pictures.

Long-distance Working

IN the present absence of home-television broadcasts there is surely no reason why the experienced amateur who has a good television receiver should not undertake tests in an effort to receive some of the foreign broadcasts. The most fruitful source of regular transmissions is America, and in the case of the National Broadcasting Company there is an hour's broadcast starting at 8.30 a.m. and another at 2.30 a.m. The picture signals are radiated on 45.25 megacycles and the sound on 49.75 megacycles. Adjustments will therefore have to be undertaken on the set itself in order to ensure that the vision and sound receivers are capable of functioning satisfactorily at these two new frequencies instead of the 45 and 41.5 megacycles respectively. Another factor to be considered is the increase of the pulse generation on the time base generator to 13230 and 60, so as to correspond to the 441 lines and 60 frames per second interlaced. The method of modulation is the reverse to the British one, and finally, horizontal polarisation is used and not vertical.

Dipole Aerial Requirements

A NEW dipole aerial with reflector must be used, this being cut to suit the vision carrier frequency. The calculated length for this is a little under 11ft., but to bring in the usual correction factor each element of the dipole should be a little less than 5ft. Space the reflector a quarter of a wavelength away and mount the aerial array horizontally in as high a position as possible. This should be beamed in the right direction, and where such a course can be undertaken the horizontal array, suitably supported, should be made rotatable. It has already been reported that the ultra-short-wave sound signals emanating from America have been heard in this country, so there is every encouragement for the skilled amateur to undertake experiments on his own, and as has so often been the case in the past, show the way to the professional engineer.

Internal C.R. Tube Coatings

IN a recent paragraph in these columns attention was drawn to the undesirable effects produced by internal light reflections occurring on the inner walls of the cathode-ray tube's glass envelope and how this had a material influence in reducing the contrast range of a received picture. It is quite a common practice to introduce a thin coating of silver on the inner wall of a cathode-ray tube, and this can either function as part of the focusing system of the scanning beam of electrons or be a section of the accelerating anode to which a high potential is applied. The normal bright silver surface, however, must be blackened to eliminate the internal reflections, and various schemes have been proposed. In one of these the continuous layer of bright silver is replaced by a number of very thin parallel lines of liquid gold which are painted on the inner wall of the tube, while a coating of black paint or lacquer is applied to the outside of the glass container.

Planning an I.F. Amplifier

Practical Notes on the Choice of Circuit Details According to Individual Requirements and the General Design of the Receiver.

By FRANK PRESTON

IN many respects the intermediate-frequency amplifier can be considered as similar to an H.F. amplifier in a "straight" set. It is, of course, an H.F. amplifier, with the difference that it operates at a fixed frequency and therefore that it may be of simpler design.

A single I.F. stage is generally sufficient, although when extreme sensitivity is required, two stages can be used. But it can be taken as an established fact that it is generally better to add a pre-frequency-changer H.F. stage than a second I.F. valve. If the preliminary H.F. stage does not give the required degree of sensitivity, it may be feasible to add a second intermediate-frequency stage. My advice, is, however, to avoid two I.F. stages whenever possible, for they often increase background noises to a greater proportional extent than they improve sensitivity. Provided that the single stage is well planned it will give as much amplification as is generally needed, whether the set is for broadcast or all-wave use.

The Standard Circuit

Most readers are familiar with the general circuit arrangement of the amplifier; an I.F. transformer in the anode circuit of the frequency-changer feeds into the grid circuit of an H.F. pentode I.F. valve, in the anode circuit of which there is a second I.F. transformer feeding the second detector. The frequency at which the stage is to operate is governed principally by the design of the frequency-changer, but 465 kc/s is now most generally employed—simply because it has been proved the best all-round figure. This does not necessarily mean that the stage must be tuned to precisely 465 kc/s, for the built-in trimmers provide a fair latitude, and the frequency at which the receiver operates most efficiently can be found by trial.

I.F. Transformers

There is a wide range of transformers, some of which are ultra simple, while others are fitted with various refinements. In the case of an experimental set it is worth while to choose transformers with centre-tapped secondaries, because these simplify the alteration of selectivity and sensitivity. It is usually found that the centre-tap need be used only on the second transformer—and then only when a double-diode is used as second detector. This type of detector is inclined to apply a certain amount of damping, and the centre-tap reduced the effect of this. There are cases where it is found, contrary to general theory, that efficiency as well as selectivity is improved by connecting the second detector to the centre-tap.

When high efficiency is the first requirement (and most experimenters are anxious to obtain the highest possible efficiency) it is worth while to use transformers of the more expensive type. Many of these have air-dielectric trimmers, and these are especially valuable for short and ultra-short wave use.

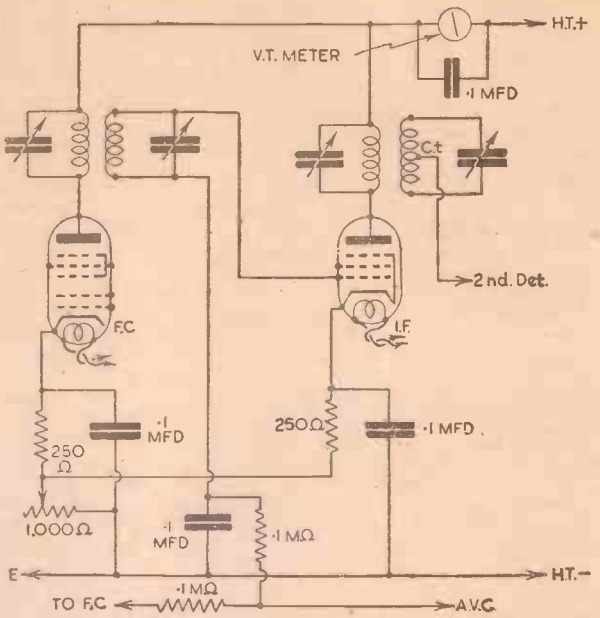


Fig. 2.—Connections for a visual tuning meter, and also for V.M. control in conjunction with A.V.C. The connections shown are not necessarily the best, for reasons which are explained on this page.

Selectivity Control

Many constructors, when planning the intermediate-frequency amplifier, overlook the fact that it is possible to obtain transformers with variable selectivity characteristics. Thus, it is possible to provide a convenient manual control by means of which the band-width, and hence the quality, can be varied between certain limits. Transformers of this type are especially valuable when it is proposed to have one receiver for both DX work and also for use as a "home-quality" set. In some instances selectivity is varied by arranging one winding (say the secondary) so that it can be moved in relation to the other. When the two are parallel and close together, tuning is at its broadest, and quality at its best (for the particular receiver in use). If one coil is turned through 90 degrees, selectivity is at its peak, but reproduction suffers due to high-note cut-off.

A simpler arrangement consists of the provision of a small winding, called a tertiary winding, placed adjacent to the fixed primary and secondary windings. It is completely insulated from the primary and secondary, but by connecting a variable resistor in parallel with it the coupling can be varied. Yet another method of varying selectivity—and this can be applied to existing transformers—is to connect a pre-set or variable condenser between the high-potential ends of the two windings; that is, between the anode terminal of the primary and the grid terminal of the secondary. This provides "top-capacity" coupling, which is in addition to the inductive coupling which normally holds between the windings. In most cases a bakelite-dielectric variable condenser is to be preferred, and this may have a

(Continued on next page)

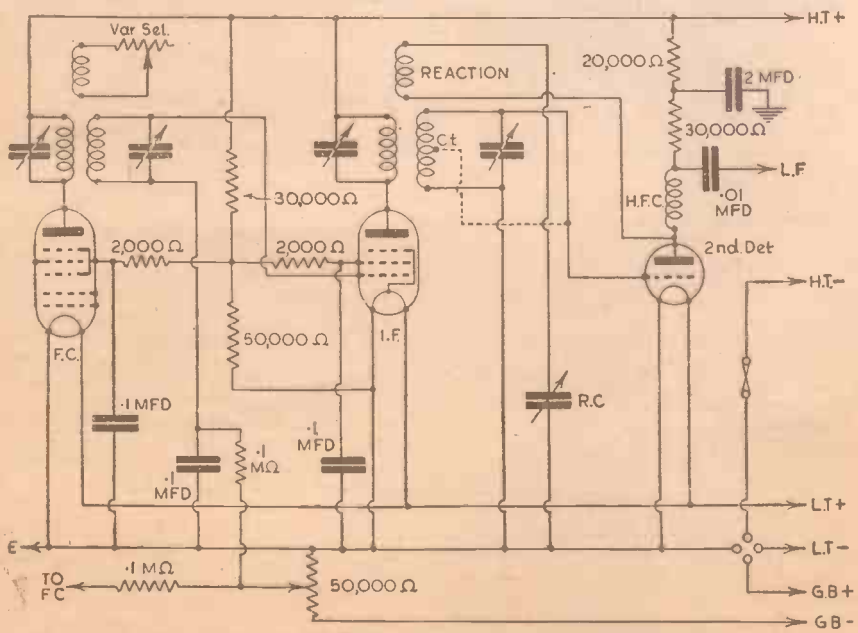


Fig. 1.—Skeleton circuit of an I.F. amplifier, illustrating some of the points raised in the text.

PLANNING AN I.F. AMPLIFIER

(*Continued from previous page*)

capacity between .0005 and .001 mfd.

Variable selectivity may be provided on both transformers, no matter which of the three systems is employed, and the two controls may be ganged. In practice, however, it is generally found sufficient to use selectivity control for the first transformer only, the second transformer being set to give a band-width up to between 10 and 12 kc/s. By following this system there is less difficulty in carrying out the preliminary trimming operations, and also a greater likelihood of obtaining the best possible quality in all conditions.

Applying Reaction

Fig. 1 shows a skeleton circuit for an I.F. amplifier using a variable-selectivity transformer in the anode circuit of the F.C. and a different kind of transformer in the second position. In this circuit the second transformer is shown as having a reaction winding, but that is optional and is generally desirable only when the set is to be used for C.W. reception. It is suitable only when a triode, H.F. pentode or tetrode is used as second detector. In most cases the triode would be replaced by a diode, and then the transformer need not be provided with a reaction winding. Additionally, the diode feed would probably be best taken from the centre-tap, as indicated by a broken line.

V.M. and A.V.C.

In Fig. 1 it will be seen that provision is not made for A.V.C., and that there is a manual variable-mu control operating on both F.C. and I.F. valves. Here again there are possible variations, for it is often sufficient to apply the variable-mu control to the F.C. valve only, or to the signal-frequency H.F. valve when used. Note that, in the case of a battery set, a four-point on-off switch is required when using variable-mu control. This serves to break the G.B. circuit through the potentiometer and the H.T. circuit through the fixed screening-grid potentiometer, as well as the L.T. circuit.

It is found in practice that a comparatively simple system of decoupling is generally sufficient in the anode and screen circuits of the F.C. and I.F. valves—a far simpler arrangement than that called for with two H.F. "straight" sets. In most cases a single fixed potentiometer can be used for the screens of both F.C. and I.F. valves, and that the additional 2,000-ohm decouplers shown are unnecessary. The latter may be necessary, however, if there is any difficulty in ensuring complete stability, as there might be if the H.F. valve were of the high-gain type.

Tuning Indicator

Fig. 2 shows how A.V.C. and manual V.M. volume-control can be combined, but in this case also it will usually be sufficient to apply the V.M. control to one of the valves. Fig. 2 also shows the position in the circuit of a visual-tuning indicator of the milliammeter type. It is in series with the H.T. + lead to the controlled valves. Despite the attraction of the cathode-ray type of visual-tuning indicator the simpler meter method of providing visual tuning is better for the experimenter and constructor. The meter is even more sensitive than the cathode-ray indicator and provides a means of comparing signal strengths.

