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EVERY WEDNESDAY
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ROUND THE WORLD OF WIRELESS

Radio Careers

AN increasing number of readers are turning their attention to the question of radio as a career. The recent announcement that the Royal Air Force were introducing a new trade to be known as "Radio Mechanic" has re-awakened interest in this field of work, and accordingly this issue carries a number of articles dealing with the question of radio as a career. Some readers are interested purely in the operating point of view, seeing in the mysteries of the morse code a certain glamour or excitement. They wish to be seated at the operating desk of a large ocean-going liner or warship, or alternatively in the wireless cabin of a modern air-liner. Others are more interested in the production department of a large modern radio manufacturer, whilst yet others would prefer to service receivers, seeing in the unravelling of obscure faults something which is both intriguing and interesting. We have endeavoured in this issue to give some idea of the requirements of these individual branches of the trade, and also of the prospects, but with all of them it is highly desirable that some specialised course of training be first adopted so that the experience gained will enable a higher standard of efficiency to be attained. There are now many training colleges who specialise in such training, and home-correspondence courses are available for those who cannot spend their time at school during the daytime.

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How Many Valves?

THE question of whether or not a rectifier should be included in the number of valves employed in a receiver has again come up for consideration in America. It is customary to refer to a set as a four-valve plus rectifier, rather than a 5-valver, but the use of dummy valves and similar items has given rise to troubles in the U.S.A., as they have been included in the number of valves actually in use. The Trade Commission recently reiterated to the R.M.A. that "References to rectifier valves, and to valves, devices or accessories which do not serve as signal-amplifying or detecting valves or heterodyne oscillator valves, should be such as to clearly avoid misunderstanding or deception of purchasers." This means that in any reference to the number of valves in a set, rectifiers, tuning indicators, ballast or resistance valves, must either be indicated separately or not included in the total valve count.

For the Forces

THE wavelengths for the programme for the Forces will be, during the daytime, 373.1 metres, which is marked on many receivers "Welsh Regional," and, during the evening, 342.1 metres, marked "London Regional."

The time at which the change in wavelength occurs will vary with the season of the year. The following are the transmission details for the period February 18th to March 16th. It will be noticed that during that period the wavelength of 342.1 metres will broadcast the Home Service programme from 11 p.m., when the programme for the Forces ends, until 12.15 a.m.

During this period, and at other times when the programme for the Forces is the same as the Home Service programme, listeners in Britain who find difficulty in receiving the Home Service on 449.1 metres or 391.1 metres, may find it better to tune in to the wavelength for the Forces programme.

European Broadcast

TWO countries very much in the news at the moment are Norway and Sweden. Some months ago, D. G. Bridson, the B.B.C.'s Northern feature expert produced a programme showing the racial and cultural links between Norway and the North-country. This programme, which had a background of Norwegian music, was one of the most successful features of its kind, and it is now to be revised and broadcast again on March 8th.

Tunes for the Troops

IAN WHYTE inaugurates on February 28th a series of concerts of popular music by the B.B.C. Scottish Orchestra. He believes that many listeners who declare their objection to the classics really enjoy many classical pieces of music without being aware of it. His series, called "Tunes for Everybody," the first of which will be broadcast for the Forces on February 28th, is a non-stop collection of tunes taken mostly from symphonic music, with the names kept secret until the broadcast is over.

When Jimmy James was a lad in Chillicothe, Ohio, he used to thump a drum in the local band. Nobody knew that he was studying flute, then clarinet. It was the latter, however, and not the drums which got him a job first with local orchestras, later with Hal Kemp and Henry Thies, and finally, a spot as a band leader at WLW. His "rhythm against the strings" arrangements are heard over that station every Monday and Friday at 7.30 p.m. E.S.T., on "Four Stars To-night."

A Universal Valve-tester—2

Details of the Bridge Unit are Described in this Article.

By F. DAY-LEWIS, A.M.I.R.E.

THIS bridge unit is used with the valve panel already described, and with the two combined instruments it is possible to measure the mutual conductance or "goodness" of a valve, without the necessity of complicated meter readings and calculations.

The Unit is an adaptation of the common A.C. bridge, and with the aid of headphones and a L.F. signal generator (a number of which have been already described in PRACTICAL WIRELESS) we can conduct a real laboratory type test. The valve is handling a signal from the generator, and thus is operating under its natural working condition; this is totally unlike the "static" condition mentioned when taking characteristics by meters, as already outlined.

As phones are used to obtain a "zero" signal, it is also possible to hear any noises in the valve under test, and in this way we have an audible and visual test for the valve at the same time. If short-circuits or open-circuits are present, this method will certainly show them up, and due to the weakness of the applied signal to the grid of the valve under test there is less likelihood of an arc-over of signal, as with a high voltage test. The high-voltage inter-electrode test can, of course, also be used.

The Panel

The panel can be of plywood or ebonite, according to the constructor's liking, and either will do equally well. It measures 9in. square, and is drilled as shown in Fig. 4.

There are a number of holes for the sockets which are so placed on the panel that they offer convenient and neat connections to the master valve panel when placed alongside it. The two left-hand top sockets are connected to a signal generator, the two below these are for phones. The three top sockets on the right-hand side of the panel are connected to similarly marked sockets on the valve panel, and the two sockets below these are connected with long leads to the sockets similarly marked on the valve panel.

In the centre are three resistances, and these are so mounted that small scales may be fitted on the bushing under the knob and pointer for reading their value at any point.

The Circuit and Wiring

The circuit is shown in Fig. 5, and from this it will be seen that the input signal from the generator is applied via the 1-mfd. condenser, and 50,000 ohm resistance, to the three variable resistances which are in series. The signal also passes on to the grid of the valve under test via the 4-mfd. condenser.

From the other end of the resistances the signal also passes to the anode of the valve in the test panel, and when the three resistances (or perhaps only one) are suitably adjusted, no sound, or a very much weakened signal is heard in the phones.

The variable resistances are of the wire-wound, straight-line-characteristic type, and when they are in place on the panel it will be necessary to plot their individual resistances for various rotations of the knob. When this is done the constructor will always have a complete resistance value from a few ohms up to and slightly above 100,000 ohms. This is obtainable by placing an extra plug socket on the panel (marked X), and connecting this as shown. The resistances when required for other purposes (such as substitution testing) can then be isolated, and used by connecting a pair of leads to the sockets marked "A" and "X."

The condensers are of the paper type, and must not be electrolytic, and the L.F. transformer is joined up as shown; its ratio is not very critical, but its primary winding must not have too high a resistance—up to 800 ohms is recommended, but the lower the better.

The wiring can be done with any good wire, and good soldered joints are preferable.

The Scales

The scales are cut from cardboard covered with transparent celluloid, and can be of any convenient size. A hole is cut in the centre of the discs from which they are made, and this should allow them to slip over the bushing around the spindle of the resistances so that when the bushing holding screw is tightened it holds the scales in place. For the purpose of calibrating, the celluloid should at first be left off until the scale is marked.

Divide the scale into sections of approximately equal length, as shown in the diagram of the panel front, and arrange these as far as possible so that the equal resistance values will fall upon a line of division. The resistance values are found as follows:

Obtain either a Resistance Bridge meter of known accuracy, or a good ohm-meter, and connect across the sockets marked A and X. Rotate the knobs of all the resistances so that with no resistance in circuit their separate pointers fall on the first marked line of the scale. Now gradually rotate V1 until approximately the first line of division is reached, and obtain the nearest whole number resistance value there.

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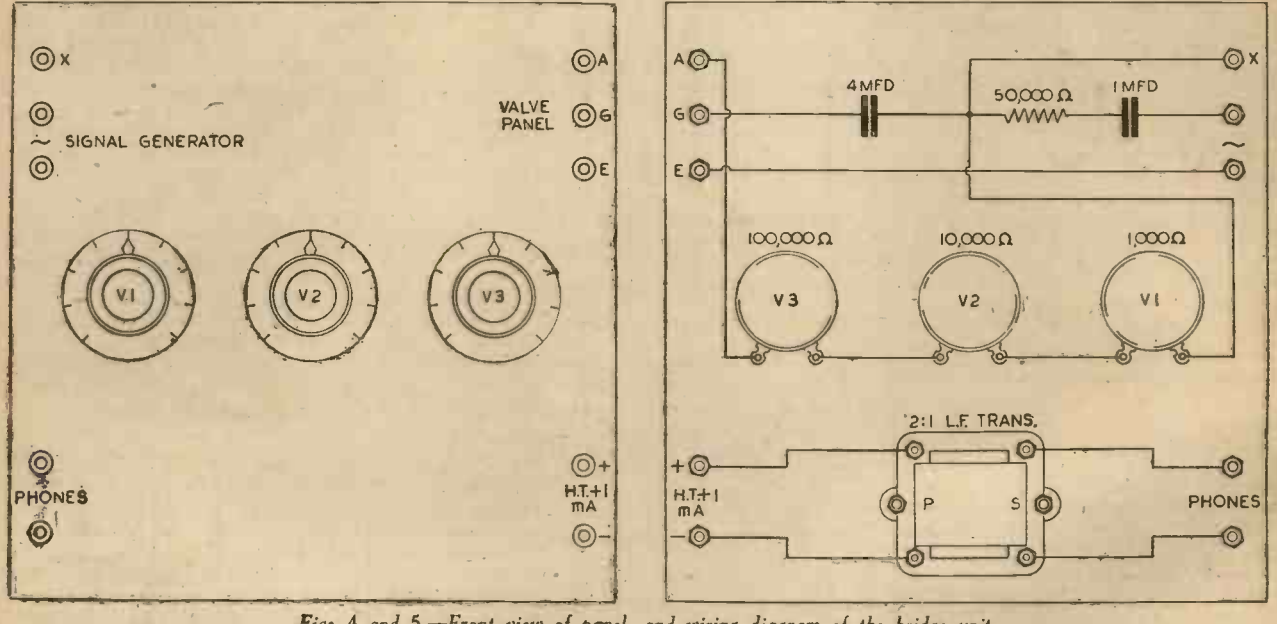

Figs. 4 and 5.—Front view of panel, and wiring diagram of the bridge unit.

VOLUME CONTROL METHODS

In This Article Various Points with Regard to the Correct Selection of Volume Control for Particular Purposes are Dealt With

THERE are four principal points in a radio receiver at which volume control may be exercised. These are, first in the aerial circuit; second, in the H.F. stages; third, in the detector stage; and fourth, in the low-frequency amplifier. Each type of control can be achieved in various ways, each has its own particular advantages and disadvantages, and sometimes it is desirable to employ more than one form in a single receiver in order to obtain perfect control.

Volume control applied in the aerial circuit usually takes one of two main forms, either a potentiometer or variable resistances connected across the tuning coil, as shown in Fig. 1, or a differential condenser, connected in a similar way, as indicated in Fig. 2.

The result in each case is to reduce the effective strength of the incoming signal, and since the strength of the effective aerial signal is operative on every valve in the receiver, this device controls the ultimate volume of sound. There is a further point, however, in that these methods allow the input voltage to the grid of the first valve to be reduced on powerful signals, thus avoiding any overloading of the valve with the consequent introduction of distortion.

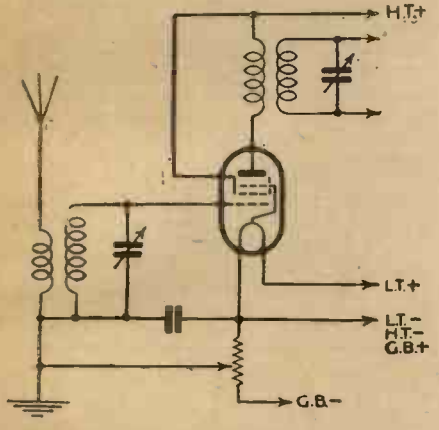

Fig. 4.—Theoretical circuit for battery variable-mu valves.

A Serious Disadvantage

Unfortunately, however, this form of control has a somewhat serious disadvantage, in that any adjustment which is made alters the tuning constants of the circuit, and thus upsets the calibration of the receiver and also the ganging of the tuned circuits. In spite of this, however, these methods are quite widely used in circuits employing ordinary straight high-frequency valves, that is to say, valves which do not possess the variable-mu characteristic and which, therefore, are rather susceptible to overloading when powerful stations are tuned in.

An interesting variant of this device is the local-distance switch which is sometimes fitted to a powerful receiver. This usually takes the form of a resistor having a value of 100 ohms or so, which is shunted across the aerial coil when the local station is tuned in, thus by-passing a portion of the signal energy in order to prevent overloading of the first valve.

We now come to volume-control devices,

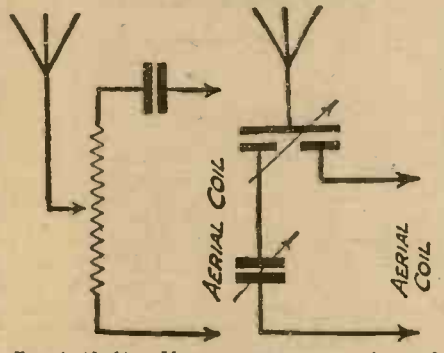

Fig. 1 (Left).—Using a potentiometer form of input control. As an alternative, the arm of the potentiometer may be joined to earth, instead of one end, thus providing a resistance control. Fig. 2 (Right).—A "capacity" potentiometer or differential condenser as input control.

which are applied to the high-frequency stages themselves and not to the incoming signal. The first two forms shown are not much used to-day, but may still be found in older receivers built in the days when the powers employed for broadcasting stations were not so great as they are to-day.

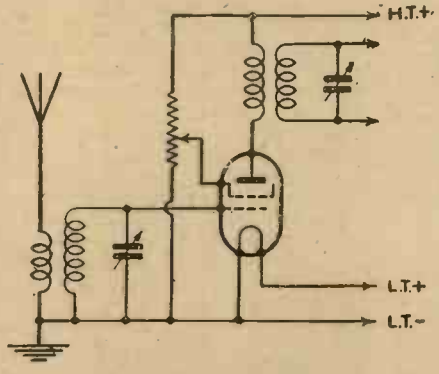

Fig. 3.—Variation of screen voltage for volume control in H.F. stage.

The most primitive of these control devices, which can only be applied to a battery set, is a variable resistance in the filament circuit of the high-frequency valve. By dimming the filament the amount of amplification is correspondingly reduced, but the grave disadvantage of this arrangement is that considerable distortion is introduced, especially on low volume.

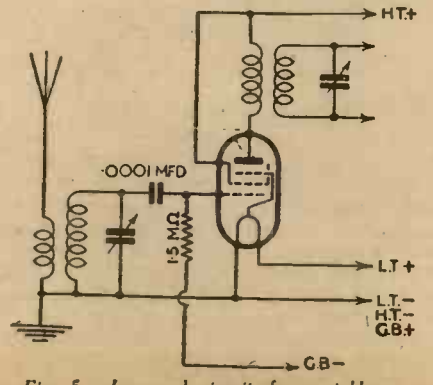

Fig. 5.—Improved circuit for variable-mu control.

A rather better device is to lower the volume by reducing the screen voltage of the screen-grid valve—usually achieved by the inclusion of a potentiometer across the H.T. supply, as illustrated in Fig. 3. This is fairly satisfactory for its purpose but, of course, suffers from the disadvantage that it still leaves the first valve liable to overloading.

Better H.F. Methods

The only really satisfactory high-frequency volume control is the use of the variable-mu valve. This form of control has been described very fully on so many occasions that it will suffice to remind listeners that in a variable-mu stage specially-designed valves are employed, having the important characteristic that their sensitivity is very high when operating with zero or small grid-bias values, and is gradually reduced as the negative bias voltage is increased. Not only does this give a smooth and conveniently applied control of the ultimate volume of sound, but, what is even more important, when operating on increased grid bias the variable-mu valve can handle without distortion correspondingly greater signal inputs.

Fig. 4 shows one theoretical method for applying volume control in this way in a battery-operated receiver, but an improved circuit giving the same effect is illustrated in Fig. 5. Here, instead of applying the variable bias through the tuning circuit, it is fed directly to the grid of the valve through a grid leak of from 1 to 5 megohms resistance, a small fixed condenser being included in the lead between the grid and the high potential end of the tuned circuit to prevent the controlling bias being short-circuited by the tuning coil.

A further refinement is indicated in Fig. 6, wherein the aerial coil itself is

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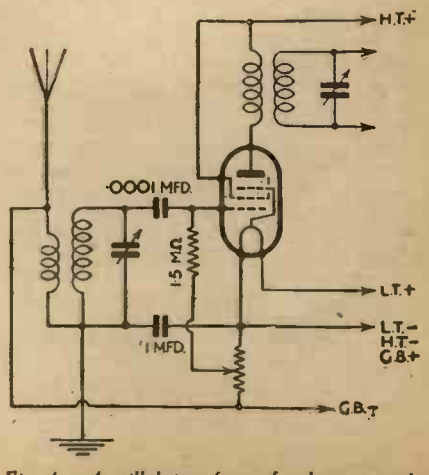


Fig. 6.—A still better form of volume control—combined variable-mu and aerial damping.

VOLUME CONTROL METHODS

(Continued from previous page)

included in the circuit and is damped by being shunted by a part of the bias potentiometer, this shunt being decreased in resistance as the negative bias to the variable-mu valve is increased. This combination of variable-mu gain control and aerial damping gives a more effective and uniform action than simple variable-mu control.

It has already been pointed out that variable-mu control can be used to avoid overloading the early stages in addition to controlling volume. A very important adaptation of the principle is automatic volume control, or A.V.C., in all its various forms. Here again, it is not intended to describe in full detail all the various A.V.C. circuits, as these have been given in recent issues. Readers should remember, however, that in A.V.C. the extra bias required to control the variable-mu valves is provided by the rectified carrier voltage, either direct or after amplification, with the result that the biasing voltage is proportional to the signal voltage. Strong signals are, therefore, given more control than weak signals, and overloading is thus automatically avoided. In its best form, A.V.C. ensures a fairly even volume level for all signals above a certain maximum value. Even so, however, many listeners prefer to have some means of controlling volume to suit their personal taste, and this can be arranged easily in addition to the automatic device. Fig. 7 shows a typical A.V.C. circuit for a battery-operated receiver employing one or more high-frequency valves.

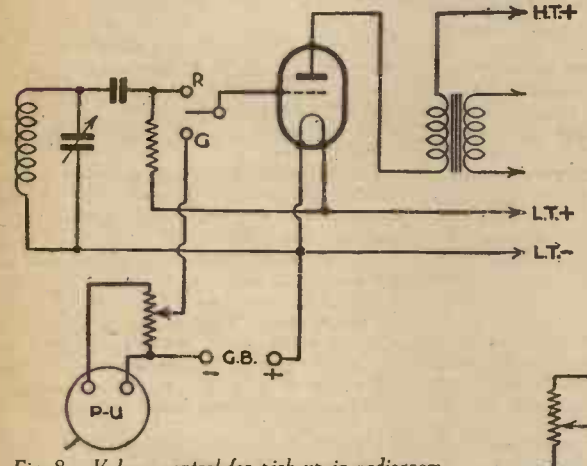


Fig. 8.—Volume control for pick-up in radiogram combination.

The Detector Stage

Volume control can be obtained in the detector stage by the very simple but popular device known as "reaction." As most listeners know, reaction consists in returning to the grid circuit of the detector valve a controlled amount of the unrectified high-frequency energy present in the anode circuit of that valve. The arrangement is familiar to everyone—an H.F. choke is included in the anode circuit of the detector to divert the H.F. energy through an alternative path, consisting of the variable reaction condenser and the reaction coil.

Reaction control is now falling into disuse quite rapidly for very many reasons. In the first place, it has no effect whatsoever on the high-frequency stages, and so cannot be used to prevent overloading in that portion of the receiver. Then, it can be employed only to increase volume above the minimum value dependent upon the strength of the incoming signals and the general sensitivity of the receiver. This means that in order to obtain any volume greater than the minimum which the set will give with a given signal strength, reaction must be applied and the application of reaction always introduces a certain degree of distortion, although this is more in evidence as reaction is applied to the limit. Any degree of reaction, however, has a definitely deleterious effect on quality which is only partly compensated by the improved selectivity which results if a reasonable degree of reaction is used. Misapplied, however, reaction is a definite menace, because in addition to the normal amount of distortion one would expect, there is always the risk of the receiver bursting into oscillation to the utter destruction of entertainment and to the possible annoyance of listening neighbours.

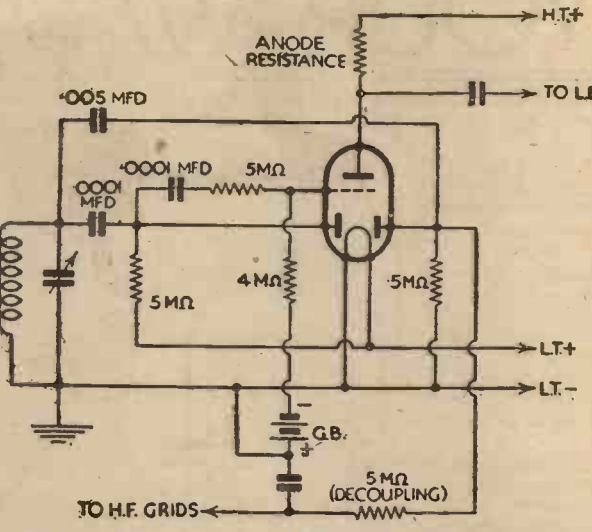


Fig. 7.—Simple A.V.C. for a battery set using double-diode-triode.

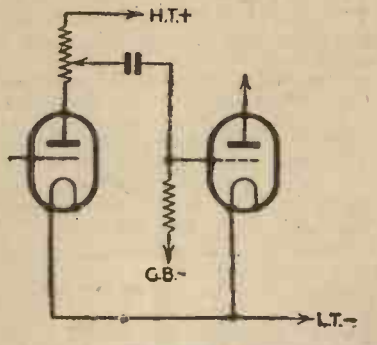


Fig. 9.—L.F. volume control by variable anode resistance.

Moreover, variation of reaction upsets both the calibration and the ganging of the receiver and this is a grave disadvantage when accurate single knob tuning is demanded on every hand. Fortunately, however, the need for reaction becomes smaller every day, as the overall sensitivity of the modern receiver fitted with high-frequency pentodes is sufficiently high for all normal purposes.

On the L.F. Side

Finally, consideration must be given to volume control in the low-frequency amplifying stages. This form of adjustment is, of course, essential if the L.F. side of the receiver is arranged for use in connection with a pick-up for the reproduction of gramophone records. In such a case, the conventional circuit comprises a potentiometer connected across the pick-up terminals, as shown in Fig. 8. Such a potentiometer can be ganged conveniently with the variable-mu volume control, so that both are operated from a single knob. In this case the variable-mu control is operative on radio only, and the L.F. control is operative only when gramophone records are being played.

The control applied direct to the low-frequency input in this way is almost essential if the gramophone pick-up is likely to develop an audio-frequency voltage greater than that which could be handled without distortion by the first low-frequency valve—which is usually the detector.

Other positions where volume control can be applied to the low-frequency amplifier are shown in Figs. 9, 10, and 11.

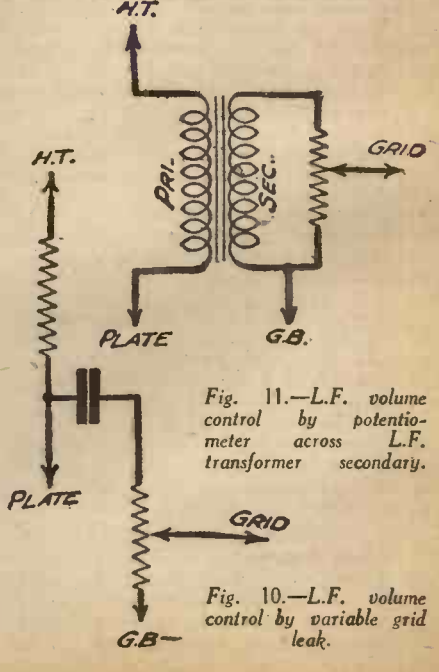


Fig. 11.—L.F. volume control by potentiometer across L.F. transformer secondary.

Fig. 10.—L.F. volume control by variable grid leak.

ON YOUR WAVELENGTH

By Thermion

Careers in Radio

THE announcement over the wireless that a new wireless trade has been created in connection with the Forces has aroused the enthusiasm of keen wireless fans with the necessary qualifications, and also the enthusiasm of those who would like to possess those qualifications. The cryptic reference in the broadcast speech of a possibility for the resumption of television has no doubt accounted for the jump in the sales of our "Television and Short-wave Handbook."

However, there are some excellent careers in radio with good prospects for advancement, good pay, and with tenure of office. Our postbag has bulged with letters of inquiry regarding particular points concerning qualifications, rates of pay, etc. To meet this demand I understand that elsewhere in this issue there is a career supplement, explaining the various opportunities that are open. Excellent books (we publish many) are available for the student, and these, together with the postal radio courses, make study and the obtaining of the necessary qualifications easy.

Wireless is playing an increasingly important part in the war. If the war is, unhappily, of long duration, it will play an even larger part, especially now that nation speaks hate unto nation. Germany has practically no surface craft afloat. The British Navy roams the seas, and its various units are able to keep in touch with one another by radio. Ships are able to call for the assistance of others when a submarine or a raider is spotted. Aircraft is able to keep in touch with our ships and our submarines by means of radio. The recent tracking down of the *Altmark* would not have been possible without the combination of radio and aircraft, plus our remarkable Navy. It was a tonic to me to read, once the ship had been located, the classic order to the Captain of the *Cossack*: "Go and fetch our men." Once the Captain received that order he lost no time in *making fast* to the *Altmark* whilst its German crew scuttled like a lot of anæmic rabbits.

Thus a radio operator plays an important part in modern warfare. They want men with technical knowledge to help to play that part. This journal and its associated technical books exist to give it.

The New Wavelength

THE wavelengths for the programme broadcast to the Forces are: during the daytime 373.1 metres, which corresponds to the Welsh Regional wavelength, and during the evening 342.1 metres, which corresponds to the London Regional.

The B.B.C. announce that the time at which the change in wavelength occurs will vary with the season of the year.

Club Journal

I HAVE received a copy of *Topical Topics*, the new club journal of the Romford Amateur Radio Society. The Editor is Mr. A. J. Hallett (G3CQ). It is a foolscap duplicated production, and is brightly written. Apart from club news it contains some practical hints and kinks, and a list of members' bargains, as well as a circuit diagram for a direct coupled amplifier.

Stereophony

A READER asks what this means. It is a term applied to the experiments which have taken place in an endeavour to obtain the illusion of depth in broadcast reception. As at present known, the sounds are picked up by a single microphone, which, of course, destroys all sense of "relief," and are relayed from a single point in the room. Experiments in stereophony have consisted of using two microphones arranged at each end of a studio, and relaying the sounds picked up by one from one station and those from the other microphone from a different station. At the receiving end the two stations are received on separate receivers and two loudspeakers. Two loudspeakers arranged in different places will also give an effect of stereophony.

War-time Developments

IT is a well-known fact that aircraft owed its rapid development to the last war, and I am quite certain that there will be similar rapid development and change in the field of radio arising from this war. Extensive use is being made of the art in all branches of the services, and it is only natural to assume that with the large number of experts who are engaged, various incidental inventions will arise, and, who knows, perhaps the real cold valve will eventuate. This is undoubtedly the radio designer's dream, and many attempts have been made to produce a device which will perform like a modern valve, but which requires no battery supply source. With aircraft radio size and weight is of considerable importance, and maybe this will lead to some new technique. Secrecy is another important point—code not being regarded in the same category as a "secret ray" or some similar method of sending a signal which can only be received by a listener for whom the signal is intended. I expect there are dozens of real experts engaged by the Government in research and it would be interesting to try to forecast the state in which we shall find radio at the end of hostilities. The amateur can, of course, play his part, and although transmitting activities have been curtailed there are many interesting fields which he can explore if he is not otherwise engaged in work of National Importance.

Suggestion for Radio Clubs

IT is practically impossible to spend an evening in any Club without becoming painfully aware of the repetition of certain "pet phrases." At first, some of these can be mildly humorous, but after a while they lose their wit, and become boring and irritating. I would suggest that many club secretaries could do much to save the tempers of their members by adopting the system mentioned below.

The constant reiteration of the word "actually" so preyed on the nerves of a squadron-leader at a Fighter Command station that he suggested a fine of sixpence for each use of this adverb.

The squadron agreed. The cash collected in a fine box was to be devoted to brightening up their rest room.

At the end of the first week they had enough to buy a new dart board. Next week there was hardly anything in the box. The squadron had been cured of "actually."

So they invented rest-room "crimes." There were fines of sixpence for using the floor instead of the ash-tray for cigarette ash, for leaving newspapers on chairs instead of on the table, and for entering the room in dirty boots.

The radio set, for which pilots subscribed weekly sums, is naturally a precious instrument. Anyone who mishandles it must pay a fine of 1s.

The rest room, where the pilots wait "at the ready," is now a cosy place. It is close to one of the hangars. The "fine fund" is increasing fast. The men hope soon to be able to buy a carpet, 15 feet by 20 feet. But if someone should "actually" make them a present of a carpet the fines would be liquidated by the throwing of a party.

Replacing Components

THOSE readers who have endeavoured to repair a fairly complicated commercial receiver well know the difficulty of tracing the wiring—if access can be gained to it. In many cases it is reasonably easy to find that, say, a bias resistor has developed an open circuit, by making standard tests with a meter. But when you try to find the resistor the trouble starts. It is sometimes necessary, for instance, to remove two or three leads in order to reach the faulty part. To avoid difficulty in replacing these it is a good plan to make a rough wiring plan of that part of the set that is being worked upon. Another way is to mark the leads removed by attaching pieces of stamp edging.

By the way, there is one good hint which many constructors can take from commercial practice. I refer to the use of a detachable plywood or fibre panel at the bottom of the cabinet. When this is taken away the underside of the chassis is fully exposed without the need for taking the set out of the cabinet.

Comment, Chat and Criticism

Beethoven's Key Preferences

Our Music Critic, MAURICE REEVE, Discusses the Frames of Mind and Mood of the Great Master

ANYONE possessing an intimate association with the work of the great composers cannot fail to be struck by their distinct preferences for certain keys. The frequency with which a composer will select one certain tone colour, or one nearly related to it, as the medium through which to present his work to the world, unquestionably proves that he has a definite viewpoint, or psychological outlook on life and things which repeatedly "will out." In a large number of cases it doubtless expresses itself despite the composer's volition: his train of thought just takes him into it as a diner will turn to chicken or beef instinctively for the majority of his meals, or a lady to a certain colour for the majority of her frocks and hats. In few of the great composers can this be more illuminatingly illustrated than in the works of Beethoven. Not only did he show an unquestioned preference for a certain group of closely related keys but his choice can be easily and interestingly associated with his mentality, and with certain notable events in his life. A brief study of these events, and of his favourite keys, should serve as an excellent guide to the same problem in other composers' music.

Philosophical Outlook

Beethoven was probably the most philosophical of all the great musicians. From the earliest age life dealt him the heaviest blows. Tragedy succeeded tragedy throughout his agonised life of fifty-eight years. A drunken father placed on his shoulders the responsibility for his mother's, and her her younger children's maintenance. Intense study made him a professional musician before he was twenty. Fortunately he had a lion's constitution. At about thirty came the realisation, following a severe chill caught after getting wet through, that he was to be deaf for the rest of his life. Seeing that he had already produced sufficient work to mark him out clearly as the legitimate successor to Haydn and Mozart, he must have been overwhelmed by the news. He was, in fact, so profoundly moved that it made him the great introvert he became for the rest of his life, and caused the commencement of that series of master works which, for passionate depth of human feeling and, later, for spiritual and eternal affinities, have never been equalled before or since.

Of an intensely romantic nature, this deafness became one of the chief preventives of his ever marrying. Many love affairs were denied fruition because of this, and a grinding poverty. The adoption of his nephew, the son of a dissolute brother and an equally worthless wife, brought further torment to the harassed master's soul, culminating in the young man's attempted suicide over some petty frustration. The crowning tragedy was when total deafness finally closed in on him. His death rings like the tragedies of ancient Greek drama. Although in abject poverty, he refused to touch a little money he had saved for the ingrate nephew although it might have been able to purchase sufficient to transform the misery of his last days on earth.

Tragic Influences

Although Beethoven's life also contained many rays of sunshine, all of them faithfully portrayed in such works as the Pastoral and Eighth symphonies, and the G major Piano Concerto, the dominating influences in his life were tragedy and disaster. Seeing that he was a man of the greatest piety and moral integrity (this in spite of a few commercial lapses with his publishers, and others, largely inspired by a desire to get as much as he could for his worthless nephew), the effect on his creative life was constant, from first to last. He looked at the world in greys and browns, except when his thoughts left it altogether and soared to higher realms.

It is generally agreed that the brightest and gayest keys are to be found amongst the sharps, whilst the more solemn, thoughtful and lofty moods are far better represented by the flats. Also that minor tones are less suitable for expressing joy or vivacity than the major ones. At least this is borne out most conclusively by even a cursory perusal of the great composer's music. In programme music, where the writer expresses his thoughts and intentions at the head of a work, a major sharp key is almost always selected through which to express the liveliest feelings, with perhaps the most beautiful key of all—C—heading the list. Mendelssohn's Wedding March is in C, and Wagner's in G, whilst Chopin's Funeral March is in B flat minor. These are typical of the unfailing associations of key with emotion and experience.

Typical Phases

A study of Beethoven's works reveals the most extraordinary partiality for a little group of keys which, commencing on E flat, flows to right and left as it were and, embracing many of his most famous compositions, seems to prove satisfactorily that they typify the great master in his noblest and sublimest phases.

The focal point is E flat. From there he proceeds in one direction to A flat, and in the other way to C minor (relative minor of E flat), and to C major—the tonic major to C minor. What wonderful works he wrote in these keys! The Eroica Symphony has three of its movements in E flat, and the fourth, the sublime Funeral March, in C minor. The Emperor Concerto is also in E flat, as are the "Les Adieux" Sonata, and two others. The most tempestuous of all his sonatas, the noble last one, is in C minor and C major. The third piano concerto is in C minor, and the beautiful Pathetique Sonata, also the Passionate Piano and Violin Sonata. Above all, perhaps, is the Fifth Symphony, opening with its challenge to the world, and unquestionably the favourite of all symphonies. A flat was one of his favourite keys for slow movements, and in these we find him almost invariably in a mood of perfect tranquillity and sweet reasonableness, free from the storm and stress of the other movements.

In C major he most always strikes a note of extreme brilliance and proud triumph. Witness the famous "Waldstein" Sonata, as well as the very early one, the 33 Variations, the finale to the Fifth Symphony, the First Symphony, the First Concerto, and other pieces.

Varying Moods

Although Beethoven, as if purposely to show the world that he could write great works in almost all keys, used most of them, this collection of great compositions in one little closely related group of keys clearly proves that those keys definitely represent frames of mind and mood which were amongst the most powerful in the master's make-up.

In the key of F we always find him in his moments of complete peace with the world. No troubles beset him, and even happiness would seem to have entered by the front door, even though for a brief visit. Never a cloud crosses his pages when in this key. Witness the ineffable Pastoral Symphony and the eighth, an early piano sonata, the Andante Favori, the string quartet Op. 18, the Rassoumowsky Quartet, the Violin and Piano Sonata, etc. All tell the same tale.

D major seems to denote religious exultation, judging by the Missa Solemnis, and the finale of the Ninth Symphony. The Missa, of course, passes through many keys on its divine journey. A major might be associated with some wild carousing. Tovey calls the Seventh Symphony a "bacchic orgy," whilst the Kreutzer Violin-Piano Sonata is very similar. The slow movement of the latter, however, might point to a "breather" between the storms. It is in the key of F, and as tender and romantic as any of the works in that key just mentioned.

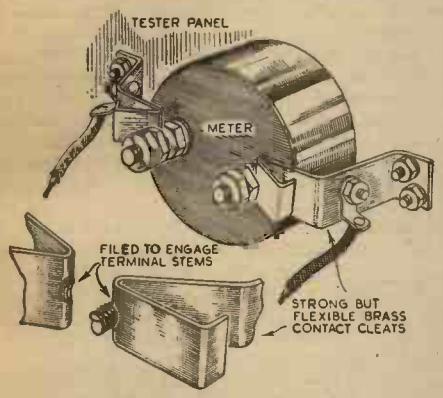
G flat and D flat, with their corollaries in sharps, were strangly neglected, though C sharp minor owns the immortal Moonlight Sonata, and the great quartet, Op. 129. G major, too, always portrayed happiness which was allied to good spirits rather than the "peace of mind" mood portrayed in F. The Fourth Concerto, and the sonata are typical.

Beethoven faithfully presented himself to the world in this way, mood by mood, and facet by facet. Even his fluctuating material circumstances can be traced. His thoughts and mental states are there to be read by all. He had no secrets, he pictured life as he himself experienced it. Keys were his medium as colours were to Rubens. That is the secret of his greatness.

Practical Hints

A Novel Meter Fitment

POSSESSING a 1,000 o.p.v. meter, and wishing to construct a multi-range tester, it occurred to me that whilst this tester would meet the majority requirements which prompted its design, there would be occasions when I should require the use of the meter separately, as, for example, in H.F. tests where it is important to take into consideration the length of



A meter holder which allows for the quick removal of the instrument, when necessary.

leads. Consequently, a scheme which would permit the removal of the meter from the tester panel without going to any length of trouble, would be a decided advantage, and I therefore carried out the arrangement illustrated. At first I tried two clips without filing to engage the meter terminal stems, but this did not provide any means for retaining the meter in its correct position, there being a tendency for it to turn with any degree of vibration; the slot overcame this admirably, and as my tester is of the simple baseboard and front panel type not housed in a case, removal is facilitated by easing the clips, turning, and withdrawing the meter—S. E. FARNHAM (Melksham).

A Volume-control Headphone Attachment

AS I use a single earpiece for listening-in when in bed, and in view of the receiver not being conveniently accessible from the bed, I have evolved the single headphone volume control illustrated in the accompanying sketch.

From an old volume control I obtained the 50,000 ohm resistance element R, and before fitting this to the earpiece as depicted, I hunted amongst the odds and ends of the junk box for a suitable means to effect the wiper movement.

Discovering an odd earpiece cap, and with a little sawing and filing, I cut an ebonite slip ring Er, and to this ring I fitted a phosphor bronze wiper W by drilling, tapping and using round-head 8BA screws.

A guiding block Gb similarly fitted to the ebonite 'phone case, but with 6BA screws, serves to retain the slip ring in position in conjunction with the channel

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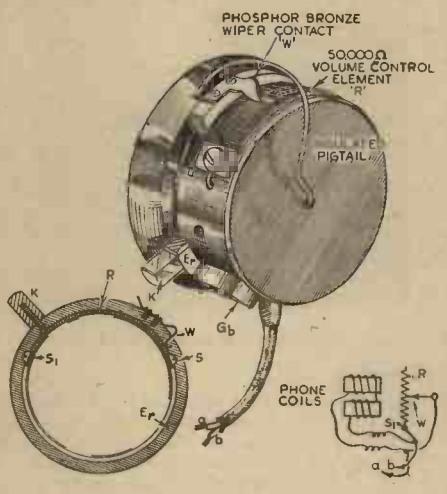
SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.

provided by the fitment of the element. The element is fitted with two screws (optional size), indicated by S and S1; one connection only is made to the element, and this is by S1.

The rest of the detailing will be clear from the pictorial and inset diagrams. There is one point, however, which should be mentioned, and this is with regard to the wiper control K, which comprises a switch arm from an old electric light two-way adapter, the 6BA c'sunk screw



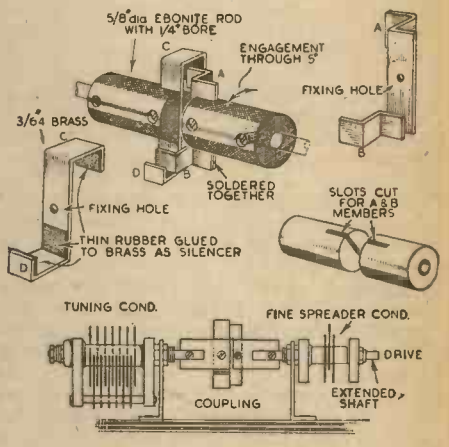
A single headphone volume-control device.

securing this control to the slip ring should be well recessed, the countersinking being finally filled with wax, thus affording protection to the element.—G. M. LEMOCK (Otley).

A Fine-tuning Device

IN addition to the normal bandspreading in my short-wave receiver I have devised a further system of fine tuning, as illustrated in the accompanying sketches. In this arrangement a small-capacity variable condenser is linked with the tuning condenser (one of about 15 to 20 mfds., and having as low a minimum as possible), the linking being so carried out that there is a 5° action, that is to say, provision is made in the method of linking for a 2½° movement either side of the tuning condenser position.

On referring to my sketches, it will be seen that to obtain this function there



A novel fine-tuning device.

is a separate linking device which fits on to the original driving shafts of the tuning condenser and the fine-tuning or spreader condenser, the dial drive being taken to the protruding "ganging" shaft of the additional condenser. The details in the illustration are fully explanatory, and an important advantage in the scheme is that the actual condensers themselves need not be interfered with in any way.—L. E. OLIVER (Eltham).

Voltage Tappings

WHEN using A.C. supplies for test purposes, the experimenter often requires voltages not available from a standard mains transformer and, being placed in this predicament myself, I found that I was able to utilise an old transformer in the following manner.

When the primary is fitted with tapping points for different supply voltages, it is possible, with certain makes, to make use of these to obtain various output voltages within a limited range.

With American valves, however, which required 6.3 volts for their heater supply, this variation was not sufficient so the procedure given below had to be adopted. Two four-volt windings were available, each centre-tapped, so one complete winding was used in conjunction with half of the second. The latter gave two volts when the connections were taken to one end and the centre tap, but a word of warning is necessary, as the connections between the two windings must be such that the outputs are in phase. This may easily be checked with a good meter, and if wrongly connected, it will be found that the voltage is lower than a single winding. By using the windings delivering a large current, the additional .3 volts was easily obtained.—P. W. WELLING (Glos).

PRACTICAL TELEVISION

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The Importance of Sound

So much attention is devoted to the vision side of a modern television service that the dual nature of the transmission is apt to be overlooked, or, in other words, the extreme importance which must be attached to the sound side is forgotten. The authorities responsible for the service cannot be classed in this category, however, and details which have been released of late, concerning television broadcasts in other countries, prove conclusively that the sound which accompanies the radiated pictures is being made the subject of careful research, to ensure that it becomes something more than an unconscious background to the interested viewer. Due to the much wider side-band available on the ultra-short waves, it is found with many installations that from microphone input to radiated output, the amplifier characteristics are such that they exhibit a perfectly level amplitude curve from zero to 20 kilocycles. This ensures that overtones and all the true nature of the studio or outside broadcast sound are inherent in the sound signal, and any mutilation that occurs before the final sound waves reach the ear of the viewer is brought about by the poor efficiency of the sound receiver and its associated loudspeaker. It reveals a very short-sighted policy on the part of the manufacturer who tries to effect a saving in works cost by "cheese-paring" the sound side of the set, for it not only annoys the user, but nullifies all the good work which has been devoted to the problem by engineers responsible for the sound at the transmitting end. It is therefore a matter for congratulation to those concerned to find that abroad, where television services are still being maintained, an economical receiver policy in so far as the sound is concerned is more the exception than the rule.

A Typical Example

Regarding the problem on broad lines, it is found that on the transmitting side the equipment used is somewhat similar in its characteristics in the various installations, and it is useful, therefore, to study a typical form in order to obtain a clear idea of what is done. First of all, it is usual to find that two complete chains of amplifiers and control equipment is employed, the design of the individual units being of such a nature that they are rapidly interchangeable, a factor which safeguards or reduces to a minimum delays arising from possible breakdowns. In the studio itself it is quite common to find that four microphones are provided, three of these being in fixed positions, while the fourth is mounted on a universal boom. The operation of this boom in relation to artist movement in the studio is of extreme importance, and it is only after months of training that personnel are fully qualified to handle the boom without marring the transmission. The microphone has to be kept out of sight, exact panning has to be undertaken to ensure that the pick-up is natural, and in the proper direction; jerky motion has to be avoided, while the cables must in no way foul other operations that are being carried out with the camera. The sound on film as used in the telecine machines, so essential in the complete make-up of the programme, will be taken off the film track through the medium of the usual form of standard film sound heads using a photo-electric cell and small projection lamp. In addition, it is usual to find that two gramophone desks are employed, each of these being fitted with a pair of turntables and a central change-over fader to ensure continuity when a musical background or special effects are needed during the course of the transmission.

A typical example of a high fidelity sound installation used for a modern television service.

Control

All the different sources of sound needed for the complete service are fed straight into their respective initial amplifiers, which are similar in design but have slightly different electrical constants so as to correct for any differences in the signal characteristics of the varying types of sound source—that is, sound on film, fixed microphones, boom microphones and gramophone pick-ups. All the amplifiers, control equipment and meters, with the exception of the gramophone apparatus and the control desk housing the different fader controls and programme monitoring instruments, are accommodated in vertical racks. A reference to the illustration on this page will make this clear. On the left are the racks with their uniform sized metal panels and measuring instruments. An engineer is shown carrying out tests with a jack field and jumper plugs to set them up according to programme requirements. Once this has been done according to the particular channels that are to be employed for the forthcoming programme, the entire installation is controlled remotely from the sound control desk unit which is housed in the production control-room. All the cueing and signalling to the studio staff is carried out from this desk, and its appearance can be gathered from the desk featured on the right-hand side of the photograph. The specially shaped fader knobs are seen on the sloping panel, while the appropriate key switches are just below the meter. The needle-kicks on this meter must be kept within limits during the course of a transmission so as to prevent overloading and distortion, and this is where the skill of the operating engineer becomes apparent.

Line and Frame Impulse Separation

Very many schemes have been tried, and abandoned, in an effort to find what can be regarded as the ideal method for separating the frame impulses from the line impulses in a television receiver so that they can be applied to their appropriate circuits in the time-base generator, and trigger the saw-toothed oscillator. In one of the latest schemes it is proposed to give the same amplitude to each set of impulses but allow them to be of different duration, and also arrange for them to be superimposed on the radiated carrier wave in a sense opposite to that of the picture modulation. The idea behind the scheme is to transform the difference in duration into a corresponding difference in amplitude for triggering purposes, without the necessity for passing the impulses through a filter circuit which is the more usual practice. For this to happen, the mixed signals, after the vision modulation has been removed, are fed to the triode section of a standard form of triode-hexode valve. From the anode circuit of the triode, the line and frame impulses are fed back through a resistance-capacity combination to the control grid of the hexode section of the same valve. By joining the triode grid to the inner grid of the hexode, it is said that the output taken across the anode and cathode of the hexode will contain the line impulses at one amplitude, and the frame impulses at a greater amplitude. Each impulse can then be made to trigger directly its own separate saw-toothed oscillator generator.

Radio as a Career

The Service Engineer is One of the Most Popular of Radio Professions

A typical scene in the service department of one of the big radio firms. A modern receiver being lined up.

THERE are several different opinions as to what constitutes a modern radio serviceman. Some listeners think that he is merely a radio dealer who carries round a universal type of meter and with a few mysterious tests can put right a receiver which is out of order, whilst others look upon him as a sort of magician who carries a bag full of weird and wonderful apparatus. Actually, of course, neither of these conceptions is correct—the serviceman is neither a magician, nor a man who with the aid of one small instrument can diagnose and put right a modern receiver. A very good analogy may be made between him and the modern doctor. If you call in the doctor it is true that he usually only brings a thermometer and a stethoscope, and that his first task is to take your temperature. He may then use his stethoscope, but he has to ask you whether you have any pains and for other symptoms to enable him to diagnose the likely cause of your illness. He does not bring with him a complete surgical outfit, and he cannot, merely by taking your temperature or sounding your heart, tell you what is wrong. So with the serviceman—he must have some indications from you as to what is wrong, and these, in conjunction with *preliminary* tests with a meter may enable him to get down to the cause of the trouble, and then he can get out the equivalent of the doctor's surgical apparatus.

Knowledge Necessary

It will be seen from the above, therefore, that, just as a doctor may not practise as a surgeon but must have a working knowledge of the subject taken in his student days, so must the serviceman have a full working knowledge of radio, although he may not intend finally to carry out actual repairs. He may employ mechanics for this purpose, if he intends to carry on a large scale business, carrying out his diagnosis and instructing the mechanics as to the procedure to be adopted for repair. Or, on the other hand, he may intend to run a one-man business and do all the work for himself. In any case, the first and most important requirement is a good working knowledge of radio and radio valves, and although there are many servicemen who have obtained such a knowledge by experience, it is far better to take a course of training from a school or institute which specialises in the training of service engineers. As in all trades, some people are gifted with a sort of "second sight," just as in the case of the doctor who upon a more or less superficial examination sends you to hospital suspecting something internal which he is not able to determine without X-ray examination. A more or less cursory examination of a receiver, plus a list of "symptoms" may enable some people instantly to lay their hands on the fault, where others would have to make further tests.

Apparatus Required

After a course of study has been decided upon there is the question of the equipment required. For the fully-equipped service depot, obviously elaborate apparatus such as a cathode-ray oscilloscope would be needed, although it is possible to service even television equipment without such an instrument. Among the apparatus which may be regarded as essential are meters for all voltage and current readings; valve tester; signal generator for lining-up superhets or other tuning purposes where an artificial signal is required; L.F. oscillator, for testing the L.F. section of a receiver if the signal generator does not include a suitable circuit; and all the tools which are necessary in making the repairs. These will include all kinds of pliers and cutters, soldering equipment, replacement resistors and condensers in all ranges, valves, and perhaps some coils and transformers for replacement purposes. In addition it is necessary to hold sundry repair apparatus such as wire, insulating materials, cabinet repair accessories, such as polish, plastic wood or similar material, glue, etc. Manufacturers can supply replacements for most of the components in their receivers, and these should be obtained where possible, rather than make substitutions, and thus it may also be desirable to make a study of the principles adopted by individual manufacturers. These include colour-coded wiring, special arrangement of various sections of a receiver, and so on.

Making Business Pay

Apart from these problems there is finally the question as to how the business should be run. There are shops where you can take a receiver to be "seen to" and you get it back in a few days looking the worse for wear. The cabinet may be scratched, screw heads torn, and an inquest may be held when you collect the set as to how much it will cost. This is the way to lose custom. A small van in which the receiver may be collected from the customer's house, and a printed receipt form giving full details of the receiver will go a long way to winning the confidence of the customer, and a receiver which is then returned, not only in

(*Continued overleaf.*)

RADIO AS A CAREER

(Continued from previous page)

working order, but with the cabinet obviously "rubbed up" will do a lot to enhance your reputation as a good man for service work. It does not take long to go over a cabinet and take out scratch marks with suitable materials, and give it a polish up, and the cost and labour involved is practically negligible, but it does put the finishing touch to a job of work and creates the impression that any servicing work in the receiver may have been as conscientiously carried out. A duplicate of the receipt label attached to the receiver, and indicating the work done and the charge will create a business-like atmosphere.

Prospects

So far as the prospects are concerned, there is ample scope for many more reliable trained servicemen in the industry. When television returns there will also be a need for men who can service television receivers, and thus any training which is undertaken should include television. A carefully planned scheme will enable a good foundation to be laid which will result in a very comfortable position, especially if a small shop can be taken in one of the "new" districts. In America, of course, the service branch of the industry is very extensive, and there is great competition, resulting in the introduction of ingenious schemes for obtaining custom. Circularising of the residents, weekly or monthly visits, 'phone calls from time to time, and other ideas are adopted, and the trade which results will keep a man fully occupied and bring in a very comfortable income. The initial outlay for equipment will, of course, have to be covered before any profit is shown.

The Radio

A Sound Working Knc Code is Necessary fc

THERE is undoubtedly an air of glamour surrounding the radio operator as he sits at his desk and takes down messages coming from various parts of the world. Whether on a ship, air-liner or in a land station, he is the main link between the station and every other part of the world, and he is relied upon to despatch and receive messages faultlessly during his hours of duty. To many people, of course, this branch of radio is of much greater interest than the building or servicing of equipment, although it is necessary for the operator to know something about his apparatus. On some stations, he will have to know sufficient to keep it in good working order and make repairs as they are called for, whilst at others such work will be left to maintenance engineers and mechanics. The first and most essential item for the would-be operator is a sound knowledge of the morse code, and this may be acquired at home without any difficulty. The acquisition of the necessary speed is another story, however, and in this connection there are several alternative fields. Gramophone records are available, special training courses may be taken, or small suitable apparatus may be built up at home, and two or more readers may practise together and acquire the necessary speed.

Speeds Required

The speed at which it is necessary to send and receive signals varies in the different branches. It may be necessary to send and receive at 20 words per minute in straight language or at 15 or 12 words per minute in code. On the other hand, in some branches of the service a speed of about eight words per minute may suffice.

Radio in th

THE recent appeal of the R.A.F. for men for a new trade to be known as "Radio Mechanic" has re-awakened the interest of all radio enthusiasts who would like to join the Services but who would prefer to make use of their knowledge of radio rather than to serve in a non-technical capacity. There is, of course, room for radio experts in all branches of the Services—Navy, Army and Air Force. The widest field is undoubtedly that of operator, but for this a really sound working knowledge of the morse code is essential. This is dealt with elsewhere in this issue. Some branches of the Services will, of course, train men for this purpose, if they have a suitable preliminary knowledge, and the special requirements of the apparatus used in all branches necessitates also the need of a

Operator

wledge of the Morse
the Radio Operator

Speed can only be obtained by constant practice, and until thoroughly familiar with the code it will be found that should the practice drop for two or three days a considerable loss in speed will take place. Therefore constant practice is essential during the initial stages of speed acquisition, and although it is possible to hear morse signals on a standard receiver and use these for practice, the fact that no key is available will in many cases render this form of practice undesirable. The gramophone records previously mentioned are, however, supplied with a printed key, and thus the work may be checked. Against this advantage must be set the disadvantage that after the discs have been played several times one becomes familiar with the text, and thus a certain amount of guesswork comes into play. The records, incidentally, are supplied by Columbia Nos. 3262/4 (three discs) and by F. L. Masters.

In addition to these methods of obtaining speed there is also the Candler System, which is designed to enable students to obtain the necessary speed to pass the P.M.G.'s "Special Examination," which is the only one being held at the present time. For this transmitting and receiving at 20 w.p.m. in plain language, 16 w.p.m. code, and 12 w.p.m. figures are necessary. The course offers a junior section for beginners, which teaches all the necessary code fundamentals scientifically; an advanced high speed telegraphing section for those who wish to increase their speed and improve their technique, and a telegraph touch-typewriting section for those who are interested in the teleprinter and similar work. This course originates in U.S.A., but there is a London branch at 121, Kingsway, W.C.2.

ıe Services

training course. The operator on board ship is expected to have a reasonable knowledge of his equipment, and know how to maintain it. In the Army there are various branches and in some mechanics are available for the necessary servicing work, although, again, a fair working knowledge of the apparatus is expected. In the Air Force, as already mentioned, the operator mechanic will be distinct from the radio mechanic, the latter seeing to the installation, maintenance and repair of the apparatus.

The Royal Corps of Signals is the field for those who wish to join the Army in this connection, and some of the apparatus used is very interesting—when compared with standard broadcast equipment. Portability is a very important item in such modern

(*Continued in next column*)

RADIO IN THE SERVICES

(*Continued from previous column*)

apparatus, and the majority of it operates on short wavelengths. Telephony as well as code is employed, and aerial design is a very important item. Mobile units also employ radio and thus there is a possibility of combining various trades, although the expert in radio as such will obviously be employed on the radio side.

In the R.A.F.

Direction finding is being employed to a very large extent in modern air technique and thus the aerial radio equipment is taking on a very elaborate nature. The systems now in use will be very greatly expanded, and the technique improved and there is every opportunity for advancement for those who have sufficient knowledge to be able to service such equipment rapidly. Unlike the ordinary broadcast service trade, time is the essence of the job in the Services. There is, however, no scarcity of test apparatus, and all of the apparatus reaches the highest standard. In the Army and the Air Force it is not necessary for the radio technician to remain in the ranks. Every opportunity for advancement is offered, and commissions may be obtained by those who are so fitted. Apart from the actual work which is carried out during service in the forces, there is also the important factor that a trade is being developed and that on the cessation of hostilities the knowledge which has been gained may be of the greatest use in obtaining a position in civilian life. Radio is one of those trades which is constantly developing, and if its development is not consistently followed it is possible to find that in a few months you will be out of your depth if you have not kept pace with it.

"Sparks" Aloft and Aground

"SPARKS," the wireless operator, is one of the most valuable members of any aircraft crew. Without him, air warfare and reconnaissance would be robbed of half their efficiency.

Every aircraft of the Royal Air Force is fitted with wireless, and wherever one may fly, communication can be instantly made with the base by wireless. The aircraft crew communicate everything of value and keep their base posted as to their own movements. The base may want to divert aircraft out on patrol to intercept and attack a U-boat, or an enemy surface vessel that has been reported to the base.

Equipment

Wireless equipment plays a big part in the navigation of aircraft on long-distance flights and at all times in bad weather. By getting a directional bearing on two transmitting stations, the operator can find the exact position of the aircraft. In fog the wireless equipment enables a comparatively safe landing to be made. The aircraft is guided by wireless in its approach to the aerodrome.

The radio installation of an aircraft is not the only apparatus for which the wireless operator in the air is responsible. In addition to being able to signal his base, the pilot must be able to speak to other members of the crew—which is done by a special intercommunication system.

Moreover, the leader of a flight must be able to speak to other pilots in the flight. For this, low-power telephony is sometimes used.

"Sparks" is largely responsible for all working parts of the aircraft which are electrically operated—petrol gauges, landing lights, bomb release gear, and generators.

The wireless operator is also nowadays a trained air gunner. At any moment, "action stations" order may ring through the aircraft, and "Sparks" will leave his instrument to serve a machine-gun.

Ground Organisation

Behind the wireless operator in the aircraft stands a highly efficient ground organisation of wireless stations and wireless maintenance.

In the event of a severe dislocation of the ground communication of the country, this organisation can provide a ready-made alternative system.

Between the personnel of the wireless ground organisation and the air-borne wireless operator there is the wireless electrical mechanic. His responsibility is to see that the whole electrical installation on board the aircraft is functioning at maximum efficiency, and especially to look for signs of potential trouble, which can then be remedied.

Every day the electrical mechanic checks carefully every part of the electrical equipment before the aircraft leaves the ground. Sometimes, after repair, he may fly, to give the apparatus an air test.

Whether he is working at an operational station, on aircraft installations, or stationed at a repair depot, the work of the electrical mechanic is a unique experience which will be invaluable to him in radio work when he returns to civil life.

Postal and Personal Tuition

THOUSANDS of students have obtained technical training by post in the past few years, not only in radio, but in all trades and professions. At one time a correspondence course was regarded with suspicion, but it is definitely possible to obtain a very high standard of knowledge by this means, and diplomas and other degrees testify to the efficacy of such courses. There are to-day many schools which specialise in postal radio training, and some which are devoted entirely to radio in all its branches. In addition there are colleges or training institutes which take in students for a thorough training in all branches of radio. Of these, the Wireless College of Colwyn Bay, N. Wales, and of Calmore, Southampton, is probably the widest known. The N. Wales college is able to accommodate some 100 students in residence, and at Southampton there is space for 150 students. Elaborately equipped workshops and laboratories enable students to obtain practical experience in all types of the industry, and there are also sports grounds and other recreation facilities. On the postal side there are such colleges as the T. and C. Radio College, of High Holborn; The Bennett College, Ltd., of Sheffield, and others whose advertisements will be found from time to time in these pages.

Specialised Training

In some cases it is possible to take a special course, such, for instance, as for radio operator, where the art of sending and receiving is of more importance than the technical knowledge of receiver design. Combined courses will, of course, embrace both of these sections. The age at which training may be undertaken varies, and although in the case of the Wireless College, for instance, the age at which students are admitted is from 15 to 25 years, it is possible for a student over 25 to be admitted, and since the war began, many elder men have taken up the study in order to obtain a post where they will be carrying out work of national service. It may be desired by some to brush up their morse code—old operators, for instance, who have been out of practice for some time may still remember the code, but are now unable to acquire the necessary high speeds. The Candler System caters for such as these, and there is really no age limit from this point of view, although some difficulty might be experienced in obtaining a situation if you are too old.

For those who do not wish to take a correspondence course, or attend a training centre, there are many books on the subject which may be studied with a view to obtaining the desired knowledge. Apart from those published by us, there are various specialised books also obtainable, and Messrs. Foyles, the well-known book-store, carry a wide stock, and should be visited by all those who are in London.

It is not possible, of course, to give full details of every course or source of study in the space available, but brochures and handbooks may be obtained from the firms who are advertising in this issue to give some idea of the lines of study and the fees which are necessary. Remember that with many of these colleges or schools the fees may be paid by deferred payments, and this is an important point where economy is a consideration.

Design and Research

Necessary Preliminary Qualifications: Scope of the Work: What Must be Learned: Gaining Experience: Courses of Study — By FRANK PRESTON

IN the mind of the average person, a research worker is inclined to be confused with the long-haired inventor who lives in an attic and dies penniless. But the idea is as old-fashioned as the coherer; a modern radio research engineer must be a very wide-awake person with a sound education and clear brain. What is more, he must be a tidy and logical thinker—and the person of untidy appearance rarely has a "tidy" mind.

Possibilities

What scope is there in this field? is a logical question. For the right man there is ample scope, but for the "dabbler" there is no room at all. It is obvious that there can be only one first-class research engineer for, say, every hundred other persons employed in radio work. Consequently, there is little room for any other than the right man. Another question that will occur to the reader is: what are the essential qualifications? This cannot be answered quite as simply. The reason is that there are many sides to the work of the research engineer and designer. For example, the work of research may be confined to the development of valves and other thermionic tubes, or it might be in connection with tuning systems or with amplifier and reproduction problems. Even thermionics may be sub-divided, for the research man might decide to specialise in cathode-ray tubes and oscillograph work.

On the other hand, a designer might not be the type of person who would be described as a research worker in scientific circles. His work might consist of producing designs for receivers or components, in which case he would have to operate in close association with the production manager. He would, nevertheless, find it essential to carry out research work, although it would be of a more practical nature.

Technical Research

Let us first consider the question of the research worker purely and simply; that is, the man who is concerned primarily with theoretical and highly technical aspects. It is obvious that he must have a fairly sound general education before he can successfully take up the serious study of radio research. Many organisations and firms insist that the men they take on for work in their research laboratories should have a university degree. That is the concern of the firm, but a degree is by no means a hall-mark of suitability for the work. Far greater success has in many instances been achieved by the radio amateur whose school education did not go beyond the matriculation stage. Having reached that stage it is not difficult for an enthusiastic and intelligent youth to "complete his education" by spare-time study, either at home or in an evening school or college. Most people will agree that wireless amateurs have proved more successful than have the professionals. At least, this applies to those who have started their career as amateurs—they probably took up radio as a profession later.

There is no doubt that home construction and experimental work provides an excellent grounding. When more serious study is commenced, preparatory to applying for a job as research worker, it may be necessary to discard many of the ideas which have been cultivated as an amateur, but it will always be found that the essential theory can be learned far more easily after at least some preliminary practical experience has been gained.

Necessary Qualifications

Assuming that a youth has matriculated, is so interested in radio that he had been able to construct one or two receivers and has cultivated a knack for simple fault tracing, what other qualifications should he have if he is likely to be successful in commercial life (even research must be considered as all part of commerce) as a radio research engineer? He must certainly have shown sufficient interest in magnetism and electricity to obtain good marks in his exam., he should have a good working knowledge of mathematics, preferably applied mathematics, he should have taken chemistry in his matriculation, he must have developed the habit of logical reasoning, and he must be reasonably resourceful. That catalogue of requirements might at first appear formidable, but it must be remembered that the job in view is an important one.

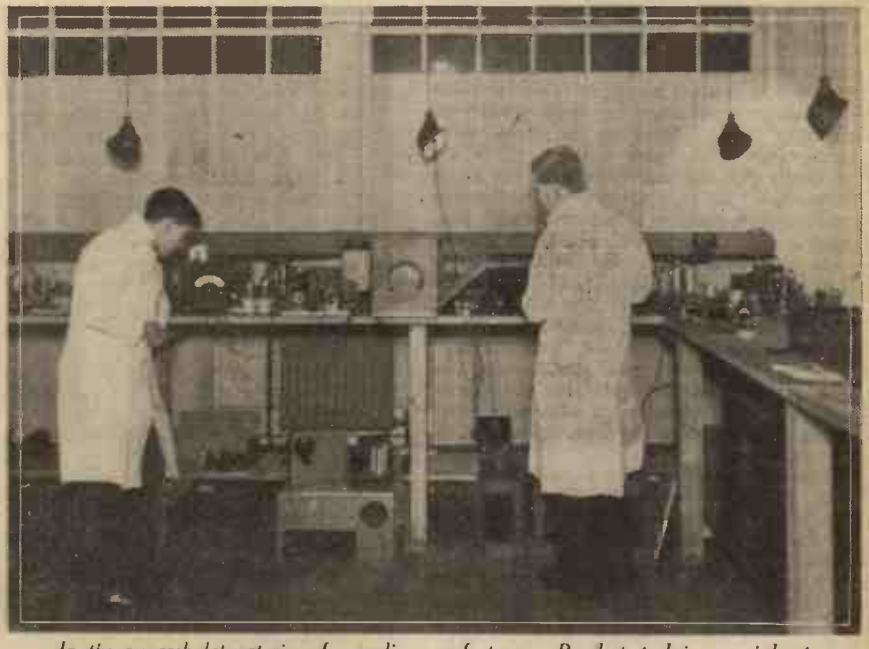
The qualifications just mentioned apply especially to the person who is more interested in the theoretical than the practical side.

A man who proposes to concentrate on design, or "applied research," requires rather different qualifications. In the first place, his knowledge of physics, mathematics and chemistry need not have reached as high a standard. On the other hand, he must have distinct mechanical ability and should be able to make and read working drawings; resource and adaptability must also be part of his make-up. Before he can take up his real work of designer, he should have gained some practical experience in a workshop and have become reasonably familiar with the straightforward engineering workshop processes. Sometimes this important experience can be gained in a wireless factory if he can convince the employment officer that he has good ability in other directions.

Further Study

Taking these qualifications as basic ones, what remains for the prospective research engineer or designer to learn? Quite a lot, but if he is interested in his subject he will not find the learning hard. In the first place, he will require to gain a complete understanding of circuit diagrams of every conceivable kind. He should be able to read and interpret a circuit diagram as easily as he can read and paraphrase a passage from a book. An understanding of the essentials of design of every component used in a receiver is necessary. The usual electrical formulæ and calculations must be mastered and the function of the generally-used measuring instruments must be understood.

If it is proposed to specialise in television—in which branch there are sure to be many wonderful opportunities in coming years—he must be familiar with the principles of operation of a television receiver, time base and cathode-ray tube, and should also have studied the technical development of the subject from the scanning-disc days.



In the research laboratories of a radio manufacturer. Bench tests being carried out.

(Continued on page 507)

Radio Production

For Those Interested in the Practical Side, the Production Department Offers an Interesting and Remunerative Occupation

By L. O. SPARKS

THE section of the radio industry which would come within the meaning of the word "production," is one which offers genuine prospects to the radio enthusiast who has a flair for practical, mechanical and electrical engineering combined with organising abilities. This rather comprehensive combination may seem to indicate that one has to be something of a superman but, although this article will indicate that the qualifications mentioned are very desirable, the would-be production man must not be discouraged by the general statement, as that, naturally, applies to one who has reached a position of responsibility and, incidentally, one carrying a worthwhile salary.

Production engineering covers a multitude of trades and products, and while it is quite reasonable to assume that a fully-qualified production engineer could tackle most problems generally associated with such work, it must be appreciated that one invariably specialises on one particular industry and, therefore, becomes fully conversant with, and master of, those problems directly connected with the trade concerned. In this article, we are solely interested in matters relating to radio but, unfortunately, space will not allow this to be covered in detail, owing to the fact that it is built up of multitudinous sections or branches, each of a different character, but all of which are embraced within the rather unromantic term "production." Let us, therefore, now enumerate the chief sections, as these will give some indication of the class of work with which one entering this part of the industry will have to contend.

The following could be stated to be the chief or most familar products: Radio receivers, television apparatus, transmitters, valves, loudspeakers and components. These bare items alone do not present a very complicated array, but if one thinks for one moment of all the closely related and allied work, such as that involved in the making of mains transformers, condensers, coils, resistances, cabinets and metal parts, to mention but a few of the items, then it will be seen that the chief products are but really the finished or completed article depending on the efforts of several less conspicuous, but equally important, industries.

What Qualifications are Required?

When speaking of production, one naturally thinks of factories, and at the same time, unfortunately, is inclined to think of "dead-end" jobs, unless actual production experience has been gained. While the authorities responsible are doing all in their power to eliminate such undesirable problems from modern production methods, it cannot be denied that a very great deal depends on the actual person concerned, and the view, interest, ambition, or call it what you will, they have in their work.

Speaking as one who has had many years production experience, there still exists far too much *false pride* and *snobbery* about factory work. Quite a number of lads and young men have the idea that to be associated with such work is something far below their scale in life. To those I would say, shake up your ideas, examine the careers of the majority of the key-men and heads of our big industries, and then think the matter over again. The men that are now drawing big money have gained their skill and experience by starting at the bottom and working their way right through the business, and *they* will tell you that this can only be done by hard work, perseverance, and the determination to learn everything possible about the work being undertaken.

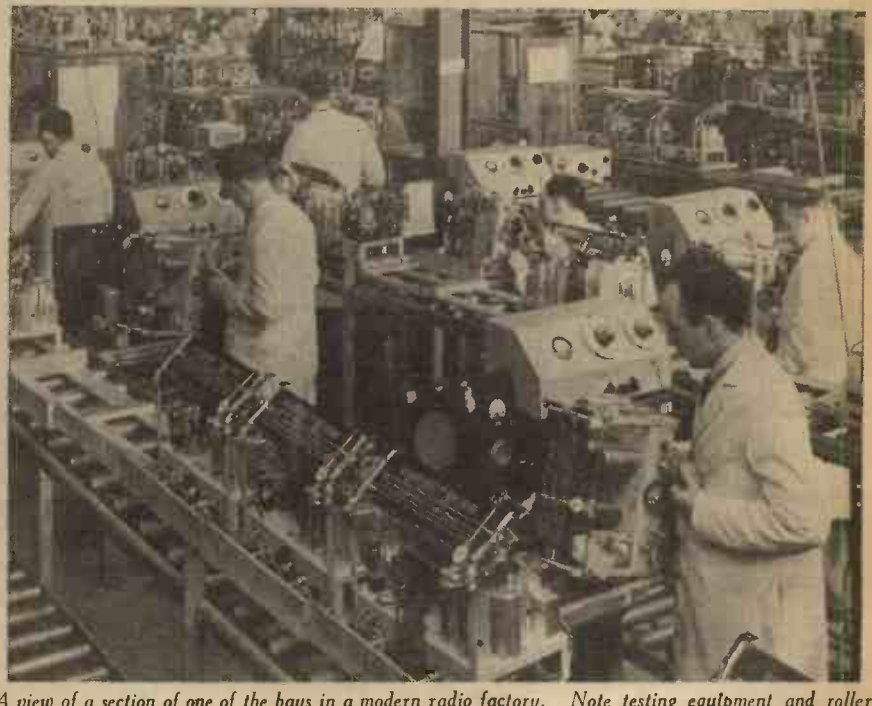
For anyone considering entering into production work, it is *not* absolutely essential to have a sound technical knowledge of the subject but, if one does already possess the foundation of such knowledge, and takes the trouble to add to it as time goes by, then it will become a *very valuable* asset, and stand him in good stead. While on this item, it should be noted that a science degree does not carry much weight in production work, *unless* it is backed with practical experience.

It is really essential for one to have a flair for things practical, electrical and mechanical. By this I mean that happy knack of being able to see the best way of making things, the procedure to adopt, and the ability to use one's initiative to the improvement of the product, the elimination of waste of both time and material and, last but by no means least, the faculty which allows one to plan ahead and make one's plans accurately.

These desirable features are, of course, developed, together with others, as progress is made, provided one has reasonable signs of these qualities, is quick on the up-take, and is not afraid of hard work, then production offers a most interesting field for advancement.

What Positions Are There?

For a lad entering a works for the first time, it must not be expected that he will be able to pick and choose the work he would like to do. He will, no doubt, be put on various jobs, according to the work in hand and the demand, but if he is smart at whatever job he is given, he will soon be marked up for more advanced work. The thing to remember is, find out all you can about each task you have to undertake; it is part of the education of the production man.



A view of a section of one of the bays in a modern radio factory. Note testing equipment and roller conveyor tracks.

The practical knowledge thus gained is, in itself, not sufficient if one is going to make progress, and make the business his livelihood. One might say; and I am sure records would prove it, that it is absolutely essential for the lad and the young man to build a good solid foundation for, and, of course, increase his knowledge of, the work he is undertaking, by undergoing a recognised course of training, either by correspondence or evening classes. The value of this procedure cannot be overrated. The chief trouble is that when we are young, we are all loath to give up a certain amount of our spare time but, as years go by, and, perhaps, as we see other fellows getting the better jobs, we

(Continued on opposite page)

RADIO PRODUCTION

(*Continued from previous page*)

realise that the time devoted to the improvement of one's knowledge is *well worth while*.

Once one has had some works experience, or, in certain instances, connection with other branches of the trade, the following positions will be open to capable men.

Wirer, assembler, tester, charge hand, shop foreman, manager, and finally, works manager. The order in which these positions are given can be taken as a rough indication of their value as regards salary, but it must be appreciated that there are other appointments, of rather a different nature, which are closely allied to the actual production shops.

For those more inclined towards records and figures, there are such positions as store-men, store-keeper, chasers, costing-clerks and buyers, and it is usually possible to make progress through these positions in the order shown.

A Common Problem

Space does not permit dealing with the work involved by all these individual jobs, but as their titles are more or less self-explanatory, it is hoped that they will give a general indication of the various activities open to the right sort of person in a modern factory.

Often the question is raised, should one stay with the same firm for years or should one change frequently ?

The question is too involved for me to give advice, therefore the following must be taken only as a personal opinion. A great deal depends on the firm. If they are progressive in methods, and if progress is open to those who show the necessary qualifications, then there is much to be said for sticking to them, provided one does not lose the opportunity of making an advance. The fact that one has served with a well-known firm for several years is usually a very good testimonial but only provided one can also prove that during that period progress has been made.

On the other hand, the young man is often tempted to secure positions, progressively, in various firms for reasonable periods, with the sole object of gaining greater experience. This has many points in its favour, provided the prospective employer can always be given a sound reason why one has left the other firms. Unless this can be done, there is the great danger of creating the impression that one cannot hold down a job, either by reason of being unsuitable, or because of a too roving disposition.

Like all the other branches of the radio industry, which by virtue of infancy has been swamped with workers from all sorts of trades, there are good positions open to the radio enthusiasts who are prepared to prove their worth, gain a sound knowledge of the industry, and *work*.

DESIGN AND RESEARCH

(*Continued from page 505*)

The necessary practical experience cannot be gained as easily in this sphere, since television does not come as easily within the scope of home construction as does sound radio. It is therefore desirable to attend practical classes, unless there is an opportunity to enter a television firm in order to gain the necessary experience. Before the war, many good radio engineers were able to obtain work of this nature, and opportunities are sure to arise again.

Reversing the Process

Regardless of the particular branch which it is proposed to follow, practical experience in the use of measuring instruments will be necessary. This can only be obtained by attending classes, although it is possible to "break the ground" by reading good books and by taking correspondence courses. Many of those who are already employed as service engineers will have gained as much experience in the use of meters as is essential in the initial stages. They will also be familiar with most of the practical and semi-technical aspects of the work. Consequently, they might find it necessary to start at "the other end" by taking a course which will enable them to pass the matriculation exam., or to take an external B.Sc. (preferably in Engineering). Instead of studying for a B.Sc., the objective might be the A.M.I.E.E. or M.I.R.E. Or again, there are the various electrical and radio examinations of the City and Guilds Institute. All of the examinations mentioned, as well as a few others, are recognised in the radio profession. It would not be advisable to concentrate too much on some of the other examinations which are held by bodies with little standing in the radio world, for they might take up valuable time which could be better occupied in studying for the better-known qualifications; these are generally more difficult to obtain, but that is because they are of better standing.

Those who are in any doubt as to the most suitable examination, or as to the best starting point for their studies, are advised to write confidentially to the principal of one of the colleges specialising in home study. These gentlemen are in an ideal position to offer sound advice, and will do so free of charge. In many instances, it may be possible to arrange a personal interview, when the matter can be fully discussed.

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).

"Practical Wireless" with the B.E.F.: Pocket Receivers

SIR,—I am at present on leave from the B.E.F., and being an ex-amateur transmitter, anything in wireless interests me. I have PRACTICAL WIRELESS sent out every week, and I can assure you it is in great demand after I have finished with it. In your February 3rd issue you have a few words by "Thermion" on Pocket Receivers. I use a 1-valve short-wave set with a 4-pin plug-in coil up to 520 metres. The set measures 4in. wide, 7in. high, 8in. long to fit in my carrier; headphones and coils fit inside the set. I have an H.T. and L.T. battery as supplied to portable sets in France, and my reason for keeping down to one valve is that the L.T. side of the battery usually runs out first. The alternative would be a transformer wound for 230 volts and 110 volts, with a metal rectifier, to charge a 2-volt semi-dry battery. The 230 volts and 110 volts are about the usual voltages I have come across so far. I could think of quite a lot of arrangements, but one has to carry one's house on one's back here, so to speak. In closing I want to thank you for many happy hours with PRACTICAL WIRELESS, and wish your paper every success.—J. E. THOMSON (G3RY) (Stockport).

A Reader's Thanks

SIR,—With reference to my appeal for a back number of your interesting paper, giving constructional details of the "Universal Hall Mark," might I state that I have been inundated with copies, and to reply and thank them all I should have to employ a secretary.

May I through your valuable paper thank all the kind people who have been so good and prompt in acceding to my request. —I. D. HARRIS (Beaufort, Mon).

Regeneration on an A.W. Superhet

SIR,—Having found conditions for DX short-wave listening none too good during the last few weeks I was reduced to the medium waves for entertainment! About a week ago I picked up an old copy of PRACTICAL AND AMATEUR WIRELESS for April 23rd, 1938, in which is described among "Readers' Wrinkles" a method of obtaining regeneration on an all-wave superhet. As I had a one-valve battery set handy, I tried this idea, and after a little practice in tuning the two receivers, and in applying the reaction control on the one-valve set, I was astounded at the results. The following is my log for the week ending February 3rd, all stations on loud-speaker: 14 mc/s—WI9; W2IXY, JEH; W4DSY, BMR, DAA; W7ESK; PY4BK; CE3CB; CX2CO; CO6OM. The following broadcasting stations were received on Sunday, February 4th, on the 9 mc/s band, between 9.30 a.m. and 1 p.m.: VLR, VLQ, VUD2, KZRM, while in the afternoon PMN was a good signal. The aerial is a doublet, running north and south.—K. I. BROWNE (London, S.W.).

Freak Reception

SIR,—As a reader of your journal from the first issue, I have built several receivers with success. In a recent issue I saw a letter from R. Robertson on freak reception, and I think the answer is to be found in the fact that it was a programme from America for Norway, Sweden and Denmark, relayed by them on both long and medium wavelengths. The station received by your reader may have been Falun, Sweden, on 1,086 kc/s, with an output of 2 kW. I am uncertain about the date, but the time coincides. The RX used by me was the "Admiral Four." I also am a short-wave listener, and a B.L.D.L.C. member. Hoping you will carry on with the good work.—W. BUGG (Churwell).

Exchanging QSL Cards

SIR,—It appears that the QSL situation requires clarification. First, definitions are necessary.

A QSL card is a verification. It verifies that the recipient has heard (in the case of a listener) or contacted (in the case of a "ham") the station that issues the QSL.

An SWL card is used for sending reports to stations in order that as a result of the information supplied thereon, these stations may issue QSLs.

The exchange of QSLs, except when they verify a contact, is to be deprecated. The person who possesses QSLs that were not issued to him may be only the victim of a collecting mania, but he is almost certain to be suspected of dishonourable intentions. It must be clearly realised, however, that the majority of those who offer to exchange QSLs are merely making a nomenclative error. They do not mean QSLs, but SWLs. The exchange of SWLs, except between friends, is rather pointless, but it is quite harmless.

I wish to raise another point. It is my opinion that there are certain moral obligations binding both parties. The listener, in addition to providing the necessary information so that his reception of the station may be proved beyond any shadow of doubt, should also include every detail that can help the station operator, or engineer, to judge the performance of the station. Exaggeration of signal strength cannot be excused. The average SWL card is defective in so far as it does not provide sufficient space for all these details. The station, similarly, should carefully check the information submitted, and should refuse to issue a QSL where reception of the station is not adequately proved.—H. W. DARVILL (Enfield).

SIR,—I notice in a recent issue of PRACTICAL WIRELESS a letter from Mr. F. W. J. Cooper commenting on the increasing number of SWLs who mention in letters published in the "Open to Discussion" section the fact that they are willing to exchange cards. Although I agree with his remarks concerning the class of SWL whose sole reason for exchanging cards is to give the impression that better results have been gained with his "rig" than is really the case, I am not in agreement with all his remarks. The fact that a SWL exchanges cards with other enthusiasts means more than just sending a card, and then waiting for an answer. Most fellows mention on their cards the receiver in use, also details of the antenna, and what is more, the number of countries heard. Surely, then, the exchanging of cards has served a purpose if only to enable the SWL to compare the results obtained at his QRA with those gained at that of the fellow with whom he has exchanged the card. In the same issue as the letter in question I noticed one from Mr. J. Greenwell, who mentions his willingness to exchange cards. I think his DX log is one of the finest I have seen for some time, and obviously this SWL really searches the bands for DX. Now, finally, a request. I would like to correspond with any SWL using a "Bush Model BA53" in order to "swap" experiences with the receiver in question. — A. HART (16, Ash Street, Ilkeston, Derbyshire).

Wireless Class in South London

SIR,—I shall be very grateful if you will draw the attention of readers resident in South London, to the Radio Class at the Walworth Men's Institute, John Ruskin Street, S.E.5, on Monday and Friday evenings.

It affords an ideal opportunity for those interested to learn the Morse Code, and for individual practice up to 30 w.p.m.—of great value for work in the Forces, or for DX contacts "later on." Instruction in radio theory is also given.

All enthusiasts, beginners included, will be most welcome on either or both evenings at 7.30 p.m.—J. H. PAYTON (G2JB), Instructor (London, S.E.).

Prize Problems

PROBLEM No. 389.

GREENAWAY built a small A.C./D.C. receiver of the superhet type which on test proved very satisfactory. After using the set for two or three days, he decided to fit a new dial with wavelength markings, and obtained a suitable component which had two dial-light fittings for illumination purposes. He mounted the dial and fitted two standard six-volt dial-lights, which he connected across the nearest heater terminals, but when tested again the receiver failed to give the same performance as originally. He tried re-ganging the condenser but could not get the same high standard as when the set was first tested. 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. 389 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, March 4th, 1940.

Solution to Problem No. 388.

The receiver which Jerome built had an H.F. transformer coupling the first two stages, and thus it failed to pass the L.F. signals when a pick-up was connected in the H.F. stage.

The following three readers successfully solved Problem No. 387 and books have accordingly been forwarded to them: V. Lamb, 52, Inglemere Avenue, Hull; H. Coble, 21, Canning Road, Southport, Lancs.; L. Sharp, 213, Amberley Street, Bradford.

Taylor Model 40 Valve Tester

Review and Test Report of a New British Test Unit

ONE of the most valuable accessories or testers for the modern serviceman is a valve tester, especially if this is simple to operate, and carries only a moderately simple indication which can be read by both the dealer and the customer. A small unit which may be kept on the counter, and which, when a customer brings in a valve, may instantly show him on a dial that the valve needs replacing, will gain his confidence and at the same time remove those doubts which are sometimes expressed by the inexperienced listener that the dealer has sold him a new valve when the old one was not really in need of replacement. The Taylor Valve Tester, (Models 40, 40P and 40B) is an instrument of this type, but in addition it has several features which, whilst not of use to the ordinary customer, enable the dealer or serviceman to ascertain accurately the condition of any valve, giving an electrode short-circuit test, a cathode leakage test, a filament continuity test and measuring the slope of the valve, all of which tests may be carried out in a matter of seconds. The top panel carries a dozen valve-holders, a neon lamp, a meter, five selector switches and four press-buttons, in addition to the on/off switch. A mains selector panel is mounted on the side of the cabinet, which measures 12in. by 11in. by 4in. and weighs 11¾ lbs.

Circuit Arrangement

The instrument is A.C. operated, the input being taken to a mains transformer, the secondary of which is tapped and taken out to the voltage selector switch, giving voltage supplies for the filaments or heaters from 2 to 50. Multi-contact ganged switches are used in these selector units so that any desired electrode combination may be picked out, and a book is supplied with the instrument giving full details for setting for upwards of 800 different standard British and American valves. The process is extremely simple and the book need not, in fact, be referred to when once the working system has been grasped. The valve is plugged into the appropriate holder, the filament voltage selector switch set to the voltage suitable for the valve in question, the lower switch set to ampl. or rectifier according to the type of valve and the unit switched on. The meter will then indicate the condition of the valve, the dial being marked "replace" over part of the scale and "good" over the rest of the scale. To take the slope of the valve the right-hand switch is adjusted until the needle of the meter takes up a zero setting (actually in the centre of the scale), and then the slope test button is depressed. The needle then rises to a higher setting and the slope may be read off from the slope test scale above the meter. The short-test is carried out in a similar manner, the button being depressed and the neon lighting up if a short exists. If, of course, the needle fails to give any reading when the valve is inserted, the filament button is depressed and failure of the neon to light will indicate a broken filament. The cathode short test will show the actual cathode leakage resistance on the meter scale which is marked in megohms, and the instructional booklet gives an indication as to the tolerances which may be permitted.

Test Report

We tested one of these units within about five minutes of receipt, the instructional details being exceedingly clear, and valves of all types were tested with the greatest facility. Multi-electrode valves are just as simple to test as simple triodes, and dealers and servicemen will find this a most valuable instrument for the purpose and the price very reasonable at £9 9s. If desired, it may be obtained in a small carrying case with room for tools, etc., or in a bench model designed for mounting on the back of the service bench. All models are fully guaranteed for six months and may be thoroughly recommended. The makers are Taylor Electrical Instruments, Ltd., of 419-422. Montrose Avenue, Slough.

RADIO CLUBS & SOCIETIES

THE CROYDON RADIO SOCIETY

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

MR. H. G. MÉNAGE, of R. A. Rothermel, Ltd., addressed the Croydon Radio Society for its monthly meeting on Thursday, February 1st, in St. Peter's Hut, Ledbury Road, South Croydon, and Mr. P. G. Clarke presided. The subject was: "The Latest Developments in Piezo Crystals," the lecturer recalling first of all some interesting facts about the growing of crystals of Rochelle Salts. He then went on to discuss new uses of these crystals. The society was familiar enough with the 45 degree, or "bender." type in pick-ups, and a development on this was the 90 degree, or tortional crystal. As its name implied, movement came from a twisting action, and altogether was much more robust than the other. A new type of Piezo pick-up used a sapphire jewel needle, its great advantage being record wear was much reduced, 2,000 playings without deterioration of the record being possible. Many other applications of crystals were mentioned, such as their full use in recording studios, and finally Mr. Ménage indicated his keenness to co-operate with the society in its next pick-up night. The next meeting is on Thursday, March 7th, when Mr. Nixon, of the General Electric Company, will speak on: "Latest Valve Developments." He will accompany his remarks with lantern slides, a demonstration, and a new film on the subject.

EASTBOURNE AND DISTRICT RADIO SOCIETY

Hon. Sec.: T. G. R. Dowsett, 48, Grove Road, Eastbourne, Sussex.

AT the meeting of the Eastbourne and District Radio Society, held on Tuesday, February 6th, Mr. J. A. Penfold gave a lecture entitled "Problems of the Superheterodyne."

First of all he spoke on second-channel interference and the removal of it by using one or more H.F. stages of amplification before the first detector, or by using a cathode rejector coil in the tuning circuit of the first detector. Valve noise was then dealt with, and the use of special valves for short waves, and the importance was stressed of stray capacities and the effect they had on the circuit. The use of a separate oscillator, the intermediate frequency, iron cored coils, oscillator problems, and frequency-changer valves were dealt with. Adjustment of oscillator circuits was also dealt with. Lastly the aerial connection, regeneration, and A.V.C. and delayed A.V.C. were studied.

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.

Meetings: Alternate Tuesdays, at 7.30 p.m.

THE Bristol Experimental Radio Club now holds meetings at the above time and place. Recent agendas have included a demonstration of a Public Address amplifier, a talk on the theory of this type of apparatus, and details of frequency meters and similar instruments.

It is anticipated that the principal item of interest at the next meeting will be a description and demonstration of an amplifier with an unusual though simple circuit by the designer, Mr. W. White.

The committee are hoping shortly to complete arrangements for a demonstration of a Hallicrafter "Super Sky Rider." Mr. R. Griffin (Pre-war G5UH) has promised to give another of his interesting talks in the near future.

All experimental radio enthusiasts, including those temporarily billeted in the district, are heartily invited to attend the club meeting on Tuesday, March 12th.

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
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/3 " "

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 CRYSTAL SETS.	Date of Issue.	No. of Blueprint.
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set ..	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
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Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
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The Signet Two (D & LF) ..	24.9.38	PW76
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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) ..	12.6.37	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
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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.		
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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) ..	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	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)	24.7.37	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)	30.7.38	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))	19.3.38	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

Short-wave Adapter

"I have made up a simple short-wave adapter but apparently had made a failure of it because I find that unless I include a grid leak to the adapter plug I cannot get a sound from my set and when I do add the leak I can get S.W. signals only by using my broadcast set tuner and only on the medium-wave band. I am sure I have followed every detail on the circuit diagram. My set is a commercial superhet and I use the frequency-changer in the adapter. I shall be very grateful if you can tell me where I have gone wrong."—T. F. (Craigmillar).

THERE are several confusing points in your arrangement. First, as pointed out many times in these pages, an adapter is intended to replace the detector stage in a receiver. In this case the tuner in the broadcast receiver is inoperative, and all tuning is carried out on the adapter. The valve which should then be used in the adapter is a simple triode. We note that you have to include a grid leak and that you tune your broadcast receiver to medium waves. This tends to indicate that the adapter is working as a converter and that the intermediate frequency being developed is somewhere in the medium-wave band. We do not know what circuit you can employ with a frequency changer in the adapter circuit, but in the circumstances we suggest that you consider a modification of the adapter so that it becomes a proper short-wave converter, and when this is joined to your broadcast receiver aerial terminal it should work properly.

Valve Tester

"I thank you for your reply to my query regarding the valve tester and am pleased to note that you are going to describe the construction of such an instrument. I will await the details, but in the meantime there is just one point I should like you to clear up in this connection. Is it true that raw A.C. may be used for all the supply voltages, even for testing the simple 2-volt battery-type valve?"—T. U. (Peckham).

THE standard types of tester make use of raw A.C. throughout, although for the home-constructor it is quite a satisfactory procedure to use battery supplies. The main drawback to this is that the supply sources will not be constant and thus comparisons will not be easily made. On the other hand, with a mains transformer tapped to deliver given voltages, and used with a given mains supply system one can rely upon the output and thus test characteristics may be kept for checking valves at any time, without the need for measuring the supply source each time and if necessary adjusting this to given values. Incidentally, the Taylor Valve Tester reviewed in this issue employs the tapped transformer system.

A.C. Amplifier

"I should like a design for a good amplifier for use with pick-up for small dance purposes and also for some home-recording which I wish to carry out. I do not want a 10 or 15 watt unit, as the dances take place in a very small hall, and are purely local village affairs with very small attendance. On the other hand, I wish to try cutting some records and want a really good output for this, when added to my commercial 5-valve superhet. What design can you recommend from your blueprint list?"—K. E. (Martham).

THERE is not a design in our Blueprint list which will answer your requirements, but in the near future, probably next week, we shall describe an A.C. amplifier which is ideal for the purpose. This is a three-stage unit with two Cossor 41MXP valves in push-pull in the output stage, and will be admirable both for the dance work and for the home-recording.

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.

Tetrode Connections

"I have just been looking at a circuit in which a tetrode valve was specified for the output stage, but it appears from the diagram that the valve is used as a triode. The screen is joined to the anode, and I should be glad if you could let me know what advantages, if any, this arrangement provides."—G. R. (Hull).

THE usual arrangement with the valve in question is to connect the screen grid through a 100 ohm resistance to the anode. The effect of this is to provide a triode of low impedance which, although the mutual conductance may be higher than when the valve is used as a tetrode, will take a slightly greater input voltage. The load impedance is, of course, increased, and the output wattage will be lower, whilst in addition the anode current will also be slightly greater than with the triode. The usual arrangement is to use these valves only in a push-pull stage as triodes, and there would be little, if any, advantage in using one of the valves alone as a triode.

Address of R.S.G.B.

"I believe I saw a note some time ago in your pages that there was a new war-time address for the Radio Society for Great Britain, but I cannot trace the number in question and should be glad if you could give me the address."—L. E. W. (S.E.).

THE present temporary head office of the society is 16, Ashridge Gardens, London, N.13, and the secretary is Mr. J. Claricoats. The registered head office is at 53, Victoria Street, S.W.1.

Transformer Rewinding

"I wish to make up a small mains transformer, and should like to use material which I have on hand. I have two old L.F. transformers which are burnt out, and wonder if it would be possible to use the cores of these, and perhaps the existing bobbins. The only thing I am not sure about is whether the material is the same as that used in mains transformers, and should be glad of your advice on this point of the question."—B. R. E. (Ilford).

IN general stalloy stampings are used for mains and L.F. transformers, but some types of the latter component are made from special alloys to maintain a high inductance with a minimum of core material. These would not be suitable for your proposed mains transformer, but if the stampings are of stalloy you could no doubt use them. The main point is that a fairly substantial core is necessary in a mains transformer, and in most L.F. transformers the core is not only fairly thin, but the width of the various pieces of stalloy are rather on the narrow side which would not permit you to build up a satisfactory core. However, we refer you to our book on Coils, Chokes and Transformers, and also to the series of articles now running on the subject.

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.

R. J. C. (Yeovil). We regret that we could not give constructional details, but the theories of design were covered in our companion paper, "Practical Mechanics" for January last.

B. G. D. (Hereford). The potentiometer is connected across the reaction coil. A better idea is to use an S.G. valve and with fixed reaction coupling vary the H.T. on the screen by means of a potentiometer.

C. A. M. (Denton, M/c.). The wattage rating is dependent upon the current-carrying capacity of the element. Thus you could have a very small 1,000 ohm resistance which would only carry 1 or 2 milliamps, and yet have another still rated at 1,000 ohms, but of such material or size that it would carry 1 amp. You can compare it with resistance wires of different gauges. We have not published a book on the subject mentioned.

S. K. (Clapham). We regret that we have no details of the coil mentioned.

J. Van P. (Southport). We regret that we are unable to trace an English agent of the firm in question.

R. S. M. (Halifax). The coils were specially designed for a periodical not now on the market, and we have no details of them.

S. M. (Teddington). Push-pull would be satisfactory and the current available is just right. Use automatic grid-bias.

R. E. (Chelmsford). A wire-wound component would be suitable and one of the special Bulgin components will be found most satisfactory.

V. E. W. (Stalybridge). A mains transformer could be used, especially if the type of component having tappings at each 10 volts is employed.

G. T. (Perranporth). Test with a good milliammeter and you will find that the resistance has altered due to overheating.

L. R. (Uxbridge). The note is undoubtedly above audio frequency and this would account for the peculiar effects mentioned.

K. S. (Colchester). Portability is the first essential and the parts are definitely unsuitable. Special parts are, of course, now obtainable.

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

Classified Advertisements

RECEIVERS, COMPONENTS AND ACCESSORIES

SOUTHERN RADIO'S BARGAINS.

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

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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.

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SPARK COILS, ex-Naval, 2in. spark, complete for 12-volt working, 25/- each, post 1/6.

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A.C. INDUCTION MOTORS, 200/250 volts, 1 ph. 50 cy., approx. ¼ h.p., 1,440 r.p.m., in new condition, 25/- each, post 1/-.

STANDARD TELEPHONE CONDENSERS, 1 mf. 400-volt wkg., 4d. each, or 4 for 1/-; 2 mf. 400-v. wkg., 6d. each. Muirhead, 1 mf. 4,000-volt test, 2/- each. Phillips, 1 mf. 8,000-volt test, 5/- each. T.C.C., 2 mf. 1,000-volt test, 1/- each. T.C.C., 2,000 mf. 12-volt wkg., 2/- each.

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 volts 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., 200/240 v. 50 cy. 1-ph. primary. 5,000 and 7,000 volts secondary, enclosed in petroleum jelly. Size: 5⅜in. x 4¼in. x 4¼in., 7/6 each, post 1/-. Ditto, skeleton type, 5/6, post 9d. All brand new.

MAINS TRANSFORMERS, 200/240 volts input, 12 and 24 volts at 4 to 6 amps. output (useful for model trains, etc.), 15/- each. post 1/-.

EX-G.P.O. GLASS TOP RELAYS, Type B. Useful as Keying Relays, 5/- each, post 6d. Also a few only that needs points, which are easily fitted, 2/6 each. P/F.

T.C.C. 2,000 MF. ELECTROLYTIC CONDENSERS, 50-volt working (brand new), 5/- each, post 6d.

STANDARD TELEPHONE BELL WIRE, all brand new, 150-yd. coils, twin 22 gauge, 4/-, post 9d.; 250-yd. coils, single 18 gauge, 4/-, post 1/-; 300-yd. coils, single 22 gauge, 3/-, post 6d.

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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/-.

Terms: Cash with Order

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BANKRUPT BARGAINS.—Good stock of all types of receivers, practically every type of replacement valve, service goods, repairs. Keenest prices. All new goods. Please state requirements.—Butlin, 6, Stanford Avenue, Brighton. Preston 4030.

VAUXHALL. Skeleton metal rectifiers, HT10, 11/-; HT9, 9/-. Valveholders. 7-pin, 6d.; 5-pin, 5d. Volume controls, 2/-; with switch, 3/-.

VAUXHALL. T.C.C. cardboard containers; 8 mfd. 500v., 2/-; 6 plus 4 mfd. 350 v., 1/9; 50 mfd. 50v., 1/9. Rola 8in. P.M. speaker with transformer, 14/9. Other sizes in stock.

VAUXHALL. Bar type condensers, straight 0.0005 mfd., 2-gang, 6/6; 3-gang, 8/6. Full-vision drives, station names, 6/-.

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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.

MISCELLANEOUS

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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.

APPLICATIONS from candidates previously interviewed and declared unsuccessful will be considered provided the necessary additional experience has been gained.

ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three 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 9s. 0d. per annum (payable monthly in arrear) if service is satisfactory, and must be prepared to serve in any part of the United Kingdom.

NORMAL age limits 25 to 55.

CANDIDATES should indicate on their applications for which vacancy they wish to be considered—a, b or c.

APPLICATION 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. 52), Brandon Steep, Bristol, 1.

A NEW EXPANSION CIRCUIT — See page 519.

A NEWNES PUBLICATION

Edited by F. J. CAMM

Vol. 15. No. 390.

Practical Wireless and PRACTICAL TELEVISION

3D.

EVERY WEDNESDAY

Mar. 9th, 1940.

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Practical and Wireless
★ PRACTICAL TELEVISION ★
EVERY WEDNESDAY
Vol. XV No. 390. Mar. 9th, 1940.
EDITED BY F. J. CAMM
Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Amplifier Design

AN amplifier has a much wider range of circuits than a standard broadcast receiver, although there are many types of receiver. These may be divided roughly into straight or superhet circuits, and beyond this there is very little with which to experiment. On the other hand, an amplifier must be designed first to give a certain output—according to the uses to which it is to be put—and, secondly, to incorporate a certain type of circuit. This may incorporate push-pull, transformer coupling, resistance-capacity coupling, or even mixtures of these. Thus, when an amplifier is designed, it will probably only meet the requirements of a few listeners, and so we receive many requests for amplifier designs for special purposes. We have, of course, described dozens of alternative designs, all embodying various features, and in this issue we give yet another, built from spare parts, and employing a push-pull output stage. This is regarded by most listeners as the best type of output, being simple to wire and construct and giving the best quality for a medium H.T. supply. It is reasonably free from trouble, and due to the special working of the push-pull valves hum and distortion troubles are reduced to a minimum. We shall, however, continue to describe various types of amplifier, and in a forthcoming issue shall give details of a new high-quality unit incorporating the direct-coupled principle.

Austria

MORAY McLAREN is preparing for March 12th a programme which is of topical interest. This is the anniversary of the day on which Hitler's troops marched into Vienna. McLaren, who knows Austria intimately, will show in this programme how much of the real spirit of the country has been destroyed since it was incorporated in Hitler's Reich. The feature will include tributes to Austria by English people who knew it in its happier days, and the music and the poetry of life in Austria of those days will be strongly featured.