It should be borne in mind that the meter must be capable of carrying the full anode and screen currents of the controlled valves, and that it is most satisfactory to have a meter which shows almost a full-scale deflection when the A.V.C. is out of use and when the manual control is full on.

It is often better to include the meter in the anode circuit (between H.T.+ and I.F. transformer primary) of the first controlled valve. When that is done the meter has to carry the anode current of that valve, and no more. As a result, variations in anode current are greater in proportion to the total current passed by the meter, and therefore the sensitiveness is greater.

Telenews

Flicker and Band Width

FOR sustained entertainment value the television picture shown by any home receiver must be free from flicker. This has been proved on many occasions when careful investigations were made into the public reaction to deliberate faults introduced into sets by engineers conducting the research. Every increase in the number of complete pictures radiated per second, however, necessitates a proportionate increase in the band width of the signal and a resultant reduction in the number of separate television services which can be furnished within a given frequency allocation in the ether. It was for this reason that the artifice of interlacing alternate picture frames was developed in spite of the fact that it adds to the complication of the circuits used at both the transmitting and receiving ends, and gives rise to the possible fault of line pairing with all its attendant disadvantages. Many other schemes for radiating flickerless pictures within a reasonably narrow band width of frequencies have been tried but many suffer from undue complications in the equipment necessary. One of the most promising methods, however, relies on developments which have been made in the chemical composition of the powder constituents of the fluorescent screen of the cathode-ray tube. It is simply a case of applying the old principle of persistence of illumination supplementing persistence of vision, a fact which was well known even in the days of low definition television. The idea is to make the cathode-ray tube with a fluorescent screen having an after-glow characteristic or persistence of illumination corresponding to the frame frequency period of time. That is to say, once the tiny area of fluorescence has been stimulated by the impact of the beam of electrons and glows with an intensity corresponding to the density of the beam which, of course, is controlled by the incoming television signal, then this fluorescence should be maintained at approximately this value for the stated period and then fall almost instantaneously to zero. The scheme is not easy of solution and if not carefully controlled then contrast will be spoilt. It is a method, however, which deserves the very closest investigation.

Line Television Transmissions

THE oft repeated suggestion that a television service may ultimately be provided via cable links has brought into prominence once more the work carried out to design suitable equipment capable of feeding signals at television frequency over telephone wires. One of the factors met with in this connection are the enormous losses encountered as a result of using the same cables which have no difficulty in handling a frequency band up to say, five or even ten kilocycles. Now this loss varies with frequency, and in consequence arrangements have to be made so that the loss at all frequencies is substantially the same number of decibels. Having overcome this problem the heavy losses involved must be made good by the use of very high-gain amplifiers. These must have a level characteristic over the whole modulation range of frequencies, that is, up to about 3 megacycles for modern high-definition pictures. Unless care is taken in design the signal-to-noise ratio will become unsuitable, and it is for this reason that secondary emission valves have been tried, and also electron multipliers. Finally, cognisance has to be taken of the fact that there is a variation in the time taken for the various frequencies to travel from one end of the line to the other. Unless this is corrected, transients and reflections will be set up and this will cause ghosts on the picture, while the essential detail which is so necessary to give value to the picture itself may be lost. The phase equalisers provided for this purpose must work down to tolerances much smaller than a micro-second, and when these three items alone are taken into consideration it will readily be appreciated that the cost involved in work of this nature is a very prime factor in settling the area of coverage over which signals can be successfully transmitted.

SCHOOL BROADCASTING IN WAR-TIME

SCHOOLS programmes are working as near to normal as possible and circumstances will, it is hoped, allow them to go on during the summer term. As children have returned to evacuation areas, substitutes for ordinary schooling have been sought for—hence Mr. Cobbett, who talks specially to such children, and will continue to do so next term, even though they are now getting at least part-time schooling.

As the Board of Education said in their *Schools in War-time* Memorandum No. 6 on the use of School Broadcasting (with which schools in England and Wales will be familiar):

"School broadcasts, which have established themselves in peace-time as a valuable aid to the teacher, can be still more valuable in war-time if wisely used. The schools, many of which are facing an entirely new situation, are all the more in need of supplementary material and stimulus; and broadcasting is one way of compensating for the scarcity of books and equipment, and of meeting some of the other difficulties imposed on the schools by war-time conditions."

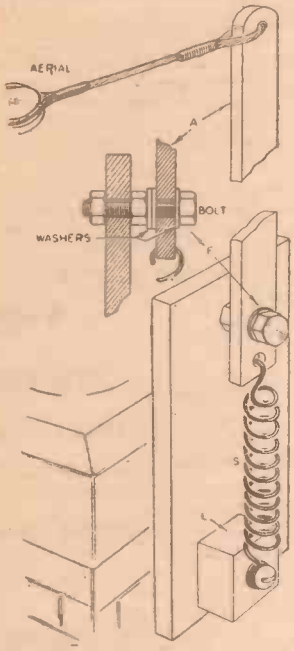
The councils and the B.B.C. in co-operation are trying to provide a service suited as closely as possible to the circumstances of the schools, and, to do so effectively, have need more than ever of the help of teachers at a time when committee meetings are very difficult to arrange. They hope, therefore, that any Head of a school, who is willing to listen and to report regularly on one or more series, will write to Broadcasting House, London or Glasgow, and the B.B.C, will be pleased to send the necessary reporting forms.

The greatest possible continuity has been preserved with the spring term programme. The time-table, programme notes, and titles of broadcasts for the summer term, 1940, may be obtained on application to the nearest B.B.C. office.

Practical Hints

Aerial Suspension

FOR those who have to suspend one end of their aerial from a tree or very pliant pole, and in consequence constantly have the wire broken in windy weather, I would recommend the following dodge.

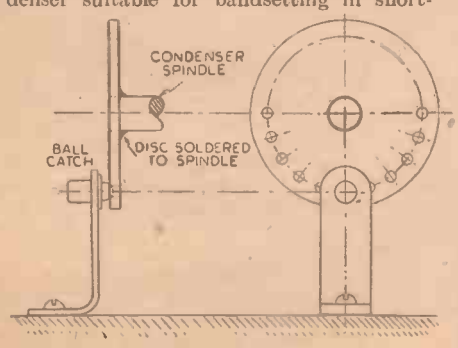


A novel method of spring suspension for an aerial.

A piece of wood "A" about 3ft. 6ins. by 2ins. by ⅝in. is drilled at "F"—6ins. from one end—to suit a ½in. standard bolt, and is bolted on to a backboard as shown. It should swing freely. A spring "S" such as is used on a garden gate, is mounted on a block "L" level with "A" to which it is screwed so as to be constantly in a state of tension. The whole can be lashed to a chimney, or screwed on to a window casement, and the aerial attached to cord passed through a hole at the top of the arm.—JOHN CAEN (N.W.6).

A Condenser Locking Device

THE accompanying sketch shows a device I have made which enables any tuning condenser with a ganging spindle to be converted into a tank condenser suitable for bandsetting in short-wave receivers. It consists of a brass disc (No. 10 gauge), with eleven holes drilled in it, and a bracket to support a ball-type door-catch. In operation, the ball engages with one of the holes, and thus locks the condenser in position.—L. STEINES (Feltham).



A simple ball catch is used for this condenser locking device.

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 hint 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., Tower House, 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 "Practical Hints." DO NOT enclose Queries with your hints.

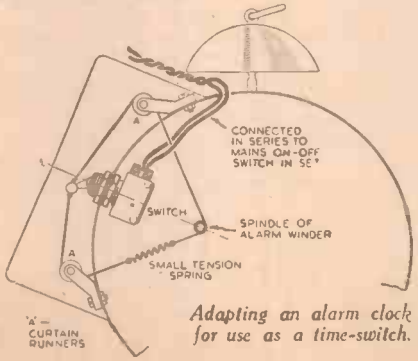
SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page 148.

A Simple Time-switch

FINDING that I needed a timing-switch for my wireless, so that it would turn on regularly at 7 a.m., and not being able to buy an actual time-switch since they were rather above my means, I contrived the device shown in the accompanying sketch. The parts required are:

1. A heavy alarm-clock.
2. A small mains on-off switch which is easy to switch, but has a good "positive" contact. This switch is placed in series with already existing mains switch on wireless.



Adapting an alarm clock for use as a time-switch.

3. Two curtain-rod runners of the old single-wheel type (or any small pulleys that can be rigidly mounted on the clock) as shown in sketch.
4. A length of picture wire.
5. A small tension spring.

No dimensions are given, but holes should be drilled to suit individual needs.

A hole for the head of the switch must be drilled in the side of the clock casing, and also two holes to take the fixing-screws for the two curtain-runners. Holes are also drilled to allow free passage for picture wire, and another hole through the spring spindle used to drive alarm clapper.

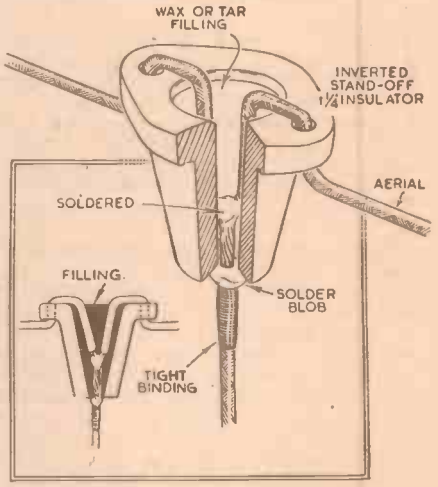
The wire should first be knotted securely on both sides of the hole in switch dolly, then passed over the corresponding curtain pulleys, one end being wound four times round alarm spindle, through hole in spindle and four times round spindle again in same direction, the wire having been knotted on each side of hole so as to prevent slipping.

The ends of the wire are attached to the ends of the tension spring, as shown.

The tension spring should be so placed that it does not touch either the clock case or alarm spindle at its extreme positions. The alarm spring should be wound up when the wire is fixed to the spindle.—J. R. WOOD (Aberdeen).

An Improved Method of Aerial Connection

HAVING in mind the idea of using some form of insulating "cup" for the connection of the down lead of my aerial to the conductor, I decided to carry out a thorough modification in which the arrangement illustrated was used.



A method of insulating the joint between an aerial and down lead.

I noticed that in the original naked connection, the soldered joint, although apparently quite good from external appearances, actually constituted a partial dry joint, that is to say that a number of the aerial strands were insulated quite effectively by the resin introduced by soldering, the consequence being a noisy high-resistance connection.

By using a stand-off insulator of the type employed for short-wave receiver construction, it occurred to me that after removing the terminal, and by inverting the insulator, the down lead could be protected at the joint, which would be more effectively soldered after cleaning, the inverted insulator being filled with wax or tar after fitting in the manner depicted.

To "anchor" the lead, although the stress is reduced by the bends in the aerial wire, a blob of solder was made where the lead passes through the hole in the insulator—the inset diagram illustrates this point clearly.—J. C. SEARS (Welling, Kent).

THE SHORT-

A Battery Receiver Incorpora

Three-quarter front view of the Short-wave Four.

IT will be recalled how, in the introductory article on suppressor grid reaction (issue dated March 30th), the fundamental principles only were dealt with. During tests in connection with the design of this receiver, a number of further interesting points have been noted, the most important of these providing plenty of room for thought when weighing up the pros and cons of this method of reaction control, in comparison with the more usual arrangements.