Goebbels Exposed

THE fourth talk in "The Voice of the Nazi" series, in which W. A. Sinclair, of Edinburgh University, is giving such a telling exposure of Nazi propaganda methods, will be repeated on March 7th, following its first appearance in programmes on February 20th. It is entitled "Some Tricks of the Trade."

"Convoy"

ONE of Britain's greatest war efforts since the commencement of hostilities has been the successful convoying of many thousands of tons of shipping to and from the ports of this country. This service, carried out by the Royal Navy in conjunction with the Merchant Navy, is to be made the theme of a special programme which has been written by Captain Taprell Dorling, R.N., who is perhaps better known as "Taffrail."

This will be heard in the Home Service programme on March 15th. It is a survey which searches back through Britain's maritime history. Naturally, it draws upon the experiences of the Great War, and it is documentary in so far as it quotes the official naval history of the Great War, words by the late Lord Jellicoe and the Rt. Hon. Winston Churchill when he was First Lord of the Admiralty in the last war, and, more recently, quotations from speeches made during the present war by H.M. the King, Mr. Chamberlain, and Mr. Churchill.

With a risk, in an air raid, of failure of the electricity supply, battery portables have distinct advantages for A.R.P. work. This portable, working 10ft. below ground level in the Ekco radio shelter at Southend-on-Sea, gave results identical with those obtained in normal conditions on the surface.

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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.

Composer Cavalcade

RAY NOBLE will be the subject of the next "Composer Cavalcade," to be broadcast on March 7th. It is probably not generally realised that Noble is an Englishman. He has lived for many years in the United States, and for a long time his band has been associated with the famous Rainbow Room in New York.

He won a competition for orchestration in 1927, and in 1928 he started composing, almost at once joining the front rank of song writers. He has been responsible for the scores of several famous stage successes and film musicals, including "The Little Damozel" and "Brewster's Millions." Probably his most famous number is "Love is the Sweetest Thing." Many listeners will also remember "Good-night, Sweetheart," "The Touch of Your Lips," "What More Can I Ask?" and a score of others.

Rawicz and Landauer

RAWICZ and Landauer, whose performances in "Saturday at 9.30" have been a highlight in that series, are to give a lighter programme with the B.B.C. Theatre Orchestra, conducted by Stanford Robinson on March 7th. This should be of special appeal to younger listeners, though it is expected that it will be appreciated by listeners generally.

The programme will include such pieces as Debussy's "The Golliwogs' Cakewalk," "The Teddy Bears' Picnic," by Bratton, "The Parade of the Tin Soldiers," by Jessel, and a selection from "Snow White and the Seven Dwarfs," by Churchill. The broadcast will be taken by the Home Service and For the Forces programmes.

Flexible Leads and Connectors

Some Practical Hints and "Safety-first" Measures which should be Adopted when Wiring Receivers and when Making Mains and Battery Connections

By FRANK PRESTON

IT is probably because of the apparent simplicity of the work that the making of flexible connections is so often badly done. Take, for example, the wiring of the heater leads in a mains set. The average constructor simply cuts off two or three lengths of flex, scrapes the insulation off the ends and then either solders them or forms loops which can be gripped under the valveholder terminal nuts. Not only does this give an untidy appearance, but there is always a danger that one or two strands of the flex will make contact with a nearby terminal and cause a short-circuit.

The correct method is to measure the

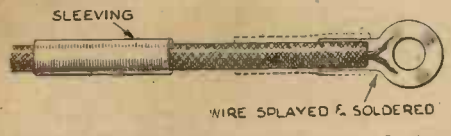


Fig. 1.—The best method of connecting a flexible lead to a terminal: by soldering on a tag.

lengths of flex carefully, then to push back the cotton insulation. The next step is to remove the rubber covering by using the blunt edge of a knife blade. When the connections are to be soldered it is necessary to bare the wire for only about ¼in., but when a terminal loop is to be formed the wire should be bared for rather more than ¼in. In any case, the strands should be tightly twisted together after baring, whilst if the wire is dirty it is wise to clean it before twisting; cleaning can be done by dipping the wire into methylated spirit or carbon tetrachloride and then wiping with a clean duster—this is better than using fine glass paper or scraping the wire.

Forming Looped Ends

When the wire is to be looped, curve it round a short piece of rod or a pencil point and make a tight twist at the neck of the loop. Lightly smear the bared wire with flux and then tin it with a hot soldering iron, holding the iron in contact with the wire for only two or three seconds. When making soldered joints the same general procedure should be followed, without making the loop. After the ends of the wire have been tinned, bind the ends of the insulated portion with strong thread. An alternative method is to slip a short length of insulated sleeving over the wire before treating the end, and to slide this along to the end of the insulation afterwards.

It is in many respects better to fit tags to the ends of the flex when terminal connections are to be used. A better contact can often be obtained and there is less chance of the wire being damaged or frayed when tightening the terminals. The method suggested is shown in Fig. 1, where it will be seen that the bared end of wire is splayed out before being tinned. The metal eye should also be tinned and the wire laid over it after smearing with flux, when the joint can be sweated. If the tag is intended to clamp round the wire, it can next be curved round by gripping with a pair of pliers. Finally, the sleeving can be drawn over it, or the joint can be tightly bound with thread. A slightly different procedure might be better with some forms of connecting tag, but the general method outlined is applicable in nearly every case.

Mains Leads

The above methods of dealing with the ends of flex can be applied to nearly all leads, including those for batteries and mains supply, but especial care should be taken with leads for use in the mains system. The chief precaution should be that there is no exposed bare wire, the shrouding of the plug, socket, switch or other component covering the bared portion and also some of the part which is insulated. A little hint which is worth remembering is that if there are any loose threads of the cotton sleeving they can be trimmed off flicking them through the flame of a match.

When flex leads are used for battery connections from the receiver, there are various methods of dealing with them. One is to fit them with plugs at each end so that they can be plugged into the batteries and also into terminal-socket strips on the receiver. It is generally

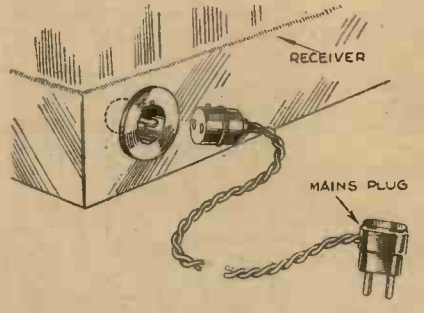


Fig. 3.—"Live" mains connectors should always be insulated. Connectors with open pins or sockets should be "dead" when removed.

more convenient, however, to attach the leads to the receiver in more permanent form. They can therefore be dealt with in the manner described above. It is rather important, however, that they should be anchored to the set so that, should they be tugged, they will not come adrift; if they did a short-circuit might be produced—with expensive results. Two methods of anchoring the leads are shown in Fig. 2. In the case of the wooden

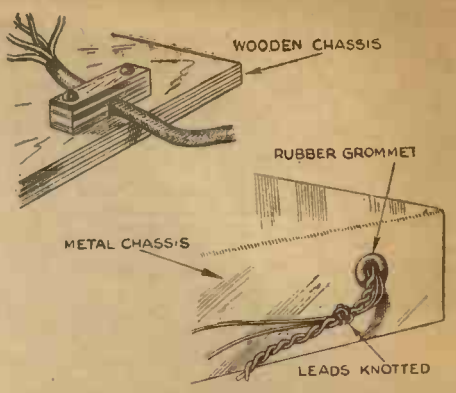


Fig. 2.—Methods of anchoring flex leads to prevent them from being pulled away from the chassis.

chassis a small bridge is made from five-ply or a strip of hardwood, it is notched slightly on the underside, so that when it is screwed down to the chassis it grips the battery-lead assembly or the separate flexible leads. Sometimes it may be more convenient to make a bridge from strip brass, but the edges should be rounded over so that they cannot cut into the insulation.

Another method is also shown in Fig. 2, but this is more suitable when using a metal chassis. A rubber grommet is fitted in a hole in the side of the chassis and the leads are passed through this before being attached to the receiver components. A knot is then made in the assembly of wires so that they cannot be pulled through the grommet.

H.T. Connectors

In dealing with mains-supply leads it is impossible to be too careful. The first point which should receive attention is that all "live" points should be so insulated that it is impossible to touch them without dismantling the connector. An example of what is meant is given in Fig. 3, where it is assumed that there is a supply socket on the set and that a length of flex is used to connect a plug fitting into this to the power point on the wall. It will be noticed that the pins of the power-point plug are exposed (since they are "dead" when the plug is removed from the point), whilst the socket at the other end of the flex is completely insulated (since this is "live" whenever the mains plug is inserted). There is a wide variety of plugs and sockets, but whatever type is employed the rules just outlined should be carefully observed. It is also important that the ends of the flex leads should be protected after being joined to the connector. This can be done by binding with stout thread, although it is still better to fit a short length of rubber tubing, if possible clamping this in the end of the connector. Not only does the tubing prevent the insulation from fraying, but it strengthens the wire, preventing it from breaking due to constant bending against the edge of the connector.

A similar arrangement is applicable when two mains leads, or wires carrying H.T., are to be joined together. An example of this is sometimes to be found where the receiver proper and combined amplifier-mains unit are mounted on separate chassis. Irreversible connectors should be used, whether they are of two-, three-, four- or multi-way types. That which is connected to the mains unit should be completely shrouded, whilst there may be projecting pins on the connector fitted to the receiver.

(Continued on page 532)

A Universal Valve-tester—3

Details of the Power Supply Unit are Given in this Article - - By F. DAY-LEWIS, A.M.I.R.E.

WHEN all these values have been obtained, erase the marks first put on the dials, and if carefully done the first resistance dial, V1, should read something like 100, 200, 300, 400, and so on to 1,000, and the same with the second dial V2. but this time in steps of 1,000 ohms.

Remember, of course, that when one resistance is being measured the others must be at zero resistance. or otherwise the values would he hopelessly incorrect.

Calibrating for Emission

For the purposes of testing valves we rely on the well-tried mutual conductance test, and with our instrument it is found that when the zero signal is denoted in the headphones, then the resistance in circuit bears a constant relationship to the mutual conductance of the valve. Without going into the mathematical side of the matter it is found that the mutual conductance in milliamps per volt is equal to 1,000/total resistance,

or mutual conductance $\frac{1,000}{\text{resistance}}$ milliamps per volt.

The resistance is found by adding up the total resistances as shown on the dials when the zero signal point has been found. In this way we can also plot by graph (mutual conductance against resistance value), and also on the scales the direct reading of mutual conductance for the total resistance in circuit.

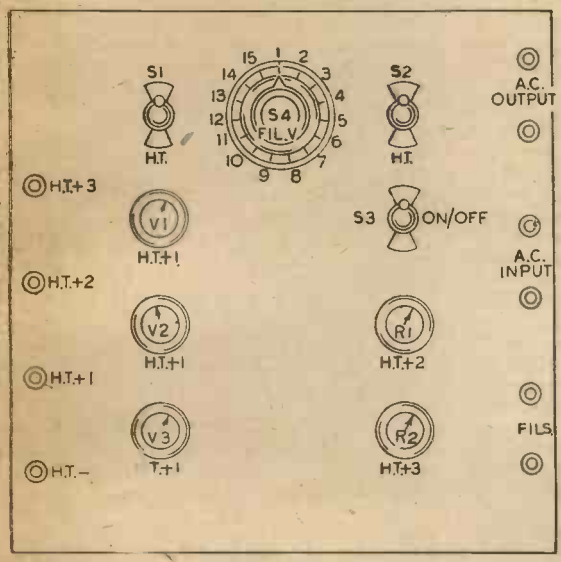


Fig. 6.—Panel layout for the power supply unit. The size of the panel can be made to suit requirements.

Operation

Connect up the phones, signal generator, and leads to the valve panel. From the valve index card apply the correct voltages to the valve being tested. Switch on the signal generator and listen in phones. Rotate *one resistance* at a time. First take V1 and rotating slowly listen for zero signal, if not present on whole scale, return to zero and try V2. If still unsuccessful, return to zero and try V3. If still no zero, then valve must be defective. When zero is obtained (it should be possible to get it on one resistance only) this gives the reading corresponding to the mutual conductance.

Again, as in all valve testing, tap the valve as the test is conducted, and see if there is any change in the sound or position of minimum signal.

It will be found that each of the variable resistances will cover a certain range of mutual conductance values, and then when testing any valve it is only necessary to see what the maker's stated value of this is, and compare it with the range covered with one of the resistances. This will show which one to operate.

The headphone section of this tester is also useful for connecting into other circuits when set testing, and by using a blocking condenser in one lead it can also be utilised for the testing of L.F. anode circuits.

The Power Supply Unit

This unit has been primarily designed for use with the valve tester already described, but the designer has also remembered that in most experimenters' experience an instrument with more than one use is very handy, and thus it is possible to utilise this unit in more than one way.

There are A.C. filament outputs from 12 volts in steps up to 40 volts, and the range covers all the common heater voltages found in all valves on the market; it is not likely that any valves will be designed with heaters outside this range. Furthermore, for use with the tester this range is very useful for a quick check of valve heaters (to see if they are lighting at all),

(*Continued on next page.*)

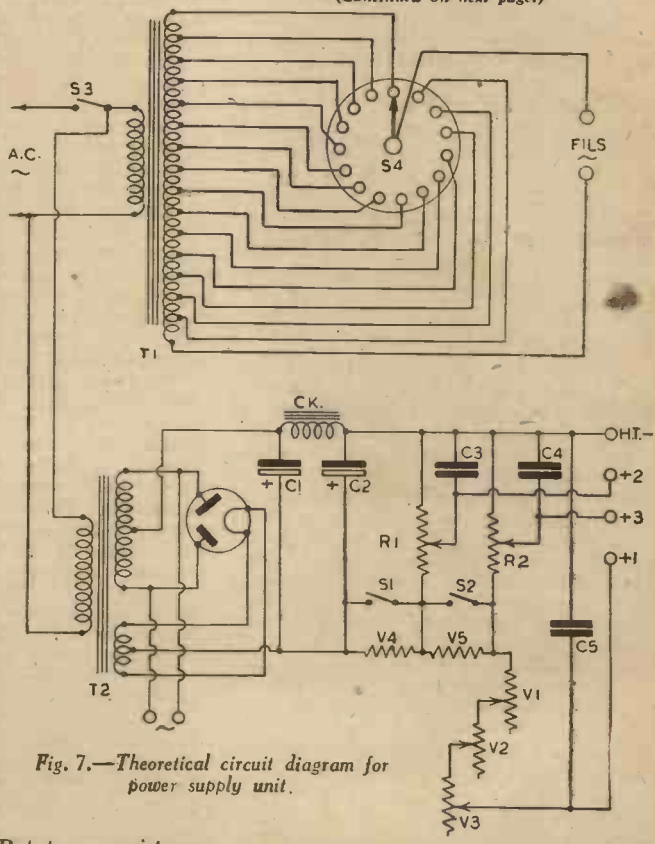


Fig. 7.—Theoretical circuit diagram for power supply unit.

LIST OF COMPONENTS FOR THE BRIDGE UNIT

- Ten banana type plugs and sockets.
- One 4 mfd. fixed condenser. Paper type.
- One 1 mfd. fixed condenser. Paper type.
- One 50,000 ohm fixed resistance
- One 1,000 ohm variable wire-wound square law resistance.
- One 10,000 ohm variable wire-wound square law resistance.
- One 100,000 ohm variable wire-wound square law resistance.
- One 2 : 1 L.F. transformer.
- Insulated wiring.
- Nuts and bolts.
- 9in. square panel.
- Extras to use : headphones and signal generator (L.F. type).
- Cabinet if required.
- Pieces of stiff paper and celluloid.
- Pointer knobs for var. resistances.

COMPONENTS REQUIRED FOR POWER SUPPLY UNIT.

- Ten plugs and sockets.
- One 15-way switch or equivalent type.
- Three toggle switches, single pole.
- One filament transformer, as described, and mains transformer.
- Two 8 mfd. electrolytics, 600 W.V.D.C.
- One 4 mfd. electrolytic, 600 W.V.D.C.
- Two 2 mfd. electrolytics, 600 W.V.D.C.
- One L.F. smoothing choke, Bulgin, L.F.21.
- Two 5,000 ohm fixed resistances, Bulgin PR9.
- Two 100,000 ohm var. resistances, wire wound, 4-5 watts.
- One 300,000 ohm var. resistances, wire wound, 4-5 watts.
- One 25,000 ohm var. resistances, wire wound, 5 watts.
- One 10,000 ohm var. resistance, wire wound (Bulgin MV14).
- Panel, 9in. square, plywood or ebonite.
- Nuts, bolts, and connecting wire.
- Mullard DW4 rectifier, and valveholder for same.

A UNIVERSAL VALVE-TESTER—3.

(*Continued from previous page.*)

and the supply can also be used as a substitute for a set's filament winding of the mains transformer (where this is suspected to be faulty). Other uses will, no doubt, occur to the constructor.

The filament transformer is quite separate from the H.T. one, and this obviates interaction faults between the two, and makes for safety in use.

The H.T. section supplies three rectified and smoothed outputs for operating the anodes, screens, and extra screen or oscillator anode of the valve panel electrodes. This supply can also be used for other purposes as the outputs are variable and very well smoothed. A large range of output voltages is possible with thé aid of the series of resistances and volume control resistances. Pos. 1 is the large current output for the plates of valves or other purposes where a large current may be drawn. Pos. 2 is for screens, and Pos. 3 similar, and these can only supply small currents; it is dangerous to try and take a large current and damage may result.

This supply can also be used for substituting the H.T. supply of a set where this is suspected, and for applying a large voltage to test condensers.

Components and Parts

The filament transformer is specially wound, and any good transformer winder can make it easily. The maximum current drawn is 2 amp. in the secondary, and the output voltages are obtained by tapping the winding for 2, 4, 5, 6, 6.3, 7.5, 13, 14, 20, 24, 25, 26, 30, 35 and 40 volts.

One end of the transformer is connected directly to a socket, and the other taps go to a multiple-contact rotary switch with 15 contacts. In the writer's model this was one of the old rotary arms making contacts with studs, each separated enough to prevent the switch arm from being on two studs at a time (and shorting the particular section there). The centre arm is connected to the other socket.

The H.T. transformer is wound to take a Mullard DW4 rectifier valve, i.e, filament winding for 4 volts, 2 amp., and H.T. winding to deliver 400-0-400 volts, and giving 400 volts D.C. at approx. 120 mA.

The smoothing choke is a Bulgin L.F. 21, or any other reliable component having 15 hys. at 100 mA will suffice.

C1 and C2 are each 8 mfd. electrolytic type, C3 and C4 are 2 mfd. each, electrolytic, and C5 is 4 mfd. electrolytic.

V3 is a 300,000 ohm 3 watt variable resistance, V2 a 25,000 ohms 5 watt variable resistance, and V1 a 10,000 ohm resistance; a Bulgin MV14 is recommended. This last is a power resistance, and if it is of the sliding top bar type, then it will not be mounted on the panel, as shown at V3, but can be placed elsewhere or on top of the cabinet.

V4 and V5 are each 5,000 ohms, and Bulgin PR9 were used.

R1 and R2 are each 100,000 ohms variable.

Construction

From the foregoing remarks a good idea of the circuit will have been obtained. The panel layout is depicted in Fig. 6, and the panel itself can be of any convenient size, about 9in. square is suggested, but the constructor can suit his own requirements.

The D.C. H.T. sockets are placed on the left for easy connection to the valve panel, and the A.C. is on the right-hand side. The top two sockets give the output from the secondary of the H.T. transformer (useful for a number of tests), and the centre two are for the input from the mains, or these can be dispensed with, and the mains cord led in directly at the back of the unit.

The bottom two sockets are from the filament transformer, and their output is controlled by the filament selector-switch S4 (Fig. 7.)

S1 and S2 are shorting switches for cutting out the voltage dropping resistances V4 and V5. S3 is the mains on-off switch.

A baseboard is cut to hold the two transformers behind the panel, and also the rectifier valve and large filter condensers. There are no difficulties in the assembly, and the usual precautions are necessary to space the transformers well, and also away from the choke which is screened and can be earthed.

Operation with Tester

When using with the valve tester (or otherwise) always use V1 before V2 and V3 when adjusting the voltage of the Pos. 1 output. This is to avoid overloading the smaller wattage resistances on a heavy drain of current. It will be found that these resistances give all the control required over the Pos. 1 output, but if extra control is needed then the other two resistances, V4 and V5, can be brought into circuit. The resistances are operated in the order: V1, V2, V3, V4 and V5. This is important, as they are then placed into circuit according to their power-handling capabilities.

The connections to the valve tester are self-explanatory, and need little adding to; the filament supply to fils. on tester, negative to negative, and the same with the other outputs. The valve being tested is not inserted in its holder until the applied voltages have been roughly adjusted, and then when it is in place the voltages are accurately made.

The H.T. outputs are from practically zero up to 400 volts at 60-80 milliamps for power valves, etc., and smaller currents for the screens. The output voltages and currents will be found to satisfy the requirements of all modern valves. The H.T. outputs can be removed from the valve tester, and with the aid of a neon lamp in series with one of the leads we can test for short-circuits between the various electrodes (the filament transformer meanwhile heating the valves).

This finishes the complete outfit, and it can now be seen that the three units, although primarily made to work together for the testing of all valves, can also be very useful for other purposes. The cost of the whole is not heavy, and if made in stages will be easier, and yet will not prevent the carrying out of very useful work with the apparatus already assembled.

Impressions on the Wax

A Review of the Latest Gramophone Records

Vocal Variety

HEADING a quite remarkable array of light vocal talent, there is a new record by none other than Sophie Tucker this month. The coupling is a wise one—a new tune, "The Lady is a Tramp," has been paired with an old Tucker favourite—"Some of These Days"—*Brunswick O* 2893. Jack Doyle and Movita, who recently made a successful broadcast, have recorded "Speak to me of Love" and "Romance in Rio," which comes from Movita's film, on *Decca F* 7351.

Also in the Decca list there are new records by Vera Lynn singing "I Shall be Waiting" and "I'll Pray for you"—*Decca F* 7330; Adelaide Hall singing "The Lady is a Tramp" and "Where or When," both from the film, "Babes in Arms"—*Decca F* 7345; Al and Bob Harvey with their version of "Sing Hullabaloo Belay" and "You Never Miss the Old Faces"—*Decca F* 7353, and Ben Lyon and Bebe Daniels—*Decca F* 7349-50.

Sidney Burchall—he was the first to record "There'll Always be an England"—has now recorded a ballad hit of to-morrow in the form of "Absent Friends" on *Decca F* 7354. He has coupled it with "The Old Lady of Armentières."

Elsie and Doris Waters bring typical Gert and Daisy touches to "Please Leave my Butter Alone" and "Knees Up, Mother Brown" on *Decca F* 7309.

Connie Boswell fans will be glad to hear that this famous American singer, who has been crippled since birth, is now able to walk again. Connie has recorded a song called "Stra-va-na-da," coupled with "At Least You Could say 'Hello,'" on *Brunswick O* 2891, and has also made a duet record with Bing Crosby of "Start the Day Right" on *Brunswick O* 2890.

For Dancers

AMBROSE and His Orchestra have made some attractive records this month, one of which introduces that popular hit tune of the moment, "Scatter-brain." It is coupled with "Over the Rainbow" on *Decca F* 7348. His other records are "Give me my Ranch" and "Bella Bambina"—*Decca F* 7347, and "Where or When" coupled with "Are You Havin' any Fun?"—*Decca F* 7346. Jimmy Dorsey and His Orchestra have a really grand tune in "Let's Make Memories To-night" on *Brunswick O* 2895, whilst Guy Lombardo leads his Royal Canadians through a typical version of "Faithful Forever" on *Brunswick O* 2897. Count Basie and His Orchestra play "Jive at Five" and "Evil Blues" on *Brunswick O* 2894. Billy Kyle's solo piano record of "Between Sets" probably has nothing to do with tennis, but makes delightful listening. On the other side is an opus called "Finishin' up a Date"—*Brunswick O* 2898.

Brian Lawrence and His Lansdowne Orchestra appear in the Rex list with two new records. They are "Where or When" and "Good-morning," both from the film "Babes in Arms" on *Rex* 9711, and "Are You Havin' any Fun?" from George Black's show shop, "The Little Dog Laughed" and "You Never Miss the Old Faces" on *Rex* 9712. Horace Finch at the Empress Ballroom plays a number of popular tunes on the organ in "Finch Favourites, No. 5"—*Rex* 9709, whilst Billy Cotton and His Band play "Red, White and Blue" and "Massed Bands of the Guards" on *Rex* 9699.

ON YOUR WAVELENGTH

By Thermion

The Television Black-out

THERE is not, as was hoped, any possibility at present of a resumption of the television service in any shape or form. I quoted the question which Sir Reginald Curry asked in the House of Commons on January 1st, when he asked: "What is the present situation with regard to television broadcasting in this and other countries; whether the Postmaster-General will consider an early resumption of television broadcasting as an encouragement both to research work and to manufacturers of television sets enabling them to establish a British product in world markets." Major Tryon replied that he could hold out no hope of its early resumption, and although he agreed that television services were in operation in other countries he did not believe that they had passed the experimental stage. Another speaker pursued the question some days later, and received the reply that the P.M.G. could see little prospect of the provision of a television service during the war. The Television Advisory Committee is, however, to meet representatives of the manufacturers to probe the question of the development of television "in the more distant future."

Nomenclature for Metallised Valves

THE importance of distinguishing between a valve with a clear bulb and one with a metallised bulb is becoming increasingly appreciated. The General Electric Company has, therefore, decided that in certain existing, and in all new types of Osram valves of the metallised type, the suffix M shall be included in the coding.

It is felt that this step will do much to obviate many of the difficulties encountered by traders in making out their orders for each type of valve.

It is not intended that this distinctive nomenclature shall apply to older type valves. It will, however, provide a safeguard in ensuring delivery of the correct finish of valves in the case of new receivers, where the new reference number indicating plain or metallised type will be specified in the manufacturers' instruction booklets.

The types involved in this change are DH63, KTW61 and X63 with plain bulbs, which will be specified as DH63M, KTW61M, and X63M when required with metallised bulbs. Types Osram X73M, KTW73M, KTZ73M and DH73M are available only with metallised bulbs.

Most traders will appreciate that there is no difference in the list price between plain and metallised valves.

"Newnes Short-wave Manual"

THERE has just been published from the offices of this journal "Newnes Short-wave Manual"—a complete treatise on the design, construction, operation, and adjustment of short- and ultra-short-wave receivers, aerials and equipment with designs for eight short-wave receivers. The chapters include: An Introduction to the Short Waves; Operating Your First Short-waver; Band Spread Tuning; Hand-capacity Effects; Short and Ultra-short Wavelengths; H.F. Amplification; Tuned H.F. versus the Superhet; Metres, Kilocycles and Megacycles; Mastering the Morse Code; Minimising Interference; Tuning Short-wave Aerials; Making a Screened Aerial-coupler; Couplings for Aerials; More Aerial Couplings; Reflector Aerials; Coil Design; Measuring Wavelengths or Frequencies; Ultra-short-wave Converters and Adapters; Finding and Measuring Wavelengths of Five Metres and Below; Two Simple One-valvers; Two Simple Two-valvers; An A.C. Two-valver; A Standard Three-valver; An A.C. Four-valver; A Nine-valve Communications Superhet. The book contains valuable tables, a list of world short-wave stations, and is fully illustrated. It costs 5s or 5s. 6d. by post from The Publisher, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

It is attractively bound.

By the way, those of my readers engaged in the engineering trades may also be interested in our new volume "Dictionary of Metals and Their Alloys," which is also published at 5s. or 5s. 6d. by post.

What is a Crooner?

MOST of my readers know my attitude to crooners, and the following is an interesting discourse on the subject which I came across in the *Voice*. I give it for your attention.

"Let's have a few facts about crooning. Even if you're not very interested in the subject, a lot of people are—violently for or equally violently against. Yet I'll guarantee not one in a thousand of them could give you a definition of it.

"If one were to believe the stories in the papers, crooning can be regarded as a substitute for ipecacuanha, for, on being asked his opinion, the Average Reader (we are told) invariably replies: 'It makes me sick.'

"And such is the power of suggestion by newspapers, music-hall comedians, weekly 'funny' papers and others whose self-appointed task it is to raise a smile, that sure enough the average record buyer—*if asked his opinion of crooning*—will automatically reply: 'It makes me sick.'

"If, however, the dangerous word is not mentioned, the selfsame average customer will listen to and enjoy many samples of the art. It is the word itself which conjures up the dislike complexes, not the actual crooning.

"Of course, there is crooning and crooning. Some of it is so bad that even the strongest stomach will turn at it.

"But let us get quite clear in our minds about exactly what *is* crooning. The dictionary will tell you that it is 'to sing softly, as a mother to her child' and is unconsciously near the modern definition, which is 'to sing softly for microphone purposes.'

"Before microphones were in everyday use, a singer *had* to develop lung power or be lost at the back of the hall. Who has not seen a fifth-rate tenor going black in the face and with bulging veins reaching for his top notes? Was it pretty to see? Or enjoyable to hear?

"It is not fair to take the *best* of 'legitimate' singers and compare them with the worst of 'crooners.' You might just as well base your opinion of Wagner on a pub-door cornet player's rendering of 'O Star of Eve.'

"Crooning, as I have said, came into existence with the microphone—which is, literally, the 'magnifier of sound.' It was found that a lot of people had a talent for singing these popular ballads of the day in ways which were amusing, entertaining, unique or just appropriate—but whose voices were not strong enough for the public platform. Who has not had a talented friend who can entertain the drawing-room circle for hours singing at the piano or with a ukulele to accompany himself? Why waste such talent? Before the advent of the microphone such people had to be wasted by reason of sheer lack of carrying power.

"Following these 'natural' but untrained artists came those who grew up with the microphone, who were born into the microphone age. Singers and artists who spent their periods of study not in learning how to reach the back of the hall, but in learning how to master the microphone. For, make no mistake, the 'mike' is a merciless critic and will magnify the slightest weakness.

"It is not the crooner's fault if the songs he or she is paid to sing are banal and trivial. But it *is* his fault if his diction is bad, his intonation faulty or his treatment inappropriate. These are the points on which you should judge a crooner—not the sentimental words he sings. And within these limits he meets the 'legitimate' singer on equal grounds, and often beats him. The only points in which he can't compete are volume (which doesn't matter for microphone singing), tone (which is usually a natural asset with the crooner, otherwise he seldom gets as far as making a record) and technique in vocal tricks (which are not required for the singing of 'pop' ballads)."

Designing Mains Transformers—2

The Question of Determining Suitable Wire Gauges, the Winding Space Required, and Voltage Regulation are Discussed in this Article

By L. O. SPARKS

THE next consideration is what gauge of wire can be used for the various windings, bearing in mind such factors as winding space available, current flowing and the number of turns required. The selection of the most suitable gauge for any given section of the transformer often causes some little worry to the constructor, as the items mentioned above involve a certain amount of calculation which, if not accurate, will upset the whole of the constructional work and/or results obtained.

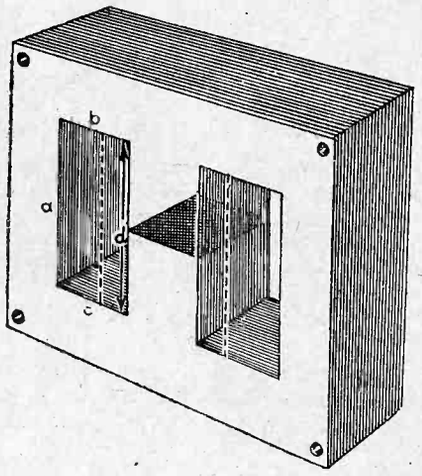
As the current flowing is of prime importance, it is first necessary to consider the value for each winding. These are usually pre-determined by the output requirements, but in the case of the primary winding this has to be determined, and this can readily be done by the following method. We have already calculated the wattage of the input or, in other words, the primary, therefore, knowing this and that watts are expressed as current multiplied by voltage, we can apply a simple twist and express the current flowing as watts divided by voltage, which, in the example under consideration, becomes $\frac{42}{250}$ or .168 amps. The value for the voltage, will, of course, be governed by the voltage of the mains supply on which the transformer is to be used.

Once the current value has been determined, then reference can be made to a wire table to find out the most suitable gauge to use.

When examining a wire table, it will be found that one column deals with the safe maximum current value for any particular gauge of wire. The column is usually headed "Max. Current in Amps. at 1,000 A. per square inch," but in some tables, separate columns are provided for different ratings, i.e., 1,500 A., 2,000 amps, etc. Without discussing the actual meaning of this, it can be noted that for most amateur transformers, the maximum current value can be doubled with reasonable safety. For example, if one looks up the safe maximum current for, say, 22 s.w.g. wire, and finds that the value is 0.6158 amps. (at 1,000 amps. per square inch), then it would be permissible to use that gauge to carry 1.316 amperes. For normal transformer constructional work it is advisable to use the 1,000 amp. rating and apply the above method.

Once the required wire gauge has been determined, reference must be made to the column which gives the number of turns per inch for the wire selected, not forgetting to note the difference between the space required for D.S.C. (double silk covered), D.C.C. (double cotton covered) and enamelled. If any doubt exists as to which form of covering or insulation should be employed, it should be remembered that the D.S.C. is the finest, especially where very high voltages are concerned, although it is the most costly and, for that reason, the other types are more widely used, particularly the enamelled wire. The latter is quite satisfactory, providing it is of reliable make, that care is taken when handling it, and reasonable insulation is used between layers.

If Fig. 1 is now examined, the rectangle formed by a, b, c and d represents what is known as the window of the stampings, while the shaded portion is intended to indicate the cross-sectional area of the core. The length of the window space is that indicated by "d," but the *actual length* available for winding purposes will be "d" minus twice the thickness of the walls of the bobbin which is going to carry the windings. The safest way is to take the measurement between the insides of the walls of the bobbin, as this prevents the calculations being upset by any variation due to the making of the bobbin.



Knowing the number of turns required for the primary, it is not now a difficult matter to calculate the number of layers that will be necessary to complete the winding. If, however, the wire gauge selected is stated to allow 30 turns per inch, it is always advisable to allow a little latitude for imperfections in the winding. Once the number of layers is known, the thickness of the winding can be deduced, but when doing this, it must not be overlooked that insulation, in the form of Empire cloth or dry brown paper, between layers will increase the calculated thickness; therefore, it becomes necessary to add, say, 50 per cent. We will assume that the winding under consideration will occupy the space shown by the dotted lines in Fig. 1.

For a satisfactory product, one or two more calculations become essential. It is advisable to determine the resistance of the wire used for the primary and the secondary (H.T.) windings, as these have a direct bearing on the accuracy of the output voltages when the pre-determined loads are applied.

Knowing the thickness of the primary winding, one can calculate or measure the average length of one turn. This is shown, in a simple plan view of the winding, in Fig. 2, the turn concerned being the heavy black dotted line.

If the length of the turn is multiplied by the number of turns in the winding, the total length of the wire used will be obtained and, by further reference to the wire table, its resistance determined. This resistance will produce a certain voltage drop in the effective primary voltage, depending, of course, on the current flowing and, as it is necessary to know how much is dropped, the following formula is applied. Vd = resistance of winding multiplied by current flowing in primary (in amps.). It is usual to express Vd. as a fraction of the primary voltage. Supposing Vd came to 20 volts and the applied mains voltage to the primary was 200, then the fraction would become 20/200 or, simplified, 1/10th.

The object of going to this trouble is to correct errors which will be present, due to losses, if the secondaries are wound according to the rule of so many turns-per-volt. The output voltages are likely to fall below the calculated values when loads are applied, if some allowance is not made for iron and copper losses, especially in the case of the low-voltage/high-current windings. With the latter, owing to the heavy gauge wire usually employed, the actual resistance of the winding will be of a very low order.

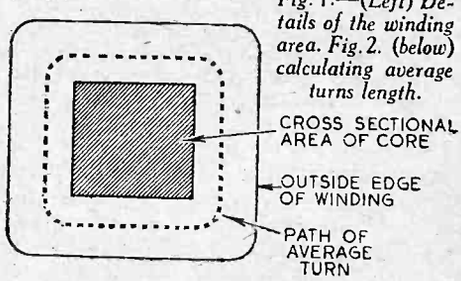


Fig. 1.—(Left) Details of the winding area. Fig. 2. (below) calculating average turns length.

Assuming that we have a figure of 1/10 for Vd., it would mean that the number of turns for the L.T. windings would be *increased* by 1/10th of the number arrived at by the turns-per-volt calculation. When considering the H.T. secondaries, it is not so essential to make this correction, owing to the difference in characteristics between this and the L.T. winding, but if one is prepared to go to the slight extra trouble and correct for losses, the output will be in keeping with the calculated value. In this instance, the actual resistance of the secondary winding must be calculated to determine its own voltage drop.

Voltage Regulation

This is another item which causes amateurs a little uncertainty. As mentioned above, if the design is not good, the voltage output of a secondary winding will vary according to the load applied or, in other words, the current flowing. It is possible to state the variation in output voltages secured under the two conditions as a percentage of the calculated value, and it is this figure which indicates the efficiency of the transformer as regards voltage regulation.

A New Expansion Circuit

The Pros and Cons of Contrast Expansion, and Details of a New Type of Circuit. By W. J. DELANEY

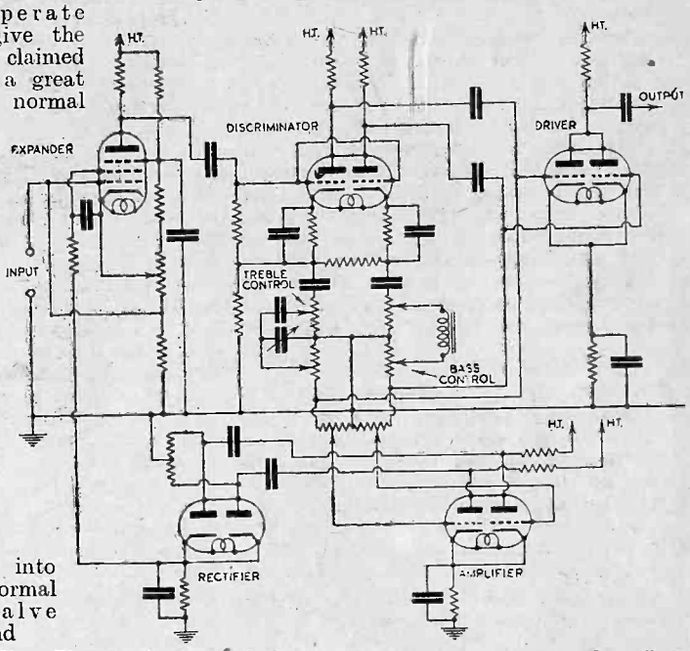
OWING to the restriction of broadcasting there is an increasing interest in gramophone record reproduction, and the great interest which has been shown by readers in the "Ideal" Radiogram circuit which was recently published shows that the contrast expansion circuit has a wide appeal. Many queries have been asked concerning the arrangement, and certain doubts have been expressed in some quarters concerning the advisability of using it. For the benefit of those who are not familiar with the arrangement it may be stated that it consists of a special amplifier so designed that loud passages, or increases in volume on a record, are given additional amplification, whilst the amplification is cut down when a quiet passage is reproduced. In this way the balance of the volume on a record is expanded and a more realistic effect is obtained. The reasons for the use of such a circuit are that the recording engineer has to reduce the contrast due to the deficiencies of the normal recording process and the limitations imposed by the record material. Now the purist or musical critic argues that the arrangement is worthless for several reasons. One claim which is put forward is that there is a form of frequency distortion which unbalances reproduction and which cannot be tolerated in spite of the contrast improvement.

Tonal Balance

Another, and perhaps more important point, is that of tonal balance. Take, for example, a dance band which has been recorded. Suppose that the trumpet suddenly takes a solo at full volume. Owing to the increased input to the expander amplifier the gain will be increased and the trumpet will sound appreciably louder. But, at the same time, all other instruments in the band will also be increased, as the overall gain has been so modified. Therefore, says the critic, the expander amplifier is spoiling the balance of the band, as all other instruments should remain at the same level. Against this, however, one may argue that the balance between the solo instrumentalist and other parts of the band will not be modified, and thus, although the whole record is increased in volume, one still retains the perspective of the record and does not notice the increased output of the rest of the band —the soloist standing out. A great deal thus depends upon personal taste, and some listeners will prefer to hear the record with expansion, despite this wrong balance due to unequal amplification. However, this point seems to have created considerable interest in America and a new circuit was recently introduced in an endeavour to overcome the "defect," and in view of the wide interest in this type of circuit we give on this page a theoretical diagram of the expansion arrangement which has been developed by the Radio News of America. The theory underlying the scheme is that a special discriminator circuit is provided in the expansion chain and this "sorts out" the high and low frequencies, and each may be boosted or attenuated as desired. In this way it is possible to pass on certain frequencies for normal expansion, whilst others may be stepped up to receive additional amplification, or cut down so that they are not expanded. Obviously, such a scheme necessitates that the operator knows the musical score of the record being played and must operate the controls to give the desired effects. It is claimed that the result is a great improvement on the normal expansion circuit, but it is obvious that the results are in the hands of the operator and thus personal preferences will enter into the reproduction. Many will prefer the automatic reproduction of the disc. However, the arrangement utilises five valves, and we have not yet had an opportunity of trying out the scheme in full.

The Circuit

The signal is fed into the grid of the normal expander type of valve in the usual way, and the output of this valve is regulated by signals coming from the amplifier and rectifier of the expander circuit in the normal manner. The fifth valve of the circuit is the input to the final amplifier or output stage. The output from the expander valve is taken to the two grids of a double-triode, and in the cathode circuits of this double valve the special discriminator or tone-selector circuits are arranged. Adjustments of the ganged potentiometers in these two cathode circuits attenuate or boost bass or treble according to their settings, and the output from each of these circuits is split and taken to the grids of the output or driver valve and also to the grids of the expander amplifier. This is also a double-triode valve, and the grids are fed in push-pull, the output from the two anodes also being taken in push-pull to the anodes of a double-diode rectifier. The output from this stage is taken from the two cathodes (linked) round to the expander or input valve. The output from the two anodes of the discriminator valve are also taken to the driver or output valve and thus there is a double mixing in this stage. It will be seen from the explanation and the diagram that the idea is to select any desired balance of high and low frequencies in the detector stage for subsequent rectification and this is fed back as control voltage on the expander.



Theoretical circuit of the new expansion arrangement. It will be seen that the signal passes from the expander stage and thence to the discriminator stage. From here it is taken both to the driver or output valve and to the expander amplifier. The A.F. currents are stepped up here, passed to the rectifier and the resultant rectified D.C. is applied to the expander as control bias. At the same time the signal is taken from the cathode circuits of the discriminator stage and through tone-control arrangements is also fed to the amplifier and driver.

Modifications

The idea is very fascinating and to my mind represents one of the most interesting fields for experiment in modern radio. Too little attention has been paid to the reproduction of records and there have been very little changes compared with the vast developments in the radio side of receivers. The L.F. amplifier has remained unchanged since the earliest days, and with the improvements in records due to electrical recording it is desirable to take steps to improve the amplifier as the pick-up is beyond the hands of the ordinary listener from a development point of view. The ideal arrangement would, of course, be an automatic discriminator which would not operate beyond certain levels so that in a case such as that mentioned earlier, where a soloist takes a lead at increased volume, that instrument would receive additional boost, but all others which were below a given level would remain unchanged. But whatever form of circuit is adopted one of the most difficult things to eliminate is frequency distortion or effects due to the time lag of various condensers and similar components connected in the circuit.

Comment, Chat and Criticism

Listening to Music

Ways and Means of Gaining Pleasure and Instruction from Music is Discussed by Our Music Critic, MAURICE REEVE

TO a person of average intelligence, of good hearing and perhaps possessing an executive ability at some instrument, it may seem redundant, or even inpertinent, to suggest that they may know little or nothing of the real meaning and content of the music to which they are listening. Many people listen to lots of good music and sometimes play it quite well. They usually get good fun and intellectual recreation from it—or else, of course, they would naturally spend their time doing something else—and yet they may not "hear" more than a fraction of what they are listening to, in the same way that they do whilst reading literature. It is therefore hoped that this and the following articles will be of help and interest to those who, whilst spending much time and gaining great pleasure from music, feel that there is still something in the music which has not yet reached them, and which, if it were brought nearer to them, would greatly enlarge the scope of their horizon and add to their pleasure and instruction.

The first thing we must bear in mind is that music is a language which all but a very few of us do not commence learning until we are many years older than we are when we begin our study of English, and that when we do "take it up," we only do so for about an hour a day, not giving it a thought during the other twenty-three. The result is obvious. While the constant use of words, from the very dawn of our consciousness and all day and every day, implants in our minds an acquaintance with them which is intimate enough to enable us to read them in silence without our losing one atom of their meaning (all of us hear the words in our minds as we read the paper every morning at breakfast, or going to our work in the train), few have the ability similarly to hear the sounds of notes or combinations of notes from the mere sight of them, or the music or the keyboard. We have to strike them first. Consequently, when reading we gain the full import of the text without having to mouth each word, and we can also anticipate the probable course the words we are reading are liable to take. We are so familiar with all this that our minds also have the ability of almost instantaneously adapting and adjusting themselves to the matter in hand, whilst they can also maintain the closest contact with what has gone before—our familiarity with the medium being such that retention is equally facile.

Reading Notes

With music, however, all is different. Although recorded in a similar way to other languages through the medium of an "alphabet," plus many cabalistic signs and orders, it cannot be spoken except through the interposition of a third party—an instrument. And here I may add that, though the voice is the only medium with which we can *actually* read notes off a piece of music comparable to the way we read words, the parallel ends there, because the voice's inability to make harmony, together with its limited range, renders it almost, if not entirely, disfranchised as a means for reading music.

This is fundamental. Unless we can develop the ability to hear all the notes in our minds, just as we do the words on a page of English, we *must* bring in our instrument on which to produce their sound. And that instrument will of necessity be the piano or the organ, as they are the only ones capable of reproducing harmony.

Consequently we have the following situation, at any rate, where the subject has no power to either read musical sounds or retain them in his memory. The instant he passes on to one note from the previous one, that previous one passes completely from his recollection. Coupled with the fact that he cannot anticipate what is coming, he is, as a reader of music, constantly perched on one note, completely isolated and divorced from the content of the music. Musically he is in a perpetual black-out. A similar effect in reading the newspaper would be something like this: THE | FINNS | ARE | CONTINUING | THEIR | GALLANT | RESISTANCE | TO | THE | RUSSIAN | HORDES—with each word on a separate and plain piece of paper. Connected thought would be impossible; by the time we reached the word "hordes" we should have forgotten whether we were reading about Finns or Poles fighting Russians or Germans, and whether their resistance had been gallant or cowardly.

Sound in Relation to Key

Therefore, the very first thing to do is to gain a knowledge of sound in relation to key. It is very easily done. Commencing with some practice of singing single notes, and checking up each one on a piano, we pass via careful scale practice on to simply constructed pieces built on a tonic basis, with one or perhaps two of the simplest modulations. It is most important to learn *how* a scale is made, as only by this means can we learn to separate each key from another and make of it an independent, vital thing to us, as are colours. Everything springs from these major and minor keys as founded in the scale and arpeggios. They should be practised until assimilated to such a degree that the titles "E Major" or "D Minor" strike up their "colour" (tone colour) in our minds as do the words "red" or "blue." Also their relationships and affinities, although this will very often follow on as a natural sequence once the former problem has been mastered. Our ability to anticipate what is coming will largely depend on the facility we acquire in mentally judging which keys blend, or match up, and which don't.

Get hold of this thoroughly, and the rest, I am sure, will prove a much easier nut to crack. Naturally no piece of music would be possible if wholly maintained in its original key; at least its monotony would cry out for vengeance. It is, of course, largely the simple and "unsophisticated" character of their modulations that causes the dissatisfaction with "old" music that is too prevalent amongst some of the "bright young things"—of to-day. "It lacks 'pep,' 'it' or 'oomph,'" they will say. Well, everything comes bit by bit, and great edifices are only reared brick by brick. And the way that the master musicians have built up their art forms no exception. Even such things as dominant and diminished sevenths, or chromatic or tonal sequences, were only introduced after much experimenting and careful thought. To-day, they too are deemed old fashioned and commonplace by some who possess more wit than learning.

Musical Composition

But all these things are only ingredients, and though key in some modern compositions is little more than a name, and is difficult to follow by any but the most enthusiastic listener (Shakespeare's "What's in a name? A rose by any other name would smell as sweet," may form a text for some modern writers), it is, nevertheless, still there. Just as the meat or the fish in certain dishes may be so garnished or dressed as to be almost unrecognisable from the mere namings on the menu, such as "poularde duchesse," or "supreme de bonne nuit," the poularde is there, nevertheless, just as the C Major or the B Minor are in two pieces of music. They are the roots or jumping-off grounds and must be properly understood for a full appreciation of a musical composition.

They, however, form only half of a work of music; perhaps less. Next week I will inquire into some other points which must be grasped with equal firmness if a composition is to be appreciated and understood to any extent. Sound (harmony and melody) is so obviously the first thing we clutch when we dip our hand into the musical bran pie, that we are apt not so much to give it undue importance but to relegate the other essentials too far to the background. "Sound" and "Music" would seem to be synonymous terms; so they are, in some ways. But we are not dealing with them here, but with musical composition.

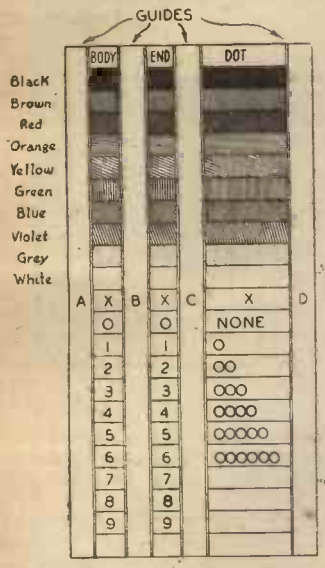
Just as sound, or a sequence of sounds, must have rhythm to give it life, so must a composition be written to a plan or, as it is known in music, a form, if it is to have a corporal existence. It is this side of the question that I will discuss next week.

Practical Hints

A Colour-code Calculator

A VERY handy device that can be quickly and easily made is illustrated herewith. It is drawn to scale and can be made any size to suit requirements. It consists of a base (either plywood or card) on which are fixed spacers A B C D. The pieces marked X are made to slide between these spacers, and can, with advantage, be slightly thinner for easy running.

These slides are marked as shown, and it is important that they are of equal width. The top part can be painted with



A simple colour-code indicator.

the actual colours (this has proved best) or the colour merely written in. In the specimen I have, the measurements used were ¼in. for the fixed rails, ⅜in. for two sliders, and 1in. for the last one, the distance between horizontal lines being ¼in., the whole board thus measuring 5¾in. by 2¾in.

Over the whole a piece of card or plywood is placed, fixed to the fixed rails, with two windows cut in it, one across the brown colour line and the other across the No. 1 lines. The slides will then, when moved up and down to show particular colours, give the reading for that particular combination in the lower window.—I. HASTINGS (Ickenham).

A Receiver Time-piece Winder and Setter

IN improving the appearance of the front panel of my short-wave receiver by adding a time-piece in the form of a small chromium clock, a neat method of winding and setting the hands had to be provided, so I made up the simple extension fitment illustrated.

For the winder, I used a standard Eddystone extension control outfit, slotting both brass rods or shafts to take the two strip fitments depicted, one serving as the manual winder, and the other as the attachment to the clock winder.

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.

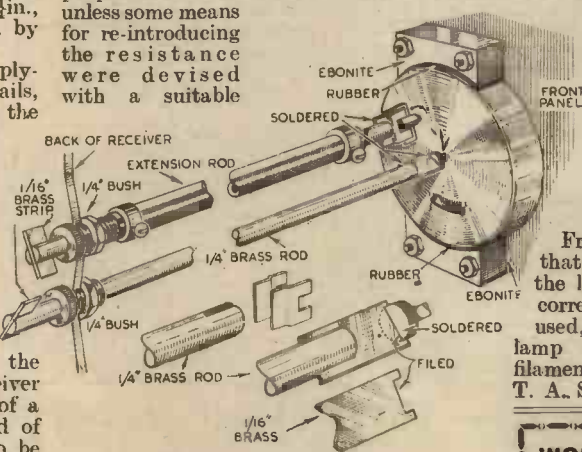
SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page 532.

Standard ¼in. bore brass bushes are used for both extensions protruding through the back of the receiver, and it will be seen that whereas in the case of the winder, the bakelite extension sleeve retains the correct distance between the clock and the back of the set to keep the winder cleat in engagement, the hand-setting extension rod is permanently fitted to the adjusting knob on the clock by solder. The inset diagrams show the formation and details of the brass engaging strips.—A. G. STORE (Shenfield).

A Dual-purpose Neon Adapter

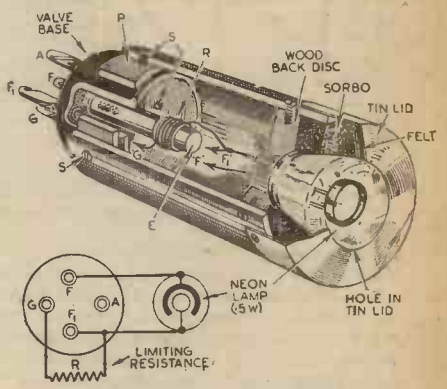
WISHING to remove the limiting resistance in a neon lamp for the purpose of various tests, I realised that unless some means for re-introducing the resistance were devised with a suitable holder to protect the naked bulb, the project would more than likely result in the lamp being damaged or rendered useless.



Extension controls for a time-piece fitted to a radio set.

Through my practice of not discarding anything which may prove of some use in the future, I found a bakelite former, an old valve base, some sorbo and another former of ebonite, and with these I arrived at a suitable scheme. As is shown by the accompanying illustrations, the body of the adapter comprises the bakelite former B, the valve base being fitted into one end and secured by means of a short length P cut from the ebonite former, 6BA screws S holding this assembly securely by tapped holes made in the valve base.

To the valve base is fitted a length of ebonite rod internally E, this rod being filed slightly to take the resistance tube, whilst a little glue keeps this resistance firmly in position. At the other end of the bakelite former, and a short way down, a wooden backing ring is fitted by small countersunk wood screws as is clearly depicted.



A dual-purpose neon adapter.

To preserve the bulb against excessive vibration, a sorbo pad is glued to the inside of the former, so that when the tin lid is finally fitted, the bulb is retained in a semi-floating position, not being pressed against the wooden back disc. A hole was cut in the tin lid with a diameter less than the limits of the bulb, whilst as a further means of protection, a felt ring, glued to the inside of the lid, keeps the bulb in a state of resilience. This tin lid is fitted to the former by means of four small wood screws equidistantly located.

From the inset circuit, it will be seen that when a test is being made in which the limiting resistance is required, the corresponding valveholder sockets are used, G, F, whilst for direct use of the lamp without the resistance, the two filament sockets are connected up.—T. A. STEAR (Sudbury).

EXPERIMENTAL 6-WATT A

Constructional Details of a Self-contained A.C. Mains Unit for Microphone or Pick-up Work

ALTHOUGH we have published several constructional designs in the past for various types of amplifier they are, like all published designs, incapable of satisfying every particular reader, and so we give in this issue a further type of amplifier which covers some of the points which have previously not been incorporated in a single design. Economy has been one of the main keynotes in view of the present general conditions, and at the same time a reasonably high output has been aimed at. The amplifier was, in fact, designed primarily for home-recording purposes, and many existing components were incorporated. The amplifier is not critical in its design, and any suitable parts which you have on hand may be substituted for those which we used, provided the main essentials are borne in mind. The circuit which was adopted included a single input stage feeding two high-power triodes in push-pull in the output stage, and a valve rectifier was incorporated on the mains side. The input is, as already mentioned, designed for a microphone or similar input for recording purposes, but there is no reason why this should not be modified for normal microphone and pick-up work, or for connection to a radio unit for normal broadcast reception. One of the main difficulties of using only two stages is that of lack of amplification, so that the output stage is not fully loaded, and in this design we have endeavoured to overcome this drawback by using a high step-up transformer—actually a Q.P.P. component.

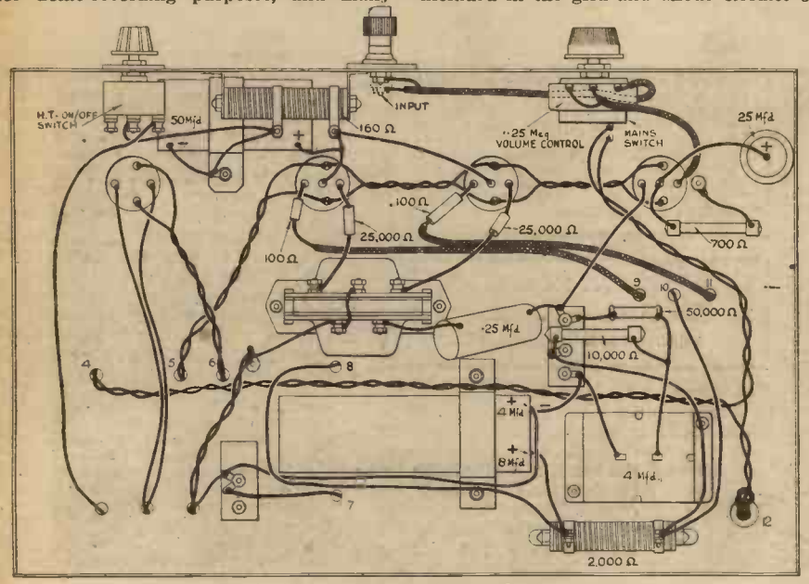


Fig. 1.—Wiring diagram of underside of chassis.

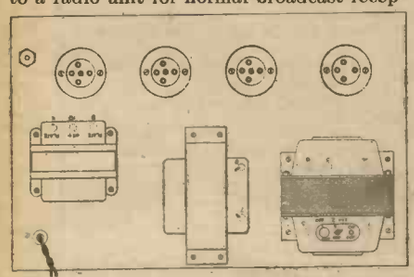


Fig. 2.—Top of chassis showing position of main components and holes.

General Features

This transformer is parallel-fed, and to avoid all forms of instability in the output stage, which in the original model would have rendered it useless for recording purposes, oscillation stoppers have been included in the grid and anode circuits of the two push-pull valves. The first stage is adequately decoupled—the parallel-fed transformer also assisting in this direction. The valves in the amplifier are of the indirectly-heated type, but the rectifier which was on hand was of the directly-heated type, and, therefore, it was necessary to take steps to avoid damage to condensers and other components due to voltage surge when the amplifier is switched on. For this purpose an on/off switch has been included in the H.T. negative lead, and this is not operated until the valves have been switched on for some minutes. If, however, an indirectly-heated rectifier is available this switch could be eliminated, and the H.T. negative line joined direct to the chassis. The latter is of the all-metal type and carries on the front runner the H.T. switch just mentioned, the input terminals and the input volume control. The output leads are taken direct from the output transformer. On the mains input side the transformer which was used had plug-in sockets and the mains lead was fitted with suitable plugs and mains switching was effected by the combined volume-control switch.

Constructional Details

The chassis must first be drilled in accordance with the detailed drawing, Fig. 5, and although standard dimensions are given for the valveholders, the remaining holes may be modified according to the components which are employed. The choke should, however, be of the type specified, and the output transformer should also be identical. The front runner strip should next be drilled to accommodate the three items which are mounted on it. There are only the three components on the upper surface, and thus to simplify assembly and wiring it is desirable to leave these three items until last, when the chassis may be placed upon the bench in an inverted position and all parts mounted and wiring carried out so that the unit is practically completed before the main three items are mounted. Note that a small clip will have to be made to hold the electrolytics in position, and also that certain of the wires are screened. It is also very important to note that the metal case of the volume control must also be earthed, as it was found that hum was experienced until this had been carried out. The resistors, with the exception of the large wire-wound resistors, are suspended in the wiring, and an insulated anchoring point is provided for the H.T. positive connection. This could be dispensed with but there is always a risk that a short-circuit might develop due to the metal chassis being "live" and accordingly the insulated anchoring point is a worth-while refinement. Although an earth connection has not been shown on the chassis, it is usually necessary to provide an earth to the metal work to obtain the most efficient screening and to reduce background noises.

The input terminals on the original model were mounted on a small strip of insulating material, which was finally bolted to the chassis, after the rectangular opening shown in the drawings had been made. Insulating bushes can, of course, be used in place of the strip. A further

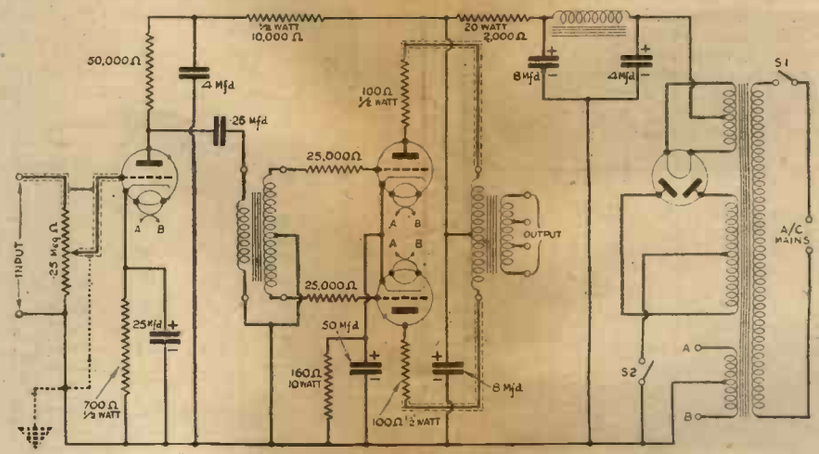


Fig. 3.—Theoretical circuit of the amplifier.

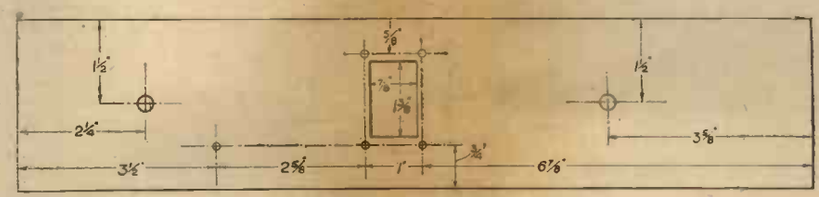


Fig. 4.—Drilling details of the front chassis runner.

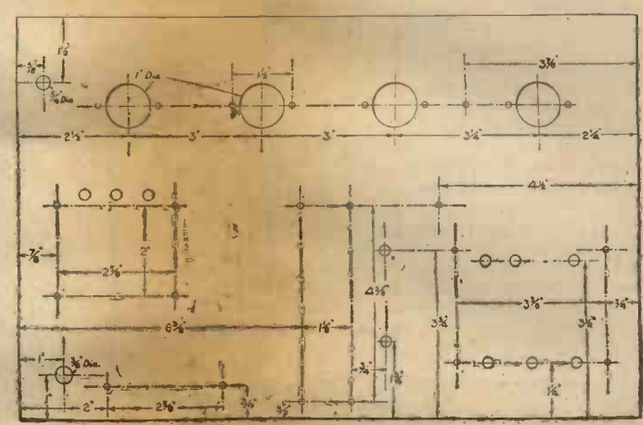


Fig. 5.—Drilling details for the chassis.

MPLIFIER

point concerns the 4 mfd. fixed condenser which, in the original model, was one of the paper type which was available. These are rather expensive and if condensers are being purchased for the amplifier it would be preferable to obtain a multi-block electrolytic condenser in which this also

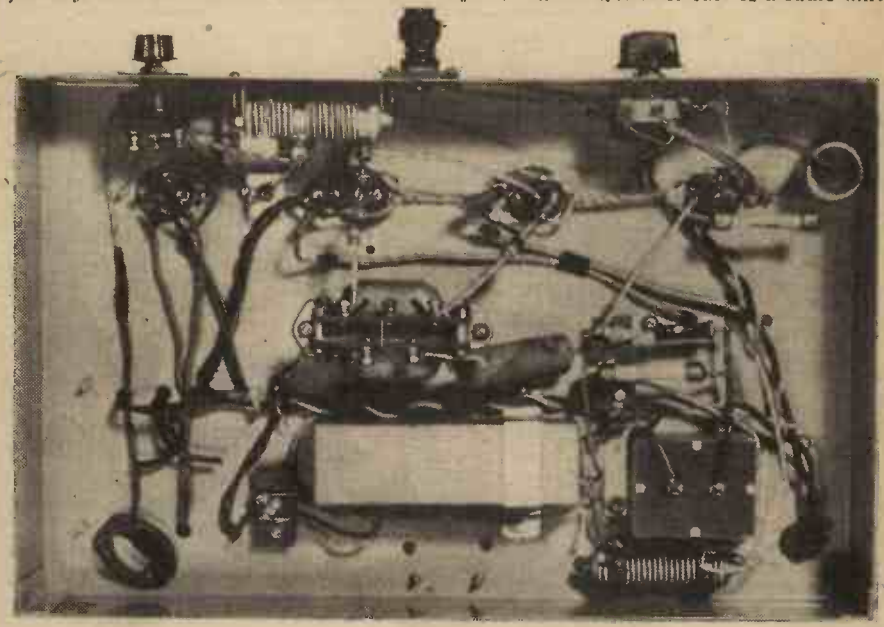


Fig. 6.—Compare this illustration with the diagram in Fig. 1.

was included. Thus, instead of obtaining the type 0288 condenser, consisting of two 8 mfd. and one 4 mfd. you should obtain the type 317 which contains two 4 mfd. units in addition to the two 8 mfd. sections.

The output transformer should be selected according to the type of speaker which is going to be used, and this will govern the question of the ratio of the transformer. It is possible to obtain them with a high ratio or low.

Input Arrangements

A particularly important point to be noted in connection with an amplifier of this type, or any equipment used for microphone work, is that voltage fed to the output stage is dependent upon the type of microphone which is employed. As already mentioned, the gain from the single valve through the high step-up transformer is sufficient under *normal* conditions to load the output stage, and for this purpose we assume an efficient microphone of the transverse-current type matched to the input circuit by means of a suitable microphone transformer. If other types of microphone are employed it will be necessary to add a further stage of amplification, and this may be built as a separate self-contained unit or included on the same chassis. Many operators of amplifying equipment prefer a separate amplifier built into the base of the microphone and the necessary mixing or volume controls are mounted on this. By doing this it is possible to have ready at hand means of controlling the output of the amplifier, which may then be placed in a suitable out-of-the-way position in the hall or other place, and the user of the microphone may actually operate the amplifier at the same time.

If the amplifier is to be used in conjunction with a radio receiver, then no additional amplification should be necessary and the input circuit may be taken direct from a detector stage where resistance-capacity amplification may be included, or, if a unit is being specially built, it would be possible to use a choke-capacity filter. If headphones or speaker are at present joined in the anode circuit of a radio unit, and this is to be used with the amplifier, the two phone terminals should be bridged by a good L.F. choke, and a 2 or 4 mfd. fixed condenser joined to the anode terminal and this may then be joined to the grid end of the input volume control.

LIST OF COMPONENTS

- One mains transformer—350-0-350 at 120 mA; 4 volts at 3 amps; 4 volts at 2 amps.
- One smoothing choke (Partridge).
- One push-pull output transformer (see text) (Ferranti).
- Three 5-pin valveholders, chassis type (Clix).
- One 4-pin ditto (Clix).
- One .25 megohm volume control with switch (Dubilier).
- One Rotary on/off switch, type S.91 (Bulgin).
- Two large insulated terminals.
- One 2,000-ohm, 20-watt resistance, type PR.7 (Bulgin).
- One 200-ohm ditto, type PR.24 (Bulgin).
- One Q.P.P. input transformer (any make).
- Seven fixed resistors:
  - Two 100 ohm.
  - Two 25,000 ohm.
  - One 50,000 ohm.
  - One 700 ohm.

  } Half watt type (Dubilier)
  - One 10,000 ohm, one watt type.
- One .25 mfd. fixed condenser type 4608/S (Dubilier).
- One 50 mfd. electrolytic condenser, type 3,004 (Dubilier).
- One 25 mfd. electrolytic, type 401 (Dubilier).
- One block electrolytic, 8-8-4 mfd., type 0288 (Dubilier).
- One 4 mfd. fixed condenser (see text) (Dubilier).
- One 442 BU. valve
- One 41 MH. valve
- Two 41.MXP valve

  } (Cossor).

PRACTICAL TELEVISION

March 9th, 1940. Vol. 4. No. 193.

Renewed Activity

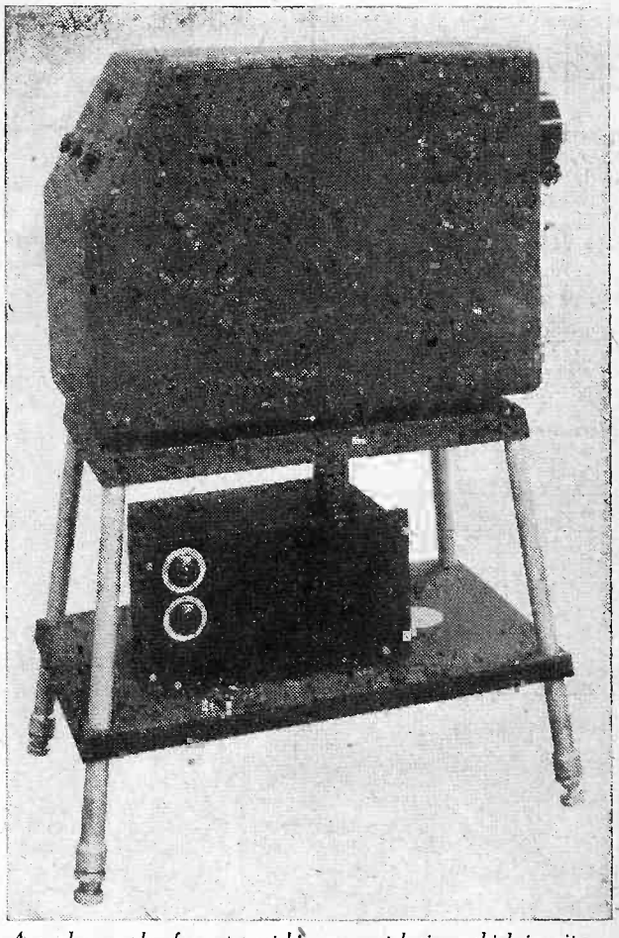
THERE is every sign of renewed activity in the television front line, in spite of the Postmaster-General's recent statement in Parliament that he could hold out no hope of an early resumption of the television service. Although nothing is heard of their activities or deliberations in committee meetings, there is still in existence the Television Advisory Committee, and it is known that a meeting was held by them a few days ago. Following past practice, however, there is little hope of any statement being issued by them, but many conjectures are being made as to the possible renewal of some form of television service, in spite of war's activities. Even if it is accepted that the radiation of signals into the ether is impossible for a variety of reasons, the fact that vision and sound can be sent over cable keeps cropping up as an alternative. It cannot be dismissed solely on the score of expense, for there are many far-seeing people associated with the television industry, in one form or another, who have pinned their faith in a rediffusion of television signals through the medium of a wire connection. Originally, it was proposed to have a series of main receiving centres from which the radio signals would be redistributed by means of cable links to houses willing to pay rental fees, the idea being an elaboration of present-day sound rediffusion practice which is so popular in many districts. Since these centres cannot now obtain their signal as an incoming radio link, the suggestion has been put forward that these centres could be connected to the main television station by coaxial cable, and then rediffused by means of less expensive cable over relatively small areas.

Big-screen Possibilities

IT is known that television signals, with their very high frequency characteristic, have been relayed jointly by the Post Office and the B.B.C. over normal telephone cable circuits, and the hope has been expressed that carefully directed research would enable this scheme to be developed for home consumption. No question of providing an ideal direction finding station for enemy aircraft would then arise, and the rebirth of a badly hit industry would be ensured. Quite apart from the home entertainment angle, however, there is always that important question of big-screen working which must not be forgotten. Certain of the large London cinemas were installed with up-to-date big-screen receivers before the outbreak of war, and first-class variety programmes could be rediffused to these and other entertainment centres from a central studio, and thus add materially to box office receipts which have been so seriously affected since hostilities started. By accommodating the artists in one spot, and allowing their acts to be seen in a number of theatres and cinemas, the costs involved would be shared on an equitable basis. Not only the large halls and theatres need be involved, but the smaller ones as well, for compact intermediate-sized television receivers could be developed for this purpose. As an example of what could be expected in the way of equipment capable of giving a good television picture up to, say, 8 or 10ft., reference can be made to the accompanying illustration. It shows one of the earlier model receivers employing a projection type cathode-ray tube. The fluorescent screen can be of the direct type, in which the built-up picture is projected right through the screen on to a remote screen, or use could be made of the later types, in which the picture was projected directly from the front face of the fluorescent screen set at an angle to the scanning beam of electrons. Suitable for front theatre projection with the receiving set, time-base generator, scanning equipment, cathode-ray tube and lens complete, the unit can be built up in a compact form and provide a satisfactory service for relatively small halls unable to meet the expense incurred by the larger screen prototypes. In any case, it will be interesting to watch the developments of the present-day television agitation and to hope that a satisfactory solution will be found that in no way interferes with vital defence services which are essential at this stage of the war.

A Progress Review

IN a recently published review of progress by the Institution of Electrical Engineers, in so far as it applied to the trends associated with the use of electricity in ships, some very interesting comments were made in relation to the research problems which are now being investigated. It was pointed out that these were largely concerned with the minute investigations of innumerable problems, which although in themselves could not be classed as those of major order, were capable of ultimately producing a matter of first-class importance. As examples of this, mention was made of the question of stabilised frequency control for radio communication purposes so that the most minute and accurate adjustments could be made. This same problem has a high degree of importance in the radiation of television signals, for with the very high carrier frequency involved, deviations from the frequency of operation cannot be tolerated if a satisfactory service is to be provided, and that is why crystal controlled transmitters are employed having a performance factor better than 0.01 per cent. in carrier stability. Other problems alluded to in this same review made reference to the commercial application of scientific discoveries, and in the examples furnished they all had a direct bearing on television and its associated ramifications. They were visual direction finding, penetration of fog by the reflection of electric magnetic rays, remote frequency control, applications of television and variable frequency modulation. It was said that the field of research in this subject was wider to-day than ever before, not only because of the youth of the subject, but also because every day a new tool or instrument is being forged for commercial use. How invaluable it would have been to British ships working in fog, mist and darkness if apparatus had been developed to a commercial stage whereby the captain on his bridge would have been able to "see" his way by some form of noctovisor? There is no doubt at all that this is one of the most urgent needs of a maritime nation, such as Great Britain, and in many quarters the hope has been expressed that inventors will exercise their ingenuity in this direction, and so remove one of the terrors of those who go down to the sea in ships.



A good example of a compact big-screen televisor which is suitable for small halls for signal rediffusion.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 19

List of Prefixes

mega means a million times.
kilo means a thousand times.
hecto means a hundred times.
deca means ten times.
deci means a tenth part of.
centi means a hundredth part of.
milli means a thousandth part of.
micro means a millionth part of.

Square Measure

100 sq. metres	=1 are.
10,000 sq. metres	=1 hectare.

Weight

10 grammes	=1 decagramme.
10 decagrammes	=1 hectogramme.
10 hectogrammes	=1 kilogramme.
1,000 kilogrammes	=1 tonne.

Capacity

1 litre	=1 cubic decimetre.
10 litres	=1 decalitre.
10 decalitres	=1 hectolitre.
10 hectolitres	=1 kilolitre.

Length

10 millimetres	=1 centimetre.
10 centimetres	=1 decimetre.
10 decimetres	=1 metre.
10 metres	=1 decametre.
10 decametres	=1 hectometre.
10 hectometres	=1 kilometre.
10 kilometres	=1 myriametre.

No. 20

METRIC CONVERSION FACTORS

To convert—	
Millimetres to inches	× .03937 or ÷ 25.4
Centimetres to inches	× .3937 or ÷ 2.54
Metres to inches	× 39.37
Metres to feet	× 3.281
Metres to yards	× 1.094
Metres per second to feet per minute	× 197
Kilometres to miles	× .6214 or ÷ 1.6093
Kilometres to feet	× 3,280.8693
Square millimetres to square inches	× .00155 or ÷ 645.1
Square centimetres to square inches	× .155 or ÷ 6.451
Square metres to square feet	× 10.764
Square metres to square yards	× 1.2

Linear Measure Equivalents

1 inch	=2.54 centimetres, or 25.4 millimetres.
1 foot	=30.4799 centimetres, 304.799 millimetres, or .3047 metre.
1 yard	=.914399 metre.
1 mile	=1.6093 kilometres=5,280 feet.
1 millimetre	=.03937 inch.
1 centimetre	=.3937 inch.
1 decimetre	=3.937 inches.
1 metre	=39.370113 inches. 3.28084 feet. 1.093614 yards.
1 kilometre	=.62137 mile.
1 decametre (10 metres)	=10.936 yards.

No. 21

METRIC CONVERSION FACTORS

To convert—	
Square kilometres to acres	× 247.1
Hectares to acres	× 2.471
Cubic centimetres to cubic inches	× .06 or ÷ 16.383
Cubic metres to cubic feet	× 35.315
Cubic metres to cubic yards	× 1.308
Cubic metres to gallons (231 cubic inches)	× 264.2
Litres to cubic inches	× 61.022
Litres to gallons	× .2642 or ÷ 3.78
Litres to cubic feet	÷ 28.316
Hectolitres to cubic feet	× 3.531
Hectolitres to bushels (2,150.42 cubic inches)	× 2.84
Hectolitres to cubic yards	× .131
Hectolitres to gallons	÷ 26.42
Grammes to ounces (avoirdupois)	× .035 or ÷ 28.35
Grammes per cubic cm. to lb. per cubic inch	÷ 27.7
Joules to foot-lb.	× .7373
Kilogrammes to oz.	× 35.3
Kilogrammes to lb.	× 2.2046
Kilogrammes to tons	× .001
Kilogrammes per sq. cm. to lb. per sq. inch	× 14.223
Kilogramme - metres to foot-lb.	× 7.233
Kilogramme per metre to lb. per foot.	× .672
Kilogramme per cubic metre to lb. per cubic foot	× .062
Kilogramme per cheval-vapeur to lb. per h.p.	× 2.235
Kilowatts to h.p.	× 1.34
Watts to h.p.	÷ 746
Watts to foot-lb. per second	× .7373
Cheval-vapeur to h.p.	× .9863
Gallons of water to lb.	× 10
Atmospheres to lb. per sq. inch	× 14.7

No. 22

TRANSFORMER DATA

DETAILS OF STALLOY CORE STAMPINGS.

Size No.	Dimensions. A	B	C	Number of Stampings.	Approx. Watts.	Turns Volt (50 cycles).	Approx. Winding Area.
	in.	in.	in.	doz. prs.			sq. in.
4	15/16	25/16	7/8	6	50	8	1 1/16
5	5/8	1 1/2	3/4	6	30	12	1 1/4
28	1 1/4	3	1 1/4	6	250	6	3
29	2	4 1/2	1 3/4	6	300	4	5 1/4
30	15/16	1 7/8	7/8	6	45	8	2 3/16
31	1	3 1/2	1	6	100	8	2 3/4
32	1	2 1/4	1	6	75	8	1 3/4
33	1 1/4	2 3/4	1	6	125	6	2 1/4
35	1 1/2	3 1/4	1 5/8	6	200	5	5 1/4

This table covers most of the commoner sizes of stampings, but some makers give different numbers to stampings of similar size.

COPPER WIRE DATA

Standard Wire Gauge	Max. Working Current (amps.)	Enamelled: Winding Turns per sq. in.	Enamelled: Yards per lb.	Double Cotton-Covered: Winding Turns per sq. in.	Double Cotton-Covered: Yards per lb.
16	6.5	226	26.3	173	25.5
18	3.6	392	46.9	297	45.5
20	2.0	685	83.3	472	79.4
22	1.25	1,110	137	592	129
24	0.76	1,770	221	977	203
26	0.51	2,560	330	1,280	294
28	0.35	3,760	488	1,630	422
30	0.25	5,370	694	1,990	587
32	0.18	6,890	915	2,550	755
34	0.13	9,610	1,202	3,020	1,024
36	0.10	13,500	1,840	4,100	1,477
38	0.06	20,400	2,810	5,100	2,287

In the above table the "MAX. WORKING CURRENT" (in amperes) is based on a figure of 2,000 amperes per square inch.

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.

DIRECTIVE WIRELESS SIGNALLING.—Lorenz Akt.-Ges., C. No. 499708.

Relates to a radio-goniometer of the kind described in Specification 477963 in which an auxiliary coil 11 (Fig. 1) is mounted at right-angles to the search coil 6 and is substituted for it, in order to give the "sense" of the bearing. According to the invention, the switches 9 and 15 which control the setting of the "sense" coil and insert it, first in phase and then in phase-opposition, are mounted on the hand wheel of the direction-finder, and may take the form of a push-button or press-ring.

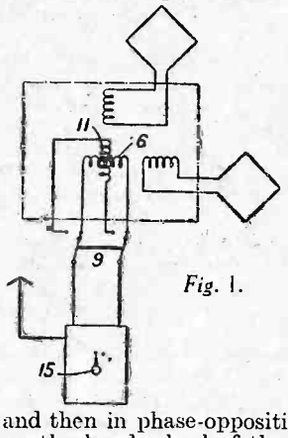


Fig. 1.

WIRELESS RECEIVING-APPARATUS.—Pye, Ltd., Butler, C. E. M., and Root, E. V. No. 500873.

The waverange switch of a wireless receiving-set is operated by rotating the tuning knob after the tuning condensers have been moved to a limit of movement. When the spindle 10 (Fig. 2) is rotated balls 14 rotate and transmit movement of the spindle to sleeve 20 to which the arm 26 controlling condenser shaft 27 is fixed. The movement of the shaft 27 is slow at first, but after rotation through a predetermined angle

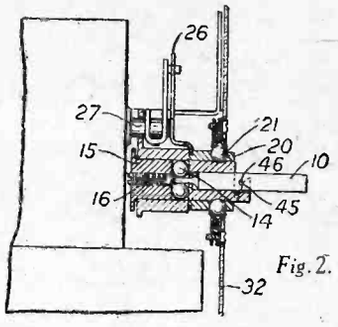


Fig. 2.

pin 46 on shaft 10 engages a cam surface 45 and the shaft moves axially against spring 16, to replace the drive through balls 14 by a direct drive through sleeve 15 so that the condenser shaft 27 can be rotated quickly. When the condenser reaches its limit of movement, rotation of sleeve 20 is prevented and further rotation of the spindle 10 is transmitted through sleeve 15 and balls 21 to disc 32. The disc carries the waverange scales and contacts such as 33 (Fig. 3) which co-operate with stationary contacts such as 34 and these may alter the waverange of the receiver, the disc being centred in the various positions by roller 37 on arm 38 which engages detents such as 41. An extension 42 of arm 38 may operate muting

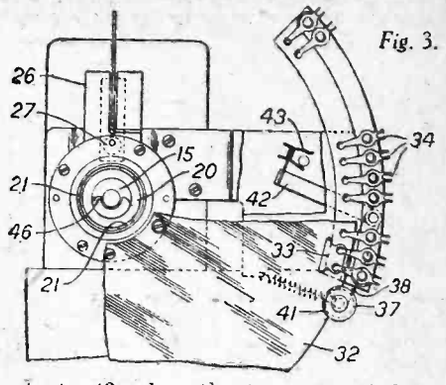


Fig. 3.

contacts 43 when the waverange is being altered. The device is said to be particularly suitable for mechanical remote control by means of a flexible shaft.

TELEVISION. — Radioakt.-Ges. D. S. Loewe. No. 501608.

The Specification as open to inspection under Sect. 91 comprises the following subject-matter. A scanning disc with spiral scanning holes and synchronising slots is lighted by a lamp to form a ray of less width than the slots. A photo-cell is coupled to an amplifier with oscillatory circuits tuned to the frame frequency and provided with screening grid tubes. The frequency reducer comprises a pentode to the outer grid of which the amplified filtered slot frequency is conducted. The anode circuit is adjusted to one quarter of the slot frequency. The impulses are led to a circuit tuned to the reduced frequency. This subject-matter does not appear in the Specification as accepted.

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.

2116.—British Artid Plastics, Ltd., and Bamberger, M. O.—Indicator dials. February 2nd.

2376.—Dalgleish, J. W., Durrant, H. C., and Pye, Ltd.—Device for attaching fabric screens, etc., to cases, etc. February 7th.

2359.—Symonds, F. C.—Timing apparatus for use on wireless receiving-sets. February 7th.

Specifications Published.

517514.—Baird Television, Ltd., and Chapter, C. F.—Electron-discharge devices.

517420.—Cooper, A. H.—Radio-receivers.

517427.—Baird Television, Ltd., Denisoff, A. K., and Spiers, J. M. S.—Luminescent screens in cathode-ray and like electron-discharge tubes.

517428.—Baird Television, Ltd., and Bentley, L. C.—Television or like receivers.

517482.—Baird Television, Ltd., and Jones, V. A.—Electron-discharge devices for television and like systems.

517483.—Baird Television, Ltd., and Jones, V. A.—Television and like receivers.

517578.—Marconi's Wireless Telegraph Co., Ltd., and Brett, G. F.—Thermionic valves.

517579.—Marconi's Wireless Telegraph Co., Ltd., Brett, G. F., Herriott, E. G., and Gratze, H. J. S.—Cathode-ray tubes.

517555.—Harman, W. E.—Electric sound-reproducing appliances for deaf-aid or for small portable wireless receiving-sets.

517627.—Standard Telephones and Cables, Ltd., and Newton, G.—Bearings, particularly for the tuning mechanism for radio-receivers or the like.

517636.—Marconi's Wireless Telegraph Co., Ltd. — Automatic tuning systems for radio-receivers.

517597.—Baird Television, Ltd., and Tingley, G. R.—Deflecting means for use with cathode-ray tubes. (Cognate Application, 27367/38.)

517602.—General Electric Co., Ltd., and Espley, D. C.—Nipkow discs for use in television.

517605.—General Electric Co., Ltd., Jesty, L. C., and Sharpe, J.—Screens of material adapted to be excited to luminescence by the incidence of charged particles.

517607.—Associated Press.—Scanning devices.

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.

ASTRONOMICAL TELEVISION

THE application of television to astronomical studies has been advanced as a serious possibility in many quarters, and varying degrees of success have attended the efforts of inventors who have built apparatus to assist in the study of the heavenly bodies. One of the biggest difficulties seems to be associated with the employment of the correct types of lens to allow the objects to be focused on to electron camera photo-electric surfaces for synthesising purposes. In spite of this, however, it was stated recently that in America television apparatus has been built for the specific purpose of providing aid to the study of the behaviour of the sun. Except on those rather rare occasions when a partial or complete eclipse is visible in some part of the earth, the brilliance of the sun's face prevents astronomers from making an exact study of the corona of flaming gas which surrounds the periphery. In this new television equipment, therefore, the sun's face complete with corona is projected on to scanning equipment of a mechanical type. The circular image corresponding to the sun's surface is then masked off, and the remaining flaming corona ring is scanned and reproduced as a television picture on the face of a cathode-ray tube receiver to which the transmitter is directly coupled. An uninterrupted study can then be undertaken, and the higher the degree of picture definition used for dissecting the picture the more accurate becomes the resultant picture. When such a course is found necessary it is possible to make a film of the television picture or alternatively static photographs

MAINTENANCE OF WIRELESS APPARATUS IN THE R.A.F.

ALTHOUGH communication in the R.A.F. is largely by landline and teleprinter, there is still much wireless signalling between ground and aircraft, as well as from aircraft to aircraft. The maintenance work is carried out by the wireless and electrical mechanic. The wireless operator uses the set, the wireless and electrical mechanic, commonly called the WEM, maintains it.

In a transmitting station we may find a number of transmitters working quietly by themselves without any apparent cause. The transmissions are made by a cable laid from a distant receiving station, this method being termed "remote control." These transmitters, being of low power, seldom require maintenance; but when they do, the replacing of a component is a fairly simple matter. A bank of condensers may be giving trouble: fitting one or more new ones takes but a short time. The adjustment of a relay, cleaning of a contact, checking up insulation, or correct tuning adjustments indicated by readings in the indicating voltmeter, ammeter, or milliammeter on the front of the transmitter can easily be carried out. A red light shows that the current is on. If access is required to the interior of the set, the opening of a door or panel automatically cuts off the power. A knowledge of relays is an advantage in this respect, and is quickly gained in practice. Remote control lines have to be tested for insulation and continuity periodically.

The Superhet

The type of receiver almost generally in use is the superheterodyne, and the many adjustments required to obtain maximum efficiency from this type of receiver are carried out by referring to a chart of readings for each frequency. Lift the lid of this receiver and one finds that screening is most efficient. To remove a valve is quite simple, testing of the various valves is carried out by simply plugging a milliammeter into the various stages, a more thorough method of testing the various circuits is carried out with an Avometer.

With wireless sets installed in aircraft, the problem of maintenance is more difficult and of the utmost importance. Aircraft installation has to put up with hard knocks and atmospherical changes, for aircraft are sometimes left in the open for days on end. Vibration is absorbed by "slinging" the radio set on shock-absorbers in a cradle, that may be bodily removed from the aircraft to facilitate repairs. Aerial and earth systems have to be checked for efficiency of insulation. This is one of the chief problems of aircraft wireless and electrical gear, as insulation must be maintained up to certain standards.

Radio Workshop

Every hangar has its wireless work bench, and in warmth and comfort the WEM can carry out the overhaul and testing of his sets and components. The Avometer and Megger, most useful detectives of circuit faults, mysteries in themselves to the untrained amateur, become the mechanic's most useful guides. Inside the set, compactness and accessibility have been remembered, and the designer has taken care that the soldering iron can reach most places.

Nowadays a great deal of work is done on high frequencies, and the problems that arise from the use of these frequencies require a good knowledge of the principles involved. Not only is morse code used for communication of the air, but also radio telephony. The latter is also used for inter-communication between members of the crew in large aircraft. The marvel of being able to speak or hear someone who is a mile or two overhead and perhaps travelling at something like 300 m.p.h., has now become commonplace, but the man who has to look after the wireless sets knows that upon his care of the sets depends the results with the R/T. Faults are soon brought to light, when there is background noise, gruffness of speech, or merely a noise, and here the aeroplane itself can often solve the riddle.

Every aeroplane used for radio has to be carefully bonded. By that is meant the joining-up of all metal parts of the aeroplane by small pieces of copper wire, so that there is continuity, and bad electrical joints between members are short-circuited by the bonding wire. This is also a safety measure, to ensure that all metal members of the airframe are maintained at the same potential, so preventing a discharge due to a "static charge." This would often occur when flying through clouds or storms.

Interference

The engines of an aircraft generate a mass of high-frequency currents, from magnetos, leads, and sparking-plugs; all these have to be completely screened. Here the aero-motor engineer has to co-operate with the radio engineer to ensure clear speech.

The power for operating the aircraft transmitter is obtained from a generator driven by the engine. Generators do overtime work; they have the stresses of sudden acceleration and deceleration, and the moisture and oil which inevitably seem to get into generators. They are really fine precision instruments, and when on the workshop test bench and dismantled, require careful handling and inspection.

Between the men on the ground and the men in the air there exists a close liaison. Inevitably special wireless jargon has crept into use. We all know what an amp or an ohm is, and that a "dis" or a "short" can cause a great deal of worrying, but other words have their meaning, too, such as "juice," "revs," "using his foot" (used to describe a bad morse sender), and so on.

There is ample opportunity for the keen wireless and electrically-minded man in the R.A.F., and a practical one at that. He will undoubtedly learn a lot that will be useful to him on his return to civil life.

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).

Exchanging QSL Cards: Is it Desirable?

SIR,—I was very pleased to read the remarks of Mr. Cooper and "Thermion" on the QSL exchange racket. I have been fed up with this situation for some time and I heartily agree with them.

I would like you to impress upon your readers, many of whom are very hazy on amateur procedure, the idea of the QSL, and its value to the serious SWL and Ham, that a QSL is not a gaudy card which saves the listener from buying wallpaper for his "shack," but a card, sometimes very plain indeed, which reflects his skill at the controls of his receiver, and is always well earned, but never exchanged through the post without radio contact taking place first.

Also, for the above reason the exchanged card cannot be called a QSL since it verifies nothing, and has little to do with radio at all. It could be called an SWL card or some other name to distinguish it from the genuine article. I am not suggesting that the serious SWL should not refer to his cards as QSLs. I class him along with the Ham operator. It is the card exchange fiend who should be separated from the rest. No Ham would be found guilty of such an action, and most requests for a card on the exchange basis, would, I think, go into the waste-paper basket, and quite rightly so.

Having got that off my chest, I would like to say that I am a fairly new reader of P.W. and I like it very much, although I would like to see more mains circuits given, for the advanced constructor as well as the beginner, and the short wave section could be enlarged to include a station list, a review of conditions, new stations, and photos of QSLs from real DX stations.

I find the Club News and Open to Discussion columns very interesting, also the Radio Engineer's Pocket Book series.

At present I am using a Pilot 10-valve commercial receiver on short waves, but I have almost finished a communications receiver using English valves and having 1 RF stage, mixer, separate oscillator, 1 stage IF and 2 stages LF, and BFO, using nine valves in all. To improve this on the higher frequencies I am completing a two-stage pre-selector similar to the one recently described in P.W. and using two 6K7G Octal valves.

My TX was 6F6 tritet, or CO. and 6L6 PA. with a speech amplifier—modulator of 6C5, 6A6, 6L6, line-up, but of course this is now laid up with all the rest of such gear.

I will be pleased to hear from any reader of P.W. and to exchange views.—N. HORROCKS (2CUZ), 32, Sandbrook Road, Ainsdale, Southport, Lancs.

Manila and Lourenco Marques

SIR,—In the issue of PRACTICAL WIRELESS dated 10th February, I note a letter from a Mr. R. T. G. Davis regarding the reception of Manila and Lourenco Marques. As these stations have already been logged by me, I feel sure Mr. Davis and possibly other readers would be interested in the following information.

Manila: This station is KZRH and not KZRA, operating on 9,640 kc/s. It was logged on the 31st January from 15.10–16.00 G.M.T. and the call is "KZRH—The voice of the Philippines on a frequency of 9,640 kc/s." At 16.00 G.M.T. the station closed till "6 a.m. Manila time" (22.00 G.M.T.). Incidentally it can be easily identified by the "wisecracking" announcer employed in the afternoon session.

Lourenco Marques was logged on the 9th February, from 20.30–21.00 G.M.T. at Q5 R5/6 The call is CR7BE and operate on 9.64 mc/s or 31.10 m. from 19.00–21.00 G.M.T. Full details are: "The Radio Club of Mozambique—CR7BE—on a frequency of 9.64 mc/s or 31.10 m., at Lourenco Marques, Mozambique, Portuguese East Africa," preceded by four chimes. Address reports to P.O. 594, Lourenco Marques, Mozambique, Portuguese East Africa. Reports are wanted.

In conclusion, I would like to say that since taking P.W. I have gained many friends through the medium of "Open to Discussion," a column which I should like to see extended. Furthermore, I think that "Leaves from a Short-wave Log" ought to be reinstated as I, like many other readers, miss it very much.

Thanking you for a splendid magazine.—ROBT. WM. IBALL, Worksop, Notts.

Correspondents Wanted

SIR,—As a reader of your excellent wireless paper, I should like to get in touch with any other reader who, like myself, is actively interested in home recording.—P. LANDAUER, Burchetts Farm, Ockley, Surrey.

SIR,—I have been a reader of your fine paper for over nine months, during which time I have been interested in short-wave reception. I have been logging my stations on a 4-valve all-wave receiver, and here are some of my best catches:

The Ideal Radiogram

CERTAIN queries have been raised regarding the prices of the components needed for the Ideal Radiogram, which was recently described in these pages. Prices were quoted in the published lists of components, but in our issue dated February 10th we stated that these were subject to modification due to war conditions. It should therefore be noted that there are increases in the prices of certain parts supplied by the Premier Radio Company, and the following are the components and the current prices:

Mains Transformer, type S.P.352A, 15s.6d.

Smoothing Choke, type C 150/185, 13s. 6d.

8 Triad Octal Valves at 6s. 6d. each, 52s.

The Premier Radio Company can supply a complete kit for this receiver and a quotation will be supplied upon request.

FG1RJ, K4SKC, W3XFT, SM5VW, W2TAV, W1COO, LX1BO, OM4, VE1IX, ZBIL, OH2OI and PY2S. I operate on the 20m. and 40m. bands, and would be glad to exchange SWL cards. I would also like to get in touch with anyone interested in short-wave amateur reception who resides in my locality.—R. PIKE, Burlington, Albert Road, Parkstone, Dorset.

Freak Reception: DX Catches

SIR,—I started taking your excellent paper about twelve months ago, and all my knowledge of radio has been gained from it. I very much miss the "Leaves from a Short-wave Log," and am one of the many listeners who wish for its return.

Referring to Mr. R. Robertson's letter, I have picked the following out of my lists, the stations around 1,070 kc/s.: Charlotte (N.C.) 1,080 kc/s, WBT; Chicago (Ill.) 1,080 kc/s, WMBI; Cleveland (Ohio) 1,070 kc/s WTAM. I think WTAM would be the station heard.

I would like to correspond with any S.W. fan living in the U.S.A., who is also interested in stamp collecting. My best DX catches are Manila, KZRM (31.35m.), Georgetown, B. Guiana (48.92m.), Halifax, N.S. (48.9). RX is a commercial 4-valve superhet, antenna 75ft. long and running N.W. to S.E.—D. WILLETT, Main Street, Bagworth, Leicester.

SIR,—I read with interest recent letters in PRACTICAL WIRELESS concerning DX on the medium waves. Here is my experience. On the morning of February 24th, between 6.30 and 7.0 a.m. I heard a weak transmission at the bottom of the medium waveband giving the call W2JY. According to the dial the wavelength was 204 metres. The receiver was an old A.C. 4-valve superhet using an outdoor aerial.—S. JOHNSON (Matlock).

Prize Problems

PROBLEM No. 390.

BRADLEY had a four-valve battery set which had been in use for some time and which was highly satisfactory. He decided to apply some economy schemes to the receiver and accordingly purchased a smaller H.T. This worked quite all right, except that it needed more frequent replacement. He next considered the accumulator and tried to think of a way to avoid frequent recharging. To this end, as he did not wish to cut out any valves, he thought he would reduce the total filament current drain and to do so he connected the filaments in series instead of in parallel. When he tried the set with this modification, however, he could only obtain the faintest of signals. Why was this? 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 should be marked Problem No. 390 in the top left-haud corner and must be posted to reach this office not later than the first post on Monday, March 11th, 1940.

Solution to Problem No. 389.

The method of connection which Greenaway adopted resulted in the valve in question being partially short-circuited by the dial lights and accordingly the valve worked very inefficiently and resulted in the poor performance. He should have connected the dial lights in series in the heater circuit.

The following three readers successfully solved Problem No. 388, and books have accordingly been forwarded to them: N. Shirley, c/o Soldiers' Home (Annexe), Whittington Heath, Nr. Lichfield, Staffs; D. Byford, 134, Mile End Road, Colchester, Essex; N. R. Broadbear, "Kolonga," Pennyacre Road, Teignmouth.