The condition in question concerns the effect the method of feed-back has upon the reactance of the grid coil and condenser, since by virtue of the fact that there is a residual supply of negative feed-back, regardless of the position of the reaction potentiometer (this being taken with a value of 50,000 ohms), the effective H.F. resistance of the tuned-grid inductance is lowered, with a consequent increase in the sensitivity of the tuning.

As only a small percentage of the resistance of the potentiometer is required for reaction control, the remaining portion is used for maintaining the residual feed-back, and it will, of course, be realised that the smoothness of the control is dependent on the proportion of the effective potentiometer resistance and the residual resistance load, any lower value of potentiometer resulting in not only a difficult control, but affecting the tuning range of the receiver by making it liable to react before required on higher frequencies.

Now, in view of the increased state of sensitivity, a very noticeable advantage is apparent, making it possible for maximum stage gain to be effected, since by the method of operation, which will be dealt with later, a considerable portion of the waveband will be operative with a minimum of reaction control, this bringing about a "superhet" effect.

Preference was given to the use of a potentiometer for the reaction circuit, for the reasons that a more compact layout, and therefore shorter wiring between the suppressor grid and the potentiometer, could be had, the cost also being appreciably reduced, whilst at the same time a very stable form of control is provided by this means.

The Circuit

To observe more closely the behaviour of the detector stage it was decided, as will be seen when referring to the circuit diagram in Fig. 1, to resort to the popular untuned pre-amplifier for the input, and as no doubt readers who decide to try this circuit will agree, the gain control screen-grid potentiometer proves a desirable way of obtaining maximum results, the extra control proving really necessary for adjustment on varying signals.

V1 feeds directly the aperiodic winding of the coil, and it will be noticed that the only screening effected between this valve and V2 is that which is provided by the metallising and layout.

In view of the stability which this circuit affords, a precision instrument dial of the Eddystone pattern was chosen for the band-spread condenser C4, the band-set condenser being furnished only with a ten position dial, this being found all that was required for ease of adjustment.

This view of the receiver shows the arrangement of the condensers and coil.

The coil is connected in the same way as for any ordinary leaky-grid detector, but to permit exacting conditions on the higher frequencies, a potentiometer of 400 ohms is provided to adjust the sensitivity of the detector; it being found advisable to set this so that the reaction can be made as smooth and critical as is required for the 9-metre band.

This potentiometer and the screen-grid potentiometer R9, are so located on the chassis as to afford ease of adjustment

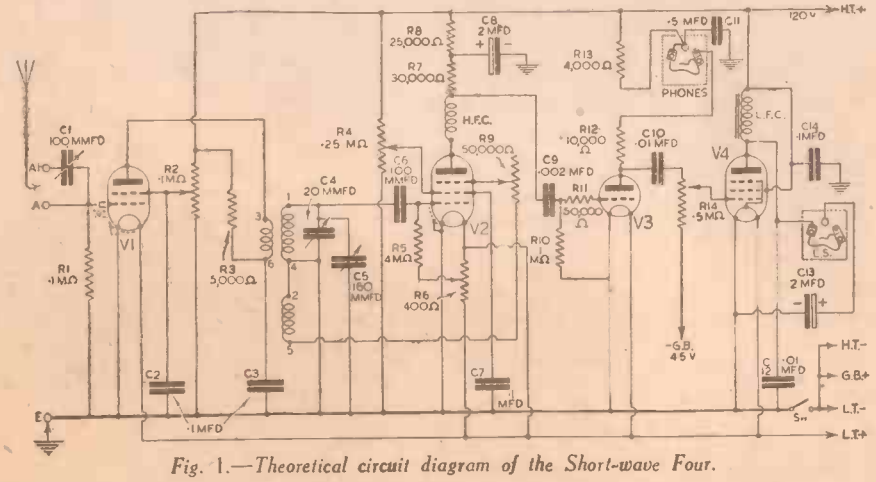


Fig. 1.—Theoretical circuit diagram of the Short-wave Four.

WAVE FOUR

ting Suppressor Grid Reaction

whilst observing the rule of short wiring, and when setting these controls it will be necessary that a long insulated trimming tool be used for obvious reasons.

From the wiring diagram it will be noticed that a direct connection is made between the suppressor grid of V1 and the reaction potentiometer R9; it is advisable to reiterate here the importance of observing this point, whilst the lead from the potentiometer to the coil should be pressed well down to the chassis, anchoring, as illustrated, with any suitable form of cleat.

It can be mentioned here that although the chassis design recommended consists of a wood chassis faced with sheet copper, the front panel being of aluminium, there is no reason why the receiver should not be built on an alternative form of chassis provided the same layout is adopted.

Now, following the detector are two stages of L.F. amplification, the characteristics of this portion of the receiver being quite along ordinary lines.

This particular method of introducing the headphones in the first stage of L.F. amplification is not usual, but has proved to be both convenient and economical. Two Clix loudspeaker control panels are employed for 'phone and speaker switching, the circuit in the case of V3 consisting of an interruption of the anode circuit, the 'phones being introduced by plugging in the associated two-pin switch plug which is then turned to disengage the contacts.

It will therefore be seen that without removing the plug, the 'phones may be circuited by merely turning the plug.

For the use of a loudspeaker, a choke-filter output circuit was chosen, the speaker, which is plugged into the control panel, being similarly rendered operative or inoperative by the turn of the plug.

The rest of the circuit is self-explanatory, but before dealing with the chassis work, a word on the consumption of the set.

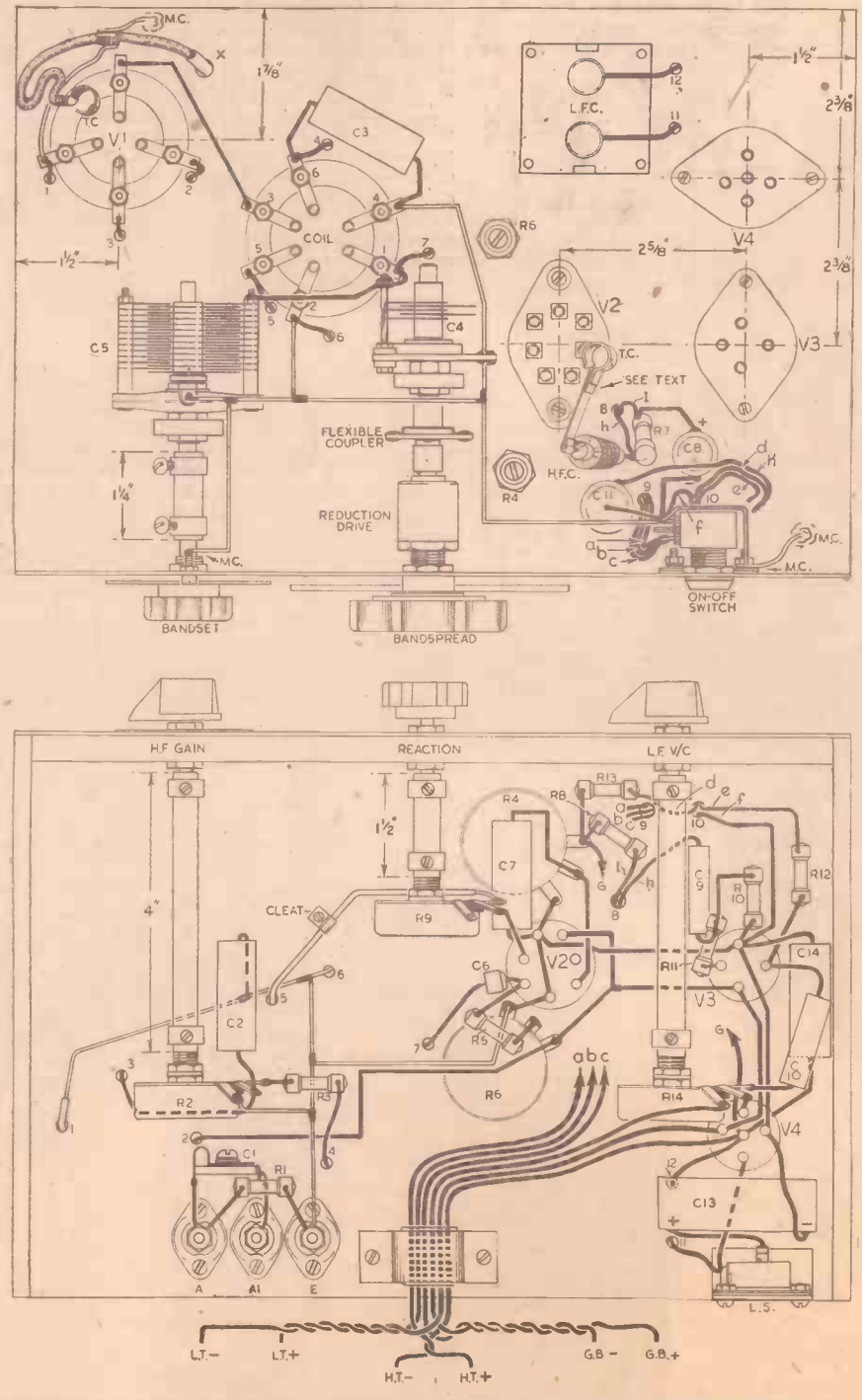
Economy

The H.T. required is of the order of 120 volts, under which supply the total consumption should be closely 10 milliamps, the detector anode current registered under correct adjustment being very nearly 1 milliamp.

With the set switched off, but with the accumulator connected, there should be a reading of 1.25 milliamps, this being due to the screen-grid potentiometers which find a completed circuit across the H.T. through the accumulator when the switch is open.

(To be continued)

Fig. 2.—Wiring diagram of the Short-wave Four.



SUPERHET BEAT NOTES

A Simple Explanation of One of the Superhet Features

THE broad principles involved in the superheterodyne receiver are sufficiently well understood to enable the average constructor to build such a set from a published design. But the radio enthusiast passes quickly beyond the "average constructor" stage towards the experimenting stage, in which he applies his theoretical knowledge both in constructional work and in the analysis of designs evolved by the experts. Successful experimenting and critical analysis demand a firm grasp of the physics of the various

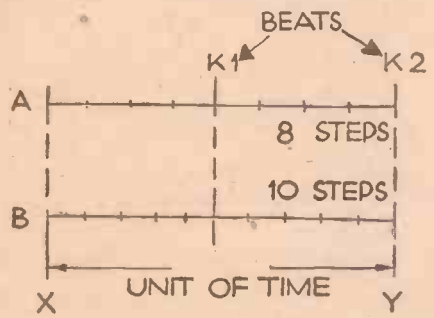


Fig. 1.—Shows how the two walkers will create a series of "beat" notes.

principles involved. Who could explain the thermionic valve without some knowledge of the behaviours of electrons? Or who can fully understand the superhet receiver without being capable of explaining the production of "beats"?

It is with this latter question that I propose to deal, as simply but as fully as possible, since it is of importance both to the amateur designer and service engineer alike.

What are "Beat Notes"?

The text-books tell us that the "supersonic heterodyne" principle involves the mixing of a signal frequency with a locally generated frequency to produce a third, or "beat," frequency. Then follow the usual sine curves and resultant waveforms which, though irreproachably scientific, do not always convey their intended meaning, even when the student is thoroughly versed in angular velocities, rotating vectors and harmonic wave formulæ. So let us avoid such arguments and approach the matter from a common-sense angle.

How does the mixing of two different frequencies produce a third frequency? In short, what is a "beat" frequency? The simplest illustration of "beats" that I can conceive is as follows:

Imagine two men walking down an otherwise deserted street. A is tall and takes eight steps in a certain time, while B, who is short, takes ten steps. They start from a point X (see Fig. 1) and are immediately out of step. But a point is reached (namely K1) when two heels touch the pavement simultaneously. Then they are out of step again until the point K2 is reached. Here they are in step again, and the whole procedure is repeated. Now, on listening carefully to these two sets of footsteps, one at a frequency of 8 per unit of time and the other at a frequency of 10, what would you hear? There would be the uncertain "clickety-clack" and then a firm, definite "beat." Then more "clickety-clack" and another firm "beat." These beats would occur twice in the chosen unit of time. Speed things up and let A take 8 steps per second while B takes 10 per second. The "beat frequency" would then be 2 per second. (Notice that this is also the difference between frequency A and frequency B). Fig. 2 shows that if A travels with B, who takes 12 steps per second, they are "in step" four times. Or, beat frequency is 12-8, i.e., 4 beats per second.

The same principle applies when dealing with higher frequencies. Two strings vibrating at different frequencies can produce a beat frequency which may be heard as a definite tone differing from both parent frequencies. Further, the principle is the same whether the waves are longitudinal or transverse. That is, electro-magnetic waves behave like sound waves as far as the production of beats is concerned.

The Frequency-changer Valve

Now, how is this principle made use of in wireless receivers? Obviously, the ability to change any given frequency into a pre-determined frequency is of great value, since, once we have decided on a suitable figure, we can adjust our receiver to respond faithfully to that frequency. A figure originally popular was 110 kc/s, but designers tend more and more to adopt 465 kc/s for what is called the intermediate frequency. There is something to be said, however, for both figures.

Let us suppose that we have decided to use 110 kc/s for our I.F. This means that we intend to resolve all signal frequencies into 110 kc/s before rectifying and amplifying them. First, we need to select and "detect" the desired signal frequency. This can be done by means of the usual tuned coil and valve circuit. Secondly, we must generate a frequency that is 110 kc/s above (or below) the signal value. This is done by means of a tuned coil and oscillating valve circuit. Finally, we must mix these two frequencies (differing by 110 kc/s) to produce the necessary "beat" of 110 kc/s.

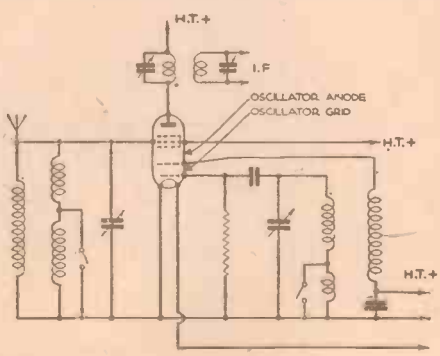


Fig. 3.—A typical pentagrid frequency-changer circuit.

A difficulty is at once obvious—keeping the oscillator frequency "out of step," by exactly 110 kc/s throughout the whole range of signal frequencies. But, by means of a specially designed coil, shaped condenser vanes, and the use of trimmers and padders, this difficulty can be overcome well enough to allow the use of ganged condensers for aerial and oscillator circuits.

The problem of mixing the two frequencies has been adequately solved by the production of efficient frequency-changer valves. As we have seen above, a valve is required to "detect" the signal frequency and another to generate the oscillator frequency. Though two valves could be

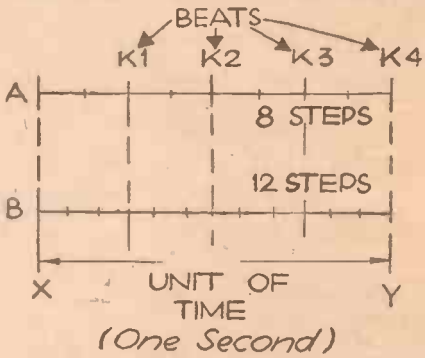


Fig. 2.—An elaboration of Fig. 1 depicting the formation of the "beat" frequency.

used, both jobs are done much more efficiently by the modern frequency-changer valve, of which the pentagrid, octode, triode-pentode, and triode-hexode are examples.

An examination of Fig. 3, showing a pentagrid (or heptode) as frequency-changer will reveal two distinct circuits: (a) the tuned circuit on the left of the valve, which selects the signal frequency, and (b) the oscillator circuit on the right, which provides the local frequency, always 110 kc/s above the chosen signal frequency. The valve is made up of two sections, the first performing the functions of an H.F. pentode (or screen-grid), and the second those of a triode oscillator (the anode of which is in the form of a grid). By providing these sections with a common source of electrons (filament or cathode) and a common outer anode, an efficient mixing can take place without any external coupling. Having thus obtained the required beat frequency, it can be fed to circuits designed expressly to receive it. These circuits are based on the use of I.F. transformers—pre-tuned coil arrangements that accept and respond to the chosen frequency.

But another point arises out of this chain of reasoning, a point which greatly influences the design of the superhet receiver. As will be readily understood from the preliminary explanation, an oscillator frequency of, say, 987 kc/s will produce a beat of 110 kc/s with a signal frequency of 877 kc/s and *also* with one of 1,097 kc/s. Thus arises the problem of "second channel" interference, when the I.F. circuits have two signal inputs to cope with simultaneously. These two signals will give rise to beats that may be heard as a whistle. Hence the need for a selective signal-frequency circuit, which will reject the unwanted second channel frequency.

Impressions on the Wax

A REVIEW OF THE LATEST GRAMOPHONE RECORDS

SPRING'S first record lists are topically showered with a variety of good things. There is a record boom on at the moment, but that doesn't mean the introduction of slap-dash treatment at any stage of production. Now it often happens that a title that takes only three minutes to play over will cost as much as a whole hour of a radio show. Listen, for example, to Decca's new album set of "Gulliver's Travels."

The real stars of the new Decca album of the entire musical score of the film cartoon, "Gulliver's Travels," are the recording engineers. These records are some of the most technically perfect I have heard.

Chorus and orchestra are beautifully blended, and great as is the credit we must give to Victor Young for his musical direction, the engineers must have greater credit for having so perfectly presented the complete conception.

The actual melodies are well known to everyone with the possible exception of "Forever" and "Faithful." The first of these is sung by Bob Stevens and the second by Wynne Davis on *Decca F* 7519. On the following record, Gulliver explains that Bob and Wynne want to sing together but each wants to sing their own song. They finally fix it by both singing "Faithful Forever." The reverse side to this compromise is perhaps the loveliest in the whole album: "I Hear a Dream" ranks with the finest ever in concert jazz—*Decca F* 7417 to *F* 7420.

Arthur Young, whose Novachord music continues to thrill the customers at Hatchett's Restaurant as well as Decca record buyers, has added to his laurels with the setting of four of Shakespeare's lyrics. Although primary intended as "swing" versions, they rate high for concert rendition when the swing fad has died.

First band to record them—incidentally, they are all to be heard in "New Faces," a revue due for London's Comedy Theatre soon—is Bob Crosby's Bob Cats, which is one of America's very swingiest. "It was a Lover and his Lass" and "Oh! Mistress Mine" appears on *Decca F* 7426, and "Sigh No More, Ladies" and "Blow, Blow, Thou Winter Wind" on *Decca F* 7427. The vocal choruses in each case are sung by Marion Mann.

Vocal

SIDNEY BURCHALL, the popular baritone, who is well known to B.B.C. listeners, records "Wandering the King's Highway" and "Phantom Fleets" on *Decca F* 7432, whilst we have Greta Keller, with piano and guitar accompaniment, singing "The Lamp is Low" and "Melancholy Mood" on *Decca F* 7433. Al and Bob Harvey make a duet of "Little Patchy Trousers" and "Yodel in Swing" on *Decca F* 7432; Vera Lynn, accompanied by Arthur Young on the Novachord, sings "Who's Taking you Home To-night?" and "A Little Rain Must Fall" on *Decca F* 7429, and finally Adelaide Hall has made a recording of "Careless" and "Don't Make Me Laugh" on *Decca F* 7430.

Brunswick

WHEN you turn to Brunswick's March list you will find under Bing Crosby's name that very old favourite, "Wrap Your Troubles in Dreams." It is nearly ten years since Bing first made a recording of this tune and this latest record shows how his voice technique has improved. On the reverse side is "If I had My Way"—*Brunswick* 02900.

A new Brunswick record makes one wonder whether it is better to filch a tune from the classics and make a straight ballad of it or render it unrecognisable (well, nearly!) by swinging it. Little Mary Martin has a beautiful soprano voice—and she can swing it—so she takes one of Tschaikovsky's most delightful melodies and sings it as a ballad under the name of "Our Love." Then, on the other side, she sings "The Maids of Cadiz," by Delibes, in true coloratura style. I think you'll like it, but would Mr. Delibes have liked it? Hear it for yourselves on *Brunswick* 02937.

The new Brunswick lists contain what I believe to be the first recordings of Victor Herbert's "March of the Toys." And what a contrast the two records present. On the one hand, there is a swing version by Teddy Powell's Orchestra; on the other a beautiful orchestrated performance in symphonic style by Victor Young and his Orchestra. Which will be the most popular? I leave it to you, chums! Powell is on *Brunswick* 02904, and Young on *Brunswick* 02939.

Bing Crosby's sister-in-law, Florence George, sings "Viba" on *Brunswick* 02885, whilst the Mills Brothers produce more of their fantastic musical imitations in "Sweet Adeline" on *Brunswick* 02932.

For dancers there is Jan Savitt's immaculate version of "Good Morning" on *Brunswick* 02905, Jimmy Dorsey's "Body and Soul" on *Brunswick* 02905, Lew Stone's "Give a Little Whistle" on *Decca F* 7425, and Ambrose's "When You Wish Upon a Star," with a vocal duet by Vera Lynn and Jack Cooper, on *Decca F* 7422.

Rex

THE Rex list shows a number of interesting records by popular artists. First there is "Phantom Brigade" and "Down South" played by The Belgrave Salon Orchestra on *Rex* 9642, and George Eldrick gives a vocal of "Scatter-brain" and "She Would Wind Him Up and He Would Whistle" on *Rex* 9755. Jay Wilbur's Serenaders record "Tristesse" and "Moonlight and Roses" on *Rex* 9756, and Horace Finch, of the Empress Ballroom, plays "Finch Favourites, No. 6" on *Rex* 9752.

THE "STUDENT'S" THREE

(Third of a Series)

How Selectivity May Be Improved, and Modifications which Can Be Made in This Connection

WHEN the receiver has been thoroughly tested the builder will no doubt be anxious to make some modifications in order to see the effects of various changes in general design. In this direction one of the first changes which might be made is in connection with the selectivity of the receiver. There are at present two tuned circuits, and under all normal conditions the selectivity provided will be adequate for general purposes. When, however, it is desired to receive a station working on a wavelength close to a station which is received more powerfully, then selectivity difficulties occur and the weak station will only be heard with difficulty against a background from the other station. In some cases it may not be possible to avoid this trouble—even with the most powerful superhet type of circuit, as in spite of regulations concerning wavelengths some stations are working very close to one another. Where, however, normal station separation is obtained, then it will be possible to improve the receiver in one or two ways which will not introduce much difficulty.

The first plan is to add a series aerial condenser. This is a small variable or semi-variable condenser connected between the aerial and the aerial terminal of the receiver. When this condenser is adjusted it has practically the same effect as a reduction or modification in the length of the aerial.