VALVES WHICH REQUIRE A LICENCE

As mentioned some time ago, it is now necessary to obtain a special licence for the purchase of certain types of valve. Under the Order issued under the Defence Regulations, 1939, it is stated that "No person shall, except under the authority of a permit granted by the Postmaster-General for the purpose, sell, purchase, let, hire, supply, dispose of, receiver it is first necessary to obtain the appropriate permit. This is quite a simple procedure, and the form is obtainable from any local *Head* Post Office. The form is known as T99G, and is in three sections. On each of these the name of the proposed supplier must be filled in, together with the other appropriate details, and it is then folded and is self-addressed to the Postal

Maker's Name	*Valves over 10 W anode dissipation, and up to and including 25 W*	*Valves over 25 W anode dissipation*	*Gas-filled Valves*	*Rectifiers*
Brimar	7C5	—	4039A	—
Cossor	2XP, 4XP, 42SPT, PT41B	420XP, 440XP	GDT4B, GDT4	405BU, 225DU
Dario	TL54, TD24, TF104, TF364	—	—	—
Ekco	OP41	—	—	—
Ediswan	MR75	ES60, ES75, ES75H, ES75X, ES100, ES250M, MR300	—	—
Ever Ready	S30C, S30D, A70E	—	—	—
Marconi	KT33, KT33C, KT44, KT66, PT16, PT25, PT25H, PX4, PX25, PX25A, LS5A, LS5B, B63	DA30, DA41, DA60, DA100, DA250, DEM2, DEM3	GT1, GT1A, GT1B, GT1C, GT5E, GT25E	GU1, GU5, GU2, GU20, GU21, GU8, GU9, U6, U14, U15, U17, MR1, MR2, MR4, MR6, MR7A, MR9 MR10, CAR2, CAR4, CAR6
Mazda	PA20, PP3/250, PP5/400, AC4/Pen, AC6/Pen, Pen 44, Pen 46, PP3521, ACP4	PA40	—	—
Mullard	ACO42, ACO44, DO20, DO24, DO25, DO26, PM24B, PM24C, PM24D, PM24E, Pen B4, Pen 428, Pen 650, EL6, EL50	DO30, MZO5·20, MZO5-60, MZ1-70, MZ1-75, MZ1-100, MZ2-200, MZ2-250, RG5-1500, RG5-6000, RG10-1500	—	—
Osram	KT33, KT33C, KT44, KT66, PT16, PT25, PT25H, PX4, PX25, PX25A, LS5A. LS5B, B63	DA30, DA41, DA60 DA100, DA250, DEM2, DEM3	GT1, GT1A, GT1B, GT1C, GT5E, GT25E	GU1, GU5, GU2, GU20, GU21, GU8, GU9, U6, U15, U17, MR1, MR2, MR4, MR6, MR7A, MR9, MR10, CAR2, CAR4, CAR6
Triotron	P469, K480, K433/10, 2A3, 6A6, 6L6G, 6V6G, 6N7G, 50, 53, 79	—	—	—
Tungsram	P12/250, P15/250, P15/250S, EL5, EL6, O-15/400 OS-18/600, P25/450, P25/500, P26/500, P27/500, P28/500, OS12/500, OS12/501, OQ15/600, APP4E	P30/500, OP37/600, OP38/600, P60/500, OP70/1000, 075/1000, P100/1250, OQQ150/3000, O-240/2000, O-250/2000, OQQ15/800, OS40/1250, OQQ55/1500, OQ71/1000, P101/1000, O300/3000, O1500/5000		V21/7000, PV75/1000, PV100/2000, RG250/100, RG250/3000, RG1000/3000
American Types	2A3, 2A5, 6A3, 6A5G, 6A6, 6B4G, 6B5, 6L6, 6L6G, 6N6G, 6N7, 6N7G, 6V6, 6V6G, 7C5, 46, 50, 53, 59, 79, 250, 2151	845, 842, 841, 807, 35T, 825, 300A, RK31, 756, RK20, RK46, 203B, 830B, 203Z, ZBI20, WE242A, WE284D, 203A, 838, 845, 852, RK38, 211, 805, HD203A, 150T, HK354, 822, 250TH, WE212E, 300T, 849, 500T	—	—

acquire or distribute any of the undermentioned articles." These include transmitters, spark coils, crystals and many other items and "Electronic valves capable of an anode dissipation exceeding 10 watts." In this latter category come many output valves, as well as mains rectifiers, and therefore when replacing such valves in a receiver, or when using them in a new Authorities. One section is returned to you and another to the supplier, and you can then collect the valve without difficulty. For the benefit of those who are uncertain regarding the valves which need this permit, the accompanying list gives the majority of the valves which are included and which are in more or less general use in commercial receivers or by the home-constructor.

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
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/3 " "

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 CRYSTAL SETS.

	Date of Issue.	No. of Blueprint.
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)	12.6.37	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)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	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)	30.7.38	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))	19.3.38	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

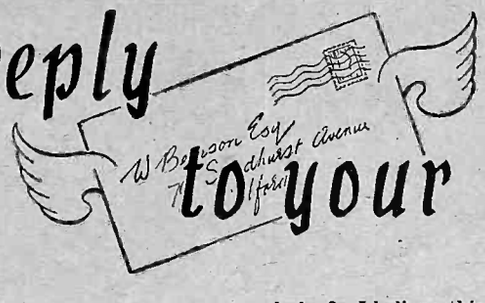
Mains Operated.

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)	*Aug.* '35	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



Spares-box Converter

"Would an Eddystone Y coil do instead of the home-made coil you describe for the Spares-box S.W. Converter in your issue of February 3rd? I am not much of a hand at making coils, but have the Eddystone coil and would like to use this."—N. F. (Hythe).

THE coil required for the converter must have three windings—aerial coupling coil, grid coil and reaction coil. The Eddystone Y coil is a four-pin, two-winding component and thus would be unsuitable without modification of the circuit arrangement. This would not be difficult, the aerial series condenser merely being connected to the grid end of the grid coil. The 6Y coil would, however, be equivalent to the coil described and could be used without altering the circuit.

Reflector Aerial

"I noted in one of your back issues a reference to a reflector aerial for transmitting and receiving. There is one thing I am not quite clear about in this type of aerial and that is the spacing of the aerial and reflector. I assume that the reflector acts as an ordinary light reflector, but why put the reflector a quarter wavelength behind the aerial?"—J. B. A. (New Cross).

THE reflector must be of such a size and in such a position relative to the aerial that current will be induced into it. In accordance with standard A.C. laws the current will lag 90 degrees and will be radiated from the reflector. It is essential to so position the reflector that by the time the radiated wave has reached the aerial the phase of the wave will have shifted so that the radiations from the reflector and aerial are both in phase. This means that the reflector will assist radiation, and if you place the reflector in the wrong position the wave radiated from it will tend to cancel the aerial radiation. Actually this is what happens in the reverse direction, the aerial radiations cancel those of the reflector in the "back direction," and this gives rise to the directional effect.

Operator Handbook

"I am thinking of taking up training as a wireless operator, and have been told that there is a special book published which gives full details of the methods of procedure and other information relative to the operator's work on ship or shore stations. I should be glad if you could give me any details of this book and where it is obtainable."—B. B. (Wealdstone).

WE think you are referring to the Handbook for Wireless Telegraph Operators Working Installations Licensed by His Majesty's Postmaster-General. This is available from His Majesty's Stationery Office, and the price is 9d.

H.F. Choke Design

"I am trying to make up a few of my own components for quite a simple set, but could you please help me in the H.F. choke? I believe this should be as large as possible to exert its maximum choking effect. In this case is there any limit, or can I simply take any suitable former I might find and wind it full of wire? I have plenty of this in my spares box."—J. R. (Uxbridge).

THERE will be little advantage gained from using more than a certain number of turns. There is a possibility that beyond the effective point you may destroy some of the properties of the choke, due to the increased self-capacity which might result. The best plan is to make the winding in sectional form, that is, by splitting up the winding into a number of separate sections. This will take care of the self-capacity. The actual number of turns is not critical, provided that you use a few hundred (assuming that the choke is for medium and long-wave working). The gauge of the wire will, of course, in conjunction with the number of turns, affect the total resistance and thus have an effect upon the H.T. voltage drop, whilst the gauge must also be considered in conjunction with the current which will flow through the wire.

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.

A.C.-D.C. Receiver Design

"I wish to try my hand at building a small A.C./D.C. set, but I am not very familiar with this type of apparatus, although I have built two or three A.C. sets. Would you give me any ideas as to the particular specialities of this type of set, as distinct from normal practice in, say, the A.C. sets?"—L. G. (Ilfracombe).

FROM the point of view of normal radio technique, there is no difference, and the only departure in design is in the wiring of the heater circuits. There is, of course, no mains transformer in an A.C./D.C. set and the mains input is taken straight to a half-wave rectifier and to the "earth" line. The heaters of the valves are also fed direct from the mains, through a suitable voltage dropping or current regulating resistance, and it is usual to wire the heaters in series with the detector stage at the earth end of the line. Pilot bulbs for panel illumination are also included in the heater circuit as a rule, and to avoid interrupting the reception of radio due to the bulbs blowing they are generally shunted by a low value resistance. In place of the regulating resistance you can use a special type of flex known as a line-cord, if you can obtain one in your locality. We hope to publish a design in the near future which may be of interest to you.

Improving Superhet Selectivity

"I have a home-made superhet which has been quite good until the new Services programme came on the air, and now I find that I cannot get rid of the Home Service programme in the background. What is the best way of improving the selectivity of the set without going to too much expense?"—K. P. (N.W.11).

AN H.F. stage is the usual way of increasing selectivity, but we presume from your final remarks that this would be inconvenient. A small wave-trap in the aerial circuit might prove effective and should not be expensive, consisting merely of a coil and variable condenser in parallel. Another idea which you might care to consider is to open one of the I.F. transformers and separate the primary and secondary windings. These may often be opened wide so that there is practically no coupling between them, and then a small variable of low-loss design connected between the two windings. This may then be adjusted to give any desired coupling and thus introduces a form of variable-selectivity device. The condenser could be controlled from the panel through an extension control outfit.

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.

R. A. N. E. (Chingford). If a field winding is used in place of the choke, then a higher mains output must be provided to allow for the voltage drop. You need at least 350 volts in this case. The meanings of the abbreviations will be found in our Encyclopaedia and other handbooks.

A. R. L. (S.W.6). Any good medium-impedance triode may be used. One of the so-called General Purpose valves would be ideal.

P. D. M. (West Acton). You will find all the data you require in last week's issue.

R. F. P. (Matfield). The trouble may be due to a faulty light switch in the house, or to a defect in the receiver. We suggest you have the set overhauled by the makers or their nearest local service agent.

F. I. (Southgate). Use two similar coils and couple them through a .0001 mfd. variable condenser.

D. E. M. (Bath). Ordinary carbon type resistances may be used quite satisfactorily.

J. D. (Glasgow). A mains transformer may be used and should be capable of delivering 4 amps.

H. R. E. (Redcar). The aerial is obviously useless and we suggest you try the effect of a mains aerial before going to any further trouble.

L. C. S. (Harlech). The valves are very old, but if you are satisfied that the emission is all right you could use them.

H. E. (Birmingham). It would be false economy to try the scheme as the current would be greatly increased and the accumulator would not last so long.

T. P. S. (Hythe). The meter has insufficient range to enable you to use it for the test in question. You could not convert this particular instrument.

I. O. (Durham). Both components may be used. Connect them in series in the particular arrangement you intend to try out.

The coupon on page 532 must be attached to every query.

FLEXIBLE LEADS AND CONNECTORS

(*Continued from page 514*)

Screened Leads

Rather different methods must be followed when dealing with screened leads, such as may be used for top-grid or top-anode valve connections or for pick-up leads.

The screening braid should be pushed back for an inch or so in the first place. Then the cotton insulation can be pushed back and the end of the wire bared. If the cotton is then slid along to the end of the bared portion it can be bound with thread, the binding being made so thick that it effectively prevents the metal braid from sliding along the lead so that it could come into contact with the bared end.

For top-cap valve connections it is nearly always best to use connectors of the hooded type, since they improve screening. They are generally provided with a small internal soldering tag, to which the ends of the lead can be attached and also with two "ears" on the outside which can be clamped round the screening braid by gripping with a pair of pliers. In addition to making connection to the braid in this way, it is best to apply a spot of solder between the cap "ears" and the braid. This must be done with a clean, hot iron, and the iron must be kept in contact with the braid for only a couple of seconds; if it is held longer than that, the insulation beneath the braid will burn and dirty the metal so that the solder will not adhere properly. In addition, the insulation might possibly be impaired.

Earthing of the screening braid can be carried out most easily by fitting a small metal bridge over it, the bridge being screwed to the metal or metallised chassis. It is important that this earth connection should be sound if the screening is to be effective.

RADIO IN THE DESERT

OFFICERS and airmen of the R.A.F. "carrying on" in the deserts of western Egypt and Iraq, are specially interested in two things—the "inside-story" of the way the air-war is going, and the latest developments in Air Force equipment. These were the questions most frequently asked of Captain Balfour, Under-Secretary of State for Air, during his recent 7,000 miles air tour of R.A.F. stations in the Middle East.

The men's own ingenuity has added a number of "home comforts" to those officially supplied. Hot plates have been made from old petrol-cans; old aircraft packing cases have been converted into sports pavilions and "nineteenth holes" for desert golf courses. Open-air cinemas are run by the airmen themselves in these remote spots out in "the blue," hundreds of miles from a big town.

Modern air and radio developments have taken much of the monotony and risk out of desert life. Big load-carrying aircraft have ended the "canned food" era, since fresh foodstuffs, as well as water and fuel supplies, are now regularly flown to the desert outposts. And although the health of the men is remarkably good, it is a comfort to know that in case of critical illness a patient could be taken by air to a modern hospital in a matter of hours.

A new use for the radio is to give warning of approaching dust-storms—one of the bugbears of desert life, and at one time a menace to flying. Such a warning sent Captain Balfour racing back from a desert air station to Cairo at 300 m.p.h. Half an hour later the dust-storm arrived, with "visibility—50 yards."

Classified Advertisements

Advertisements are accepted for these columns at the rate of 2d. per word. Words in black face and/or capitals are charged double this rate (minimum charge 2/- per paragraph). Display lines are charged at 4/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, Strand, London, W.C.2.

RECEIVERS, COMPONENTS AND ACCESSORIES

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.

BANKRUPT Bargains. Good stock of new receivers of all types. Most types valves, service goods, speakers. Please state requirements for quotation.—Butlin, 6, Stanford Avenue, Brighton.

TRANSFORMERS for L.T. Rectifiers for charging and safety, 12-volt lighting, from 12/6.—Thompsons, 176, Greenwich High Road, S.E.10.

COULPHONE RADIO, 22, Grimshaw Lane, Ormskirk. Collaro A.C. Motors, 12in. turntable, 25/-; with pick-up, 40/-. Rola G.12 energised speakers, 52/6, P.M. 65/-. Brand new goods. 1½d. stamp list.

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

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.

RADIO CLEARANCE, LTD.—All lines advertised in last week's issue still obtainable.

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

BANKRUPT BARGAINS. Brand new 1939 models, makers' sealed cartons, with guarantees, at less 40 per cent. below listed prices; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

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.

MORSE TRAINING

WIRELESS CODE COURSES. "Book of Facts" Free.—Candler System Co. (L.O.), 121, Kingsway, London, W.C.2.

COMMUNICATION RECEIVERS

THE famous HALLICRAFTER SX23, released by the makers only in July, 1939, can still be supplied by Webb's Radio at

PRE-WAR PRICES.

We fortunately had good supplies delivered in August. NO price increase on present stock of this model only, £33 10s., H.P. terms available. Write for descriptive booklet.—P. Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

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.

PUBLIC APPOINTMENTS

AIR MINISTRY.

AERONAUTICAL INSPECTION DIRECTORATE. Vacancies exist for unestablished appointments as Examiners in the General Engineering and 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.

APPLICATIONS from candidates previously interviewed and declared unsuccessful will be considered provided the necessary additional experience has been gained.

ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three 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 9s. 0d. per annum (payable monthly in arrear) if service is satisfactory, and must be prepared to serve in any part of the United Kingdom.

NORMAL age limits 25 to 55.

CANDIDATES should indicate on their applications for which vacancy they wish to be considered—a, b or c.

APPLICATION 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. 52), Brandon Steep, Bristol, 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.

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.

FREE ADVICE BUREAU

COUPON

This coupon is available until March 16th, 1940, and must accompany all Queries and Hints.

PRACTICAL WIRELESS, 9/3/1940.

NEW LOUDSPEAKERS

3,000 SPEAKERS from 6/6 each, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

COMPONENTS FOR SALE

SCRAP your H.T. battery with Mallory vibrator converter, 6/12v. 150v., 30m.a., 18/9; listed £5/5/0. Or Genemotor, 12v., 250v., 50m.a., 25/-. Postage 1/3.—Aeronautical Radio, 47, River Road, Littlehampton.

TECHNICAL PUBLICATIONS

R.S.G.B. AMATEUR RADIO HANDBOOK. 300 pages, 3s., by post.—16, Ashridge Gardens, London, N.13.

MISCELLANEOUS

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FURTHER STEPS TO HIGH QUALITY—See page 10.

A NEWNES PUBLICATION

Practical Wireless and PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

Vol. 16. No. 391. Mar. 16th, 1940.

Contents

Practical and Wireless
★ PRACTICAL TELEVISION ★
EVERY WEDNESDAY
Vol. XVI. No. 391. Mar. 16th, 1940.
EDITED BY F. J. CAMM
Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Direct Coupling

MANY attempts have been made in the past to obtain improved quality by departing from normal methods of coupling in the L.F. stages. Generally speaking there are only resistance-capacity and transformer coupling, and although these may be combined, the principles remain the same. In each case the grid of the amplifying valve is isolated from the H.T. supply, either by a condenser or through the fact that the two transformer windings are electrically separate. Many years ago a system was developed in which the grid was joined direct to a battery, and it was claimed that a great improvement was obtained, due to the lack of a time constant in the grid circuit. Since those days many attempts have been made to improve on the arrangement, and in this issue we give constructional details of an amplifier in which the grid is actually connected, through resistances of course, to the H.T. positive line. This system, known as direct-coupling owing to the fact that the preceding anode is joined direct to the following grid, has advantages when it is properly made up, and we hope that the details given will enable readers who are interested in this arrangement to try out the scheme.

Licence for Valves

IN last week's issue we published a list of valves which can only be obtained when a licence form has been sent to the postal authorities. The form in question was previously only obtainable from Head Post Offices, but supplies have now been sent to all branch and sub-offices and it is thus possible to obtain the form from any normal post office. This does not include the smaller type of office which is found in conjunction with general stores, etc.

Gerald Cock

THE B.B.C. announce that Mr. Gerald Cock, M.V.O., has been appointed its North American representative in the place of Mr. Felix Greene. The appointment of North American Representative is made for a limited period. Mr. Greene in the normal course would have returned to England last autumn, but his replacement was delayed by the war.

Mr. Cock, who is the B.B.C.'s Director of Television, lived for some years in America and revisited New York last spring. The war-time suspension of the television service has made it possible for him to succeed Mr. Greene as the B.B.C.'s representative in New York.

Lemmy Caution Calling

BEN WRIGHT has been chosen to create the radio character of Lemmy Caution in a new series of short plays specially written for broadcasting by Peter Cheyney. He will be heard in the For the Forces broadcast on March 14th.

"Lemmy Caution Calling," is the title of the series, and the first episode is "The Big Shot." The series should provide some good, rousing dramatic fare for listeners in the various Services, for they are full of action and based on strong gangster situations, with the celebrated Lemmy as the "G" man whose aim is to bring the criminals to the electric chair.

Jimmy Leonard, WLW announcer, who makes things not too easy and not too hard for contestants on "Marathon Melodies," radiated by that station to NBC on Fridays at 10.30 p.m., E.S.T. Leonard grew up in Florida, and made his radio début with his good friend Red Barber, the sports announcer. Others on the "Marathon Melodies" show with him are Sylvia Rhodes, vocalist, and Josef Cherniavsk, orchestra.

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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.

The Bing Boys

"THE Bing Boys are Here." "The Bing Girls" and "The Bing Boys on Broadway," three brilliant, colourful shows of the last war, are the subjects of the Keith Ayling and Leslie Baily programme, the second in the series "The Story Behind the Show," to be heard on March 15th. The collaborators have prepared a most interesting script, and it is hoped to have in the studio George Robey, the original Lucifer Bing; Violet Lorraine; Clifford Grey, the lyric writer; and Nat D. Ayer, the composer. They will revive some of the high spots of the shows to which went the fathers and mothers of men now in uniform.

"The Bing Boys are Here," was produced at the Alhambra on February 12th, 1916, and ran for 378 performances. The third of the shows, "The Bing Boys on Broadway," was still running after the war was over. Most people will have some outstanding memories of these great productions.

At the "Black Dog"

"AT the 'Black Dog'," the popular feature which started in the Empire Programme over two years ago and which ultimately became a regular fixture in the Home Programme, will be revived for the Forces on March 15th. Later on, it may take its place in the Home Service. There was always a wonderful feeling of spontaneity about the series, and the friendly atmosphere of a small pub was most successfully conveyed to listeners. No scripts were used, and those taking part would probably have an hour or so to get to know each other before actually going on the air.

The Visitors' Book at the "Black Dog" is a grand mixed bag and includes the names of film stars, musicians, radio artists, churchmen, writers, footballers and people from every conceivable trade or profession. Gracie Fields has been there, and other famous names which come to mind at random are A. F. Tschiffely, the great horseman and writer; Valerie Hobson, one of the best of our British film stars; George Allison, the well-known football manager; S. I. Hsiung, the author of "Lady Precious Stream"; Leslie Howard; Jean Batten, the airwoman; Primo Carnera; and F. S. Smythe of the Everest expeditions.

Designing Mains Transformers—3

How to Select Suitable Core Stampings, and How to Assemble the Transformer - - - By L. O. SPARKS

WHEN selecting stampings, it is preferable to use those of a square rather than a shallow oblong shape, as the former will invariably give a better voltage regulation figure. In addition to this important consideration, the completed transformer will be more rigid and the construction, generally speaking, more satisfactory. Insulation is one item which calls for particular consideration; bearing in mind the voltages developed across the H.T. secondary windings, it is absolutely essential to see that adequate insulation is provided between layers. It is not sufficiently appreciated by many amateur transformer constructors that a single short-circuited turn can cause currents to flow large enough to burn out the rest of the windings or, at least, ruin all insulation beyond repair.

One naturally thinks of the H.T. secondaries carrying high voltages, but the winding used for the heater of a rectifying valve is so often given no more consideration than the other L.T. windings that a word of warning would not be amiss. It must be appreciated that the rectifier heater is the supply point for the H.T. positive line and that the maximum voltage (A.C.) of the H.T. secondary winding will have to be considered with respect to the heater and the primary of the transformer.

When carrying out the winding operations, try and maintain a constant examination of the wire, as any defective insulation must be made good, and on no account should minute kinks be allowed to pass on to the bobbin. Tapping loops or points also call for special care. If they are brought out through holes in the cheeks of the bobbins, see that the wire does not cut into other turns and that a strip of insulating material is placed above and below the tapping wire.

Screened Primary

In most modern radio transformers it is usual to provide a screen between primary and secondary windings to assist in preventing the passage of high-frequency currents between the two sections. It is not a difficult matter to embody a suitable screen as this need only consist of a strip of copper foil, the width of the bobbin, long enough to go round the primary winding *except* for, say, 1/16th inch. In other words, the foil must not be allowed to form a *complete* loop, a small gap being left between its two ends. The primary winding should be covered with empire cloth or dry paper before placing the foil in position, and another strip of insulating material placed over the screen before winding on the secondary. When cutting the foil, leave a narrow strip on one edge to be brought out to form its connection to earth.

General Assembly

When all windings are finished, it is advisable to mark all leads with some means of identification, thus preventing any errors in that direction. Once they are marked, they should be twisted together lightly so that they form the least obstruction to the assembly of the stampings around and through the bobbin.

Before starting the assembly, sort out the stampings into their respective groups so that alternate shapes can be picked up easily and quickly, although there is no need to rush this part of the work. It is advisable to take a little time over the matter and see that the stampings are packed together in the proper manner and as tightly as possible. Sufficient material must be available, and used, to *fill* the core aperture of the bobbin, and a little light tapping is permissible to get the last two or three stampings in position, but don't go to the extremes and use sufficient force to cut into the bobbin.

Once a compact body has been built, clamping bars, preferably of metal, must be fixed in position across two sides of the assembly, these being held in position by nuts and bolts as indicated by Fig. 1. The bolts or threaded rod must be strong enough to allow a reasonable pressure to be exerted, as it is essential for the clamps to be really tight to prevent any possible vibration of the stampings. Pronounced hum can be introduced into radio apparatus by failure to attend to this item. The clamping strips can be bent at right angles at one end to form feet for fixing purposes if so desired.

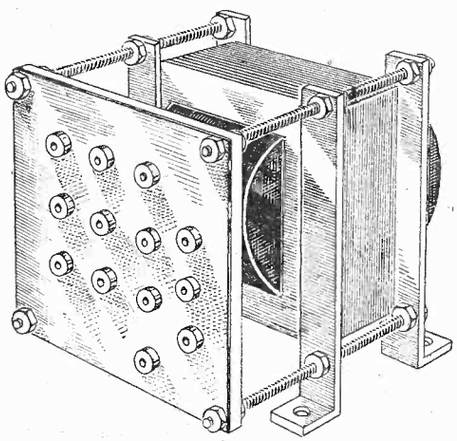


Fig. 1.—Showing how the clamping strips are made and fixed, and a suggestion for a terminal board.

Terminal Strip

Most experimenters find it more advantageous to fit a proper terminal strip for the connections to the various windings than to leave loose wire ends. This is to be recommended, as it not only allows frequent connections to be made to clearly marked points but it also removes the risk of the original wires breaking off, usually just inside the cheek of the bobbin, by the movement likely to be caused when connections are made or undone. Fig. 2 shows a simple method of mounting a terminal strip which should, of course, be made from reasonably stout insulating material. Ebonite about ⅛in. thick, or fibre ⅛in. thick, are the most suitable materials, as they are easy to work and have good insulating properties. The example shown makes use of sockets for the individual connections, but there is no reason why terminals should not be used, in fact they would, no doubt, provide an easier and quicker method for most experimenters.

Bobbins

Although these can be purchased, most constructors prefer to make their own according to the core and stampings being used. Providing a little care is taken in the selection of the material, its marking out and the actual construction, it is not so difficult as it might appear at first sight.

Cardboard, even when it is stiff and thick, is not satisfactory. It does not possess sufficient rigidity and, if it is thick enough to be strong, it makes a very clumsy looking bobbin. The best material is sheet prespahn or bakelised board, as these are strong, rigid and easy to work.

The centre of the bobbin should be marked out and cut as shown in Fig. 2, the dotted lines indicating the folding points which, to obtain a neat bend, should be scored with a penknife. Don't let the ends overlap, otherwise a pronounced bulge will be produced. If they butt together and, when the former is folded to shape, fit firmly into the cheeks, covered with a layer of empire cloth, a neat and strong job will be made.

The cheeks should just fit on to the ends of the centre former, but it is essential to see that all measurements *are* accurate. There are several good adhesives on the market for cementing all the parts together, but don't be too impatient over this part of the work, do give the adhesive time to set firmly.

Final Remarks

Whenever possible, meter tests should be applied to all windings, with and without current loads, before putting the transformer into active use. The voltage and current of the various windings should be checked and, if a meggar is available, insulation tests applied between all windings and the core and all windings.

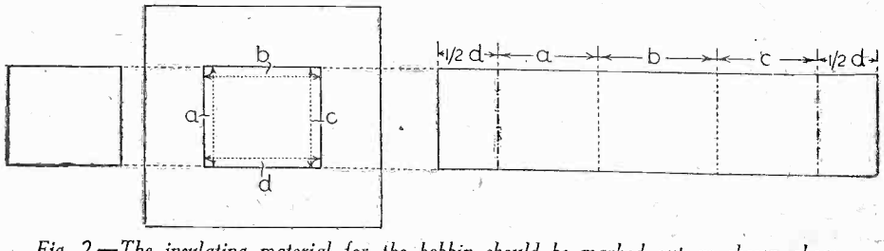


Fig. 2.—The insulating material for the bobbin should be marked out as shown above. Accurate dimensions are essential.

Radio in the Services

A Refresher Course for the Radio Mechanic—1

By Frank Preston

THE announcement, made in these pages a fortnight ago, that the R.A.F. were encouraging applications from those wishing to enrol as radio mechanics has created a considerable amount of interest among readers. Large numbers have inquired about the test which they will be asked to undergo should they apply for enrolment; most are anxious to have a fairly clear idea as to the standard of radio knowledge required. It is suggested that those who are interested should make inquiries at their local recruiting office, but it is possible to pass on the information obtained from representatives of the Royal Air Force.

Keen Constructors Encouraged

The main requirement is for keen amateurs and from those who have had some experience as service engineers. It is by no means essential that applicants should have an extensive knowledge of wireless theory, but they should have a fairly sound understanding of the fundamental principles. An ability to reason and apply logical methods of deduction are essential, but that is tantamount to saying that sound common sense, blended with a certain amount of experience in radio construction, testing and fault-finding, is required. The recruiting officer approached was anxious to make it clear that they are prepared to give earnest consideration to all applicants who can be classed as successful home constructors; naturally, additional ability is appreciated and will greatly increase the possibility of rapid promotion, with the consequential increase in pay.

A point which should not be overlooked is that all successful applicants will be given a course of training in the particular type of work which their duties will entail. This means, in effect, that the keen amateur will have an excellent opportunity to learn more about his hobby, so that he can turn it to successful account as a profession—first in the Services and later, no doubt, in civilian life.

Knowledge of the Superhet

It is not necessary here to go any more deeply into the question of prospects and requirements, for additional information can be obtained at any R.A.F. recruiting office. It will be better, instead, to consider the matter of the type of questions which may be asked. Quite naturally, it is impossible to state what questions will be asked, or even what questions previous applicants have been required to answer. But it is evident that a fair knowledge of the superhet is necessary; at least the recruiting officer with whom the matter was discussed laid emphasis on the superhet.

Those making application for enrolment as radio mechanics are required to pass a test. Success in this may mean immediate promotion. At the end of this article are some questions of a type which may be asked (it is not suggested that any of them have been asked) along with what can be considered suitable replies

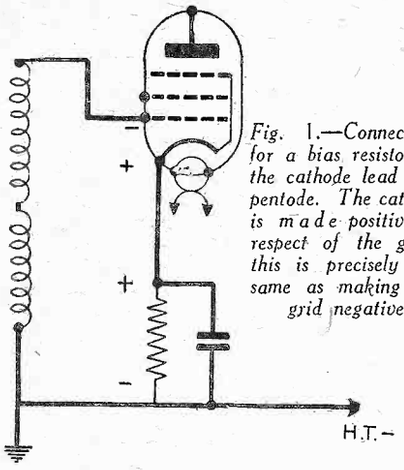


Fig. 1.—Connections for a bias resistor in the cathode lead of a pentode. The cathode is made positive in respect of the grid; this is precisely the same as making the grid negative.

That fact will, I know, tend to upset a few readers because there is still a small minority who look upon the superhet as a very complicated arrangement which is difficult to understand. The majority know that this idea is false.

Nevertheless, it is a fact that it is impossible to have anything like a sound knowledge of superhet operation if a simple "straight" circuit is not understood first, and if the underlying principles of design of all the widely-used components are not known. It would therefore be almost useless to commence an intensive study of the superhet before making quite sure that you have a fair working knowledge of simpler circuits.

Helpful Books

Obviously, it would not be possible in the course of two or three articles to pretend to give a complete course in wireless, and it is therefore suggested that those who wish to "start at the beginning" should obtain a copy of "The Practical Wireless Encyclopædia." Other books which will also be extremely useful are "Everyman's Wireless Book," "Sixty Tested Wireless Circuits" and "Coils, Chokes and Transformers." Any or all of these can be obtained from any bookseller or direct from The Publisher, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2, who can also supply a catalogue of wireless books.

Instead of attempting to provide a complete course of instruction in this series, I shall simply ask and answer a number of questions which are, in my opinion, of a type which may be asked by the examining officer. The questions will not be graded in order of difficulty, or in any other order for that matter, but will be taken almost at random. It is not suggested that any reader who learned all the questions and answers by heart would stand the remotest chance of passing the examining officer. But I believe that any reader who can make an intelligent attempt at them would have excellent prospects. This is because to answer them the reader must know far more of his subject than is wrapped up in the actual answers. In reading the questions and suggested replies it should be found that many other points are brought to mind. Those points also should be settled without delay, preferably by working out a suitable answer and then by checking it by making reference to one of the books referred to above.

Some Questions and Answers

Let us start with a few fairly simple questions; others of a slightly more advanced nature will be given in later articles of this series.

How is grid-bias applied to an indirectly-heated valve, and how can the value of the bias resistor be found when the characteristics of the valve and its associated circuit are known?

Bias is obtained by making use of the voltage drop across a resistor included between the cathode of the valve and the earth or H.T.— line, as shown in Fig. 1. Since the H.T. current for the valve flows through the resistor, there is a drop in voltage or potential across it. The voltage is proportional to the value of the resistor, in ohms, and the current passing through it.

It is generally necessary to by-pass the resistor by means of a fixed condenser; this provides a free path for H.F. or audio-frequency currents. The condenser may have a value of about 1 mfd. for an H.F. or I.F. valve, but the value should be increased up to, say, 25 mfd. (electrolytic) for an L.F. valve.

The value of the resistor is found by dividing the required G.B. voltage by the anode current (expressed in amps.). Thus, if the required G.B. voltage were 10 and the total H.T. (anode plus screen) current were 8 mA. or 8/1,000 amp., the resistance should have an ohmic value of ten times 1,000/8, which equals 1,250 ohms.

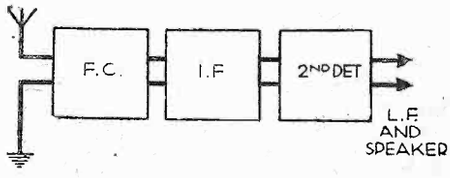


Fig. 2.—Essential parts of a superhet, where rectangles are used to indicate the stages.

What is meant by the term "intermediate-frequency amplification"?

This term, used in superhet practice, refers to amplification which takes place between the frequency-changer and the second detector (see Fig. 2). In a superhet the aerial or input circuit is tuned to the frequency of the signal being received,

(Continued on page 13)

Comment, Chat and Criticism

Listening to Music—2

Further Notes on How to Derive Pleasure and Instruction from Listening to Good Music, by Our Music Critic, MAURICE REEVE

UNQUESTIONABLY the greatest aid to the full understanding and comprehension of a work of music of any pretension—next to key—is a grasp of the plan, or form, to which it is written. Nothing can be entirely formless and at the same time intelligent. And the abstract qualities of music render this problem of even greater importance than usual—great as it is in all things. Naturally, the harmonic and melodic patterns and weavings are almost entirely ruled by the type of framework into which they are going to be fitted. A composer sets out to write a symphony or sonata just as a builder sets out to build a house. Not a note of the one or a brick of the other is laid until the plan has been decided upon and studied in the fullest detail. But owing to the "concrete" character of a house, and to our lifelong usage of it, as opposed to the "abstract" qualities of music, the house is to us as a language is, something which we can understand, and of which we can use the amenities. With a major work of music, however, it is, for the opposite reasons, impossible to find our way about it with any reasonable prospect of deriving either benefit or pleasure, without first studying the "plans" with a modicum of care.

"Sonata" form is a subject I hope to deal with shortly in a separate article. It is by far the most important of the forms, and is used for the construction of almost all the major works of music outside of opera and church music. Even a slight acquaintance with it will throw a beam of light on a symphony, sonata, or quartet that will rescue it for us from a veritable "black-out "and enable us to view it in the brilliant sunshine.

Rhythm and Accent

With form is linked up rhythm and accent, the construction of a phrase and of different types of phrases (themes, melodies, subjects, according to their character and allotted place in the scheme), and the recurring rhythmic pulse and accents.

A knowledge of harmony would complete, or round off, our knowledge of key as discussed in the last article. It takes us far beyond the mere recognition, anticipation and blending of keys as colours do the ability to trace a single line of notes (part or voice) through the texture. Then we follow two lines together and so on, until we hear the whole pattern as we would see one if looking at a carpet.

I think the facility for picking up these branches of listening (also the faculty to recognise the tones of the different instruments in an orchestra), will be greatly enhanced if the basic principle of key and key recognition are first mastered. The incentive will most certainly receive an added impetus and encouragement, because, when all is said and done, key *is* music. It is the heart and the core, and in thousands of cases it is the *only* thing that matters—in the small forms such as songs, carols, and ditties of all sorts. It is only when we begin to climb the ladder of, shall I say, musical sophistication, and its ever-enlarging horizons, that these other subjects, more especially form, enter.

I would like to conclude this brief sketch by getting back to its title, "Listening to Music." What we have done so far, as necessary here as anywhere, is to gather the material together essential for good, keen and intelligent listening; now enters that element which to many will seem the most urgent, the complete enjoyment of great music. "For," they may well say, "although you have helped us to understand the niceties of a symphony, and the polyphony of a quartet, you have not given us any guarantee that we will enjoy these things when we hear them. That is what we want the ability to do, rather than to criticise and be scholarly." True, my friends. You want to be like thousands are who watch cricket, who, whilst wishing to intelligently understand what is going on, don't wish to feel as though they were umpiring a test match. They want to browse on the grass round the boundary, quietly smoking, or drinking lemonade.

Mental Attitude

This will depend on the correct mental state we approach great music in, no matter how advanced or elementary our knowledge of it may be. It seems there are two requirements here. Firstly, never begin to listen to it in a totally unprepared frame of mind as you would always be when anything comes upon you unawares. Never be casual about it; always try to ascertain beforehand that it is taking place at such and such a time, and that you will be there. For, I am afraid, it is not a "hardy" plant which we can casually confront with pleasure, like so much of the entertainment we get nowadays. It is not entertainment at all. It is a forced, hot-house plant of the most exotic perfumes and colourings, and, like all such things, cannot stand the frequent icy blasts of casuality and promiscuity which surround many other art forms. The air which we frequently give to a radio item of "That sounds nice; we'll leave it on for a bit and see what it's like," is absolutely fatal. If, under such conditions, you should succeed in obtaining any mental reaction to the work at all, it would almost bound to be unfavourable. If, on the other hand, it should be favourable, this happy state would not be reached until the work was nearing its conclusion, upon which the effect would immediately evaporate. The result would of necessity be that, long before the next item had also been brought to an end, your favourable impressions of the former item would almost, if not entirely, have evaporated. Certainly your ability to retain even a slight recollection of a beautiful theme or other striking passage would be very small.

In fairness to the music, make adequate preparation for listening to it, and be certain that you will at least be in a mood and a frame of mind for appreciating it. You cannot enjoy excellent food or wine unless you are hungry for it, and it is the same with good music.

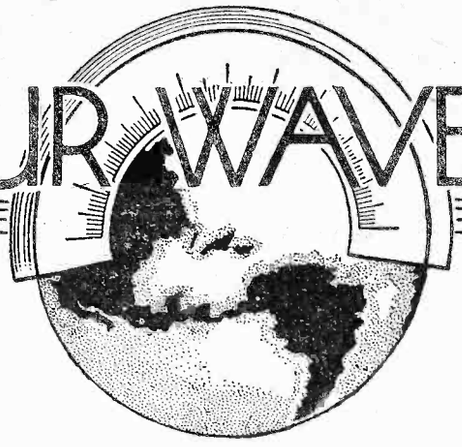
Secondly comes the all-important question of the proper frame of mind, or mental state, in which we should try to be when listening to good music. How should we approach the music? What should we look for in it or expect from it? Should we expect anything? You may reply that all this will depend on what the music is. We couldn't avoid looking on Beethoven's third symphony from even a slightly different angle than the one from which we view his seventh. And we certainly can't avoid thinking of Beethoven or Mozart in a very different light from Tschaikowsky or Ravel, and expecting something quite different from each.

Treating Music as Absolute

But I have, personally, always adopted the principle, and a few exceptions here and there will only serve to emphasise the general soundness of the idea. Treat all good music as "absolute," as I defined that word in a previous article. Certainly do not look for stories and programmes where none exist, or ever did exist. And even in such classic examples of programme music as Beethoven's Pastoral Symphony they are much more enjoyable and satisfying when divorced from their programme. At least, I find them so. I do not suggest for one moment that it is not helpful, as it is certainly interesting, to know of the story or motive which inspired the work. Even such an extraneous and unnecessary appendage as the "Napoleonic dedication to the Eroica Symphony" is helpful. But what I mean is this: forget all about Napoleon, cows, cuckoos or thunderstorms when listening to either of those works. Concerning the former, at any rate, the pastoral loveliness pervading every bar of it obtrudes itself with such an ample sufficiency that there should be no possible need for anyone to want to refer to their programme notes to see what it is all about.

Of course some works must stand or fall by the realism with which they portray what they set out to paint if for the very reason that they intended from the outset to do little else. Operatic music comes into this category. All Wagner's genius would not have been sufficient to place him in his pre-eminent position had he failed to sweep us off our feet with the marvellous realism of his canvases. The Venesbury music, the "Ride of Valkyries," and a hundred other examples, are as vivid as any painting, providing we know the story they set out to portray. They are the supreme examples of programme music, unmatched in their ability to transport us to the scenes and places they describe. But the fact that they do this to millions of people whilst listening to them in the concert hall, without any aid whatever from scenery, costume or words, is surely proof positive that *all* music can, and should, be listened to as I have tried to advocate in this article.

ON YOUR WAVELENGTH



By Thermion

The QSL Exchange

YOU will remember that I raised the question some weeks ago of the QSL exchange. I expressed the opinion that it was unfair for a reader to adorn his den with verification cards which he had not obtained in the orthodox way, but merely by exchanging them with other short-wave fans. I said that a den so adorned was intended to give the impression that the owner of the den himself had received programmes from the stations represented, and had obtained verifications. Thus the whole value of the verification card was lost.

Since that time both sides have expressed their views in the correspondence page, and we have received about an equal quantity of letters from those in favour and from those against. I am asked to exercise my casting vote, and I now say that the motion that we should continue to publish requests for QSL exchanges is lost. Therefore, will readers please note that we cannot publish further offers to exchange. It is not my wish that the QSL card shall have no greater value than a cigarette picture.

Wireless as a Profession

THE recent broadcast appeal for those with technical knowledge of radio to join the new wireless trade created in connection with the Services has produced to date nearly 15,000 applications. Our recent survey of radio careers was a much-appreciated feature, and we are still receiving large numbers of letters from readers who want to enter the radio trade as a profession, or to study for it. The suggestion has been made that we should run a regular feature dealing with radio careers. I therefore invite the opinion of my readers on this suggestion so that I can lay mass evidence, if any, before the Editor.

I understand that a large number of those who have already applied for the vacancies which have been advertised are readers of this journal, who have paid graceful and grateful tribute to the Editor and for the technical knowledge supplied by PRACTICAL WIRELESS and the technical books we issue in connection with it. Those who wish to obtain a first-class knowledge of radio cannot do better than study our series of handbooks which include "The Practical Wireless Encyclopædia" (now, unfortunately, increased in price to 7s. 6d., but worth ten times the price), "The Practical Wireless Short-wave Manual," "Everyman's Wireless Book," "The Short-wave Manual" (a new volume), "Wireless Transmission for Amateurs" (now increased in price to 3s. 6d.), "Wireless Coils, Chokes and Transformers," "Sixty Tested Wireless Circuits," "Television and Short-wave Handbook," "Workshop Calculations, Tables and Formulæ," and "The Practical Mechanics Handbook." A catalogue of our technical books will be sent free to any reader applying to the Manager of the Book Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Those engaged in the manufacturing side should certainly take each week our new companion weekly, *Practical Engineering* (4d. every Thursday).

Distortion

ONE of the queries which frequently arises in letters addressed to me personally concerns the cure and forms of distortion. For perfect reproduction the sound issuing from the loudpseaker should be an aural replica of what is taking place in the broadcasting studio. When this fails to happen, as judged by a critical ear, or by movements of a tell-tale needle inserted at correct points in the power feeds, distortion is taking place. It is not generally believed that the high-frequency section of a wireless receiver is often the cause of distortion blamed on the low-frequency side. The introduction of so many high-powered broadcasting stations has made the question of selectivity rather an acute one. When a station is sending out speech or music it broadcasts, in addition to the carrier wave, other frequencies which are known as sidebands. These are spaced equally on either side of the carrier frequency, and may extend as far as 7,000 to 8,000 cycles either side.

A receiver of the ordinary type boasting of razor-edge selectivity cuts off a large section of these sidebands, or at least reduces their amplification to such an extent that they compare very unfavourably with the amount of amplification accorded to the lower frequencies. Anyone musically inclined will realise that the higher frequencies bring about the brilliance or timbre, and if they are not present, then quality must to a certain extent be reduced.

If the constructor of a wireless receiver finds himself in a cleft stick, owing to his desire for adequate selectivity without cutting sidebands, he can adopt what has come to be known as band-pass tuning.

In the modern arrangement we have three main types. In every case it will be noticed that there are two tuned circuits, and energy is transferred from one circuit to the other by a mutual magnetic interaction, a coil common to both tuned circuits, or a carefully controlled capacity coupling.

The frequency response of each circuit is thus combined, and it is possible to make the complete circuit accept frequencies over quite a wide range and almost wholly reject the others. In other words, brilliance and reproduction are maintained, together with selectivity.

Another very marked cause of distortion is the use of "shoddy" components of doubtful origin. Too often is a set blamed for distortion when the fault is located in the fact that it is being starved of its H.T.

Returning now to the question of frequency distortion, the items chiefly responsible for this are the methods of coupling between the valves and the loudspeaker itself. Taking the first-named, it must be remembered that if L.F. transformers are employed, the primary or input winding must have an adequate primary inductance. This does not necessarily mean that the transformer with the largest size is going to give the best results. Modern development has produced transformer cores which are quite small compared to the early types. It is also necessary to maintain the inductance high even when quite large anode currents from the valve pass through the primary winding, so in this case it is necessary to learn whether a manufacturer guarantees the inductance in henries to be a certain value up to a given current, and then take steps not to exceed that current.

With inadequate primary inductance in transformers, there will be a loss of the bass frequencies, so that even if you have the most perfect sound reproducer coupled to the set, if the bass frequencies are lost they will not be heard from the loudspeaker.

Wireless for the Blind Fund

IT is interesting to note that during the ten years since its inception in 1929 to the end of last October, nearly £166,000 had been collected for the British Wireless for the Blind Fund. Of this sum, £151,500 was expended on sets and accessories for blind listeners, and there was a balance of nearly £2,000 in hand.

All sets provided by the Fund, says the annual report, are of modern loudspeaker type. Their distribution is carried out by 150 local welfare agencies.

B.B.C. Handbook for 1940

THE B.B.C. is taking its part in the dissemination of news all over the world in counteracting falsehood, in helping to make known the British point of view, but there is another side to the radio war. The B.B.C.'s war-time job is also to learn what is being said about Britain by others. It has to listen night in, night out, to the "news" and the propaganda broadcast from Germany and it has also to keep track of what neutral countries are thinking. The B.B.C. is not only the Voice of Britain; it has become the Ear of Britain. An article entitled "Listening Post, 1939," in the B.B.C. Handbook for 1940, which was published on March 4th, traces the growth of the new Monitoring Service which records, translates, summarises and distributes daily some two hundred broadcasts in twenty-five languages.

Listeners who are interested in the story of events behind the microphone can obtain the B.B.C. Handbook from booksellers and bookstalls, or direct from the B.B.C. Publications Department, The Grammar School, Scarle Road, Wembley, Middlesex, or on application to any Regional Office. Its price is two shillings, or 2s. 4d. by post.

Headphone Listening

Precautions to be Taken When Using Headphones with a Mains Set, and Points About Matching

IN the earlier days of radio headphones were the only practicable means of reproduction, since the power output of the set was too small for any other means. As loudspeakers became more efficient and less costly, headphones passed out of general use. The disadvantage of being tied to the set by 'phones contributed to their displacement, since several

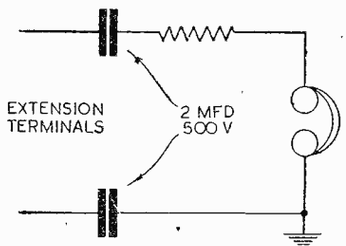


Fig. 1.—One method of phone isolation, with high impedance extension.

people could listen simultaneously to a speaker.

There are, nowadays, many circumstances in which the use of headphones is an advantage. Some people may switch off the set because of the nuisance caused to others who may not want to listen. Again, for a deaf person to hear in comfort, the volume level of the set speaker must be raised to a level unbearable for those with normal hearing. As shown by the Queries Section of this journal there are many people wanting a safe and efficient method of using headphones with their sets.

Precautions To Be Taken

The connection of 'phones to any set is subject to several important precautions, especially if the set is mains operated. Indiscriminate connection is highly dangerous and must be rigorously discouraged.

The chief precaution to be taken is against the risk of shock to the wearer of the 'phones, due to the contact of the metal headband or other metal parts of the 'phones with the listener's head. It is essential to earth efficiently one side of the 'phones, so that the voltage at the earpieces cannot rise to a dangerous value. For this to be done the 'phones must be isolated from the set. The two methods recommended for this are shown in Figs. 1 and 2. Either condensers are used, one 2 mfd. 500 volts working at least in each lead, or, better still, a transformer of suitable ratio is fitted between the 'phones and the output from the set. Two condensers should be used, since in some A.C.-D.C. sets a mains leakage may occur across some internal component in the set, or it may not be possible to earth one side of the speaker circuit. The transformer method is the better: the transformer used should be dependable and efficiently insulated.

Matching 'Phones To Set

It is desirable for the apparent volume from the 'phones to be the same as that from the speaker, so that the two units may be used simultaneously. It is more difficult to match 'phones to the set than it is to match extension speakers, where it is merely a question of matching impedances. With 'phones the impedance does not concern us; but only a fraction of the power output is required, and so if the 'phones are used alone the surplus power must be dissipated in some way. The volume of the speaker and 'phones varies with their sensitivities, and so the following details are not critical, but will give good results with average units.

The most readily accessible place for any connection to the set is the extension speaker socket. Here any output impedance from 1 ohm to about 20,000 ohms may be encountered.

If the output is of high impedance, then either a suitable step-down transformer between 'phones and the output, or else a high resistance in series with the 'phones will be needed to reduce the volume to bearable limits. To give a typical case, a battery output pentode of impedance about 11,000 ohms would need a step-down transformer of ratio 7-1 to match 'phones of 4,000 ohms overall resistance. If the

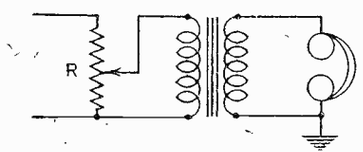


Fig. 3.—Volume control circuit for either high or low impedance extensions. For impedance Z value of R=2Z ohms.

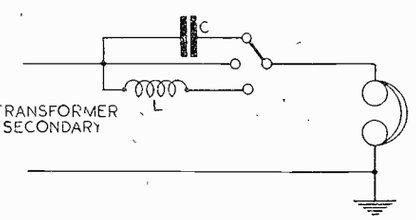
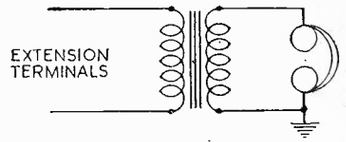


Fig. 4.—Simple type of tone control for use in conjunction with Fig. 2.
C .01 to .1 mfd.
L .3 to 12 henries.

other method is used a 500,000 ohm variable resistance is suitable. This serves as a rough volume control.

The extension impedance is commonly of the order of 5 ohms. For 'phones of 4,000 ohms a step-up transformer of ratio about 3-1 will serve.

If 7.5 or 15 ohm impedances are required, then a transformer of ratio 1-1 will be suitable. Here it is advisable to reduce the overall resistance of the 'phones from



LOW IMPEDANCE EXTENSION – STEP UP
HIGH IMPEDANCE EXTENSION – STEP DOWN

Fig. 2.—An alternative method of phone isolation, with low impedance extension.

4,000 ohms to 1,000 ohms by changing them from the usual series connection to parallel. In doing this care must be taken that the two positive and the two negative 'phone terminals respectively, are connected together. Otherwise the sounds fed to each ear will be out of phase, with unpleasant results.

For high impedance extensions the transformer ratio is roughly $\sqrt{\frac{Z.}{200,}}$ and for low impedance extensions is $\sqrt{\frac{200}{Z,}}$ where Z is the extension impedance.

For high impedance a step-down, and for low impedance a step-up, transformer is used.

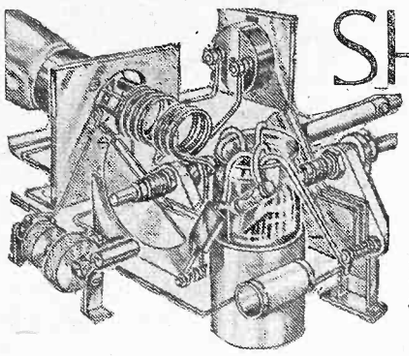
The ratio is not very critical, and may even be twice or half as much.