Aerial Dimensions

If you have facilities you can compare the effects of the condenser and the aerial. Take, for instance, a full size outdoor aerial and connect this to the receiver direct. Select a weak station and note the signal strength, and also note the strength on a powerful station, say the local. Now erect an aerial just half as long and again compare the strengths. You will probably find that the local station will not show any appreciable falling off in strength, but the weak station may be inaudible, showing that you have lost some of the pick-up provided by the large wire. Again, note the "spread" of stations, that is, the space on the dial over which the louder stations are audible. With the full aerial, for instance, the local may spread nearly all over the dial, but when the small aerial is used it may be restricted to only two or three degrees, without any loss of volume. It would, of course, be very inconvenient if you had to alter the aerial every time you wished to improve the selectivity, and yet you find that you can do with the large aerial at certain times. The series aerial condenser, therefore, enables you to carry out the desired modifications without touching the aerial, the full-size aerial being retained, and the condenser having a maximum capacity of, say, .0003 mfd. When the condenser is "all in," that is, with the vanes fully intermeshed the condenser will be found to have very little effect on the results obtained with the large aerial.

Temporary or Permanent?

If the condenser is fully opened, you will probably find that you can only just hear the local, the effect being almost the same as removing the aerial completely. In between these two extremes you can obtain any desired result, and thus the first problem is whether you need this condenser to be a permanent or a temporary installation. If you find that the local spreads too much and wish to listen to it to the exclusion of most distant stations, you can fit a pre-set type of condenser on the baseboard near the aerial terminal, and adjust this to give the desired result and then leave it alone. If, however, you require to listen at all times, on all wavelengths, then a variable condenser of small dimensions, mounted on the panel, or operated by means of an extension control from the panel, would be found desirable. This would enable you to obtain any desired degree of selectivity and thus the sensitivity of the receiver would be fully under your control at all times.

Selectivity may also be improved in a similar way by varying the gain of the first valve, and for this purpose a variable-mu type of valve would have to be substituted. This is a valve which varies its amplification according to the grid bias which is applied to it. A potentiometer having a value of about 25,000 or 50,000 ohms should be mounted on the panel and one side joined to the L.T.— line, whilst the other side is joined to the 9 volt G.B. socket. The arm of the potentiometer is joined to the grid of the first valve through a 2 megohm grid leak, and a condenser having a capacity of .0002 mfd. is inserted between the grid terminal and the junction of the tuning condenser and coil in the first stage. If, now, a variable-mu valve is inserted in place of the straight type of H.F. valve it will be found that when the arm of the potentiometer is turned so that maximum grid bias is applied to the valve, the gain of the H.F. stage will be at a minimum and, according to the bias voltage and the type of valve, signals will be at a minimum. As the bias is removed, by turning the control in the opposite direction the signals will build up and at the same time the selectivity will be modified slightly. The variation in selectivity is not, of course, of the same order as that obtained with the aerial condenser, but by using the two in conjunction you can obtain any desired degree of selectivity and sensitivity and in most cases it will be found that the two additional controls are fully justified on an experimental type of receiver.

A variable-bias control, and a series aerial control may be mounted on the panel between the wavechange switch and reaction control (two lower left-hand controls.)

LIST OF COMPONENTS

Two coils, type BP.80. (Varley).

Two .0005 mfd. variable condensers, popular log type, with two large control knobs (J.B.).

One differential reaction condenser, .0003 mfd. (J.B.).

Three baseboard-mounting valveholders, two 4-pin and one 5-pin (Bulgin).

One type H.F.8 H.F. choke (Bulgin).

One type H.F. 9 ditto (Bulgin).

One 3-point switch, type S.36 (Bulgin).

One 4 to 1 L.F. transformer (B.T.S.).

Five fixed condensers: One .1 mfd. type 4603/S. Two .0002 mfd. type 4601/S. One 2 mfd. type 3016. One .02 mfd. type 4601/S (Dubilier).

Three fixed resistances, ½ watt type: One 10,000 ohms. One 15,000 ohms. One 2 megohms (Dubilier).

One .25 meg. volume control with 3 pt. switch, type VM.62 (Bulgin).

Four terminal mounts and terminals, type P.30 (Bulgin).

Three valves: type Z.21 (4-pin), HL.2 and KT.2 (Osram).

One wooden baseboard, 12in. by 9in. One panel 12in. by 8in. Wire for connection, flex for leads, screws, etc. (Peto-Scott).

One pair 2,000 ohm headphones (Ericsson).

One W.B. Stentorian Junior loudspeaker (W.B.).

One 2-volt accumulator (Exide).

One 120-volt H.T. battery (Drydex).

One 9-volt G.B. battery (Drydex).

DENCO POCKET TWO

MANY attempts have been made to produce a real pocket-receiver, and one or two have appeared from time to time on the market. The accompanying illustration shows one of the latest productions, a real miniature contained in a metal box measuring 4½ins. by 3ins. by 1½ins. deep. The overall measurements are increased slightly by the reaction control knob on one side and the tuning knob on the front. The set does not, of course, include the necessary batteries which have to be accommodated separately, and this is naturally one of the difficulties of making a real pocket receiver. However, there should be no difficulty in making a small container to hold a 45-volt H.T. battery and small L.T. cell, and the two parts could then easily be accommodated in two normal overcoat pockets. Housed in the box are a small medium-wave coil unit with swinging-coil reaction, a bakelite-dielectric tuning condenser, a midget L.F. transformer and two Hivac midget valves. In addition, there are, of course, the usual small fixed condensers and grid leak. Small two-pin plugs and sockets are provided for aerial and earth and phones, whilst battery leads are soldered into position and are brought out through holes in the case. The circuit is a standard leaky-grid detector and transformer-coupled output stage, and the main novelty lies in the use of the moving reaction coil arrangement. This idea, which was once standard, has been superseded in recent years by condenser-controlled reaction, but it is nevertheless quite efficient, and the use of this scheme obviates the use of a further condenser. The coils are mounted on a glass-like insulating material and the reaction section is pivoted on a small spindle mounted on the end of the case. Thus the knob seen on top of the illustration is used to vary the position of the reaction coil and this produced a perfectly smooth effect which is not critical.

This view gives an idea of the size of the Denco pocket receiver.

Test Report

The receiver was tested with various types of aerial and showed a high degree of sensitivity, the only point being lack of reaction efficiency when a low value of H.T. was employed. Quite a number of stations were heard with 20ft. of flex hanging from a picture rail, and with a good outdoor aerial the only drawback was lack of selectivity. This is only to be expected, of course, as the receiver is primarily intended for use with a very short temporary "pocket" aerial. Five feet of wire enabled the Home Service and Forces programmes to be heard in Central London. The L.T. may be either a 2-volt cell or a 3-volt dry battery, a resistance being included in the L.T.+ lead so that the latter may be used. If, of course, a 2-volt cell is to be used the resistance should be cut out or short-circuited. The price of the set is £2 15s. (exclusive of batteries and 'phones), and the makers are Denco, Warwick Road, Clacton, Essex.

LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes, price 2s. each.

NEW PATENTS

These particulars of New Patents of interest to readers have been selected from the Official Journal of Patents and are published by permission of the Controller of H.M. Stationery Office. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications.

4478.—Blumlein, A. D.—Variable condensers. March 9th.

4334.—Mitchell, E. H.—Means of neutralising the effects of interfering signals. March 8th.

4565.—Philips Lamps, Ltd.—Radiogramophones. March 11th.

5416.—Igranic Electric Co., Ltd., and Field, J. A.—Cleaning of insulated wire, particularly for soldering purposes. March 26th.

5472.—Marconi's Wireless Telegraph Co., Ltd.—Tuned circuits. March 26th.

5538.—Marconi's Wireless Telegraph Co., Ltd., Cockerell, C. S., and Parker, G. P.—Radio transmitters. March 27th.

Specifications Published.

518740.—Radioaktges, D. S. Loewe.—Fading regulation in television receivers. (Addition to 464492.)

518684.—Hewett, A. B., and Head, A. G.—Aerial and earth system for radio and television transmitting and reception apparatus.

519330—Kolster-Brandes, Ltd., and Beatty, W. A.—Cathode-ray tube systems.

519334.—Dubilier Condenser Co. (1925), Ltd., and Coursey, P. R.—Electric condensers.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

(See also page ii of cover)

No. 71

POWERS AND ROOTS OF π AND g

n	$\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\frac{1}{\sqrt{n}}$	$\sqrt[3]{n}$	$\frac{1}{\sqrt[3]{n}}$
$\pi = 3.142$	0.318	9.870	31.006	1.772	0.564	1.465	0.683
$2\pi = 6.283$	0.159	39.478	248.050	2.507	0.399	1.845	0.542
$\pi^{1/2} = 1.571$	0.637	2.467	3.878	1.253	0.798	1.162	0.860
$\pi^{1/3} = 1.047$	0.955	1.097	1.148	1.023	0.977	1.016	0.985
$\frac{4}{3}\pi = 4.189$	0.239	17.546	73.496	2.047	0.489	1.612	0.622
$\pi/4 = 0.785$	1.274	0.617	0.484	0.886	1.128	0.923	1.084
$\pi^2/6 = 0.524$	1.910	0.274	0.144	0.724	1.382	0.806	1.241
$\pi^2 = 9.870$	0.101	97.409	961.390	3.142	0.318	2.145	0.466
$\pi^3 = 31.006$	0.032	961.390	29,809.910	5.568	1.796	3.142	0.318
$\frac{\pi}{32} = 0.098$	10.186	0.0095	0.001	0.313	3.192	0.491	2.168
$g = 32.2$	0.031	1036.84	33,386.24	5.674	0.176	3.181	0.314
$2g = 64.4$	0.015	4147.36	267,090	8.025	0.125	4.007	0.249

No. 72

DECIBEL.—The comparative unit of sound strength. The value chosen for 1 decibel is the sound which can just be discerned by the trained ear.

RELATIONSHIP BETWEEN DECIBELS AND POWER RATIO

Decibels.	*Power Ratio.*	*Decibels.*	*Power Ratio.*
1	1.25	—1	$\frac{1}{1.25} = .8$
2	1.6	—2	$\frac{1}{1.6} = .625$
3	2.0	—3	$\frac{1}{2} = .5$
4	2.5	—4	$\frac{1}{2.5} = .4$
5	3.2	—5	$\frac{1}{3.2} = .3125$
6	4.0	—6	$\frac{1}{4} = .25$
7	5.0	—7	$\frac{1}{5} = .2$
8	6.0	—8	$\frac{1}{6} = .166$
9	8.0	—9	$\frac{1}{8} = .125$
10	10.0	—10	$\frac{1}{10} = .1$
20	100.0	—20	$\frac{1}{100} = .01$
30	1000.0	—30	$\frac{1}{1000} = .001$

THE GREEK ALPHABET.—The Greek alphabet is as follows:

A α (alpha), B β (bēta), Γ γ (gamma), Δ δ (delta), E ε (epsilon), Z ζ (zēta), H η (ēta), Θ θ (thēta), I ι (iōta), K κ (kappa), Λ λ (lambda), M μ (mu), N ν (nu), Ξ ξ (xi), O ο (ŏmicron), Π π (pi), P ρ (rho), Σ σ ς (sigma), T τ (tau), Y υ (ŭpsilon), Φ φ (phi), X χ (chi), Ψ ψ (psi), Ω ω (ōmēga).

No. 73

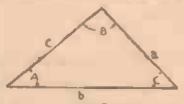


Fig. 1. Diagram for Table A.

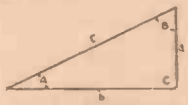


Fig. 2. Diagram for Table B.

TABLE A

See Fig. 1

Parts Given.	Parts to be Found.	Formulæ.
a b c	A	$\cos A = \frac{b^2+c^2-a^2}{2bc}$
a b A	B	$\sin B = \frac{b \times \sin A}{a}$
a b A	C	$C = 180° - (A+B)$
a A B	*b*	$b = \frac{a \times \sin B}{\sin A}$
a A B	*c*	$c = \frac{a \sin C}{\sin A} = \frac{a \sin (A+B)}{\sin A}$
a b C	B	$B = 180° - (A+C)$

No. 74

TABLE B

See Fig. 2.