'Phones Used Alone

It has been assumed so far that the load on the output stage is being maintained by the connection of either the set speaker, or some extension simultaneously with the 'phones. If the 'phones alone are to be connected, as may frequently be the case, some means of dissipating the unwanted power is to be incorporated. The primary or secondary of the 'phone transformer is shunted by a suitable resistance, and since this must be capable of dissipating the full power output of the set, it is best placed across the primary of the transformer. It should be of about 3 or 5 watts rating. Here again the value of the resistance is not critical, but it should be about twice the extension impedance value. A potentiometer is used, this also serving as a volume control for the 'phones. Fig. 3 shows a suitable arrangement for both high and low impedance extensions. This will give a range of volume both below and above the set speaker volume, whether speakers are connected simultaneously or not. The 'phone transformer need not be expensive; since its power handling capacity is small, a midget type will be suitable.

Tone Control

Since the normal tone controls of the set will work just as well with 'phones as with the set speaker, there is no need to fit any additional control for the normal listener. The frequency range of normal 'phones is not wide, but with a transformer of suitable ratio most people will be satisfied by the quality of reproduction. If some degree of tone control is required, however, and deaf persons may need either bass or treble lift, this is easily incorporated as shown in Fig. 4. With low impedance extension, a transformer of higher step-up, and with high impedance one of lower step-down, ratio than usual is used, with an inductive or reactive network between the 'phones and the transformer secondary. Experiment must determine the best values of the components for individual requirements. The condenser capacity may be .01 to .1 mfd., and the choke .3 to 12 henries. The 'phones should be paralleled as described before to give a resistance of 1,000 ohms, since then the effect of the inductive impedances will be improved.



SHORT-WAVE SECTION

SHORT-WAVE REACTION EFFICIENCY

Points Which Underline the Design of an Effective Reacting Detector Circuit

By W. J. DELANEY

MANY listeners attempt to use a simple single-valve set for short-wave work and succeed in obtaining only a few long-distance stations. Others, as may be seen from the extensive logs published in our correspondence columns from time to time, succeed with a similar simple set in obtaining signals from the farthest ends of the earth. In many cases, of course, local conditions and existing climatic conditions will play a large part in the performance of a receiver, but with a simple detector stage the efficiency of the reaction circuit is of the utmost importance. A detector valve without reaction is very little better than a crystal receiver, but when reaction is applied the results are comparable with the addition of a good H.F. stage to the crystal. Owing to the peculiar working of reaction circuits, however, very few listeners realise how valuable this part of the set can prove. The reaction control should operate exactly the same as an L.F. volume control in a receiver, building up signal strength gradually, and just as smoothly taking the set out of oscillation. But how often is this effect found? Try the control on your receiver, with the set tuned to a very weak distant station. What do you find? Probably, as the control is turned the signal builds up and suddenly there is a "plop" as the set goes into oscillation. What happens then? You turn the control in the opposite direction until the set comes out of oscillation, and when this has been accomplished you have a given signal strength. But on advancing the reaction control again you can obtain an increase to the point where the oscillation occurs. But owing to the overlap, or backlash as it is called, you find you have to try three or four times before you can get the reaction control to the exact point where signals are at maximum and oscillation or howling does not set in.

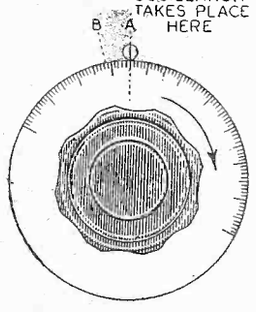


Fig. 1.—Reaction backlash is shown by an overlap of the control. Oscillation should cease at the same point as that at which it commences.

Threshold Howl

This overlap is indicated in Fig. 1, where the point of oscillation on an imaginary dial is indicated and the point to which the control has to be turned to stop oscillation is also shown. The ideal condition is that where the same movement of the control is needed to take the set out of oscillation as is needed to take it into oscillation. This can be accomplished quite easily. Before dealing with the effects and the cure, however, there is another trouble which is often experienced in a reaction circuit, and that is where as soon as the set has broken into oscillation as already mentioned a high-pitched howl also sets in, and cannot be stopped until the set has been taken out of oscillation. This, from the fact that you are trying to work on the "threshold of oscillation," and that a howl is set up, gives rise to the term "threshold howl," and also is fairly easily cured.

Detector Anode Circuit

To understand fully the causes of the two effects just described, let us look at the anode circuit of the detector valve. There will usually be an H.F. choke connected direct to the anode, and then, between the low-potential end of the choke and the H.T. supply there will be a pair of 'phones, a transformer primary or a resistance—dependent upon the type of receiver in use. Across the choke and the anode component, whatever it may be, there will be a voltage drop, dependent upon the anode current of the valve. If, now, you include a milliammeter in the anode circuit of a valve which is provided with a reaction control, you will see that with no reaction there will be a steady anode current reading dependent upon the H.T. voltage and the particular characteristics of the valve. If, now, the reaction control is set hard over, so that the valve oscillates, you will find that the anode current reading has fallen. This is, in fact, the method of testing for oscillation, as by earthing the grid of the valve, by touching it with the finger, the oscillation will cease and the meter needle will rise to the original reading, or a point very near it. Now from standard electric formulæ we know that the voltage drop across a resistance is dependent upon the current flowing through it, and the greater the current, the greater the voltage drop, or the difference in potential between the ends of the resistance.

From this it will therefore be obvious that under certain conditions there will be a given anode voltage applied to the detector valve, but as reaction is advanced and the valve passes into an oscillating condition, the actual voltage applied to the anode will vary, the H.T. voltage *increasing* as reaction increases, due to the lowered anode current and the consequent reduced voltage drop across the anode load. There is thus a double effect on the valve. Whilst you are increasing the coupling between the anode and grid—or, in other words, increasing reaction—the H.T. is automatically increasing and the two combine to produce the sudden bursting into oscillation already referred to. Turning back the reaction control does not reduce the oscillation until a large adjustment has been made, as it has no effect on the H.T. whilst the oscillation is taking place, and thus a relatively large movement is necessary to produce stability, and this is at a point beyond that at which the set went into oscillation.

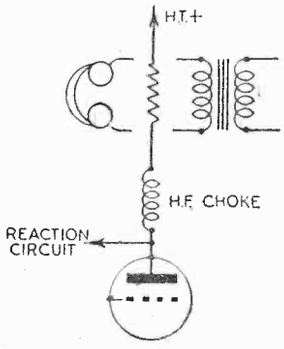


Fig. 2.—Typical anode circuit indicating the components which are found there. This explains the reasons for threshold howl.

Cures

The threshold howl is due to the fact that when the valve bursts into oscillation a momentary change in anode current takes place and this stops the oscillation, but the reaction control is in such a position that the change in the H.T. voltage due to the cessation of oscillation again causes a condition of oscillation, which just as quickly ceases again. This oscillation and stopping takes place fairly rapidly and produces the howl already referred to. It is obvious from these remarks that the first and most important factor to be watched is the H.T. voltage applied to the anode. This must be of such a value that the changes which take place due to the oscillation have the least effect. The voltage varies according to the valve, and tests may have to be carried out to find the best working voltage, although the valve-makers usually give the necessary value on their data sheets. Next, the value of the grid leak and condenser must be so selected that the working point on the curve of the valve also takes up a position where the effects just mentioned are at a minimum. Thus, there are three essential points to be watched—H.T., value of grid leak, and grid condenser. A little experiment should enable suitable values to be found where, with the particular valve in use, the valve goes smoothly into oscillation and just as smoothly slides out.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 23.

INTERNATIONAL "Q" CODE

Abbrev.	Question	Answer for Advice
QRA	What is the name of your station ? ...	The name of my station is . . .
QRB	How far approximately are you from my station ?	The approximate distance is . . . miles
QRD	Where are you bound and where are you from ?	I am bound for . . . from . . . .
QRG	Will you tell me my exact frequency in kilocycles ? ...	Your exact frequency is . . . kc
QRH	Does my frequency vary ?	Your frequency varies.
QRI	Is my note good ? ...	Your note varies.
QRJ	Do you receive me badly ?	I cannot receive you.
	Are my signals weak ?	Your signals are too weak.
QRK	Do you receive me well ?	I receive you well.
	Are my signals good ?	Your signals are good.
QRL	Are you busy ? ...	I am busy. Please do not interfere.
QRM	Are you being interfered with ? ...	I am being interfered with.
QRN	Are you troubled by atmospherics ? ...	I am troubled by atmospherics.
QRO	Shall I increase power ?	Increase power.
QRP	Shall I decrease power ?	Decrease power.
QRQ	Shall I send faster ?	Send faster (. . . words per minute).
QRS	Shall I send more slowly ?	Send more slowly (. . . words per minute).
QRT	Shall I stop sending ?	Stop sending.
QRU	Have you anything for me ?	I have nothing for you.

No. 24.

INTERNATIONAL "Q" CODE

Abbrev.	Question	Answer for Advice
QRV	Are you ready ? ...	I am ready.
QRX	Shall I wait ? When will you call me again ?	Wait (or wait until I have finished communicating with . . .) I will call you at . . . GMT.
QRZ	Who is calling me ?	You are being called by . . . .
QSA	What is the strength of my signals ? (1 to 5)	The strength of your signals is . . . (1 to 5).
QSB	Does the strength of my signals vary ?	The strength of your signals varies.
QSD	Is my keying correct? Are my signals distinct ?	Your keying is indistinct. Your signals are bad.
QSL	Can you give me acknowledgment of receipt ? ...	I give you acknowledgment of receipt.
QSM	Shall I repeat the last telegram (message) I sent you ? ...	Repeat the last telegram (message) you have sent me.
QSO	Can you communicate with . . . direct (or through the medium of . . .) ? ...	I can communicate with . . . direct or through the medium of . . .).
QSP	Will you retransmit to . . . ?	I will retransmit to . . .
QSV	Shall I send a series of V's ?	Send a series of V's.
QSX	Will you listen for . . . (call sign) on . . . kc ?	I am listening for . . . (call sign) on . . . kc.
QSZ	Shall I send each word or group twice ? ...	Send each word or group twice.
QTH	What is your position in latitude and longitude ?... ...	My position is . . . latitude . . . longitude.
QTR	What is the exact time ?	The exact time is . . .

No. 25.

MISCELLANEOUS INTERNATIONAL ABBREVIATIONS

Abbrev.	*Meaning*	*Abbrev.*	*Meaning*
C	... Yes	GA	... Resume sending
N	... No	MN	... Minute/minutes
W	... Word	NW	... I resume transmission
AA	... All after		
AB	... All before	OK	... Agreed
AL	... All that has just been sent	UA	... Are we agreed ?
		WA	... Word after . . .
BN	... All between	WB	... Word before . . .
CL	... I am closing my station	XS	... Atmospherics

AMATEUR ABBREVIATIONS

Abbrev.	*Meaning*	*Abbrev.*	*Meaning*
ABT	... About	FM	... From
AGN	... Again	GA	... Go ahead, or Good afternoon
ANI	.. Any		
BA	... Buffer amplifier	GB	... Good-bye
BCL	... Broadcast listener	GE	... Good evening
BD	... Bad	GM	... Good morning
BI	... By	GN	... Good night
BK	... Break in	HAM	... Radio amateur
BN	... Been	HI	... Laughter
CK	... Check	HR	... Hear, or here
CKT	... Circuit	HRD	... Heard
CLD	... Called	HV	... Have
CO	... Crystal oscillator	LTR	... Later
CUD	... Could	MILS	... Milliamperes
CUL	... See you later	MO	... Mater Oscillator
DX	... Long distance	ND	... Nothing doing
ECO	... Electron-coupled oscillator	NIL	... Nothing
		NM	... No more
ES	... And	NR	... Number
FB	... Fine business (good work)	NW	... Now
		OB	... Old boy
FD	... Frequency doubler	OM	... Old Man
OT	... Old timer	TNX	... Thanks
PA	... Power amplifier	TPTG	... Tuned plate tuned grid
PSE	... Please		
R	... Received all sent	TX	... Transmitter
RAC	... Rectified A.C.	U	... You
RCD	... Received	UR	... You are
RX	... Receiver	VY	... Very
SA	... Say	WDS	... Words
SED	... Said	WKG	... Working
SIGS	... Signals	WL	... Will
SIGN	... Signature	WUD	... Would
SSS	... Single Signal superheterodyne receiver	WX	... Weather
		YF	... Wife
		YL	... Young lady
SKD	... Schedule	YR	... Your
TKS	... Thanks	73	... Kind regards
TMN	... To-morrow	88	... Love and kisses

No. 26.

QSA CODE (Signal Strength)

QSA1 .. Hardly perceptible; unreadable.
QSA2 .. Weak, readable now and then.
QSA3 .. Fairly good; readable, but with difficulty.
QSA4 .. Good; readable.
QSA5 .. Very good; perfectly readable.

QRK CODE (Audibility)

R1 .. Faint signals; just readable.
R2 .. Weak signals; barely readable.
R3 .. Weak signals; but can be copied.
R4 .. Fair signals; easily readable.
R5 .. Moderately strong signals.
R6 .. Good signals.
R7 .. Good strong signals.
R8 .. Very strong signals.
R9 .. Extremely strong signals.

RST CODE (Readability)

1 .. Unreadable.
2 .. Barely readable, occasional words distinguishable.
3 .. Readable with considerable difficulty.
4 .. Readable with practically no difficulty.
5 .. Perfectly readable.

(Signal Strength)

1 .. Faint, signals barely perceptible.
2 .. Very weak signals.
3 .. Weak signals.
4 .. Fair signals.
5 .. Fairly good signals.
6 .. Good signals.
7 .. Moderately strong signals.
8 .. Strong signals.
9 .. Extremely strong signals.

(Tone)

1 .. Extremely rough hissing note.
2 .. Very rough A.C. note, no trace of musicality.
3 .. Rough, low-pitched A.C. note, slightly musical.
4 .. Rather rough A.C. note, moderately musical.
5 .. Musically modulated note.
6 .. Modulated note, slight trace of whistle.
7 .. Near D.C. note, smooth ripple.
8 .. Good D.C. note, just a trace of ripple.
9 .. Purest D.C. note.

(If the note appears to be crystal-controlled add an X after the appropriate number).

No. 27.

INTERNATIONAL MORSE CODE.

A	dit dah	· –
B	dah dit dit dit	– · · ·
C	dah dit dah dit	– · – ·
D	dah dit dit	– · ·
E	dit	·
F	dit dit dah dit	· · – ·
G	dah dah dit	– – ·
H	dit dit dit dit	· · · ·
I	dit dit	· ·
J	dit dah dah dah	· – – –
K	dah dit dah	– · –
L	dit dah dit dit	· – · ·
M	dah dah	– –
N	dah dit	– ·
O	dah dah dah	– – –
P	dit dah dah dit	· – – ·
Q	dah dah dit dah	– – · –
R	dit dah dit	· – ·
S	dit dit dit	· · ·
T	dah	–
U	dit dit dah	· · –
V	dit dit dit dah	· · · –
W	dit dah dah	· – –
X	dah dit dit dah	– · · –
Y	dah dit dah dah	– · – –
Z	dah dah dit dit	– – · ·

Number Code

1	dit dah dah dah dah	· – – – –
2	dit dit dah dah dah	· · – – –
3	dit dit dit dah dah	· · · – –
4	dit dit dit dit dah	· · · · –
5	dit dit dit dit dit	· · · · ·
6	dah dit dit dit dit	– · · · ·
7	dah dah dit dit dit	– – · · ·
8	dah dah dah dit dit	– – – · ·
9	dah dah dah dah dit	– – – – ·
0	dah dah dah dah dah	– – – – –

Note of interrogation	dit dit dah dah dit dit	· · – – · ·
Note of exclamation	dah dah dit dit dah dah	– – · · – –
Apostrophe	dit dah dah dah dah dit	· – – – – ·
Hyphen	dah dit dit dit dit dah	– · · · · –
Fractional bar	dah dit dit dah dit	– · · – ·
Brackets	dah dit dah dah dit dah	– · – – · –
Inverted commas	dit dah dit dit dah dit	· – · · – ·
Underline	dit dit dah dah dit dah	· · – – · –
Prelim. call	dah dit dah dit dah	– · – · –
Break sign	dah dit dit dit dah	– · · · –
End message	dit dah dit dah dit	· – · – ·
Error	dit dit dit dit dit dit dit dit	· · · · · · · ·

No. 28.

INTERNATIONAL AMATEUR CALL-SIGNS

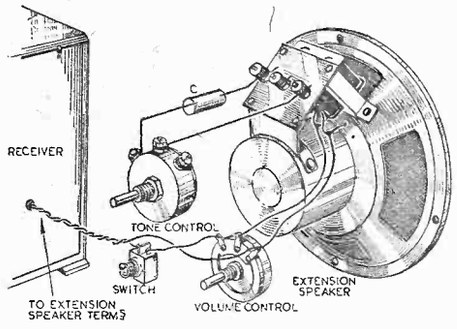
AC4	Tibet	FU	French New Hebrides
AR	Syria	FY	Guyane (French Guiana)
CE	Chile		
CM	Cuba	G	British Isles (G-England ; GM-Scotland ; GW-Wales)
CN1	Tangier Zon.		
CN8	Morocco		
CO	Cuba (fone)		
CP	Bolivia	GI	North Ireland
CR4	Cape Verde Islands	HA	Hungary
CR5	Portuguese Guinea	HB	Switzerland
CR6	Angola	HC	Ecuador
CR7	Mozambique	HH	Haiti
CR8	Portuguese India	HI	Dominican Republic
CR9	Macao		
CR10	Timor	HK	Colombia
CT1	Portugal	HP	Republic of Panama
CT2	Azores		
CT3	Madeira Island	HR	Honduras
CX	Uruguay	HS	Siam
D	Germany	HZ	Hedjaz
EA	Spain	I	Italy
EA6	Balearic Islands	J	Japan
EA8	Canary Islands	J8	Chosen (Korea)
EA9	Spanish Morocco	J9	Formosa
EI	Irish Free State	K4	Virgin Islands
EL	Liberia	K5	Canal Zone
EP	Iran (Persia)	K6	Hawaii
EQ	Iran (Persia)	K6	Guam
ES	Estonia	K6	Samoa
ET	Ethiopia (Abyssinia)	K6	Midway and Wake Islands
F	France	K7	Alaska
FA	Algeria	KA	Philippines
FB	Madagascar	LA	Norway
FD	French Togoland	LU	Argentina
FE	French Cameroons	LX	Luxembourg
FF	French West Africa	LY	Lithuania
FG	Guadeloupe	LZ	Bulgaria
FI	French Indo-China	MX	Manchukuo
FK	New Caledonia	NY	Canal Zone
FL	French Somaliland	OA	Peru
FM	Martinique	OE	Austria
FN	French India	OH	Finland
FO	French Oceania	OK	Czechoslovakia
FP	St. Pierre and Miquelon	OM	Guam
		ON	Belgium
FQ	French Equatorial Africa	OQ5	Belgian Congo
		OX	Greenland
FR	Reunion Island	OY	Faroe Islands
FT	Tunisia	OZ	Denmark

Practical Hints

Speaker Volume Control

DURING my experiments I found the necessity for a tone control, volume control, and switch on each low-impedance extension speaker, so I connected them as in the diagram below.

I have not seen low-impedance speakers



A volume control arrangement for an extension speaker.

connected like this, and I believe it is original. The volume control can be varied according to the impedance of the speech coil.—R. JOHNSON (Yatesbury).

Adjustable Nut Tweezers

ONE of the troubles that I find particularly annoying when "doctoring" a wireless chassis is that when replacing a component on the chassis after testing, bolts are sure to slip and fall on to the chassis, so that it either has to be turned upside down or the missing bolts have to be fished for with a pair of long-nosed pliers, which, owing to their breadth, cannot always be used in the limited space in a wireless chassis.

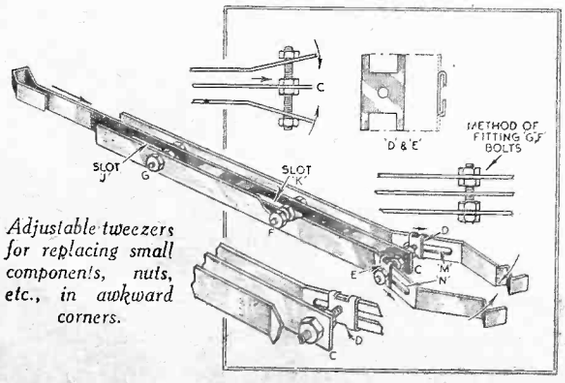
I decided to cure this trouble and have evolved an instrument of reasonable efficiency, the design of which I enclose.

The instrument itself should be constructed of some fairly thick metal which has some degree of springiness. The two pieces of metal marked D and E are of thin tin, and are bent over the strips, so as to form sliding collars.

The size of the holes drilled depends on the size of the threaded bar used, so is not marked in sketch.

The width between the jaws is controlled by the middle bar, which is moved backwards and forwards between the two outer bars. The distance between the two pairs of bolts at F and G, which keep the two outer bars rigidly connected, should be just enough to allow the middle bar to slide smoothly. The longest of the three bars at the extreme end of the strip C should be about an inch long and should be rigidly connected at the middle to the strip C, while the ends should be passed through the bolt holes in the tin collars and anchored outside by bolts, the loosening and tightening of which controls the width between the jaws.

The best way of making the inch-long slots at J, K, M, and N is to drill a row of holes close together after which the burr should be filed down.—J. R. WOOD (Aberdeen).



Adjustable tweezers for replacing small components, nuts, etc., in awkward corners.

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SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.

A Station Indicating Extension Speaker System

HAVING built a new radiogram, using the original receiver chassis only, it occurred to me that it would be well worth while converting the original receiver cabinet into a self-indicating extension speaker, retaining the original appearance by keeping the control knobs as they were.

To carry out this idea properly, I decided that some sort of remote control scheme was necessary with regard to the station indicating lights, this being effected by simply attaching an extension shaft to the receiver tuning condenser, a simple ebonite cam and contact assembly being incorporated on this shaft.

A separate switch was fitted to the receiver to interrupt the extension lighting arrangement, and in view of the short leads between the receiver and the extension speaker, very little voltage drop occurred through the resistance of the flex, the leads being taken through the skirting boards and wall, as is depicted in the inset drawing.

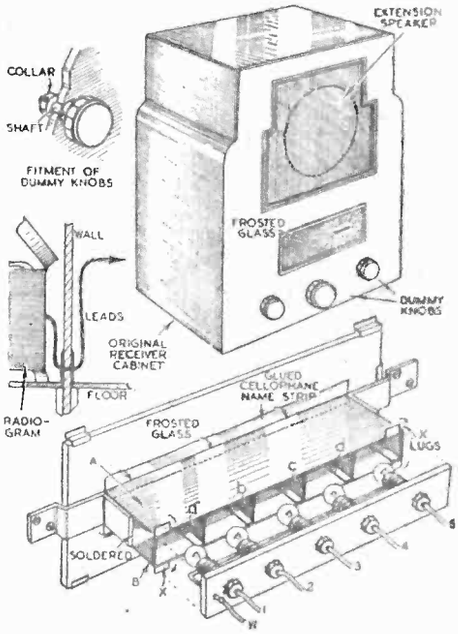
The diagrammatical illustration shows the method I adopted for the station indicating lights in the extension speaker cabinet, and the following is briefly the way it is constructed.

The housing for the bulbs comprises two tin strips "A" and "B," these having been bent to form a box when soldered together. Into this box I soldered four separating pieces of tin, as indicated by a, b, c and d.

An ebonite strip provides the mount for the five bulbs which, by the way, are 2 volt .06a type: this ebonite strip is finally secured to the housing by bending over the tin lugs provided, and indicated by "X."

Each bulb holder is fitted with a 6BA screw nut and shakeproof washer, the connections 1-5 being made by soldering, whilst a common contact "W" is made by soldering a length of heavy gauge copper wire across all holders. The housing is secured to the inside of the cabinet by two brass angle strips, these being soldered to the housing, as shown.

The knobs are rendered dummy by using short lengths of ¼in. brass rod, brass



A novel method of station indication for an extension speaker system.

collars securing these internally, as illustrated. The use of thick frosted glass gives a really attractive appearance, enhanced by the station lighting, the names of the stations being printed in indian ink on a Cellophane strip, as depicted.—J. L. HARBURN (Loughton).

FURTHER STEPS T

A New Receiver Using Direct C

IT is refreshing to note that in war-time a deep interest is still being taken in high-quality reproduction, and that designers are paying careful attention to both the amplifier and the loudspeaker.

The object of this article is to call attention to a simple yet effective method of coupling low-frequency valves with a view to attaining a really high standard of reproduction. For gramophone work I do not think it can be excelled, but it especially commends itself to those who wish to obtain the best possible results from the B.B.C. Home Service transmissions.

Before describing the amplifier, I feel it necessary to say a word on the subject of linear rectification of radio signals. The diode is still very popular with high-quality enthusiasts, but there are numbers of listeners who are unable to load the diode sufficiently; that is, the signal input is not enough to ensure linear rectification even with the assistance of a stage of high-frequency amplification. If the high-frequency amplifier is developed beyond a certain point of efficiency, distortion is inevitable. The leaky-grid detector is sensitive but is easily overloaded, while anode-bend detection introduces its own form of distortion. The negative feed-back detector requires skilful design and complicates the circuit unduly. What is left? There is the crystal, to which many of us are still attached; but the crystal does not like a big input, and we may very easily fall between two stools, with the crystal on the one hand overloaded and the diode on the other hand underloaded, if we try one or the other. A complete solution of the problem occurred to me about a year ago, and this was to employ *both* crystal and diode together *in series*. What could be simpler? It is almost impossible to overload this combination, and a small signal input does not produce distortion. I have accordingly adopted this method of detection in the receiver under consideration.

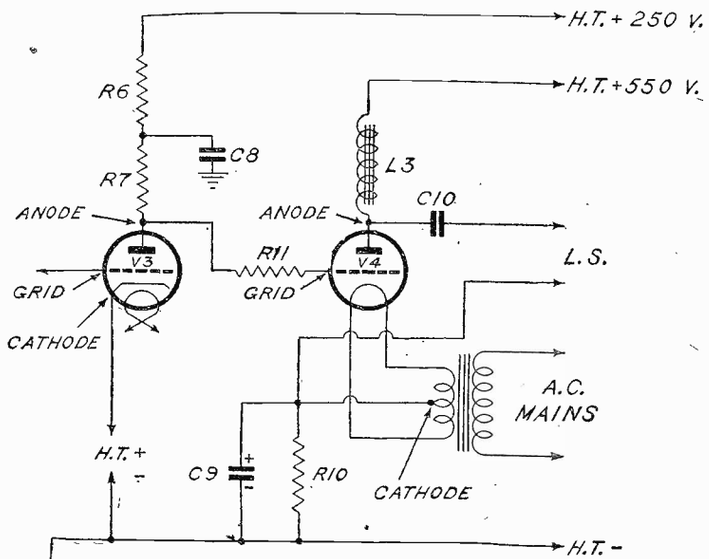


Fig. 1.—The last two stages of the amplifier described in this article.

L.F. Coupling

The most generally used methods of coupling low-frequency valves are transformer and resistance-capacity coupling. In these methods the anode of the valve is coupled to the grid of the next valve through a core in the case of the transformer or through a condenser in the case of resistance coupling. In the latter case it is not possible to get the best results except by push-pulling each stage thus coupled, as probably most readers are aware. Many amateur constructors hesitate to build such an amplifier because of the difficulties involved. But even better results are obtainable if a suitable form of what is called "direct coupling" is employed. In this method of coupling the anode of the valve is directly connected to the grid of the following valve, so that the voltage applied to the anode of the first valve is the same as that applied to the grid of the second valve. Since the grid of the latter valve has to be kept negative in respect of the cathode, it is necessary to apply a positive voltage to the cathode. Thus direct coupling is a method by which the potentials of anode, grid and cathode are carefully balanced or proportioned to enable the valve to function as a low-frequency amplifier. In order to accomplish this it is usual to employ a potential voltage divider or a number of potentiometers connected in series, and to tap off the required voltages for each electrode. The maximum voltage may be anything from 400 to 2,000. The only resistances employed are those required for the anode circuits of the amplifier. It is obvious that such a system of coupling is beyond the resources of the average amateur, and I have worked out a simpler method which I hope will prove attractive to readers. The advantages derived from the direct method are (1) the elimination of the coupling condenser; (2) absence of the "time constant factor"; (3) response to a very wide range of frequencies; (4) faithful reproduction of transients; (5) a straight-line response characteristic; (6) absence of harmonic distortion, and (7) simplicity of design.

Disadvantages

It is only fair, however, to mention the disadvantages from the constructional point of view. It is necessary to employ a high-voltage output stage; and the circuit will naturally make a more direct appeal to those who happen to possess an output valve of the PX25 class, or who obtain a permit for acquiring one. The second disadvantage is the necessity of using indirectly-heated A.C. valves in the early stages of the amplifier, so that only those who have access to electric light mains supply can avail themselves of this method of coupling. It is also most desirable to have a separate high-tension source for the output stage, and this means employing two eliminators as indicated in the diagram. The first two valves of the amplifier have their anodes supplied from a small high-tension eliminator giving a maximum output of 250 volts, and this eliminator can also be used for supplying the voltage to the high-frequency stage where such exists. For this purpose a Westinghouse metal rectifier type H.T.15 is quite satisfactory. The output valve requires an anode voltage of at least 360, after deducting the voltage dropped through the auto-bias resistor and the output choke. There must be quite a number of amateur constructors who already employ a similar output stage, and these will only be asked to make a few simple alterations.

Having stated the disadvantages thus early, I now feel less compunction in describing the main features of the circuit. Let us take a look at the diagram in Fig. 1. This shows the last two stages of the amplifier, represented by V3 and V4. When working out the direct coupled circuit it is necessary to plan from the output stage backwards. We will suppose that from a high-tension source of 250 volts a voltage of 130 is dropped through the resistances R6 and R7. It then follows that 120 volts are applied to the anode of V3. If we connect the anode of V3 to the grid of V4 (ignoring the grid-stopper R11 for the moment), then a positive voltage of 120 is applied to the grid of V4. It will now be necessary to make the grid of V4 negative in respect of its cathode, in other words, to bias the valve sufficiently to enable it to function on its straight line characteristic. This is done by applying to its cathode a positive voltage in excess of the positive grid voltage. If we apply approximately 150 volts to the cathode we shall achieve our object, and the simplest way to do this is to insert an auto-bias resistor R10 in the cathode circuit of V4 in the usual manner. The value of R10 must, however, be much larger than that

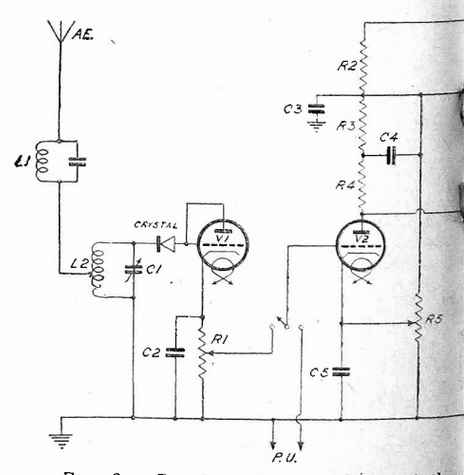


Fig. 2.—Complete circuit diagram of the system

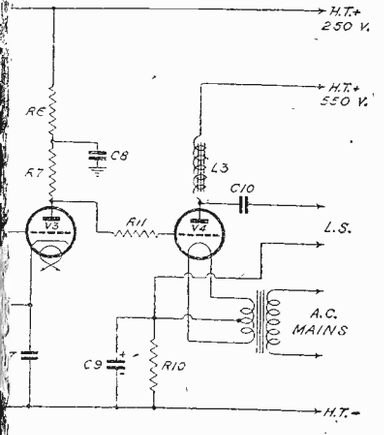
HIGH QUALITY

ling. By N. A. B. Hunt

selected in an orthodox resistance-coupled circuit, otherwise we shall not get the positive voltage required. Assuming that a voltage of 360 is applied to the anode of V4 and a current of 50 milliamperes is passed, then a bias resistance of 3,000 ohms will be found to provide the desired voltage for the cathode. The valve, which is a PX25, or its equivalent, will have a negative grid-bias of 30 volts. It must, however, be borne in mind that these values are calculated without the imposition of any signal from a transmitting station. As soon as a signal is applied the anode current of V4 is increased according to the field-strength of the transmitter. This need not worry us, as the other values alter themselves in due proportion, so that the valve is still working on its correct characteristic curve provided the signal is not so great as to overload it.

Input Stages

Let us now turn our attention to the stages represented by V2 and V3 (see Fig. 2). A valve of the small power class will be found suitable for V2, such as AC/P or ML4. For V3 a valve of the MHL4 type is recommended. The amplifier works very satisfactorily if a voltage of approximately 25 is applied to the anode of V2 and a voltage of approximately 120 is applied to the anode of V3. If these voltages are altered they must be altered in proportion and the output valve (V4) must also be biased accordingly. In order to apply 25 volts to the anode of V2 we have to drop 225 volts from the 250 volts supplied by the eliminator. To get the best results it is necessary to use anode resistances of high value in each stage, and the value of R4 and R7 will therefore be a quarter megohm. The current passed on the anode of each valve has to be very low, only a fraction of a milliampere. If a current of 0.32 milliampere is passed on the anode of V2 and 0.34 on the anode of V3, then we must calculate the values of the dropping resistances accordingly. The value of R2 may be 150,000 ohms, and that of R6 100,000 ohms. The anode of V3 will then have a voltage applied to it of approximately 120 at 0.34 milliampere, assuming the valve is correctly biased. In order to drop the required 225 volts on the anode of V2 a further resistance (employed for de-coupling) of a quarter megohm must be added to the network, namely R3. The condensers C3, C4, C6, C8 are all by-pass condensers of 2 microfarad capacity. The anode of V2 is connected to the grid of V3. The biasing of these two valves must not be effected by the usual auto-bias resistor with high capacity shunt to preserve the lower frequencies. Electrolytic condensers are not suitable for direct coupling, as, when the current is switched on, the condensers are temporarily short-circuited and take an appreciable time to settle down. Nor is the result satisfactory even when they are doing their work. It is far better to apply a positive voltage to the cathode of each valve by means of a potentiometer connected to the high-tension line. R5 and R8 are 50,000 ohm potentiometers, their sliders being taken to the cathodes of V2 and V3 respectively and each by-passed to earth through the condensers C5 and C7, which need not be more than 0.1 microfarad. The upper end of R5 is connected to the junction point of R2, R3; while the upper end of R8 is also connected to this point through the resistance R9, which is a quarter megohm. The bottom ends of the potentiometers are connected to earth and high tension negative.



...m section using the direct-coupling

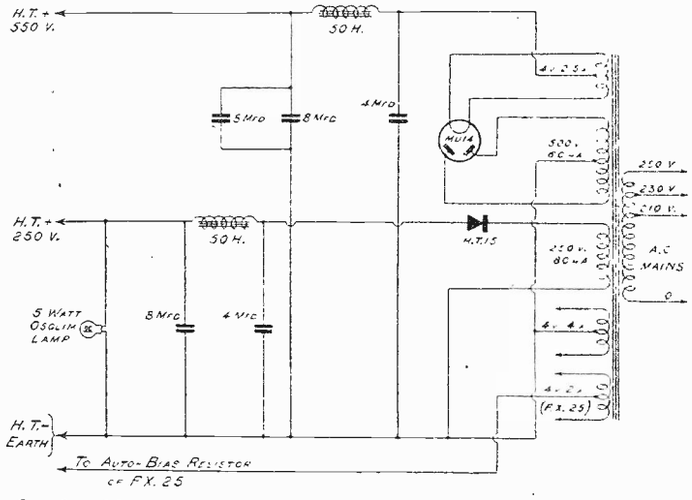


Fig. 3.—Mains section of the receiver, showing the separate H.T. feeds.

The sliders of R5 and R8 must be adjusted to settings that enable the milliammeter in the anode circuit of V2 to read a current of 0.11 milliampere, and in the anode circuit of V3 to read a current of 0.34 milliampere. The positive voltage applied to the cathode of V2 is of the order of two, and that to the cathode of V3 is approximately 35. Without the help of these two meters it will not be so easy to set the two sliders, though, of course, it is possible to form a passable judgment by aural results, and by the reasonable steadiness of the output meter needle when signals are applied.

If a Westinghouse rectifier, such as the H.T.15, is used for the smaller eliminator, it will be necessary to shunt an Osglim pilot five watt lamp across the output of this eliminator as shown in the diagram, Fig. 3, as otherwise the current drawn will be insufficient, even if a stage of high frequency is added, the rule being that a metal rectifier should not give less than a quarter of the full rated output. The total current consumed by the valves V2 and V3 is only about 0.66 milliampere. The actual *reading* of the milliammeter in the anode circuit of V2 is 0.11, but the current passed through the network R2, R8, R9 has to be added to this; so that the actual current passed is 0.32 mA.

Stability

With further reference to the output stage, I would suggest that the choke L3 should have a higher inductance than that usually adopted. Instead of the normal 20-henry inductance it is advisable to choose an inductance of 70 henries at 60 milliamperes. This will have a D.C. resistance of approximately 650 ohms. It is also a good plan to add in series with this, i.e., between the high tension positive and the output choke, a de-coupling choke of 20 henries by-passed to earth by a 4 microfarad condenser. I have not included the latter components in the circuit diagram of Fig. 2, as it is not essential to the working of the amplifier: in fact, one may regard the de-coupling choke as a refinement. If the large eliminator is designed to give a maximum output of 550 volts, there will be sufficient high tension voltage for the two chokes in series and the bias resistor between them to drop about 180 volts and leave 360 volts on the plate of the PX25 valve. Another important point is the omission of a large capacity shunt condenser across the bias resistor R10. If the loudspeaker lead is connected to the cathode (or centre tap of the heater) instead of to earth, there can be attenuation at low frequencies even if no condenser is placed there. The frequency response is linear using a plain bias resistance. A small capacity shunt is, however, desirable

(*Continued on page 14*)

LIST OF COMPONENT VALUES

Resistances:	R1, 0.5 megohm R2, 150,000 ohms. R3, R4, R7, R9, 0.25 megohm. R5, R8, 50,000 ohms. R6, 100,000 ohms. R10, 3,000 ohms (50 watts). R11, 5,000 ohms.
Condensers:	C1, 0.0005 mfd. (variable). C2, 0.0001 mfd. C3, C4, C6, C8, 2 mfd. (250 volt working). C5, C7, C9, 0.1 mfd. (non inductive) or two 32 mfd. (320 volt type) in parallel. C10, 4 to 8 mfd. (500 volt working).
Valves:	V1 (diode), any A.C. valve, e.g., MHL4; V2, AC/P or ML4; V3, MHL4 or 41MP; V4, PX25 or DO24 or PP4/500.

PRACTICAL TELEVISION

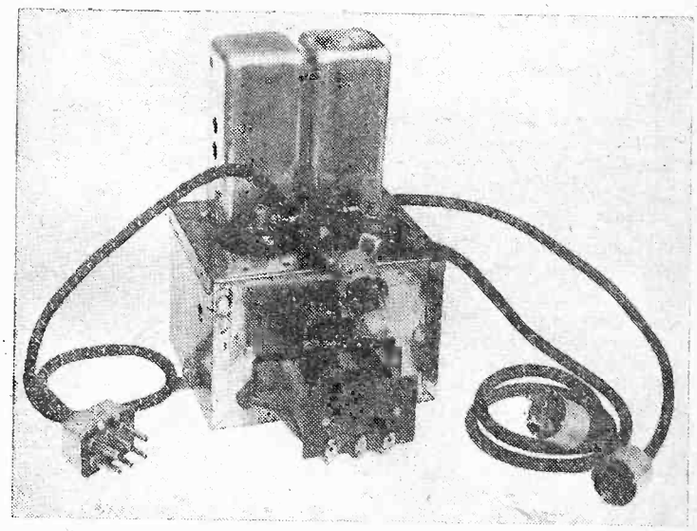
March 16th, 1940. Vol. 5. No. 194.

Caption Scanning

IN every television service which provides high-definition television pictures for radiation into the home, the necessity for some form of caption scanner will be immediately apparent. The visual announcement of items, names of artists and so on are frequently interspersed with the words spoken by the announcer, so as to add variety to the mode of presentation, and the equipment necessary for such a purpose as this can take a variety of forms. In the low-definition television days, Broadcasting House had its simple caption scanner built up from equipment resembling very much a mirror drum receiver. The beam of light from a small projection lamp was directed against the mirrors of the revolving drum and then focused on to the caption drawn in rough detail, because of the 30-line picture dissection, and the light reflected from the moving spot area, as it traced rapidly over the caption, was reflected on to photo-electric cells to generate the required television signal. A similar spot-light method has been used very successfully for high-definition working but the mechanical system has been replaced by a projection type of cathode-ray tube. This tube can be the straight through projection type, where the light area of the fluorescent screen formed by the impact of the beams of electrons is projected right through the screen and focused on to the caption cards or solid objects. A pair of photo-electric cells "collects" the reflected light or if a transparency is being televised, then a single cell placed behind serves as the light signal convertor. As an alternative to this, the cathode-ray tube can take the indirect form, where the screen is an opaque fluorescent coating mounted inside the glass envelope at an angle to the scanning beam. In this case a correction has to be applied electrically to overcome any trapezoidal scanning or focusing distortion.

Special Cells

UNDER service practical conditions the caption scanner of this form, comprising cathode-ray tube, power supplies, first stage amplifiers, scanning and focusing circuits, object platform and photo-electric cells, can be built into a single rack, or if preferred, into smaller interconnection units when transport from place to place becomes necessary. To obtain the best results from this apparatus it is essential to employ specially sensitive photo-electric cells, which have a mush or noise level very low in comparison with the main vision signal generated by the cells and scanning equipment. Then, again, it is advantageous to make these cells sensitive to the particular colour of the scanning spot, as this improves the efficiency of the combination. In some cases, it is found better to make up a caption scanner from an image dissector tube, but this is only applicable to transparencies and cannot handle the variety of subjects undertaken with the modern spotlight scanner. The keen experimenter will find an outlet for his capabilities if he applies his skill to building up his own caption scanner for transparencies, using the standard form of relatively small diameter cathode-ray tube. For home use, small interconnected units are naturally to be preferred, and some time ago apparatus of this character was described in detail in these columns. It is as well to remember that with this home-built equipment, in addition to transparencies such as films or lantern slides, relatively flat solid objects can be held in position against the face of the transmitter cathode-ray tube, and they will then appear as shadowgraphs on the receiver screen. Useful experimental information covering a very wide field can be derived from apparatus set up in this way, and although very elaborate equipment would naturally prove somewhat costly, the home constructor need not be put to much outlay if he uses components or power units already in his possession. In laying out the apparatus in units, it is necessary to avoid the possibility of stray electric or magnetic fields upsetting the regular formation of the scanning fields on the cathode-ray tubes. Furthermore, the photo-electric cell and amplifier must be accommodated in a metal screened case and a reliable earthing system employed to remove any traces of hum that would otherwise be apparent on the screens if due care was not taken.



A neat pre-amplifier unit for extending the range of reception of a television receiver.

The "T" and "B" Problems

THE increased use of the iconoscope form of television camera has brought into prominence once more the two terms "tilt" and "band," to which reference is so often made but the significance of which is frequently lost sight of by those endeavouring to understand the operation of the equipment at the transmitting end. The terms have come into common use as far as television engineers are concerned, but unless well versed in the intricacies of camera technique they fail to convey any real meaning to the lay mind. There is no doubt that the choice of such terms is unfortunate, but like many other radio terms that have become well established both in conversation and literature, there seems little opportunity at this juncture of remedying matters. These two terms came into use because of the graphical representation of certain inherent characteristics of the iconoscope. Due to certain defects, it is found that when a picture is being produced by this piece of electronic apparatus there is a gradual change of illumination from left to right which had no relation to the light and shade changes of the picture itself. The datum line of the illumination graph is therefore inclined or tilted in an upward direction. This has to be rectified at the transmitting end, and since the measure of tilt is not constant, the only reliable method of countering the defect is to electrically introduce a countering effect so as to keep this line horizontal and arrange for this degree of tilt nullification to be undertaken manually. It is quite a tricky operation and the engineer charged with this responsibility has to maintain a constant watch on the picture to ensure that his manipulation of the control is within the necessary limits. Another inherent defect in the same equipment is the fact that the illumination is greater or less in the middle of the picture than at the edges. A plotted characteristic will therefore show a concave or convex line, that is one with a bend in it, hence the significance of the term. The combination of the two is represented by a tilted, bent line and electrically this "bend" has to be countered by manual operation in just the same way as tilt. By a suitable combination of these controls it is possible to ensure that the general brightness of the picture is made uniform over the area of the picture. A failure to attend to these two features would tend to spoil the received picture very materially, and it is a good thing that the rectification of these two points is the onus of the transmitting engineers and not of the viewers, otherwise the receive controls would be complicated and continually need adjustment.

A RESISTANCE PROBLEM

SIR,—As the unfortunate possessor of a surname which Radio now associates with individuals of an inquisitive turn of mind, I cannot refrain from commenting on Dr. Fleming's article on "A Resistance Problem," which appeared in your February 17th issue, and which raises some interesting points.

It is not necessary to introduce determinants or even simultaneous equations to prove the example he gives.

As he states, the points a and b are, from symmetry, at equal potential. Likewise points b and f. Hence the current divides equally at the point A. Similarly the currents in the three branches at B are equal.

Also from these results, it follows that the potential drop across ae is equal to that across ac, hence the current also divides equally at point a. Similarly for the remaining points.

Thus assuming that the total current is 6i. the distribution is that shown above.

Considering the path AacB, the voltage drop is $2ir+ir+2ir=5ir$, and if R is the equivalent resistance of the frame, this $=6iR$, whence $R=5r/6$.

Another case besides those mentioned, of course, is the one where connections are made to opposite corners of the same face.

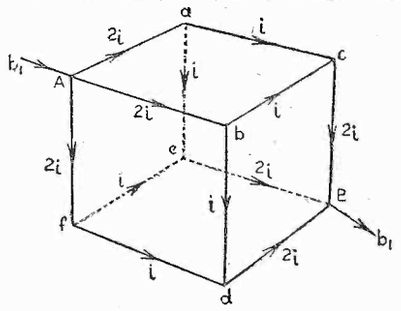
A more interesting problem arises where the cube has sides of sheet metal with points of current entry and exit at opposite, adjacent or alternate corners.

Or if this is found to be too easy, some readers may like to consider the case of a solid cube, particularly for adjacent corners.

As my radio namesake might well say, this last is "a fine old how-d'ye-do to bump into."—R. C. WALKER (Caversham).

* * * * *

MR. WALKER'S letter does not make any point against me. The problem of the resistance of a skeleton cube of unit wires between diagonal corners happens to be one in which the component resistances are symmetrically placed with respect to the diagonal line, and therefore the joint resistance can be found by the empirical method Mr. Walker uses. I gave a perfectly general method of dealing with problems in networks of conductors to the Physical Society of London in June, 1885, and it was published in the *Philosophical Magazine*, for September, 1885, or 55 years ago. I employed this method in solving the cube problem submitted to me. An empirical method, able to deal only with a few cases, is of no value compared with a mathematical method which is valid for all cases. Take, for instance, the problem of the Wheatstone's Bridge. Let Mr. Walker find an expression for the electric current through the bridge or galvanometer circuit when the resistances of the four arms of the bridge are P, Q, R, S ohms and the voltage in the Conjugate circuit is 1 volt.



Mr. Walker's arrangement of the resistance cube.

My method, as described in the Paper referred to, enables the expression for the bridge current to be written down at once as the quotient of two determinants and I doubt whether any empirical method will so easily solve this problem.—SIR AMBROSE FLEMING.

RADIO IN THE SERVICES

(*Continued from page 3*)

while the oscillator circuit is tuned to a frequency which is higher or lower than the signal frequency by a definite amount. As a result, the frequency of the received signal is changed to one equal to the difference between the input and oscillator frequencies. This is the intermediate frequency, and it is approximately 465 kc/s in most modern superhets. The I.F. amplifier is similar in all major respects to an H.F. amplifier, with the exception that it is pre-tuned.

If the loudspeaker was silent, despite the fact that the set was switched on, how could you tell whether the fault lay in the speaker or in the set itself?

With a battery-operated set, a rough check of the speaker could be made by disconnecting it and holding a lead from one of its terminals against the negative terminal of the L.T. accumulator, while the other lead was touched against the positive terminal. If the speaker was in working order a pronounced click would be heard as the contact was made, and again as it was broken. Absence of these clicks would point to a fault in the speaker, its built-in transformer or one of the connecting leads.

FURTHER STEPS TO HIGH QUALITY

(Continued from page 11)

for reasons of stability, and a 0.1 microfarad is quite satisfactory.

Should the constructor be troubled with mains hum—and some mains are more "noisy" than others—a complete cure can be effected in 99 cases out of a 100 by interposing between the mains and the eliminator input a step-down transformer with a screened primary, the screen being connected to earth. The anti-hum transformer has its primary winding connected to the mains. If, for instance, the voltage of the mains is 230 A.C., then the primary is wound to take this. The secondary is wound to step the 230 volts down to 210 volts, and the lower voltage is that supplied to the eliminator transformer primary. The voltage can, of course, be stepped up again as required and applied to the rectifier valve.

The transformers and chokes in my own amplifier and eliminator were made and supplied to me by Mr. N. Partridge, of King's Buildings, Dean Stanley Street, Westminster, S.W.1.

The detector, as already explained, consists of an ordinary crystal and a valve in series. Any A.C. valve can be used for the diode, the grid being strapped to the plate. The crystal can be omitted, or short-circuited by means of a switch, when it is desired to use the diode alone. The potentiometer R1 acts both as the output load and a volume control. Its value is half a megohm, and C2 is the usual high-frequency by-pass shunt of 0.0001 microfarad. L1 is a wave trap, which may be necessary in some districts. I can recommend the traps made by Messrs. Postlethwaite Bros., of Kinver, Staffs. The object of the trap is to cut out any one powerful interfering station by rejecting that particular wavelength. If "fading" is experienced, it is advisable to use an indoor aerial and a stage of high-frequency amplification. This, of course, is said with particular reference to existing conditions.

Provision has been made for the insertion of a gramophone pick-up in the grid of V2 by means of the usual change-over switch. A separate volume control must, of course, be employed for the pick-up.

In conclusion, I hope that at least some of my readers will be able to try out this amplifier. Its exceptional qualities will help to cheer the listener during black-out hours, and I venture to predict a new thrill for him.

IMPRESSIONS ON THE WAX

ONE of the most interesting records issued by the Decca Company this month is *Decca F* 7355. On to this single 10in. disc they have condensed the whole of "Runaway Love," the musical show that is now running at the Saville Theatre, London.

This record was actually recorded in the theatre and features the original artists—George Gee, Luanne Shaw, Eric Fawcett and Hal Gordon, ably abetted by Billy Mayerl and his Multitone Piano Orchestra. No fewer than seven tunes are included on the one record.

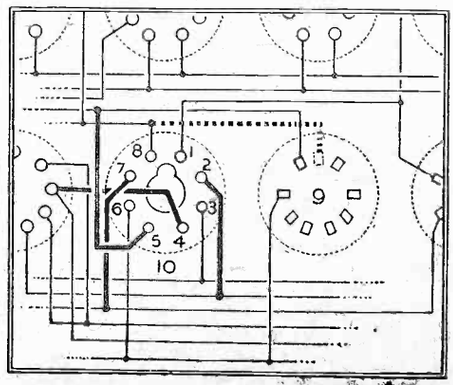
Irving Berlin Album

THE versatility of Paul Whiteman is well displayed in a new Brunswick album devoted to the music of Irving Berlin. The album has five records. The first is by the full orchestra, the second by his Swing Wing Group, the third by his Bouncing Brass, the fourth by his Sax Socktette and the fifth by his Swinging Strings. Thus each department of the orchestra becomes a band of its own. To pick out one side only sounds unfair; nevertheless, the large band record of "Alexander's Ragtime Band" is good. The Modernaires vocal quartet sing specially written words which tell the life story of the tune and by means of ingenious recording we hear the song as it was played in its youth—*Brunswick O* 2859-63.

Making a Valve-tester

IN our issue dated February 24th we published a wiring diagram for the valve panel of this valve-tester. Two small draughtsman's errors occur in the wiring of this, and will be found on the octal valve-holder and on the holder immediately to the right of it. There was an additional contact on this latter holder which should not be there, and this is indicated by the broken lines on the corrected diagram shown herewith. The octal valve base should be wired as shown also in this diagram.

The rest of the connections are correct, and although in one or two exceptional cases the filament sockets may not be those shown, these are so rare that the use of the separate panel would rectify the matter.—(F. D. L.).



Corrected diagram of part of the valve-tester.

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.*

CLAYESMORE RADIO CLUB

Hon. Sec.: A. W. G. Wilson, Clayesmore School, Iwerne Minster, Dorset.

VERY little constructional work has been done this term, as most of the members are now seniors, and are finding themselves with plenty of work of another kind on their hands. However, a S.G.-Det.-Pen. mains set has been built by Coxe, and although it has only, as yet, worked on gramo owing to the lack of a pair of coils, it should be working well shortly. The secretary has constructed a 3½-watt quality amplifier for use with microphone and gramophone.

Other members of the club and the secretary have gained valuable knowledge in power amplifier practice while operating the school cinema.

A 15-25 watt amplifier is to be put under construction shortly for Speech Day, next term. It should be finished shortly after Easter.

A REGULATED AERIAL

AN aerial is for most people a necessary inconvenience, a piece of any wire, thick or thin, connected anyhow to the set. When listeners found that modern sets could operate without aerial and even earth, and when the announcements of manufacturers told them that "this need had disappeared," they gave up all external aerials and earths. So the local and most powerful nearer stations come in because various stray wires act as an aerial; far distant reception, however, is very poor.

People with an indoor aerial or short outdoor aerials often have a lot of trouble with distant stations. It is, therefore, a good plan to "regulate" an inefficient aerial by means of a special filter, which will "lengthen" or "shorten" the aerial as needed. Usually the success of this little device is amazing, and the efficacy of the coil can easily be tested by turning the pointer of the rotary switch to different taps of the coil. There will always be a point where the volume of sound is absolutely sufficient with full rich bass and realistic preservation of the high notes. On short waves the efficacy is not so obvious, but the regulation of the aerial will always make the tuning in and the steadiness of reception somewhat easier.

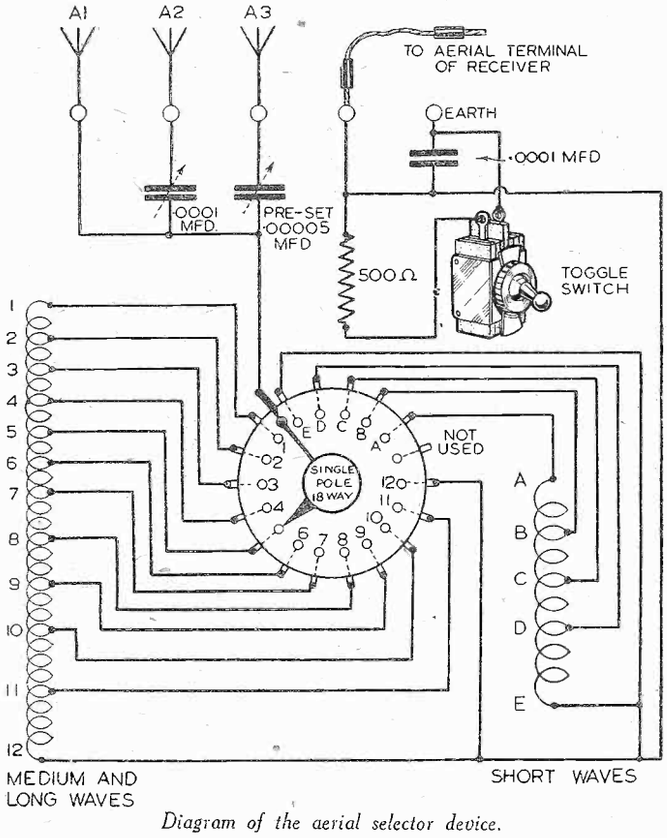


Diagram of the aerial selector device.

Constructional Details

The device is made up with a coil of about 300 turns of d.c.c. wire (29 s.w.g.), wound on a 2½in. former. The coil may be tapped every 50 turns. This gives five taps and the end of the winding for use with, say, a single pole 7-way rotary switch. I had better success, however, by tapping the coil of 300 turns at 30, 50, 75, 90, 100, 120, 150, 175, 200 and 250 turns. This gives 12 taps, including the beginning and the end of the windings. A standard rotary selector switch, single pole 18-way, meets the demands of the 12 taps. The remainder of six ways may then be used for the taps of the short-wave coil. This coil contains 28 turns of 18 s.w.g. enamel covered wire with taps at every seventh turn. The coils, condensers, switches, etc., can be built into a small plywood box.

The small variable (.0001 mfd.), being not absolutely necessary, assists the regulation of the aerial and is also a very effective and smooth volume control. The fixed .0001 mfd. condenser, however, is essential.

When the outdoor aerial is useful and not too bad, the whole box should be screened with thin copper foil and the aerial lead to the box and from the box to the aerial terminal of the set should be made of screened low-capacity wire, all screening well connected to earth.

Components

The main point is a first-class switch with silver-plated self-cleaning contacts (Bulgin List No.S.205). The other switch is a small toggle switch only (Bulgin List No. 112). This switch and the ¼ watt 500 ohms resistance between the aerial and the earth terminal are not important. This is a small device and is independent of the aerial regulation. It is a "local-distance" switch for use if the signals from the local station are too powerful. To avoid overloading of the first valve the switch contacts should be closed. For distant reception, the contacts must be open.

Put the plug of your aerial in A1 or A2 and an earth plug in "Earth" of the box and turn the knob of the rotary switch from point to point, after having tuned to the station you desire in the usual way. You will soon find a point where the reception is better than usual. When using A2 you will find that the volume of sound decreases when the vanes of the variable condenser are turned out.

A3 is for short-wave reception only. Initially the pre-set condenser must be adjusted by means of a screwdriver to the greatest volume of sound of a good audible short-wave station, and further adjustment is not necessary. The short-wave regulation should be tested on A, B, C, D and E, in the same way as the other coil. When receiving short waves the earth plug of the box should be removed. The earth terminal of the radio set, of course, must always be connected with earth.

W. F.

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).

Listening Contest for Club Members !

SIR,—I was at a local radio club meeting recently when one of the members suggested a listening contest between the club's members. As some of us know, there is a DX contest coming off soon in America, which would be ideal for such a purpose. I don't know whether any other club is doing anything like this, but I think it would relieve the monotony, and provide an opportunity for trying out the new receivers which a lot of us have been building.

What do other club members think of the idea ?—G. F. SWAYSLAND (Gravesend).

Readers' Dens

SIR,—I enclose a photo of my den taken on Saturday morning, March 2nd. It is interesting to compare this with the one appearing in the January 13th issue of PRACTICAL WIRELESS, and to note the difference resulting from a visit by the G.P.O. and the removal of my transmitter. —S. E. JANES (Croydon).

SIR,—I have received my B.L.D.L.C. certificate and am very pleased with it.

I enclose a snap of my den, which may interest other readers. My RX is a straight three using an Eddystone coil, and the set runs off A.C. mains 230v. The aerial points due south and is 40ft. long, and 26ft. high.

Of late I have been experimenting with a frame aerial, and have had fair results. The first TX received was the Irish station testing on 31.27 m. Several others came through at good strength, but I could not listen long enough to pick up the call sign. In fact I did not think a frame aerial would be of any use on the short waves.

If James Stitt should happen to read this letter I would be glad to hear from him.

Wishing PRACTICAL WIRELESS much success in the future.—GEO. B. COTTON (Liverpool).

Exchanging Q.S.Ls.

SIR,—Referring to my letter, which you so kindly published in your issue of February 17th, 1940, on the "Exchanging of Q.S.Ls. by post," and bearing in mind your invitation to put the matter "Open to Discussion," in your columns, I find it necessary to ask you to add a further instalment to my original letter. I do not wish to commence an argument in writing with your readers, but in view of Mr. H. W. Darvill's letter, published in March 2nd issue, I think that a few details will show that in the majority of cases published, it is not one of a S.W.L. exchanging with a S.W.L. as he suggests, or nomenclative errors.

During the last 13 issues of PRACTICAL WIRELESS I have noted 18 letters on this Exchange business. Six of these only are S.W.Ls. offering to exchange with S.W.Ls., which I also agree is harmless, though at the same time is a little off the true line.

However, of these six, two offer to Q.S.L. 100 per cent. in return which cannot or should not be done by a S.W.L., for no "Ham" would call himself a S.W.L. in error. If he does make this mistake why does he not quote his call sign ? Then again, I ask, can a Ham rightly send his Q.S.L. in exchange for a S.W.L. without having received anything, for the usual S.W.L. does not transmit.

Moreover, of the 18 cases quoted, 10 wish to send their S.W.L. cards not only to S.W.Ls. but A.As. and Hams in order to get a Q.S.L. in return. Out of these 12 I mention, 2 say they will Q.S.L. in return.

Now I think it would be much clearer if these "fans" who wish to Q.S.L. in return, would quote the call signs with their signatures and addresses, and if this was made a rule we should all know where we stand.

On these grounds I venture to say that if Mr. Darvill cares to examine his back issues of PRACTICAL WIRELESS he will conclude that 12 out of 18 readers could not make a nomenclative error as he suggests and I still contend that this Q.S.L. exchange business is not only a ramp but a dishonourable action in the view of genuine S.W.Ls., A.As. and Hams.

I strongly appeal to all those readers who conscientiously work at their RX, furnish genuine useful reports to all parts of the world, and who hope to get a Q.S.L. back for their trouble, to put their heads together with the help of our worthy editor to put a stop to this growing exchange business with other than S.W.Ls., as in fact the Q.S.L. should not be used for other than verification of wireless reception of the other fellow's transmission.

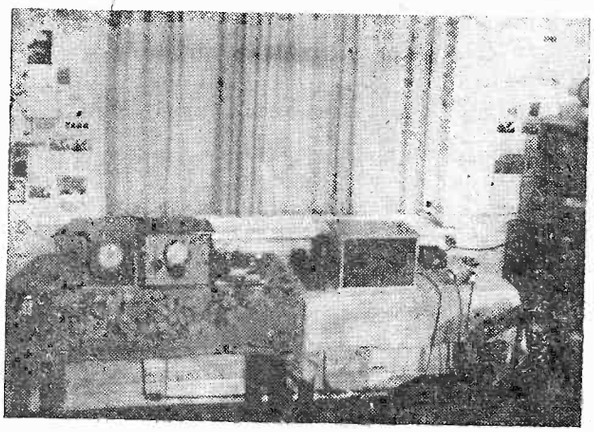
I trust, Mr. Editor, that I have made the position as I see it, quite clear, and hope for your valuable support to maintain the value of a Q.S.L. used in the correct manner by authorised persons.—F. W. J. COOPER (Belmont, Middlesex).

[*See note in Thermion's Commentary, page 5.*—ED.]

Correspondents Wanted

SIR,—I should like to correspond with any reader of your paper aged about 16-20 years who is interested in short-wave radio. My receiver, which is under construction, will be a 5-valve mains short-waver. I should like to take this opportunity of congratulating you on your excellent paper which I have only just started reading.—J. M. GOYMOUR (24, Goring Road, Ipswich, Suffolk).

SIR,—I would like to correspond with a young reader of PRACTICAL WIRELESS who is interested in short-wave wireless.—D. E. PARRISH ("Goodwood," Hadnock Road, Monmouth).



On the left is Mr. S.E. Janes's den—minus his transmitter.

On the right is seen Mr. G. B. Cotton, of Liverpool, in his radio room.

Prize Problems

PROBLEM No. 391.

MARSHALL had a three-valve battery receiver operated from dry batteries. He decided to include auto-grid bias and obtained an appropriate resistance and condenser which he joined between his H.T. negative plug and the earth terminal of his set. When he switched on signals were very distorted, but in spite of verification he found that the resistance was of the correct value and was not defective. What was wrong ? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 391 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, March 18th, 1940.

Solution to Problem No. 390.

When Bradley connected the filaments in series he restricted the current through the entire filament circuit and accordingly the valves were all underrun. This would give the same effect as when using a run-down L.T. battery.

The following three readers successfully solved Problem No. 389 and books have accordingly been forwarded to them : F. Y. Fairhall, Canterbury Bell, Sandhurst, Kent ; N. C. Hughes, 13, Broadway, Ketley, Wellington, Shrops ; T. Woodward, 50, Lillington Street, S.W.1.

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.

ELECTRICAL MUSICAL INSTRUMENTS.—Selmer and Co., Ltd., H., and Davis, B. No. 501685.

In a piano, with or without a soundboard, and having electro-static pick-up means feeding a loudspeaker, the pick-ups consist of screws 3 (Fig. 1) with flat plate-like heads 3*a* opposite each string C or set of strings sounding a note. In an upright, some of the screws 3 of the middle range of strings may be behind the strings. The screws 3 screw for adjustment into insulating strips 2*b* on the iron frame 1, or into a wooden bar mounted on the piano body, and are connected by a lead or a metal strip.

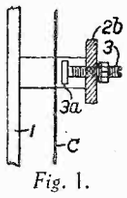


Fig. 1.

Reference has been directed by the Comptroller to U.S.A. Specification 2027074.

TRANSFORMERS; COUPLING COILS.—Michaelis, E. No. 507655.

In inductively coupled oscillatory circuits the coupling is adjusted without effecting detuning by movement of a magnetic dust core in relation to the windings. The coils 2, 3, Fig. 2, of a back-coupled oscillator, for example, may be mounted on an insulating former 1 within which the whole of the core 4 or a part thereof is so moved in relation to the windings that any detuning arising from change in coupling is compensated by change in self inductance of the coil 2. In a modification in which a part only of the core is moved to effect a change in coupling, Fig. 3 (not shown), the remaining part is independently movable to serve as a "balancing pin." Fig. 4 shows the invention applied to a frequency filter of adjustable band width in which the coils are mounted on fixed cores 11, 12 and the movable part 14 is adjusted laterally. In an alternative arrangement the fixed cores are axially bored to receive independently and axially movable core parts. Fig. 5 shows another form in which movable core parts 14, 15 are mounted for rotation with respect to fixed parts 11, 12 carrying the windings.

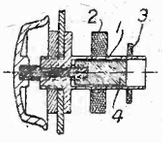


Fig. 2.

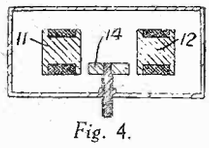


Fig. 4.

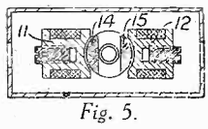


Fig. 5.

CONVERTING.—Telefunken Ges. Fur Drahtlose Telegraphie. No. 504923.

In an arrangement for supplying a load such as a wireless receiver with A.C. from either a D.C. or an A.C. source and comprising a transformer and vibratory interrupter, the transformer primary is divided into two symmetrical parts L1, L2 which may be connected at will either through the interrupter P to a D.C. source *a*, *b* so as to function alternately, or directly to an A.C. source (Fig. 6). In the latter case, either one part alone or the two parts in parallel may be used. The moving contacts of the interrupter are spring-mounted on a vibrating reed F, Fig. 7, so that they dwell on the fixed contacts and thus cause the current produced in the winding parts L1, L2, when the arrangement operates on a D.C. source, to be of rectangular wave form. Thus, when the arrangement operates on an A.C. source of a frequency, not more than half the frequency of the interrupter, the voltage produced in the secondary of the transformer is equal to that which is produced when the arrangement operates on a D.C. source of the same voltage as the R.M.S. value of the A.C. source. Symmetrical tappings *g*, *h* may be provided on the winding parts L1, L2 for adapting the arrangement to different voltages.

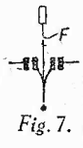


Fig. 7.

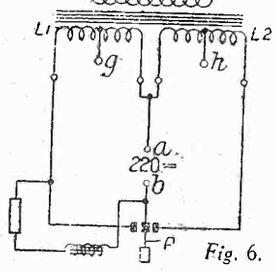


Fig. 6.

Reference has been directed by the Comptroller to Specifications 2824/08, [*Class* 38], 344, 948 *and* 359331.

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.

3138.—Hazeltine Corporation.—Television synchronizing-signal separators. February 19th.

3139.—Hazeltine Corporation.—Television receiving-apparatus. February 19th.

Specifications Published.

518128.—Rudkin, E. P.—Wireless receiving system.

518031.—Standard Telephones and Cables, Ltd.—Indicator systems for wireless apparatus or the like.

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.

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.

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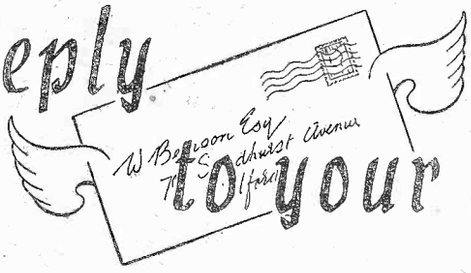
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/3 " "

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)	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)	12.6.37	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)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	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)	30.7.38	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))	19.3.38	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	WM328
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, R,C Trans)	*Aug.* '35	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



Auto-grid Bias

"I wish to fit auto-grid bias as recently described in your pages but am doubtful about one point. In my set H.T.— leads to a fuse-bulb, which in turn is anchored to the metal chassis. Will this affect the scheme in any way? To put it another way, am I right in assuming that the resistor would be in parallel with the fuse-bulb, and would this be in order?"—E. J. W. (Liverpool, 4).

THE bias resistor must not be in parallel with the fuse. In your case you must disconnect the fuse-bulb holder from the chassis and connect it instead to one side of the bias resistor and condenser. The other side of the resistor and condenser is then joined direct to the chassis. The grid return lead, that is, the grid leak or G.B. terminal of the L.F. transformer, is then connected to the junction of the fuse and bias resistor.

Resistance Wattage Rating

"I am fitting up a small mains unit and am rather doubtful regarding the wattage of the two resistors which I have to include for H.T. dropping. Can you tell me how to work out the rating so that I shall obtain the correct types of component and avoid burning out?"—A. F. (Amersham).

THE wattage of a resistor is calculated from the current which flows through it and therefore your first task is to ascertain the current at each part of your circuit. You can do this with a milliammeter connected in series when using a battery supply. The value of the resistor is then calculated by taking the voltage to be dropped and dividing this by the current in milliamps and multiplying the answer by 1,000. The wattage is then calculated in either of two ways. Firstly, you can multiply the current by the voltage dropped across the resistor, or you can multiply the resistance in ohms by the current squared. In each case the current is expressed in amps., 1 milliamp being .001 amps.

Doublet Aerial

"I wish to put up a doublet receiving aerial for use mainly on 30 metres. Could you give me some measurements for a horizontal aerial of this type? I understand that it will also operate on 15 metres and multiples of the fundamental, and I should be glad if you would confirm this."—J. H. (Birmingham).

THE exact measurements need not be rigidly adhered to as they will be in odd inches. We suggest you try an arrangement consisting of two lengths of 25ft. of standard stranded wire, with a 6in. supporting rope in the centre. Each end of each wire must, of course, be well insulated. From the centre ends of the two wires take a twisted leader to the receiver, and ordinary flex may be used for this purpose. The aerial will operate quite well on 15 metres and so on, the efficiency dropping off below 15 metres. Further details regarding short-wave aerials will be found in our new Short-Wave Manual, price 5s.

Battery Connections

"I wonder if you have ever published any hint or suggestion for simplifying battery connections? I have a four-valve battery set which has four separate H.T. positive connections, and one negative connection, and I use a multi-cable battery cord. Unfortunately, one of the plugs is always coming out, and as the battery is underneath the set in a cupboard I find it awkward when getting no signals to have to grope down and find the battery and see which plug is out. I wonder if you can assist me, therefore, to overcome this little difficulty?"—L. E. R. (Watford).

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.

THE trouble should not arise if you use good plugs. The standard split plug may be opened with a penknife blade so that it fits tightly, although perhaps you have obtained the solid type of plug which is intended for a slotted socket, not the solid socket found on batteries. The only hint we can offer for battery connections is to mount a strip of ebonite near the set, and connect the leads to this, making the strip with plugs and fitted sockets to the receiver so that the entire strip may be plugged in when battery connections are needed. This saves taking out each plug separately when tests are being carried out, but your trouble is undoubtedly due to the unsuitability of the plugs you are using.

Unusual Components

"I have recently had a small set given to me and I have dismantled it to use up the parts. I am familiar with most of them, but there are two items which I have never seen before and which I cannot understand. One is a small thing like a hollow cone with wires at each end and it is enamelled. It is about ⅜in. in diameter and ½in. overall length. The other is a small, bell-shaped metal thing with a rubber across one end,

(Continued on following page.)

IN REPLY TO YOUR LETTER

(Continued from previous page.)

and there are no tags or wires attached to it. I should be glad if you could help me to identify these items."—J. G. T. (Kentish Town).

ALTHOUGH the descriptions are brief, we think we identify the two components as a small ceramic type fixed condenser and a grid-bias cell. We imagine that the set is of American origin, and the small condenser would have a capacity of a few mmfd. The other item is a Mallory grid bias cell, which is generally mounted in a small clip near a grid terminal and applies a bias of 1.5 volts or thereabouts.

American Valve Data

"I have one or two American valves and I am not certain regarding the connections. Is there any book available in this country which gives the connections and data relative to various American valves? If so, could you tell me where I could obtain one?"—J. M. (Ilfracombe).

DATA and base connections for a large number of American valves may be found in the back of the catalogue issued by the Premier Radio Company, price 6d. Messrs. Holliday & Hemmerdinger, of 74-78, Hardman Street, Manchester, 3, can also supply the receiving valve manual ssued by the Radio Corporation of America, and this gives the characteristics and connections of all their valves, which are standardised throughout America.

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.

L. R. (Bangor). The transformer is specially designed for the purpose and will therefore be quite satisfactory.

H. T. E. (York). The article in this issue will answer all the points raised by you.

B. K. (Basingstoke). A pre-set would be preferable, and you should try and obtain one of the type which has a locking adjustment so that the setting may be made permanent.

T. G. (E.C.3). The Eddystone component would be perfectly suitable. Make certain that you obtain one of the latest types, as they have been modified recently.

R. J. (Boxmoor). 1.5 volts will be insufficient. Try at least 6 volts. A good G.B. battery will be adequate from the current point of view.

E. S. (Southwark). 36 S.W.G. enamel wire will be suitable at about 2,000 turns. Be careful with the insulation.

L. R. (Bletchley). Ordinary grease is unsuitable. Use a graphite preparation and use it sparingly.

S. P. (Cambridge). We regret that we cannot grant you space in our editorial columns, and can only suggest that you insert a small advertisement. We would be inundated with similar requests if we permitted our editorial space to be used for the purpose outlined in your letter.

S. J. B. (Bristol, 5). We refer you to our blueprint list published weekly.

W. A. (Riverstown). Perhaps now that the valve tester has been completed, the various details about which you were uncertain have been cleared up. See especially the final article on the subject.

W. J. (Wellingboro'). We regret that we cannot supply a blueprint of a receiver utilising the coil in question.

M. H. B. (Rugby). The coils are not now on the market, but standard 6-pin plug-in coils could be substituted.

L. W. (Sparkbrook). The unit is probably overloaded by your 5-valve set. The unit is intended primarily for addition to a simple two or three-valve set.

G. J. (Stepney). Class B usually does not require negative grid bias, and, therefore, perhaps you are trying to use the set in the wrong manner. We cannot deal fully with your query without further details.

L. A. D. (E.8). There is no frequency to D.C. mains and therefore we think you are under some misapprehension regarding your supply. If the mains are 50 cycles we think you will find they are A.C. In any case, the mains transformer will be burnt out if connected to a D.C. supply.

The coupon on page iii of cover 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.

COMMUNICATION RECEIVERS

THE famous HALLICRAFTER SX23, released by the makers only in July, 1939, can still be supplied by Webb's Radio at
PRE-WAR PRICES.
We fortunately had good supplies delivered in August. NO price increase on present stock of this model only, £33 10s., H.P. terms available. Write for descriptive booklet.—P. Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

CONVERTERS

E.D.C. Rotary Converter, 200-250 D.C. to 200-250 A.C. 120 watts in silence, cabinet with filter, perfect £5/15/-. 180-watt ditto, £7/15/-.—Johnson Engineering, 86, Great Portland Street, W.1.

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, Scarborough.

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 Code easily learnt by gramophone records. All speeds 2-15 words per minute. Full particulars. Stamp.—Masters, Forest Way, Pound Hill, Crawley.

NEW CHASSIS

ARMSTRONG CO. recommending the following economically priced Radio Chassis for good quality reproduction.
ARMSTRONG Model AW38.—S-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., Warlters Rd., Holloway, London, N.5.

NEW LOUDSPEAKERS

3,000 Speakers from 6/6 each, 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 and 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.
APPLICATIONS from candidates previously interviewed and declared unsuccessful will be considered provided the necessary additional experience has been gained.
ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three 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 9s. 0d. per annum (payable monthly, in arrear) if service is satisfactory, and must be prepared to serve in any part of the United Kingdom.
NORMAL age limits 25 to 55.
CANDIDATES should indicate on their applications for which vacancy they wish to be considered—a, b or c.
APPLICATION 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. 52), 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

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.

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.

BANKRUPT Bargains. Brand new 1939 models, makers' sealed cartons, with guarantees, at less 40 per cent. below listed prices; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 26-3, Lichfield Road, Aston, Birmingham.

RADIO Exchanges. Wanted good second-hand radio sets in exchange for brand new 1939/40 models leading makes with guarantees and cash adjustment. Send 1½d. stamp for list of makes. Radio Exchanges, 610, Kingsbury Road, Erdington, Birmingham.

RECEIVERS AND COMPONENTS

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G.E.C. mains transformer. 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. 24 mfd. can type electrolytics, 450v. working, 1/- each.

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RECEIVERS AND COMPONENTS

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LONDON Central Radio Stores, 23, Lisle Street, W.C.2. Gerrard 2969.

PHILIPS Step-down transformers, input 200-240 volts, output 6 volts, 3 amps., 2/9 each. B.I. Condensers 4 mfd., 450 volts working, resin oil filled, 3/3 each; .25 mfd., 1,000 volt working, 2/3 each; .1 mfd. ditto, 2/3. Valves, S.P.210, 4/3, Universal Pentode 35/20, 4/3 each.

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VAUXHALL. Skeleton metal rectifiers, HT10, 11/-; HT9, 9/-. Valveholders, 7-pin, 6d.; 5-pin, 5d. Volume controls, 2/-; with switch, 3/-.

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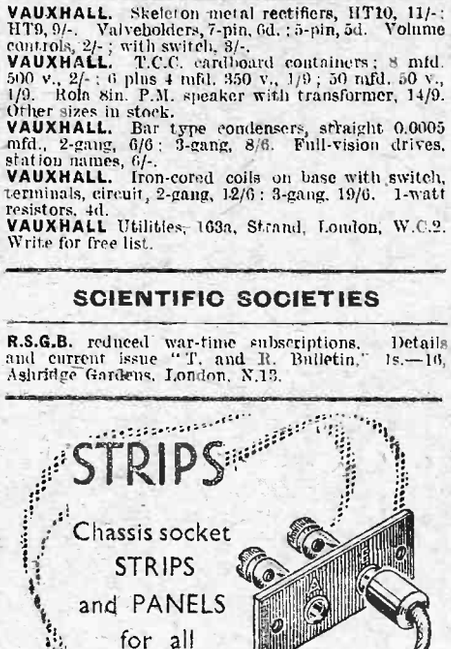

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8-10 watt A.C./D.C. „	£5 - 5 - 0	£6 - 2 - 6
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Black Crackle Steel Cabinet 15/- extra.

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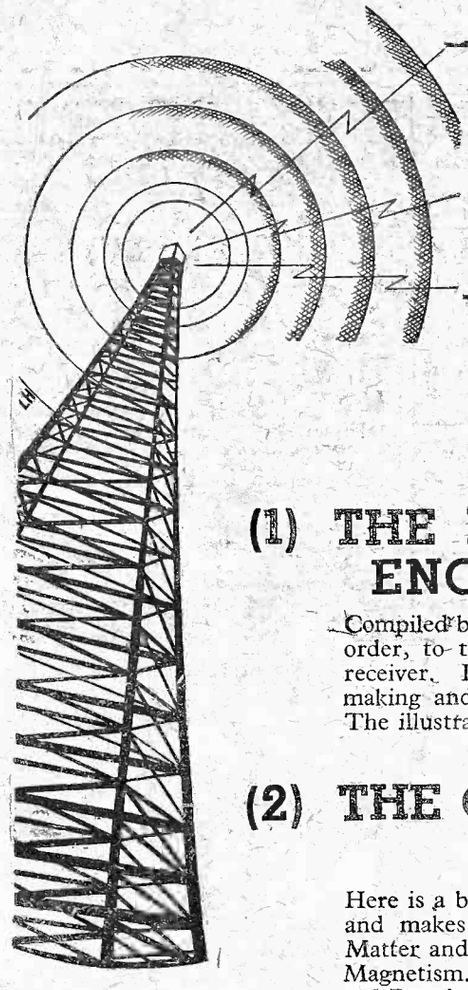

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RADIO IN THE SERVICES—See page 23.

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3D.

Edited by F. J. CAMM

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EVERY WEDNESDAY

Mar. 23rd, 1940.

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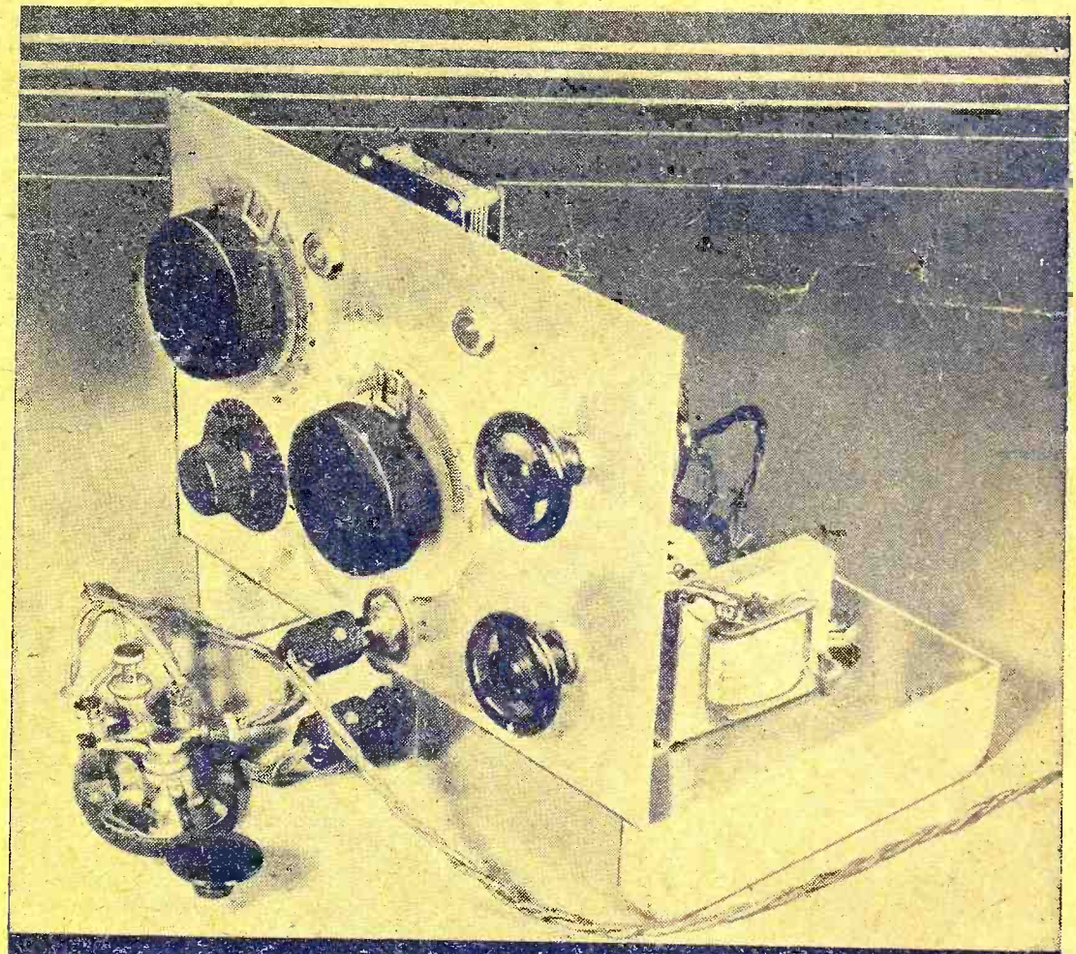

Combined Oscillator and Receiver

Practical and Wireless
★ PRACTICAL TELEVISION ★
EVERY WEDNESDAY
Vol. XVI. No. 392. Mar. 23rd, 1940.
EDITED BY F. J. CAMM
Staff : W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Morse Practice

MANY amateurs are now taking up morse practice with a view to obtaining a post in the Services as wireless operator. A simple oscillator may be built up for morse practice, but many listeners also wish to tune in commercial stations so that they can obtain actual practice at varying speeds. Thus a good short-wave set is also a necessary adjunct to morse practice. To avoid the trouble of having two separate units it is possible to make up a combined oscillator and receiver, and in this issue we give constructional details of such a unit. It must be emphasised that this is not a transmitter and does not radiate signals in any way. When the switches are operated it becomes a simple single-valve receiver of standard short-wave design. In the alternative position, certain parts of the circuit are cut out and others are connected so that it becomes a standard L.F. oscillator, and so that varying pitches may be obtained a tone-control device has been included. In this way familiarity with various notes will be obtained, and the practice is thereby improved as the user does not become familiar with one tone.

Latest Australian Broadcast Schedules

VLR, Melbourne, now uses the following wavelengths and call-signs :

Call-signs : Before 5.15 p.m., VLR3. After 5.30 p.m., VLR.

Wavelengths : Before 5.15 p.m., 25.25 metres. After 5.30 p.m., 31.32 metres.

Power : 2 kilowatts.

Frequencies : Before 5.15 p.m., 11,850 kilocycles. After 5.30 p.m., 9,580 kilocycles.

Location : Lyndhurst, near Melbourne.

All mail matter should be addressed to : Australian Broadcasting Commission, Short Wave Section, Box 1686, G.P.O., Melbourne, Australia. Cables and telegrams : "Abcom," Melbourne.

The Red Cross

THE Midland Region provides for the Home Service on Good Friday a feature programme about the history, growth and development of the Red Cross. Everybody knows of the movement, but few could tell how it originated and exactly under what conditions it works. Actually the inspiration for founding it came from a Swiss banker, M. Henri Dunant, who had this splendid humanitarian idea of non-combatant volunteers, under an international emblem, working for the care of the wounded. The Geneva flag was chosen, and it was under the Geneva Convention of 1864 that the terms of service were laid down. The international character of the movement will be stressed in the programme. An account will also be given of the British Red Cross Society and its activities up to date. The producer will be Robin Whitworth.

"The Colonel's Been Murdered at Last"

"THE Colonel's Been Murdered at Last," to be broadcast on March 23rd, is a skit on the usual detective thriller, written in a somewhat facetious vein. The leading figure, Colonel Wyndham Baggerley-Chatteris, is the perfect club bore, and unlike most club bores, he gets his deserts. He gets them, however, in a distinctly novel way, and which many sufferers from those tellers of interminable stories of what happened in '02 would probably like to emulate. The play will be produced by John Cheatle, to whose care most radio thrillers are now entrusted.

Cinema Organ from Glasgow

GERALD SHAW, the Scottish cinema organist, will play on March 23rd at the organ of the Paramount Theatre, Glasgow. His programmes are notable for their light touch and the original way in which his items are arranged.

Lulu Belle and Scotty, ballad stars of WLW, Cincinnati, will soon be seen here in a picture entitled "The Village Barn Dance," the second picture they will have made this year. The WLW stars will be seen with a supporting cast that includes Don Wilson, announcer on the Jack Benny programme ; Vera Vague (Barbara Jo Allen), radio chatterbox, and the Kidoodlers, NBC harmony group. Lulu Belle and Scotty are accompanied by Linda Lou, their young daughter.

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Royal Marines Band

THE Band of H.M. Royal Marines, Plymouth Division (by permission of Brigadier R. C. A. Glunicke, A.D.C.), conductor, Major F. J. Ricketts, will broadcast on March 23rd in the Home Service and Forces programmes. Their broadcast will begin with the March fantasia, "Colonel Bogey on Parade," by Kenneth Alford, which, as is generally known, is a pen-name for Major Ricketts. He wrote the famous march at Fort George, Inverness-shire, in 1913. In addition to military marches, Major Ricketts has composed much popular music, and his arrangements for military bands range from symphonies and overtures to popular numbers. For 19 years he was conductor of the Band of the Argyll and Sutherland Highlanders; in 1930 he was transferred to Plymouth.

Other items in the programme will include Rimsky-Korsakov's "The Flight of the Bumble Bee" and a selection from "The Fleet's Lit Up."

Reading a Theoretical Diagram

This Article Will Help the Beginner to Overcome the Difficulties Experienced in Early Stages - - - By L. O. SPARKS

THE average beginner can get along quite well with his first constructional effort, when he is working to one of the full-size blueprints produced by PRACTICAL WIRELESS. The trouble only begins when the time comes to carry out some modifications, or when it is desired to try another circuit, and he finds that the only help he can get is in the form of a theoretical diagram. He finds himself in much the same position as would an inexperienced person when faced with the problem of reading a well-detailed map. He is unable to interpret the various signs or symbols into something tangible which he could, no doubt, recognise by its shape or markings.

Shorthand of Radio

We all pass through this rather troublesome period, but if it is approached from the right angle, the deciphering of what is so often termed the shorthand of radio can become quite fascinating. Unfortunately, however, the reaction to the theoretical diagram obstacle is not the same in all cases. With some beginners I have met, the hold-up to their progress produced an attitude of defeatism, and no attempt was made to master the situation. Needless to say, such so-called enthusiasts did not carry on with the good work and, consequently, lost one of the finest hobbies going. Luckily for radio, there are the others who, when they come up against a problem or obstacle, become all the more determined to solve or overcome it. With the diagrams, for instance, they make comparisons between the theoretical circuits and their wiring plans, and by the process of tracing the wiring and applying a little sound reasoning they are eventually able to understand the symbols. If this procedure is adopted, there is no reason why every beginner should not master theoretical diagrams and soon find himself in the position of being able to draw his own circuits.

Perhaps a word or two of advice would not be amiss at this point. There is no quick cut to success. It is very much like learning the Morse Code, except one is aural and the other visual identification; practice and more practice is the only way to impress the various symbols on one's mind, and until these can be retained and recognised or drawn from memory, the beginner must keep on with the practice.

Theoretical Diagrams

Unfortunately, the above advice is not in itself sufficient to enable one to reach the desired goal. A complete knowledge of the symbols certainly allows the beginner to read a diagram, see what components are employed and how they are connected, but unless a fair knowledge of the elementary fundamentals of radio are also present, the process cannot be reversed. To draw a theoretical diagram of, say, a simple three-valve receiver, one must know how and why certain components are necessary, the parts of the circuits they must occupy, and a general idea of the essential connections.

If the would-be radio constructor has not yet acquired such knowledge, then in his own interests it would be advisable for him to start reading and digesting a reliable text-book on the subject. In this direction it is well worth while sending to the offices of PRACTICAL WIRELESS for the small booklet which gives full details of the various radio text-books edited by the Editor of that journal. Steady, diligent reading, plus a certain amount of practical constructional or experimental work, will soon enable one to build up a very useful knowledge of radio, and once a good foundation has been made, it is surprising how rapid progress can be if keen interest is shown in the subject.

Reading the Signs

On page 28 are given sufficient conventional signs for the beginner to start with, and by using these in conjunction with the theoretical diagram of a simple valve receiver it should be possible for a rough practical wiring chart to be drawn. This suggestion is, of course, for practice purposes only, as it helps one to link up the symbols with their actual components.

Ignoring the valve signs for a moment, let us commence our examination at the top of the other symbols—Notebook Page No. 31. The first two signs represent *variable* condensers, such as those used for tuning, reaction and several other purposes in radio apparatus. The arrows indicate that they are variable, as the same sign as the first one is also used to denote fixed condensers, but in such instances the *arrow* is *omitted*. Although it is usually recognised that the moving vanes of a variable condenser are connected to the low-potential part of the circuit, the second symbol is sometimes used when it is required to stress the connections to the *moving vanes* which are, therefore, represented by the *curved arrow*.

Condensers

A *differential* variable condenser has two sets of fixed vanes into which can be meshed one set of moving vanes, according to the direction of rotation of the operating spindle. To make it quite clear that a component of this type is required, the third sign is used and the small centre curved portion indicates the moving vane.

Pre-set condensers, which are nothing more than small variable condensers, are used when it is required to adjust the capacity in or across a circuit and leave it set at the correct value. For this reason the components are not usually fitted with a proper control spindle but with an adjusting screw. The fourth symbol is the one which is used in such instances. It should be noted that the arrow is *dotted*.

Chokes

The sign for a high-frequency choke, coil or any air-cored inductance comes next. An H.F.C. is indicated by the sign shown, but with modern coils, which usually have two, three or more windings, the necessary symbol is not always quite so simple. If it is remembered that each winding is generally shown, to indicate the type of coil required, by repetitions of the sign to which we are referring, it should be possible to understand most coil diagrams.

When an inductance is wound around an iron core as, for example, low-frequency chokes (L.F.C.s), L.F. transformers, mains transformers or the field of an energised moving-coil loudspeaker, it is usual to run a few lines through or alongside the coil symbol as shown in the diagram. This enables the observer to see at a glance that it is not a coil, such as those mentioned above, having a simple air-core.

Transformers

The H.F. transformer sign simply denotes that two separate coils are used with no direct electrical connection between them. The same sign is also used for aerial circuits when one winding, the primary, is connected between the aerial and earth, and the other, the secondary, across the crystal or valve as the case may be. The L.F. transformer, which has to have a very much higher value of inductance than its H.F. counterpart, uses the same two inductance signs plus the lines to indicate that an iron core is used or, in other words, to show that it is an L.F. component.

The next three signs are used to denote various forms of resistance, the first a simple fixed resistance, or to be more correct, the component should be called a resistor; the second indicates that the value of the resistance is variable (note the arrow); while the third shows a potentiometer which is nothing more than a variable resistance fitted with three connections. Two of these are taken to the ends of the resistance, while the third is connected to a moving arm which is so arranged that it sweeps over the resistance element.

(To be continued)

Radio in the Services

A Refresher Course for the Radio Mechanic—2

By Frank Preston

DRAW a skeleton circuit of a simple type of S.W. superhet, indicating the various stages; it is not necessary to include A.V.C., tuning indicators or the power-supply section. Very briefly outline your reason for choosing the principal components indicated.

An outline circuit for a four-valve, plus rectifier, superhet is given in Fig. 1, where approximate values of the chief components are marked. Vertical broken lines are drawn to divide the circuit into frequency - changer, intermediate - frequency, second-detector and output stages.

A triode-hexode valve is used as frequency-changer, it being considered that this is generally most efficient on short waves. The circuit shown should be suitable for working down to about 17 metres; for lower wavelengths it might be desirable slightly to modify the connections to the frequency-changer.

Ordinary plug-in coils would probably be used, as being most convenient in a receiver of this type. Alternatively, it would in most cases be satisfactory to employ standard, ready-made dual or triple-range S.W. tuners in conjunction with a gang condenser.

The intermediate-frequency transformers are shown as being of the 465 kc/s type, since this is found to be the most efficient standard frequency for which there is an ample choice of commercially-made I.F. transformers.

HOW would you proceed to check a wave-change switch suspected of being faulty if test instruments were not available?

The method would have to be dependent to a certain extent upon the circuit and the number of points on the switch. For example, a check could be made far more easily in the case of an H.F.-Det. receiver in which a three-point switch were used for short-circuiting the long-wave sections of the two coils, than if the switch were of the multi-gang type acting on several coils and, perhaps, bringing a load resistor or other component into circuit on one of the wave-bands covered.

In any type of circuit, however, the general procedure would be to set the switch to the position at which the contacts are supposed to be closed and then, where possible, to press the contacts together by means of a length of insulated rod. Where the contacts are inaccessible it may be necessary to bridge the terminal points with short lengths of wire.

The latter test would apply when it was suspected that the contacts were not closing when working on the lower of two wave-bands. If it were feared that some of the switch contacts were failing to open, the test would be made by disconnecting the leads when the switch was set to the "open" position. In both cases, the alterations mentioned should not have any effect if the switch is behaving correctly.

WHAT tests would you apply to a valve if only a multi-range meter was available?

First the valve should be connected to H.T., L.T. and G.B. supplies, and the voltages at each point noted. Knowing these values the anode current would be measured. If makers' data for the valve was available the general condition of the valve could be judged at once. If not, approximate anode-current figures would be known, so a good impression could be formed. A further test might take the form of comparing the anode current passed with different applied G.B. voltages; the cathode or anode-current supply should be switched off while making adjustments of G.B. voltage.

It might also be desirable to test for short-circuit (by means of a small dry battery and the meter) between cathode and heater, cathode and grid, cathode and anode, grid and anode, and also between the various other electrodes of a multi-electrode valve.

EXPLAIN briefly how a visual-tuning indicator, of any kind, could be devised and fitted in the circuit of any receiver provided with A.V.C.

All that is necessary to have a visual indication of the correct tuning point is a means of watching any change in the anode current of the controlled valves. Thus, a milliammeter included in the H.T. positive lead to the valves fed from the A.V.C. circuit would suffice. In case of difficulty in arranging this, it would generally be satisfactory to include the meter in the H.T. lead to one of the controlled valves, preferably the I.F. To avoid introducing instability the meter should be shunted with a fixed condenser of about 1 mfd.

The meter would give its lowest reading, on any particular transmission, when the set was exactly in tune; on each side of the tuning point the needle would rise. The lowest reading would not be the same on all transmissions, but would be dependent upon the signal strength of each. The needle would "dip" most on a strong signal when the A.V.C. was at a maximum.

Those making application for enrolment as radio mechanics are required to pass a test. Success in this may mean immediate promotion. In this article are given some questions of a type which may be asked—it is not suggested that any of them have been asked—along with what can be considered suitable replies. A preliminary set of typical questions and suggested replies was given last week.

DESCRIBE two methods of arranging variable selectivity control in conjunction with an I.F. transformer.

Probably the most obvious method is to mount one winding (either primary or secondary) in such a manner that its position can be changed in relation to the other. Thus, the secondary might be on a former separate from the primary, this former being mounted on a spindle so that it could be rotated through 180 degrees. The idea is similar to that employed in variometers and vario-couplers of 15 years ago. A corresponding but alternative method would be to wind the secondary on a smaller former than the primary. The two would be mounted concentrically and a threaded

(Continued on page 34)

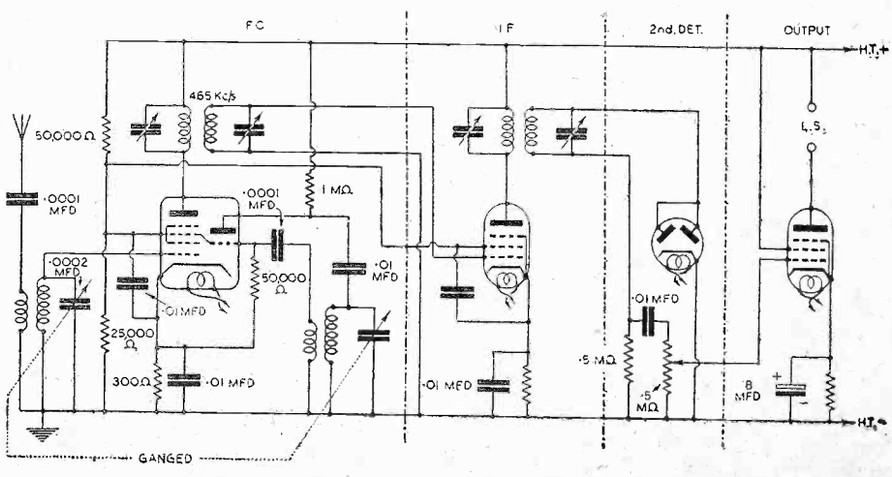


Fig. 1.—Skeleton diagram of a simple S.W. superhet. Values indicated are approximate.

Improved Permeability Tuning

A System in which Tuning Arrangements are Coupled Together by Shifting a Moulded Core

IT is well known that the tuning of oscillating circuits in receivers can be performed by displacement of the moulded core of the coils in the oscillating circuit. This method serves not only for continuous tuning, in place of a rotating condenser, but also for oscillating circuits which are connected in by actuating the push-buttons in push-button receivers. These oscillating circuits are, it is true, pre-tuned, but they are nevertheless in many cases tunable over a large range, so as to be able to pick up any desired transmitter in the wave-range for each push-button.

In order to be able more easily to achieve ganging of a number of tuning circuits over the whole frequency range, it is known to be desirable that the frequency curve representing the relation of frequency to core displacement should be as near straight-line as possible. It is then only necessary to take care that the frequency curves of different circuits have the same inclination, so that they can be brought into superposition by parallel displacement, which is not possible with non-linear curves.