Parts Given.	Parts to be Found. A	B	*a*	*b*	*c*
a & *c*	$\sin A = \frac{a}{c}$	$\cos B = \frac{a}{c}$		$b = \sqrt{c^2 - a^2}$	$c = \sqrt{a^2 + b^2}$
a & *b*	$\tan A = \frac{a}{b}$	$\cot B = \frac{a}{b}$	$a = \sqrt{c^2 - b^2}$		
c & *b*	$\cos A = \frac{b}{c}$	$\sin B = \frac{b}{c}$	$a = \sqrt{c^2 - b^2}$		$c = \frac{a}{\sin A}$
A & *a*		$B = 90° - A$	$a = b \times \tan A$	$b = a \times \cot A$	$c = \frac{b}{\cos A}$
A & *b*		$B = 90° - A$	$a = b \times \tan A$		$b = c \times \cos A$
A & *c*		$B = 90° - A$	$a = c \times \sin A$	$b = c \times \cos A$	

Fig. 3.—In any right-angled triangle:

$\tan A = \frac{BC}{AC}$, $\sin A = \frac{BC}{AB}$

$\cos A = \frac{AC}{BC}$, $\cot A = \frac{AC}{BC}$

$\sec A = \frac{AB}{AC}$, $\operatorname{cosec} A = \frac{AB}{BC}$

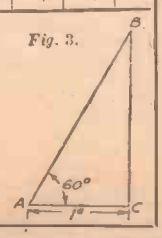


Fig. 3.

No. 75

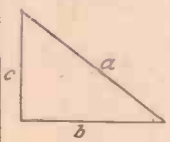


Fig. 4.

Fig. 4.—In any right-angled triangle:

$a^2 = c^2 + b^2$

$c = \sqrt{a^2 - b^2}$

$b = \sqrt{a^2 - c^2}$

$a = \sqrt{b^2 + c^2}$

Fig. 5.—$c + d : a + b :: b - a : d - c$.

$d = \frac{c+d}{2} + \frac{d-c}{2}$

$x = \sqrt{b^2 - d^2}$

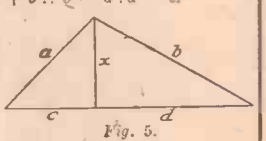


Fig. 5.

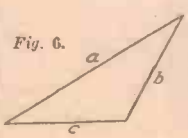


Fig. 6.

In Fig. 6, where the lengths of three sides only are known:

area $= \sqrt{s(s-a)(s-b)(s-c)}$

where $s = \frac{a+b+c}{2}$

Fig. 7.—In this diagram:

$a : b :: b : c$, or $\frac{b^2}{a} = C$.

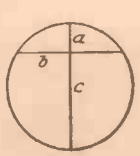


Fig. 7.

No. 76

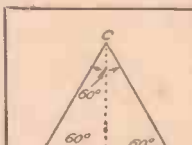


Fig. 8.

Fig. 8.—In an equilateral triangle $ab = 1$, then $cd = \sqrt{0.75} = 0.866$, and $ad = 0.5$; $ab = 2$, then $cd = \sqrt{0.3} = 1.732$, and $ad = 1$; $cd = 1$, then $ac = 1.155$ and $ad = 0.577$; $cd = 0.5$, then $ac = 0.577$ and $ad = 0.288$.

Fig. 9.—In a right-angled triangle with two equal acute angles, $bc = ac$. $bc = 1$, then $ab = \sqrt{2} = 1.414$; $ab = 1$, then $bc = \sqrt{0.5} = 0.707$.

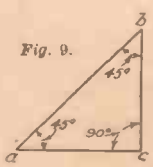


Fig. 9.

Fig. 10.

Fig. 10 shows that parallelograms on the same base and between the same parallels are equal; thus ABCD = ADEF.

Fig. 11 demonstrates that triangles on the same base and between the same parallels are equal in area; thus ABC = ADC.

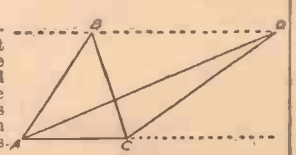


Fig. 11.

Open to Discussion

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

The Direct-coupled Amplifier

SIR,—I think it is very enterprising of you to give publicity to the direct-coupled amplifier designed by Mr. Hunt, as the circuit is quite unorthodox and might scare the engineers. However, I have made it up exactly as specified and am thrilled by the lovely quality it gives on both radio and gramophone records.

Hearty congratulations to both Editor and designer.—G. G. WILLIAMS (Guildford).

Radio Manila

SIR,—In a letter published in the April 6th issue, Mr. J. Kidd states that he heard Radio Manila, Philippine Islands, announcing themselves as KBRM. This station's number is KZRM actually, the "Z" being pronounced "zee." It broadcasts news in English from 22.00 to 22.15 G.M.T., followed mainly by light music, which Mr. Kidd no doubt heard. If any verification is needed, there is a detailed report by Mr. R. W. Hall, of Worksop, in the December 30th, 1939, issue, on this particular station, giving the station's address as well.—J. T. FISHWICK (Birkenhead).

The "Home-Service" Two

SIR,—Having a lot of spare components, I have just made up the "Home-Service" Two. The baseboard is ¼in. thick with ¼in. thick plywood fastened on top. All the wiring runs between these two boards except grid leads and the lead leading from var. condensers, mov. vanes, to switch, For the .005 mfd. I put a .003 and .002 mfd. in series and for the .0001 mfd. I put a .0002 mfd. as I did not have the value required. I used a Colvern coil, 6-pin. Valves, Mazda HL2, Mullard PM22A (both new that I happened to have). The 15,000 ohm resistance I made up from a 30,000 Spaghetti resistance. Well, I did not expect results, but what a surprise; I got the Home Service and quite a few Continental stations at good loudspeaker strength. Rome, Radio-Paris, very loud; I think the circuit a lot better than you claim for it.—G. S. BRAGG (Havant).

Club for Wrexham?

SIR,—I have been a reader of your excellent paper for about five years, and although I don't claim to be a professional, all I do know is due to PRACTICAL WIRELESS. You could well use the following slogan, "Learn Radio at 3d. per week."

I started with a crystal set and now I have just finished a H.F. Det. L.F. L.F. driver, Class B, of my own design. There isn't much interest in Rhos for radio construction, and I am a lone wolf. So I'd like you to send out an S O S to A. O. Griffiths, of Wrexham. If he reads this will he please send me his address? I'd also like to hear from anybody else in this district who is interested in radio construction.

It might be possible to form a radio club, where knowledge could be exchanged between its members. So come on you other lone wolves.—THOS. A. THOMAS (1, Pen-Y-Wern, Wern, Las, Rhos, nr. Wrexham, North Wales).

A DX Log from Oxford

SIR,—I should like to inform Mr. J. Kidd (Melton Mowbray) and other readers of the stations which operate from Manila in the 49 m. band. KZRF 48.86 m., 11.00-15.00.; Sats. to 16.00; Suns., 10.00-16.00 B.S.T. KZRH 49.1 m., 11.00-17.00; Suns., 08.30-17.00 B.S.T. KZIB 49.65 m., 12.30-16.00 B.S.T. KZEG, 49.06 m. carries the programme of KZRM, 31.35 m.

My DX log of broadcast stations heard during the past few months is: MTCY, JZJ, JZK, XGOY, KZRM, KZRH, FZR, HSP6, YOC, PMN, VLR, VLQ, CR7BE, VQ7LO, COGH, COCQ, COCW, TGWA, TGWB, HP5J, HP5G, Martinique, VP3BG, HJ1ABG, HCJB, PSE, CXA8, LRX.

Receiver used is a superhet, with an inverted L-type aerial 75ft. long running S-N.W.—H. F. BUGGINS (Oxford).

A 4-valve A.C. Short-waver!

SIR,—I am a fairly recent reader of your fine paper and am very pleased with it.

My RX is a home-made 1-v-2 battery set. I am using a small pre-selector for H.F. amplification, consisting of a Mullard PM12 S.G. valve, with Eddystone plug-in coils. This is very efficient, and I enclose my log of short-wave broadcast stations during February: WCBX, WGEA, WPIT, WNBI, WRUL, WCAB, WGEO, W4XB, TGWA, XGOY, VQ7LO, FZR, VLR, VLQ, VUD2 and MTCY.

I think many readers would like to see details of a four-valve S.W. A.C. mains receiver, with tuned var. mu., H.F. pentode, detector, pentode output, rectifier, and plug-in coils.—C. BAYNES (West Byfleet).

American versus British Valves

SIR,—I wish to thank you for your advice to the Radio Component Manufacturers' Federation in the April 6th issue of "P.W."

With regard to valve prices! Why can one buy American valves on which transport and duty is paid much cheaper than British valves?—HOWARD SOMERVILLE (London, S.W.).

Portuguese E. African Station

SIR,—Last Tuesday evening, April 9th, at about 9.15 a.m. I picked up a transmission which was announced (by a woman announcer) as Portuguese East Africa broadcasting on 30.8 metres. No call-sign was given, and as I do not possess a complete list of short-wave stations I should be grateful if any reader can identify this station for me. I have been a regular reader of your journal for the past two years.—R. SCOTTEN (Leyton).

A 14mc's Log from Wembley

SIR,—As DX conditions are improving, I enclose my log for the 14 mc/s band from March 18th to March 30th. All are phone:

W8RHC, QKS, AAG; W6KR, W4AHH, DSY; W3EZR, DOK; W2GW, W1RRS, W1FH, PK3JB, PK1OG, PY2ET, PY2NO, K7HAR, KA1RV, KA3KK, KA1AF, YV5ABE, YV5AK, HH5PA. Times between 15.00-18.00 B.S.T. Also station CB1180 on 11.97 mc/s asks for reports. QRA: Radio Nacional, Sociedad de Agricultura, Santiago, Chile. The English news is given at 5.30 B.S.T. Station PCJ sends a very nice verification card, the QRA is Philips Radio Works, Eindhoven, Holland. Frequencies are 15.22 mc/s and 9.59 mc/s. A view of the aerial masts makes the card very attractive.—C. HARVEY (Wembley).

The "Rapid Two"

SIR,—I should like to thank you for the circuit of The "Rapid Two," published some time ago in PRACTICAL WIRELESS. It is a simple circuit, but without doubt a splendid one for the Home Service programmes.

I have made an addition that, in my opinion, has proved a real improvement, viz., The Circuit No. 42 (Fig. 91) in your book "Sixty Tested Wireless Circuits—" "A Band Pass Adaptor." With a small "Stentorian" speaker, reception is wonderfully clear and volume ample.—H. FEAR (Bridgnorth).

Prize Problems

PROBLEM No. 397.

FERGUSSON had an A.C.-D.C. receiver which he had been using on D.C. mains. These were changed over to A.C. and he decided to modify the set for A.C. use only. He therefore obtained a mains transformer, connected this on the input side to the rectifying valve and joined the heater circuit to one winding on the transformer. When switched on, the set failed to work. What was wrong? Three books will be awarded for the first three correct solutions opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 397 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, April 29th, 1940.

Solution to Problem No. 396.

Manning should have connected his volume control across the first L.F. transformer, as the distortion was due to overloading of the first L.F. valve.

The following three readers successfully solved Problem No. 395, and books have accordingly been awarded to them:

W. Dunn, 1, Loftas Street, Moss Side, Manchester, 15.
H. Janes, 128, Willow Nurseries, Waterloo Road, Exbridge.
A. Oliver, 17, Alexandra Road, Parkstone.

Correspondents Wanted

J. A. Norris, 5, Kent Gardens, Ealing, W.13, wishes to correspond with a reader (about 16 years) interested in experimental work.

E. W. Wiskin, 25, Meadowside Road, Upminster, Essex, would like to get in touch with any reader who has built the Standard A.C. 4-valve short-waver. It is a W.M. 1935 circuit, and he is desirous of comparing results.

Practical Wireless
BLUEPRINT SERVICE

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Amateur Wireless ... ... 4d. „ „
Wireless Magazine ... ... 1/3 „ „

The index letters which precede the Blueprint Number indicate the periodical in which the description appears : Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS	Date of Issue.	No. of Blueprint.
CRYSTAL SETS		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve : Blueprint, 1s.		
The Signet Two (D & LF)	24.9.38	PW76
Three-valve : Blueprints, 1s. each		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three ((SG, D, Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D. Pen (RC))	3.9.38	PW90
Mains Operated		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen)	—	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-Valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-Valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	—	PW52
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	—	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model / Push Button 4, A.C. Mains Model	22.10.38	PW95
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
Simple S.W. One-valver	23.12.39	PW88
Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	1.10.38	PW68
PORTABLES.		
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS		
Blueprint, 1s.		
S.W. Converter-Adapter (1 valve)	—	PW48A
AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
B.B.C. Special One-valver	—	AW387
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
£5 5s. S.G.3 (SG, D, Trans)	—	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three : De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen)	—	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home Lover's New All-Electric Three (SG, D, Trans) A.C.	—	AW383
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM329
Harris' Jubilee Radiogram (HF Pen, D, LF, P)	*May* '35	WM386
SUPERHETS.		
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four	*Oct.* '35	WM395
The Request All-Waver	*June* '36	WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
Heptode Super Three A.C.	*May* '34	WM350
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
Rome Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-Short Battery Two (SG det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	—	WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	*Mar.* '36	WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M., A.C. Short-wave Converter (1/-)	—	WM403

In reply to your letter

Testing a Receiver

"I have a 7-valve superhet which is badly in need of readjustment. There are only a very few stations, and the quality is very bad. What do you advise as the best method of readjusting this set so that it gives the original good performance?"—H. E. R. (Hull).

IF the set needs re-trimming, then some form of signal generator is essential. You can obtain a small device known as an I.F. Liner which is sold adjusted by the makers for a given intermediate frequency, and which will enable you to line up the I.F. stages, and the others may then be adjusted on stations if care is taken to make all adjustments very carefully. Actually, if the job is to be done thoroughly and in the shortest space of time, one of the special set testers or analysers would be the most useful piece of apparatus.

Padding Adjustment

"I have a small set, make unknown, which I have tried to trim to get the Home Service station. This comes right at the top of the dial and I am unable to get it loud enough. It seems as though the condenser wants to go a little farther, but it is already all in. Is there any way of increasing the reading without getting new coils?"—D. V. (Carlisle).

IT may be possible to add a few turns to the coil, or in series with the coil, to load up the inductance, but you may find that the effect can be obtained by tightening up the trimmers fitted to the gang condenser. If the condenser is not provided with trimmers, you could connect a small preset in parallel with the condenser and adjust this to give the desired increase in capacity. Generally speaking it is preferable to increase the inductance as this will result in improved signal strength.

H.T. Battery Life

"I have a 4-valve set of rather old design which gives exceedingly good results, and I do not want to part with it. My only criticism is that the H.T. battery needs replacing very often, but I have found that a large part of the battery is still in good order and I have been using this part for a bed-light. Is there any fault in the receiver which causes it to run the battery out at one end? If so, how can I remedy it?"—R. C. S. (Basingstoke).

THE trouble mentioned by you is often experienced when a receiver is employed which has several H.T. positive leads. One part of the battery is giving a greater discharge than another, due to the fact that the part of the battery which you have found is not completely discharged only supplies a single valve. It should be remembered, however, that in most cases the maximum current is taken at the maximum H.T. lead and thus there should not be a great deal of difference in the discharge rate as the low-voltage tappings are generally only of the order of a very few milliamps. If, however, you are using a small-capacity battery, this would account for the effects mentioned, and in most cases you can overcome the trouble by obtaining a larger type of battery. The best plan, however, is to add decoupling circuits in the receiver, so that only a single H.T. positive lead is used, and thus the battery is then discharged evenly.

Push-button Tuning

"I wish to modernise my old battery set, and I have drawn up a few details as to the changes I shall make. One point, however, would be cleared up for me if you could advise regarding mechanical tuning. I should like to fit this so that I can also tune by the condenser. Could you therefore tell me the best system to adopt? I believe you can now buy the parts for this form of tuning."—H. V. (Leigh).

RULES

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.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

THERE are two forms of mechanical tuning which you can add. One utilises a number of small pre-set condensers with a separate button to switch in the main tuning condenser, and the other carries the main tuning condenser, the operation of the push-buttons being conveyed to the condenser. Thus pressure on the buttons actually rotates the tuning condenser and carries out the desired tuning. There is a clutch device fitted so that manual tuning may be effected when desired. Messrs. Peto-Scott can supply this unit (it was used in our push-button series of receivers), and they can supply the other type of unit in various patterns, together with the various pre-set condensers.

All-wave Tuner

"I should like to build an all-wave tuner capable of giving very wide ranges of tuning. I have been looking through various catalogues and there seems to be many different types of coil available, and I should therefore like to ask you to give me your advice as to the best arrangement to adopt for a home-built mains receiver."—D. B. Y. (Edmonton).

THERE are certainly many different schemes which can be adopted, and most of them have their disadvantages and advantages. You can obtain one of the screened multi-band coil units in any desired combination, and operate these by means of the special rotary selector switches, or you can obtain small separate coils for each waveband and assemble these yourself on a small panel or metal chassis and with an appropriate switch carry out the desired band selection. A great deal depends upon the type of circuit and the resultant question as to the amount of screening which may have to be employed, but we think you will find suitable coils and switches in the Bulgin range.

Wave-trap

"I am situated in a difficult position so far as general reception is concerned and I wonder if you can give me any idea as to the best improvement for my set. This is a simple battery three-valver and the trouble is selectivity. I get dozens of stations at once, especially morse, and I should like to improve this at the minimum of expense. What would you suggest in this case?"—T. C. A. (Folkestone).

A GOOD wave-trap should effect the desired improvement, and perhaps the special tapped arrangement which was described in our issue dated March 16th would be found suitable. If you require the greatest degree of selectivity in a wave-trap a good iron-cored coil should be used, although again a tapped coil is most suitable so that an exact adjustment may be carried out in conjunction with the tuning condenser.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

W. W. (Bedminster). Make certain that the new coil has the same connections as the old one. If so, then the grid condenser and grid leak and also the H.F. choke should be changed for more suitable values.

F. E. (Clacton). The H.T. should be 120 volts and the G.B. 16 volts. Your by-pass condenser is perfectly suitable.

G. R. T. (Brixton). The chassis may be of wood, provided that you earth all points now in electrical contact with the metal chassis.

C. R. (Hereford). We regret that we have no details. The makers only supply to registered dealers.

N. R. K. (Reigate). Put a .1 mfd. condenser in parallel with the component and all trouble should cease.

N. S. (Bristol). We suggest the wooden pole, and if possible, mount it on the side of the house.

D. R. (Liverpool). The wavelength is 14.35 metres. Try on a more suitable night.

M. M. (Leicester). Can you verify the current? It appears much too high for the values specified.

D. H. (Tunbridge Wells). We regret that at the moment we have no details of the station.

W. J. (Willingboro). We think the best plan would be to obtain a copy of our book "Coils, Chokes and Transformers."

J. B. (Dundee). An output meter is the best instrument, or alternatively a good Set Analyser would carry out the tests. We regret that we could not give constructional data of the second type of instrument but an output meter was described a week or two ago.

H. G. (Todmorden). Any good modern dual-range coil could be used.

C. T. B. (Deptford). The details have been given in past issues, but these are now out of print. We hope to deal with them again shortly.

A. K. (Lancing). Messrs. Premier Radio can supply the transformer mentioned by you.

The coupon on page 148 must be attached to every query

Classified Advertisements

ADVERTISEMENTS are accepted for these columns at the rate of 2d. per word (minimum charge 2/- each paragraph). Series discounts of 5 per cent. for 13, 10 per cent. for 26 and 15 per cent. for 52 insertions are allowed. All advertisements must be prepaid.

EACH paragraph will commence with the first word printed in bold face capitals. Additional words in bold face capitals are charged at 4d. per word.

ALL communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, London, W.C.2.

CABINETS

A CABINET for Every Radio Purpose. Surplus Cabinets from noted makers under cost of manufacture. Radiogram Cabinets from 30/-. Undrilled table, console and loudspeaker cabinets from 4/6. Inspection invited.
H. L. SMITH AND CO., LTD., 289, Edgware Road, W.2. Tel: Pad. 5891.

LITERATURE

NEW Edition. American Amateur Relay League Handbook. 500 pages of up-to-the-minute technical information, 7/- post free. 1940 Jones Handbook; approximately 700 pages dealing with every aspect of Short-wave Radio, 8/6, post free.—Webb's Radio, 14, Soho St., London, W.1. 'Phone: Gerrard 2089.

LOUDSPEAKER REPAIRS

LOUDSPEAKER repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

REPAIRS to moving coil speakers. Cones/coils fitted or rewound. Fields altered or wound. Prices quoted, including eliminators. Pick-ups and speaker transformers rewound, 4/6. Trade invited. Guaranteed satisfaction. Prompt service.
L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

MISCELLANEOUS

BE TALLER!!—Inches put you miles ahead!! Increased my height to 6ft. 3¾ins. Details 6d. stamp. —Malcolm Ross, Height-Specialist, BM/HYTE, London, W.C.1

MORSE EQUIPMENT

FULL range of Transmitting Keys, Practice Sets, Oscillators, Recorders and other Radio Telegraph Apparatus, designed and manufactured by T. R. McElroy, World's Champion Telegraphist. Sole distributors: Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

MORSE TRAINING

WIRELESS Code Courses. "Book of Facts" Free.—Candler System Co. (L.O.), 121, Kingsway, London, W.C.2.

MORSE easily learnt by gramophone records by ex-Service Instructor. Speeds from 2 words per minute. Also private tuition in London.—Masters, Pound Hill, Crawley, Sussex.

NEW LOUDSPEAKERS

3,000 Speakers, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

FREE ADVICE BUREAU

COUPON

This coupon is available until May 4th, 1940, and must accompany all Queries and Hints.
PRACTICAL WIRELESS 27/4/1940.

PUBLIC APPOINTMENTS

AIR MINISTRY.

AERONAUTICAL INSPECTION DIRECTORATE. Vacancies exist for unestablished appointments as Examiners in the General Engineering, W/T and Instrument Branches.

QUALIFICATIONS.
All candidates must have good general education, be able to read drawings, understand specifications, use micrometers and other measuring instruments.

(a) Applicants for the General Engineering Branch must have had practical experience in an engineering works. An elementary knowledge of materials testing is desirable.

(b) Applicants for the Instrument Branch must have knowledge of physics and training in light engineering or instrument making. Candidates with knowledge of optical instruments are also required.

(c) Applicants for the W/T Branch must have practical knowledge of W/T and electrical equipment with technical training in radio communication equal to City and Guilds final examination standard.

ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three calendar months, and will be paid £3 10s. 0d. weekly during training. Subsistence allowance of £1 5s. 0d. weekly during training is payable to married men normally residing outside the training area. On successful completion of training, candidates will be appointed as Examiners at a salary of £246, if 25 years of age or over, with a corresponding reduction of £12 per annum for each year under 25 on joining (payable monthly in arrear) if service is satisfactory, and must be prepared to serve in any part of the United Kingdom.

NORMAL age limits 23 to 60.

CANDIDATES should indicate on their applications for which vacancy they wish to be considered—a, b or c.

APPLICATIONS must be made on Form 780, copies of which can be obtained on application, *by postcard only*, to: The Inspector-in-Charge, A.I.D. Training School (I.C.S./REC. 53), Brandon Steep, Bristol, 1.

RADIO MAP AND GLOBE

WEBB'S Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6. Limited supply on Linen, 10/6. WEBB'S Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post Paid, 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

RECEIVERS AND COMPONENTS

ELECTRIC Light Check Meters, for sub-lettings, garages, etc. 200/250 volts, 50 cy. 1-ph., supply 5, 10 or 20 amps., 6/- each, post 1/-.
SAVAGE Mains Transformers, input 200/250 volts, output 50 volts at 6/8 amps., useful for arc lamps, etc., 15/- each, post 1/-.
EPOCH Super Cinema Moving Coil Speakers. 18in. cone. 6-volt field, 15-ohm speech coil, 35/- each C/F.
TRUVOX Public Address Horn Speaker Units, 15-ohm. speech coil, 6-volt field, 15/- each, post 1/6.
HIGH Voltage Transformers for television, neon, etc., 200/240 v. 50 cy. 1-ph. primary, 5,000 and 7,000 volts secondary, enclosed in petroleum jelly. Size: 5⅜in. x 4½in. x 4½in., 7/6 each, post 1/-. Ditto, skeleton type, 5/6, post 9d. All brand new.
D.C. TO D.C. Rotary Convertors, 220-volt input, 14-volt 12 amps output, useful to garages for accumulator charging 35/- each, C/F.
D.C. MOTORS, 200/240 volts, ¼ h.p. 4,000 R.P.M. double-ended shaft, good condition, 35/- each, C/F.
SILVERTOWN Horizontal Galvanometers, jewelled movements, 5/- each, post 6d.
MULTI-CONTACT Relays, EX-G.P.O., as used in automatic exchange, condition as new, small size, suitable for automatic tuning for press-button control, heavy platinoid contacts, 2/6, post 3d.; 2 for 4/-, post 6d.; 3 for 6/-, post 6d.
EVERSHED Recording Ammeter, 20 amps, D.C. in good condition, 50/- each C/F.
PHILIPS' One-valve Pre-stage Amplifiers, 200/240 volts, A.C. mains, less valves, 12/6 each, post 1s. 6d.
A.C. Induction Motors approximately ¼ H.P. 1425 r.p.m. 200/250v., 50 cycles, 1 phase, new condition, 27/6 each, post 1/-.
X-RAY tubes 4½ to 7 inch bulbs, Tungsten target 15/- each, ditto Platinum target 22/6 each, packing 2/6 extra, carriage forward.

Terms: Cash with Order.
ALL GOODS SENT ON THREE DAYS' APPROVAL AGAINST CASH.
GALPIN'S ELECTRICAL STORES, 75 Lee High Rd., Lewisham, London, S.E.13. Telephone: Lee Green 5240.

5/- BARGAIN PARCEL comprising Speaker Cabinet, 2 Drilled Chassis, condensers, resistances and many other useful components. Worth £2. Limited number. Postage 1/-.—Bakers Selhurst Radio, 75, Sussex Road, South Croydon

RECEIVERS AND COMPONENTS

RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE: HOLborn 4631.

COMPLETE KIT of parts to build Lissen Hi Q Battery Short-wave receiver. 5-91 metres switched. Brand new goods boxed, with circuit and instructions. Listed, £4/15/-. Our price, £1/19/11 less valves.

ALL-WAVE super-het. chassis, 5 valve A.C. Latest Mullard valves: T.H.4.B., V.P.4.B., T.D.D.4, Pen A.4, L.W. 4/350v. Ranges: Short-wave, 16-48 metres. Med.-wave, 200-560 metres. Long-wave, 800-2,200 metres. Size of Chassis: 14½" long, 7½" deep. Height overall, 8½". Controls tuning at side, volume on/off at side, wave change. Provision for pick-up. Complete with valves and knobs, £4/17/6. Special speaker, 1,500 ohms field, 10/6 each.

H.F. choke. Lissen Hi Q Compact disc type with feet. Boxed. List, 2/6. Our price, 6d. each.

ULTRA-SHORT and short-wave choke. Lissen Hi Q. Inductance 100 microhenries. Boxed. List, 2/-. Our price, 1/- each.

ULTRA-SHORT and short-wave double-wound low-resistance choke. Lissen Hi Q. Resistance less than .05 ohms. Boxed. List, 2/6. Our price, 1/3 each.

LOW-LOSS Ceramic valve-holders. Lissen Hi Q. Base-board and chassis. 5- and 7-pin., 10d. and 1/- each.

MANSBRIDGE type condensers. Lissen Hi Q. 250 D.C. working. Moulded case with feet. .1 mfd. and 1 mfd., 6d. each.

ROTARY coil unit. Lissen Hi Q. Four-band from 4.8-91 metres, can be selected by a turn of the knob. With circuit. Boxed. List, 15/6. Our price, 6/11.

LOW-LOSS short-wave variable condensers. Ceramic Insulation. Brass vanes. Lissen Hi Q. Minimum capacity 5 micro-micro farads. Two types. Boxed, with knobs. 160 m.mfd. List, 7/6. Our price, 3/6 each. 20 m.mfd. List, 5/6. Our price, 2/11 each.

MICA condensers, Lissen. New. Boxed. All useful sizes, OUR selection. 1/3 per dozen.

SPEAKER cabinets, finished black rexine. Circular face. Metal grille. Size 8½" x 9½" x 4½", 4/6 each.

SCREENED 3-way flexible, 4 yards for 1/6.

MEDIUM- and long-wave coil unit, with valve-holders and sundry resistances, 9d. each. (No circuit.)

MIXED tubulars, wire-ends. OUR selection, 2/6 per dozen.

4-PIN base-board valve-holders. Lissen. 2 for 3d.
4-1 L.F. transformers. Lissen. Boxed, 2/6 each.

CONE speaker unit. Lissen. Complete with reed and chuck. Boxed. 1/- each.

SPAGHETTI resistances. Lissen. Many useful sizes. OUR selection, 1/3 doz.

4-PIN valve adapters. Lissen. 6d. each.

PUSH-PULL switches. Lissen. 2-point, 4d. each. 3-point, 6d. each.

RICE-KELLOGG SENIOR 12" moving-coil speakers, 20 watts. Field 1,000 ohms. 11 ohms speech coil. Without speech transformer, 32/6 each. With transformer tapped 3,000 ohms and 7,000 ohms, 35/- each.

GRAMPIAN 10" 10-watt, 2,500 ohms energised speakers. Heavy cast frame, 15/- each. With heavy-duty pentode speech transformer, 17/6 each.

HEAVY-DUTY speech transformers. Pentode matching, 2/11 each.

2-GANG straight condensers. Plessey. 1/6 each. Ditto, 3-gang, 2/- each.

ROLA P.M. speakers. Latest type 7½" cone with pentode transformer. Boxed. 14/6 each.

CLOCK-FACED dials. 5" x 3½". With printed 3-wave scale. Ox-copper escutcheons and glass, 3/6 each. Ditto, less escutcheon, 2/6 each.

HORIZONTAL dials, with plain scale. 7½" x 3½" and pointer, 1/- each.

FILAMENT transformers, input 200-250v., output 4v. 4 amps., 4v. 6 amps., 4/11 each.

MAINS transformers, Plessey, 350-0-350v., 90 m.a., 4v., 2.5 amps., 4v., 6 amps., 8/6 each.

MAINS transformers. G.E.C. American windings, 350-0-350v., 65 m.a., 5v. 2 amps., 6.3v. 2.5 amps. Suitable for replacements in G.E.C. models, 5/6 each.

MAINS transformers. Wearite. Type R.C.1, 250-0-250v., 80 m.a., 4v. 2.5 amps., 4v. 4 amps., 9/11 each. Type R.C.2, 350-0-350v., 120 m.a., 4v. 2.5 amps., 4v. 4 amps., 12/6 each. Type R.C.3, 350-0-350v. 150 m.a., 4v. 2.5 amps., 4v. 2 amps., 4v. 5 amps., 15/- each. Type R.C.4, 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.0 amps., 21/- each. All the above centre-tapped windings. Type R.C.5, 100-watt auto transformer, 100-110v., 200-250v., reversible, 12/6 each. All transformers 200-250v tapped primaries.

CHASSIS mounting valve-holders, American 4-5-6- and 7-pin. 4d. each. Octals, 6d. each. Loctals, 10d. each. 7-pin English type, 3d. each.

1 WATT resistances, Polar N.S.F. 4d. each, 3/9 dozen. All sizes up to 2 meg.

WEARITE 110 k/c I.F. transformers, 1/- each.

(Continued on page iii of cover)

RECEIVERS AND COMPONENTS

(Continued from page 148)

VOLUME controls. American C.T.S., finest made, divided spindles. Length 2½". With switch, 2,000, 5,000, 10,000, 25,000, 100,000, 250,000, 500,000, and 1 meg., 2/6 each. Wire wound, 5 watt (less switch), 2,000, 5,000, 10,000, 20,000, and 25,000 ohms, 2/- each.

24 MFD. can type, electrolytics, 450v. working, 1/6 each.

B.I. wire-end type bias electrolytics. 50 mfd., 12v., 1/6 each; 50 mfd., 50v., 2/- each.

TUBULAR wire-end non-inductive paper condensers. All sizes up to 0.1, 5d. each, 4/9 dozen.

ENERGISED speakers, Plessey 6" cone, 1,500 ohms field, 5/11 each.

BATTERY output pentode valves. Well-known make, 3/11 each.

BATTERY double diode triode. Well-known make. 3/6 each.

RAYTHEON first-grade valves. Largest stocklists, all types in stock, including glass series, glass octal series, metal series, bantam series, single-ended series, and resistance tubes, all at most competitive prices; send for valve lists. All orders must include sufficient postage to cover. Hours of business: 9 a.m.-6 p.m. weekdays Saturday, 9 a.m.-1 p.m. Please write your address in block letters.

RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE: HOLborn 4631.

COULPHONE Radio, Grimshaw Lane, Ormskirk. 1940 Collaro A.C. Gramophone Motors 12" turntable, 27/6. Radiogram units, 45/-. American Valves, all types, 4/6. Octal, 5/6. Record F.W. Rectifiers, 5/6. Stamp for list.

SOUTHERN Radio's Bargains.
ALL Guaranteed. Postage Extra.
5/- Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.
15/- Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7". 15/- the Kit.
21/- Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.
5/- 100 Wire-end Resistances, assorted capacities. ½ and 1 watt, 5/- per 100.
ORMOND Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.
2/- Tool or Instrument Carrying Cases, ex Government Stock; Wood, 9" x 7" x 7", 2/-.
SOUTHERN Radio, 46, Lisle Street, London. W.C. Gerrard 6653.

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Those components for which you have no further use can be turned into cash through the classified columns of "Practical Wireless." Readers' advertisements are inserted at the special rate of 1d. per word (minimum charge 1/-).

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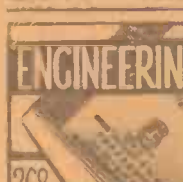

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