Capacity Tuning

With capacity tuning by means of frequency-linear rotating condensers, the adjustment to equal inclination can be achieved by equalising the inductances, and the parallel displacement by a relative rotation of the rotors. A relative deviation of the inductance values leads to the frequency curves departing from each other in the direction of increasing frequency, because with a difference of inductance only the frequency ratio and not the frequency difference of the two circuits is constant over the range, so that at higher frequencies the frequency difference is also correspondingly higher.

The same considerations hold for the inductance tuning with which we are here concerned. In this case ganging can be achieved with frequency-linear tuning

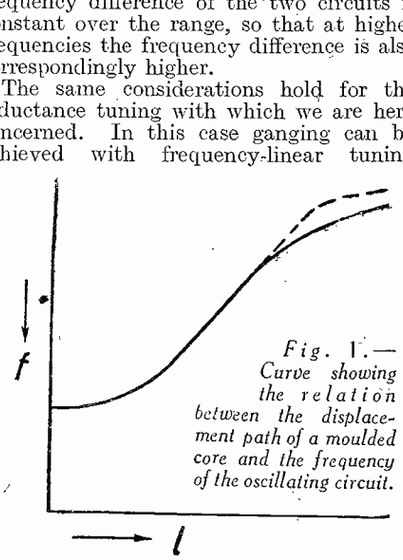


Fig. 1.—Curve showing the relation between the displacement path of a moulded core and the frequency of the oscillating circuit.

characteristic, the inclination of the characteristics being brought into agreement by equalising the capacities, which remain unchanged during the tuning, and the characteristics being brought into superposition by relative displacement of the moulded cores, which are coupled together. The advantages of this method are as follows. No auxiliary circuit elements are necessary for equalising the initial inductances, relative displacement of the moulded cores being sufficient. Moreover, on account of the absence of an auxiliary circuit element for equalising the initial inductances, the tuning variation range is not restricted.

Fig. 1 shows the relation between the displacement path l of a moulded core and the frequency f of the oscillating circuit. The beginning of the curve, at the bottom left, shows the frequency of the oscillating circuit with moulded core at a distance. As the core is approached the frequency falls at first slowly and then faster. This drop has a linear course over a small region and in the upper part the curve bends over. The upper curvature can, however, be pushed further out and at the same time made sharper, so that the straight-line region of the curve becomes longer.

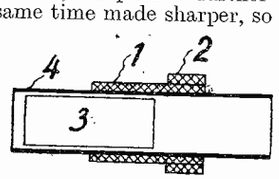


Fig. 2.—Section of a variable inductance.

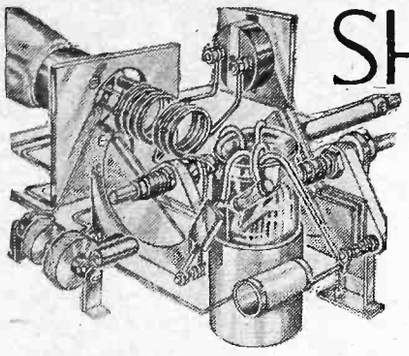
Variable Inductance

Fig. 2 shows how this can be achieved. A coil 1 consisting of a single-layer winding is first wound on the coil former 4. One or more additional layers of turns 2 are then wound on a third of the length of the coil. When the iron core 3 is pushed in the inductance therefore increases faster since the iron core is effective on a greater number of turns at the end of the coil. The inductance of the coil, moreover, increases quadratically along the linear part of the curve in Fig. 1.

This type of variable inductance can be used in circuits which are to be tuned to the same frequency as well as in superhet receivers, in which the input and oscillator circuits have to be tuned to a constant frequency difference. The frequency difference between the two circuits which is, of course, equal to the intermediate frequency, may be obtained in various ways. The cores of the two circuits may be so displaced with respect to each other that the desired frequency separation is available at the one end of the range. If the capacities are correctly set it will also be maintained over the whole range. This displacement of the moulded cores can, however, only be carried out when the intermediate frequency is small, for otherwise the range of variation is too limited. In order to avoid this it is possible to use moulded cores of different permeability, or to wind one of the coils with larger pitch, or to give it a larger diameter. It is, however, also possible to use like coils and cores for the two circuits by connecting a coil in parallel with the coil of the circuit oscillating at the higher frequency, and another small coil in series with it (corresponding to the parallel and series condenser in capacity tuning). With push-button receivers the latter case results in the advantage that it is only necessary to provide a single parallel inductance, and a single series inductance for all the tuned circuits, since the tuned circuits are, of course, connected in individually.

Television in Italy

ON two or three occasions recently attention has been drawn in these columns to the progress which Italy is making in the realm of television, while other nations are marking time because of the war. Both on the transmitting and receiving sides, as well as in the realm of special applications, evidence is forthcoming periodically of the work that is being done in that country. Quite recently it was brought home forcibly that a television service is operating by the furnishing of details concerning one of the latest types of cathode-ray-tube receivers. The set is built up into a neat skeleton framework with all the power supplies located at the base. Although the tube face has a 14in. diameter, its length is relatively small, and by mounting this at the top of the cabinet with a slight rake in the section where the picture aperture appears, comfortable direct viewing for a large number of people is made possible. Interlaced scanning is employed to reduce flicker, and the frame frequency is 50 per second. Magnetic scanning and focusing on normal lines characterise the functioning of the cathode-ray tube, while newly-developed secondary emission valves are used in the video-receiver section to segregate the synchronising pulses for controlling the time-base generator circuits. Both the vision and sound receivers are superheterodynes, and in the case of the former one video-frequency amplifying stage is used in conjunction with two intermediate and two video-frequency stages, often referred to erroneously as low-frequency stages. In the case of the sound receiver a high-frequency amplifying stage with two I.F.s are used, and steps have been taken to ensure that the frequency response is of a very high order so as to take advantage of the wide band width used when radiating sound on the ultra-short waves.



SHORT-WAVE SECTION

ADDING AN H.F. STAGE OR PRE-SELECTOR

How to Obtain Improved Summer-time Reception of Long-distance or Weak Stations.

By W. J. DELANEY.

THE longer hours of daylight which we are now experiencing are already making their presence felt in the reception of long-distance stations. It is well known that the sun's rays have a marked effect on signals which have to travel a considerable distance, and in many cases stations which have been well received during the early evening throughout the past few months are now beginning to fade out and difficult to receive until quite late at night. As many listeners are now making a regular practice of listening to news in

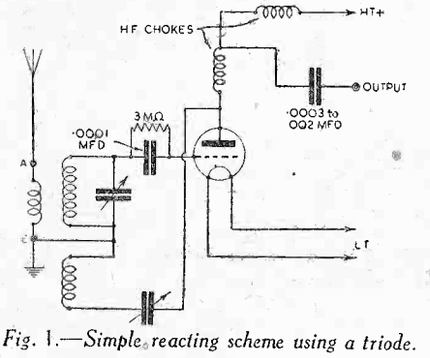


Fig. 1.—Simple reacting scheme using a triode.

English from such stations, it is desirable to adopt some scheme to enable these stations still to be heard. It must be remembered, of course, that during the summer certain bands may be found to fade out entirely and signals be unobtainable on those bands, even with the most powerful receiver. In these cases you must turn to the bands which are not seriously affected by these conditions. In general it may be said that during the summer the 15-metre band—that is, from 12 metres to 20 metres—will be found the most satisfactory. However, the simplest method of obtaining the desired improvement in normal cases is the addition of H.F. amplification, but there are several ways in which this may be carried out.

Pre-selection

The addition of an H.F. amplifier may simply add punch to an incoming signal or, by including a tuned circuit in the amplifier, additional selectivity may also be gained. On account of the latter fact such an amplifier is often referred to as a pre-selector. In the simplest form an aperiodic aerial circuit is adopted, consisting of an H.F. choke or resistance across the grid circuit of the H.F. valve, but whilst adding such a stage the advantages of the additional tuned circuit are well worth considering and the additional expense is not considerable. Many amateurs will have a spare tuning condenser and coil available, or a simple coil may be made up quite cheaply. But at the same time it is also worth while considering one other small point. As additional gain is obtained by the use of an H.F. stage it may be found in some cases that this will bring in weak stations working on wavelengths close to a desired station, and thus, in spite of the additional selectivity, some background interference may be experienced. In some cases this may negative all the advantages given by the pre-selector and thus it is worth while including a further refinement to such a circuit, namely, reaction or regeneration. By this means the gain and the selectivity of the amplifier may be easily controlled, and thereby the maximum benefits of the amplifier may be obtained.

The Circuit

For the battery user, a standard six-pin coil could be used for the tuner, with a standard short-wave tuning condenser of .00015 mfd. with, or without, the addition of a bandspread condenser. A triode or pentode valve may be employed, and the output from the anode is taken to the aerial terminal on the normal receiver, whilst the aerial is transferred from that terminal to

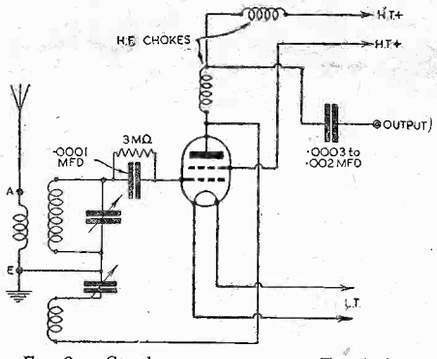


Fig. 2.—Similar arrangement to Fig 1, but using a pentode.

the aerial terminal on the H.F. unit. Reaction is adjusted in the normal manner after a station has been tuned in, such tuning being effected on both receiver and H.F. unit. The H.T. and L.T. supplies may be tapped off from any part of the receiver which is most convenient, whilst the earth terminal on the unit should be joined across to the earth terminal on the receiver.

By using an S.G. or H.F. pentode valve additional gain may be obtained, and by connecting a wander-plug to the screen-grid terminal the H.F. applied to this part of the valve may be adjusted to obtain the desired smoothness of reaction and gain in the stage.

The mains user (A.C.) is in a slightly better position, as he may make use of a much smoother reaction circuit, which will give greater benefits in all directions. This is the well-known electron-coupled arrangement, where the cathode of the valve is taken to a tapping on the grid coil, and reaction control then effected by varying the screen-grid potential by means of a potentiometer across the H.T. supply. The slight additional current taken by the valve and the potentiometer may generally be sacrificed from the receiver, but it may be found that if the heater of the valve is

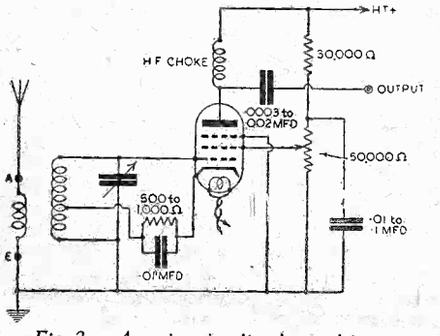


Fig. 3.—A mains circuit using resistance-controlled reaction.

joined in parallel with the valves in the receiver then the additional current drain will result in the valves being under-run sufficient to weaken reception. In this case a separate heater transformer should be obtained and mounted in the unit. The tapping point on the coil should be about one-tenth of the total grid winding, from the earth end of the coil.

Precautions

The coupling condenser in all of the circuits referred to may be of the small variable type if desired, and this will give an additional control. If, of course, a condenser of the value specified is already included in the aerial circuit of the normal short-wave receiver, it may be omitted from the pre-selector stage and the anode joined direct to the aerial terminal. In every case the unit should be enclosed in a metal box, effectively earthed, but if this cannot be done, then the valve should be enclosed in a standard metal valve screen. The lead between H.F. unit and receiver should be as short as possible, especially if the receiver is a superhet, as otherwise it will pick up sufficient energy to act as a good aerial and offset the advantages of the additional stage. It is not advisable to screen this particular lead unless it is found that it is not possible to obtain the maximum performance from the unit without doing so. A few tests will show whether or not such a step is necessary. If it is, then one of the special low-loss screening systems should be adopted, not the standard close-screened wire, which might result in much of the H.F. energy passing to earth before going into the receiver.

Comment, Chat and Criticism

Musical Criticism

Our Music Critic, Maurice Reeve, Discusses the Hazards of Music as a Profession

MUSIC has suffered grievous harm from a haphazard and often irresponsible, and most certainly unco-ordinated, system of criticism. Perhaps this is to be expected in a walk of life which is run on the most superbly individualist lines and which disdains every suggestion of a central authority or controlling body. 'Tis the greater pity because few professions own a more skilful, well-read or more devoted array of zealots. The music critic is invariably a passionate lover of the art and he invariably knows the programme he has come to assess "inside out." Yet the unmitigated harm he can, and often does, do is profound and lasting. I doubt whether any of them would believe it even from their most well-informed friends. I will first deal with these harmful effects and then treat of the cause, winding up with suggestions for a remedy.

As I said, music is individualist—fiercely so. It is the basis, and curse, of its life, but whether it can be avoided is another matter. Everything is done on one's own volition and without an atom of co-operation or help. It is the same with the individual débutant or the renowned society. In normal times it is nothing for a hundred individuals to give recitals in London between September and May. They are either freshmen, or freshwomen, or they may be up in their second or third year. But all are alike in that they are all totally unknown. In addition, there are the dozens of concerts given by the famous visiting artists and the great orchestral and other societies.

Now, every one of these "freshmen" is a most passionate and ardent disciple of music. A certain amount of arrogance and unjustifiable confidence can readily be pardoned them because they have staked their all on this appearance. After years of study and very often the expenditure of large sums of money, custom, a self-centred professor and an "easy chair" agent decree that they must give these recitals because they "must get press notices." Nothing is possible without the benediction of the critics. The critics *must* say that you are this, that and the other, all of which has to be reprinted and broadcast far and wide before anyone will have anything to do with you.

Well, not only is it a gamble as to what the critics will say (even Paderewski was severely censured on his first appearance concerning some of the fundamentals of piano playing), but it is a far greater gamble as to whether any critics will be there at all. The writer knows of two cases where this actually happened. And it is a frequent occurrence for only a small percentage of the press tickets sent out to be used. Tough luck! to put it mildly.

Few walks of life have money invested in them so promiscuously, and livelihoods sought, with so few, if any, guarantees provided or asked for.

An Explanation

What are the reasons? A hall has to be booked up quite six months before the date for which it is wanted. Consequently it is not always possible to ascertain what counter-attractions there will be on that particular day. Not unnaturally, and for reasons other than personal choice, a No. 1 critic will obviously make his way to the opera or a symphony concert rather than to G.B.'s first recital, should both happen to be on together. So would you or I, for that matter. Then, sometimes, the same critic will have two or even three recitals on the same evening, just hearing a snatch of each. If fortune should frown on the recitalist it will frequently just so happen that his critic will attend for the poorest portion of his programme. This is usually the first part, and many a concert giver has been damned just on that one group of pieces, played when nerves are highly strung and fingers unresponsive and unruly, whilst the remainder of the show has been quite brilliant. The result? Nothing less than utter oblivion, perhaps even the necessity of having to take up some other form of livelihood.

Then comes, perhaps, the most tragic part of all—that of the young artist who gets the critics to his recital and wins their praise, yet is told there is no work to be had because he has no money. No money for giving more recitals, and advertising. The public *must* be told what it was the critic said. "No money," he gasps. "But I thought that if one proved himself a first-class artist by winning over the critics, the work followed as a matter of course. Here I am, in your office. The daily 'this' and the morning 'that' say I am a great artist and you say there is no work!" Incredible hearing, but, alas, often listened to.

Some Remedies

What are the remedies for these troubles and trials? They are very difficult to put into practice in spite of their seeming obviousness. First, a duty rests with all teachers or schools of music. The mere fact that a gifted pupil has given a recital "in the West End" invariably means something to a teacher in helping him build up his connections, even if it proves of no artistic merit. When the result is a triumph in the music columns of the press it may well mean a fortune. But all teachers need to be much more sober and temperate in their advocacy of such appearances for their pupils. They owe each one the solemn duty of emphasising the fact that, for every one débutant who strikes the lucky number on the roulette table of recitaldom, there are a hundred who perish by the wayside. But I am afraid they are much too self-centred in this matter.

Secondly, a lot is up to the young artists themselves, and their intimate supporters. They, too, are much too self-centred and foolishly optimistic. Their friends, who are, in this respect, their worst enemies, load them with ignorant fulsome flattery over their "divine" playing and their "too, too exquisite" renderings of this and that, so that by the time recital time comes round there is really only one artist who is at all worth hearing—themselves. Consequently, their performance lacks that detached and respectful air which alone can give it distinction. It all speaks too loudly of "see how clever I am" instead of "I am the devoted servant of this great man whose music I am presenting to you."

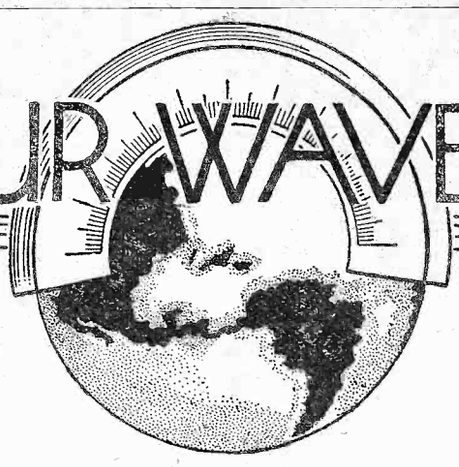
Apportioning the Blame

But it is with the critics that I think the chief blame lies. And the system prevailing. For such a body of such skilled, erudite and artistically minded men we find a strange apathy and nonchalant boredom at times. Few men give such open expression to their boredom; few men can pour such scorn on those whom they deem responsible for that boredom. We admit that it must be trying to hear the Moonlight Sonata played perhaps a hundred times during the season—and inadequately on many occasions. They should recognise to a greater extent than they sometimes do that it is their job. After all, can anyone fail to be bored with their job at times, no matter how exciting or remunerative it may be? And I should have thought it would be much more boring to have to *practise* the Moonlight Sonata or Chopin's A flat Ballade for many hours during a season and perform it many times, as a successful pianist necessarily must. I happen to know that the enormous amount of work that a big concerto demands, including rehearsals before every public performance, sometimes drives the poor artist almost frantic. But never must he dare put a finger wrong and, above all, must he never dare to show either his boredom or fatigue, in the only way he could show such feelings—through giving a cold, passionless, or in any way lethargic performance. He has to be at "concert pitch" the whole time. Paderewski has only just revealed in his own memoirs the killing effect this life had on him.

No, I am afraid many critiques seem to yawn at one while one reads them, and to add, "oh, this damned Moonlight again"! Very bad luck for a young fellow, or girl, to whom it may mean the perhaps unmerited stultification of their life's work and even a translation to an entirely different sphere of life.

The remedy would seem to lie with both sides. More critics are obviously wanted, to avoid one harassed man having to rush between two or three halls the same evening. Also a greater sense of responsibility on the part of some of them. They should not be allowed to display their journalistic talents at other people's expense. On the other side fewer recitals would be of great benefit to all concerned. Unhappily this is impossible without a central authority. At present this doesn't seem to be anywhere within music's reach, desirable as it would undoubtedly be.

ON YOUR WAVELENGTH



By Thermion

Wanted—an Announcer

AN advertisement appeared in the newspapers the other day to the effect that the B.B.C. requires an announcer at a salary of between £300 and £400 a year. An essential qualification is that the announcer must have had acting experience. Apparently, the belief is that an actor does not mumbo-jumbo his words, that his enunciation is perfect, and that he will not rerutilate his r's. This is my chief objection to a Scotch announcer. Even the late Ramsay Macdonald used to get the r in the throat and use it as a gargle. He was a standing joke with his wurrrrrrrrrrld when he was referring to the sphere on which you and I have our being.

But it is not my experience of actors that they are so nicely spoken as the advertisement leads one to convey. Very few actors speak so plainly that you can hear from the back of the auditorium what they are declaiming. It is almost impossible with a singer to understand the words of the song. No doubt microphone tests in any case will be applied to the applicants, and they will be suitably trained in pronunciation. Most actors overdo their pronunciation. They reduce the spoken passage to a caricature of the real thing. Something like this:

Thee curfewer tollser thee kneller of partinger dayer,
The lowinger herder winds slowly o'errrr the leaer,
Get the idea ?

Fuse Values

THE value of fuses for various types of receiver must be chosen with care. On the input side to mains receivers (either D.C. or A.C.), at least 1 amp. should be employed, and preferably a 1-amp. fuse should be included in each mains lead. A .5-amp fuse should be included in the H.T. negative lead of the mains section of an A.C. receiver, and in all filament or heater circuits the value of fuse chosen should be such that it will break down before any of the valves. It will vary, of course, according to the method of wiring the filaments or heaters. In battery receivers, where the filaments are in parallel, the fuse should be of the type which will blow before the current rises sufficiently high to damage the valve of the lowest rating.

Interaction

IF one compares the average home constructed receiver with a commercial product of similar size, both for appearance and performance, one will find many differences. On the grounds of appearance, the usual contrast between the two sets is that while the home product looks workmanlike the commercial receiver is usually a model of neatness and compact design. Under these conditions the performance is very often equal. When the home-made set is compressed a little, however, and made to look neat, it very seldom works as well. The one word "interaction" goes a long way to explain this phenomenon. While almost anyone with a little knowledge of radio principles can make an untidy set work well, it takes a qualified expert to design the same set in such a way that it still works when it is "tidied-up." The fact of the matter is that one cannot take liberties with the placing of the separate components of a set until one understands first principles.

New Australian Wireless School

COMPLETION of the A.W.A. Building, at 45-47, York Street, Sydney, has enabled the Marconi School of Wireless, in Australia, to make a new and handsomely appointed home at a time when the demand for trained men is becoming increasingly great.

The study of radio makes a strong appeal to many young men. In Australia several thousands have held an experimenter's licence. Few, however, have the qualifications which would enable them to take a position as wireless officer on a ship, to operate the radio equipment of an airliner, to serve in a broadcasting, coastal, or island radio station, or to design and supervise the construction and erection of wireless transmitting stations.

The purpose of the Marconi School, founded by Sir Ernest Fisk in 1913, is to train men for such positions.

Many of the senior executives of A.W.A. passed through the Marconi School; thousands of other ex-trainees are to be found either upon the company's staff in Australia or scattered up and down the world following their chosen profession.

New Phases of Radio

EVERY year new phases of radio are developed. Explorers now carry wireless into the uttermost wilds, new appliances appear on ships, broadcasting apparatus is elaborated, further radio aids to aircraft are devised. The progress thus indicated emphasises the need for the training which is given by the Marconi School.

The new Marconi School has an instructional staff of nine in Sydney (in addition to five in Melbourne)—experienced men in every phase of wireless on land, on sea and in the air.

The School occupies two floors of the sound-proof building. Morse tables are equipped with radio-frequency transceivers by means of which the students practise the sending and receiving of wireless traffic under conditions virtually identical with those met in the commercial operating services. An "apparatus room" contains several marine wireless stations complete with direction finders and auto-alarm distress signal receivers

Complete Broadcast Station

ALSO there are a complete broadcast station, aircraft transmitter and receiver. One room has been electrically screened for the testing of the selectivity, sensitivity, and fidelity of broadcast receivers; rows of benches have been set up for the training of broadcast technicians, radio mechanics, and service men. Lessons are given in the construction of broadcast receivers, the servicing and adjustment of transmitters and transmission lines.

Five separate courses are available to Marconi School students—a five-years course for engineers, a three-years course for technicians, and a two-years course for wireless operators, a year's course for radio mechanics and talking-picture operators. For the convenience of these last, the Marconi School incorporates an up-to-date theatrette.

Television for Palace of Soviets

I AM informed that the most powerful ultra-short wave television transmitter in the world, with a maximum capacity of 100 kWs., will be set up in the tall tower of the Palace of Soviets now under construction in Moscow. This, together with the antennæ system to be put up 985ft. above the ground, will make it possible for television programmes from the Palace of Soviets to be received at great distances.

About thirty outlets for television transmissions, as well as 150 sets to receive programmes, relayed by the main television reception apparatus in the Palace, will be installed at different points in the building. The large hall of the Palace, which will have seating accommodation for 21,000, will have a 478 square yard screen, and the small hall will have a screen of 120 square yards.

NEW SERIES

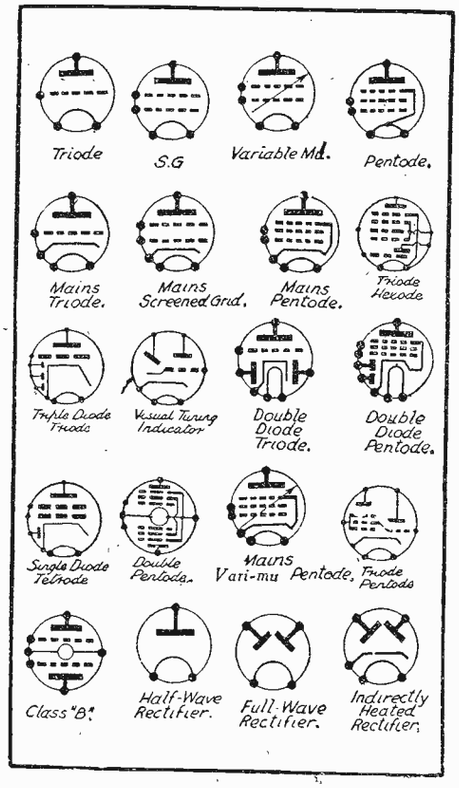
RADIO ENGINEER'S POCKET-BOOK

No. 29

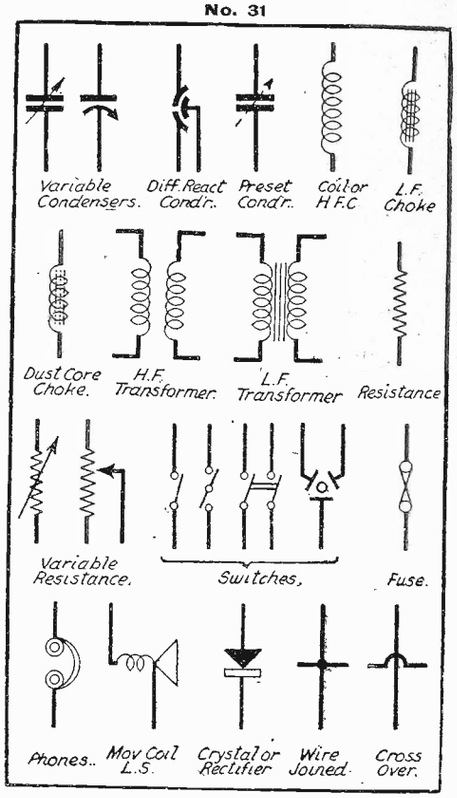
INTERNATIONAL AMATEUR CALL-SIGNS

PA	Netherlands	VK	Australia
PJ	Curacao	VO	Newfoundland, Labrador
YI	Iraq		
YL	Latvia	VP1	British Honduras
YM	Danzig	VP2	Leeward Is. and Windward Is.
YN	Nicaragua		
YR	Rumania	VP3	British Guiana
YS	Salvador	VP4	Trinidad and Tobago
YT, YU	Jugo-Slavia		
YV	Venezuela	VP5	Jamaica, Cayman Is., Turks and Caicos Is.
ZA	Albania		
ZB1	Malta		
ZB2	Gibraltar	VP6	Barbados
ZC1	Transjordania	VP7	Bahamas
ZC2	Cocos Is.	VP8	Falkland Is., South Georgia Is.
ZC3	Christmas Is.		
ZC4	Cyprus	VP9	Bermuda
ZC6	Palestine	VQ1	Zanzibar
ZD1	Sierra Leone	VQ2	Northern Rhodesia
ZD2	Nigeria, British	VQ3	Tanganyika
ZD3	Gambia	VQ4	Kenya
ZD4	Gold Coast, British Togoland	VQ5	Uganda
		VQ6	British Somaliland
ZD6	Nyasaland	VQ8	Mauritius
ZD7	St. Helena	VQ9	Seychelles
ZD8	Ascension Is.	VR1	Gilbert and Ellice Is.
ZD9	Tristan da Cunha	VR2	Fiji Is.
ZE1	Southern Rhodesia	VR3	Fanning Is.
ZK1	Cook Is.	VR4	British Solomon Is.
ZK2	Niue	VR5	Tonga
ZL	New Zealand	VR6	Pitcairn
ZM	Western Samoa	VS1	Straits Settlements
ZP	Paraguay		
ZS	Union of S. Africa	VS2	Fed. Malay States
ZS3	South West Africa	VS3	Non-Fed. Malay States
PK	Dutch East Indies		
PX	Andorra	VS4	Sarawak, North Borneo
PY	Brazil		
PZ	Surinam	VS5	Labuan, Brunei
SM	Sweden	VS6	Hong Kong
SP	Poland	VS7	Ceylon
ST	Sudan	VS8	Bahrein
SU	Egypt	VS9	Maldive Is.
SV	Greece	VU	British India
SV6	Crete	VU4	Laccadive Is.
TA	Turkey	W, WA	United States of America
TF	Iceland		
TG	Guatemala	XE	Mexico
TI	Costa Rica	XU	China
U, UE, UK	U.S.S.R.	XZ	Burma
VE	Canada	YA	Afghanistan

No. 30



No. 31



No. 32

PHONETIC ALPHABET

To avoid the possibility of the letters of a call-sign being misunderstood, it is usual to use the words given below in place of the letters. For example, G6PY would be given as G6 Paris Yokohama.

Letters to be spelt	Words to be used for spelling
A	Amsterdam
B	Baltimore
C	Casablanca
D	Denmark
E	Edison
F	Florida
G	Gallipoli
H	Havana
I	Italy
J	Jerusalem
K	Kilogram (or Kilowatt)
L	Liverpool
M	Madagascar
N	New York
O	Oslo
P	Paris
Q	Quebec
R	Roma
S	Santiago
T	Tripoli
U	Upsala
V	Valencia
W	Washington
X	Xanthippe
Y	Yokohama
Z	Zurich

No. 33

AMATEUR WAVEBANDS (BRITISH)

Five-metre Band - 56,020—59,980 kc/s.

Ten-metre Band - 28,010—29,990 kc/s.

Twenty-metre Band

Metres	Kilocycles	Metres	Kilocycles
20.9	14,353	21.2	14,151
21.0	14,285	21.3	14,085
21.1	14,218	21.4	14,019

Forty-metre Band

Metres	Kilocycles	Metres	Kilocycles
41.2	7,281.5	42.1	7,125.9
41.3	7,263.8	42.2	7,109.0
41.4	7,246.3	42.3	7,092.2
41.5	7,228.8	42.4	7,075.4
41.6	7,211.5	42.5	7,058.8
41.7	7,194.2	42.6	7,042.2
41.8	7,177.0	42.7	7,025.7
41.9	7,159.9	42.8	7,009.3
42.0	7,142.8		

Eighty-metre Band

Metres	Kilocycles	Metres	Kilocycles	Metres	Kilocycles
80.5	3,726.6	82.2	3,649.7	83.9	3,575.6
80.6	3,722.0	82.3	3,645.2	84.0	3,571.3
80.7	3,717.4	82.4	3,640.7	84.1	3,567.1
80.8	3,712.8	82.5	3,636.3	84.2	3,562.9
80.9	3,708.2	82.6	3,631.9	84.3	3,558.7
81.0	3,703.6	82.7	3,627.5	84.4	3,554.5
81.1	3,699.1	82.8	3,623.1	84.5	3,550.3
81.2	3,694.5	82.9	3,618.7	84.6	3,546.1
81.3	3,690.0	83.0	3,614.3	84.7	3,541.9
81.4	3,685.5	83.1	3,610.0	84.8	3,537.7
81.5	3,681.0	83.2	3,605.7	84.9	3,533.5
81.6	3,676.5	83.3	3,601.4	85.0	3,529.3
81.7	3,672.0	83.4	3,597.1	85.1	3,525.2
81.8	3,667.5	83.5	3,592.8	85.2	3,521.0
81.9	3,663.0	83.6	3,588.5	85.3	3,516.9
82.0	3,658.5	83.7	3,584.2	85.4	3,512.8
82.1	3,654.2	83.8	3,579.9	85.5	3,508.7

Note.—Wavelengths in Metres are not given for the 5- and 10-metre bands, owing to the narrow band width, which would result in awkward decimal fractions.

No. 34

SCREWS: BRITISH ASSOCIATION (B.A.)

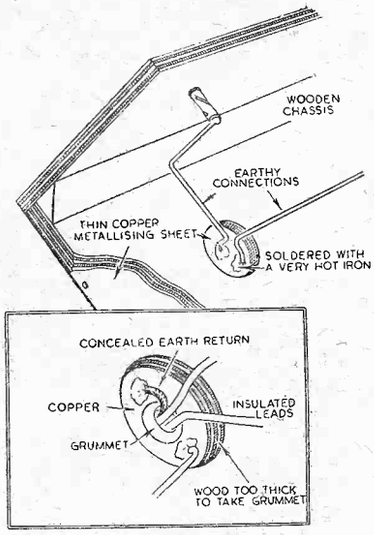
No.	Absolute Dimensions in Millimetres: Full Diameter	Absolute Dimensions in Millimetres: Pitch	Approximate Number of Threads per Inch	Approximate Dimensions in Inches: Full Diameter	Approximate Dimensions in Inches: Pitch
25	0.25	0.070	362.8	0.010	0.0028
24	0.29	0.080	317.5	0.011	0.0031
23	0.33	0.09	282.2	0.013	0.0035
22	0.37	0.10	254.0	0.015	0.0039
21	0.42	0.11	230.9	0.017	0.0043
20	0.48	0.12	211.6	0.019	0.0047
19	0.54	0.14	181.4	0.021	0.0055
18	0.62	0.15	169.3	0.024	0.0059
17	0.70	0.17	149.4	0.028	0.0067
16	0.79	0.19	133.7	0.031	0.0075
15	0.90	0.21	121.0	0.035	0.0083
14	1.0	0.23	110.4	0.039	0.0091
13	1.2	0.25	101.6	0.047	0.0098
12	1.3	0.28	90.7	0.051	0.0110
11	1.5	0.31	81.9	0.059	0.0122
10	1.7	0.35	72.6	0.067	0.0138
9	1.9	0.39	65.1	0.075	0.0154
8	2.2	0.43	59.1	0.087	0.0169
7	2.5	0.48	52.9	0.098	0.0189
6	2.8	0.53	47.9	0.110	0.0209
5	3.2	0.59	43.0	0.126	0.0232
4	3.6	0.66	38.5	0.142	0.0260
3	4.1	0.73	34.8	0.161	0.0287
2	4.7	0.81	31.4	0.185	0.0319
1	5.3	0.90	28.2	0.209	0.0354
0	6.0	1.00	25.4	0.236	0.0394

It is recommended that for screws less than ¼-in. diameter British Association Threads should be adopted. It was originally proposed by the British Association in 1884, and finally adopted by them in 1904. It is, however, not yet the usual practice in this country to use the sizes ranging from No. 17 upwards. Moreover, makers of taps, dies, screwplates, etc., usually supply sizes to No. 16.

Practical Hints

A Neat Wiring Hint

USING a sheet of copper on a wooden chassis, as I was unable to obtain an all-metal chassis, the idea occurred to me when drilling 1in. diameter holes for the valve-holders, that it would be far more convenient and neater if I made all the earth returns by drilling other holes of various diameters, in the wooden chassis only, the copper sheet covering these holes, so providing a means for directly soldering the leads to the underside, as illustrated.



A useful wiring hint for combined wood and metal chassis.

When putting this idea into effect, it also occurred to me that here again was a means for neatly grummeting holes through which a number of leads pass, since although a certain amount of protection is provided by the thickness of the plywood, the periphery of the copper sheet might soon cause fraying of insulation, and possible short circuit.

Numerous other modifications have since suggested themselves in connection with wiring facilities, and no doubt some readers will find this arrangement of use in other directions apart from those I have mentioned. It should be pointed out, however, that a really hot iron and clean Fluxite is essential if good soldered joints are to be made, the copper being thoroughly cleaned, whilst it is advisable to scratch the copper in order to provide a better purchase for the solder.—G. F. LEADER (Stratford).

Using a Torch Bulb as a Meter Shunt

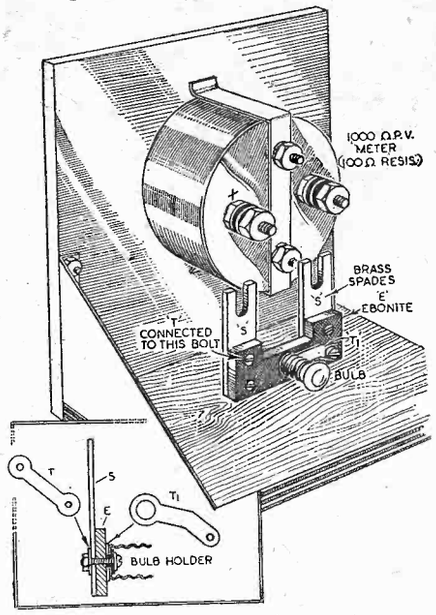
IN revising some of my test apparatus, I decided to include a 50 mA range for the 1,000 ohm-per-volt meter which I constantly use. This meter has a resistance of 100 ohms, so by applying the following formulæ it was a simple matter to determine the value of the required shunt.

$$\text{Shunt resistor} = \frac{1\text{mA (normal dissipation, full scale)}}{50\text{ mA (required range)} - 1\text{ mA}} \times \text{meter resistance}$$

$$= 1/40 \times 100 = 2.04 \text{ ohms.}$$

Disregarding the decimal places, as this only represented an error of 4 per cent. for this scale, I then hunted round for a suitable means for making the shunt, and hit upon the idea of using a torch bulb, provided that I could obtain one within the limits.

Using another meter which was calibrated to within 2 per cent., I then proceeded to check the resistance of a number of heavy current type bulbs, until I found one which gave me exactly 2 ohms: this was rated for 3.5 volts, but the current taken was not indicated. However, this would be in the neighbourhood of .25 amp., so since only 50 mA will flow for full scale deflection, the filament of the bulb will not heat up, so ensuring a constant reading.



A method of using a torch bulb as a meter shunt.

As will be seen from the accompanying sketches, the shunt fitment comprises strong brass "spades," and an ebonite cross member which also serves to fix the bulb holder.

There is a further advantage which can be derived from this method of fitment, and I propose to try it out. It consists of using the bulb holder principle for other ranges, the various resistors being in some way fitted to broken bulb cups, so that wiring can be done away with and a conveniently quick method of scale extension brought about.—B. A. SMITH (Evesham, Worcester).

THAT DODGE OF YOURS!

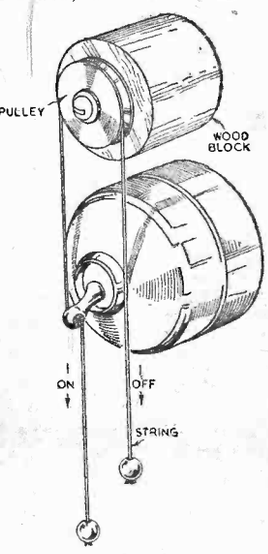
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending 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 iii of cover.

Operating an Overhead Switch

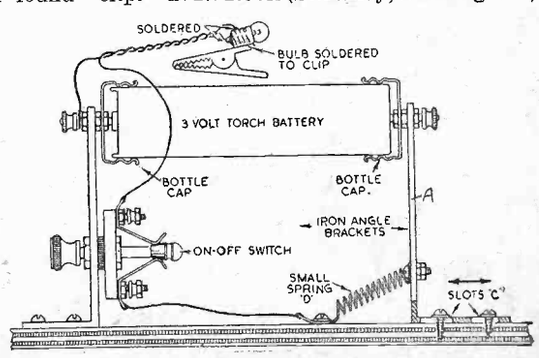
HAVING had to mount a mains switch well out of reach, and as it was a nuisance to step on to a pair of steps every time I wished to operate the switch, I contrived the arrangement illustrated. I drilled a hole through the switch dolly and threaded a piece of string through, tying a knot on each side of the dolly to prevent the string pulling through. A pulley was fitted above the switch in order to bring about the upward pull to switch off. If the dolly is a round one it will be easier to drill if a flat is filed on it.—J. W. B. EVANS (Conway).



A simple dodge for operating an overhead switch.

An Inspection Lamp and Battery Holder

THE device shown in the accompanying diagram is intended to be fixed to the baseboard of a set, so that should an inspection bulb be desired at a moment's notice, it is conveniently at hand. In order to insert the battery (of the 3-volt type), the iron strip "A" is pulled open (see slots "C") and the battery is inserted in the end holders, which consist of sauce-bottle caps. The battery is kept in place by the small spring "D." The wiring is as shown, the connections being soldered to the bulb, and the bulb to the crocodile clip.—T. N. ROCK (Stirchley, Birmingham).



A novel inspection lamp unit.

Combined Oscill

A Morse-code Practice L.F with a Single-valve

AN oscillator and key forms the first essential requirement of the student in the morse code. The next consideration, and one which is not so conveniently provided for, is the means for receiving a wide variety of morse signals, the domestic radio being frequently commissioned for this purpose, failing the help of an equally interested party, or the more expensive method of using an automatic sender.

When weighing up the pros and cons of combining the two functions it was appreciated that unless some care was exercised in the circuit arrangement and layout, there would be the possibility of losses arising in the receiver portion, particularly on the higher frequencies. Therefore, to satisfy oneself on this point, one or two different schemes were tried out before constructing the chassis illustrated, and the advantages in the circuit design will be apparent from the following notes.

The Circuit

Referring to the theoretical diagram given in Fig. 1, a study of this will soon clarify the simple way in which a minimum of switching is brought about; the wiring being arranged to reduce as far as possible any tendencies to interaction or the effect of stray capacities.

The aerial may be fed directly or through the medium of a series condenser of the preset type, this being fed into an aperiodic winding of a standard six-pin coil.

Tuning is carried out by a bandset condenser of 160 mmfds, in parallel with which is a bandspread condenser unit of the Eddystone pattern. The reaction control comprises a differential reaction condenser in a conventional circuit, whilst it will be noticed that detection is of the leaky-grid type, this proving preferable to anode-bend detection which was tried out in an endeavour to get ideal results using an L.F. "strapped" pentode valve.

The switching is effected by using three toggle switches ganged together by a brass rod and conveniently located on the chassis, since it is to be assumed that this type of chassis would not be housed in a cabinet, whilst from the design point of view, shorter wiring is in this way made possible.

Switching

The switch S1 has one pole taken to L.T. positive, this serving to change over the pilot bulbs, these bulbs being wired to the change-over contacts. To isolate the grid and anode circuits, a point was made to use separate switches to see that the

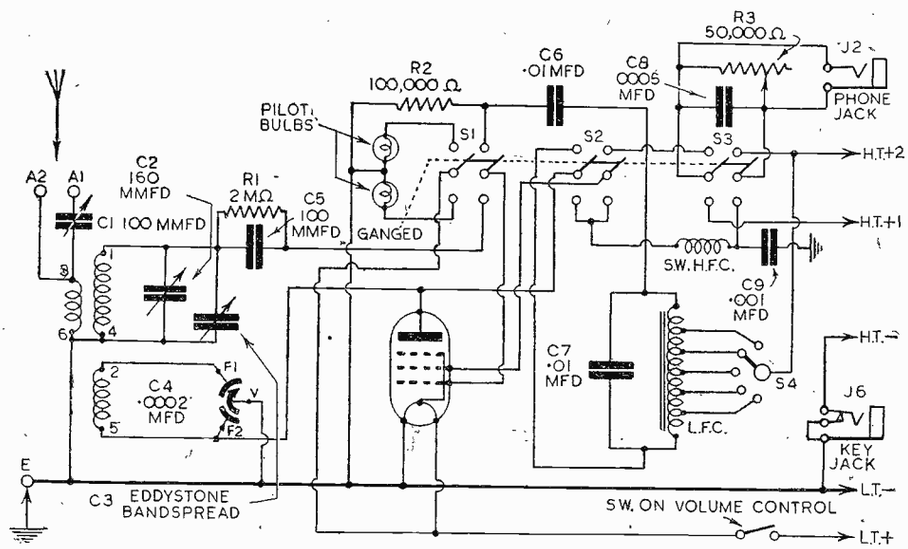


Fig. 1.—Theoretical circuit of the dual-purpose unit.

LIST OF COMPONENTS FOR COMBINED OSCILLATOR-RECEIVER PRACTICE CHASSIS

Resistors (Fixed)
One 2 megohms ½ watt (Bulgin).
One 1 megohm ½ watt (Bulgin).
Potentiometer
One type "M" 50,000 ohms (with switch) (Erie).
Condensers (Fixed)
One .0001 mfd. special mica (Radiomart).
One .0005 mfd. special mica (Radiomart).
One .001 mfd. special mica (Radiomart).
Two PC101 .01 mfd. (Bulgin).
Condensers, Pre-set
One type SW126 (70-100 mfd.) (Bulgin).
Condensers, variable
One type No. 1131 (160 mfd.) (Eddystone (Webb's Radio)).
One Bandspread unit, No. 1043. Complete with knob, dial and cursor (Eddystone (Webb's Radio)).
One type No. 2046 differential reaction (Jackson Bros.).
Rotary switch
One type S119 (5-way) (Bulgin).
Toggle switches
Three type S137 (d.p.c.o.) (Bulgin).
Ganging shaft for above (see text) (Bulgin).
6in. length of 5/32in. brass rod. (Bulgin).
L.F. Choke
One type L.F. 43 (Tone control choke) (Bulgin).
H.F. Choke
One type CHP (5-180 metres) (Radiomart).
Coils and Holder
One set of Eddystone 6-pin coils No. 959 (Eddystone).
One type V86 chassis mounting coil base (Radiomart).
Socket Strip
One type X382 (Clix).
Valveholders
One type X147 (5-pin) (Clix).
Brackets
One type No. 1007 (adjustable) (Eddystone (Webb's Radio)).
Pilot light assemblies
Two—one red and one green (Radiomart).
Two type B206 bulbs (Bulgin).
Battery cord
One type BC3 (5-way) (Bulgin).
Spades, plugs
Three type MP.1a plugs engraved (H.T.1, H.T.2, H.T. —) (Clix).
Two type R415 spade terminals (red, black) (Clix).
Jacks and jack plugs
One type J2 (single circuit) (Bulgin).
One type J6 (closed circuit) (Bulgin).
Two type P38 plugs (Bulgin).
Headphones
2,000 ohm (Ericsson).
Chassis
18 gauge aluminium (see text) (Paroussi).
Dials, knobs
Two black wheel type knobs (Eddystone (Webb's Radio)).
One No. 1,012 slow-motion driving head complete (Eddystone (Webb's Radio)).
Flexible coupler
One type 1009 (Eddystone (Webb's Radio)).
Valve
Tungsram PP2.
H.T. Battery
One 120 volts (Winner) (Eveready).
One 2 volt 10 a.h. accumulator (Exide).
Miscellaneous
Sleeving.
18 S.W.G. tin copper wire.
6 B.A. ⅜in. nuts and bolts (round head).
Four fibre embossed washers for J2 and S119.
8 round head ¾in. wood screws (brass).
Flex.

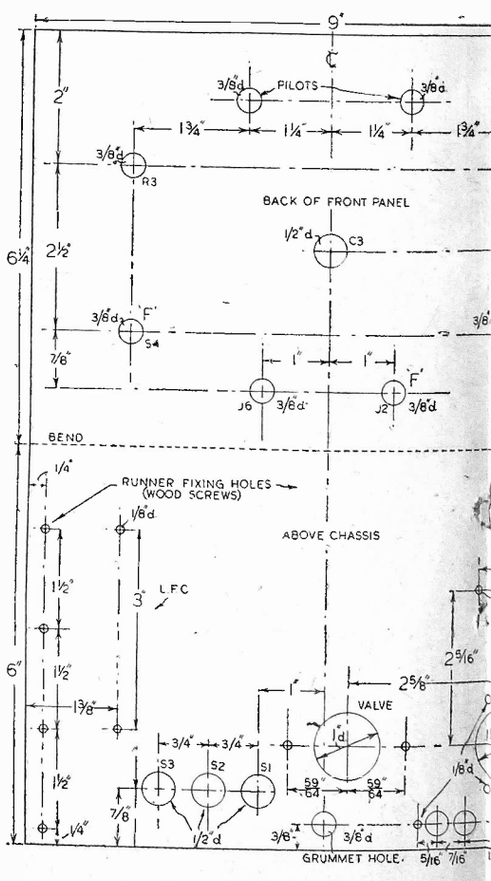


Fig. 4.—Drilling dimensions of the chassis

tor and Receiver

Oscillator Unit, Combined ort-wave Receiver

grid and anode connections were not made to the two poles of the same switch, so in the case of S1, the remaining pole is used for the grid return of the valve. This pole changes over to connect the tuned receiver circuit in the "Radio" position, whilst in the "Keying" position, the corresponding "Tuned" audio-frequency circuit is fed to the grid.

S2 serves the purpose of changing the anode and screen grid circuits over, so that in the radio position, the anode is "strapped" to the screen grid by both poles of the switch, at the same time completing the circuit for the anode H.F. choke.

In the L.F. position of this switch the anode connects up with one side of the L.F. tone control choke, while the other contact extends the screen grid connection to the 'phone and H.T. circuit in S3.

The poles of S3 are taken directly to the 'phone jack J2, across this jack being connected a volume control R3 and a small by-pass condenser C8.

In the radio position this switch series connects the 'phones with the H.F. choke and H.T.+1, whilst for the oscillator position, the 'phones are connected in series with the screen grid of the valve, H.T.2, and the wiper contact of S4.

So from this it will be seen how by ganging these switches a quick change-over may be made when it is desired to compare keying with actual transmissions.

The L.F. tone control choke circuit is provided with a frequency adjusting switch of the rotary type (S4), this making it possible for the operator periodically to change the note of the oscillator by reason of either matching a signal transmission or simply as a "Refresher."

Finally, the keying circuit. This simply comprises an interruption of the H.T.— battery connection, and it will be as well to point out the necessity for seeing that the L.T.— lead is not inadvertently taken to the H.T.— lead, for obvious reasons.

Operating Notes

Now a word on the operating conditions of this circuit prior to dealing with the construction and wiring.

In strapping the screen grid to the anode when using it for reception, it will be realised that a higher mutual conductance will result in the valve characteristic, and this is all to the good, a small grid swing giving an appreciably greater degree of conversion gain, although there is bound to occur a slightly higher anode current dissipation; however, on considering the current ratings given below, it will be seen that this is not of much consequence.

H.T. tapping (H.T.+1) I a+s (strapped)

48v.	1.8mA.
60v.	3.0mA.
72v.	4.2mA.

The oscillator should not require more than about 9 to 12 volts H.T., and the following are the current readings for tappings up to 36 volts to illustrate the proportionate increase in current.

H.T. tapping (H.T.+2) I a+s (not strapped)

12v.	.125mA.
24v.	.54mA.
36v.	1.5 mA.

Although by increasing H.T. for the oscillator a different pitch or frequency

(Continued on page 40.)

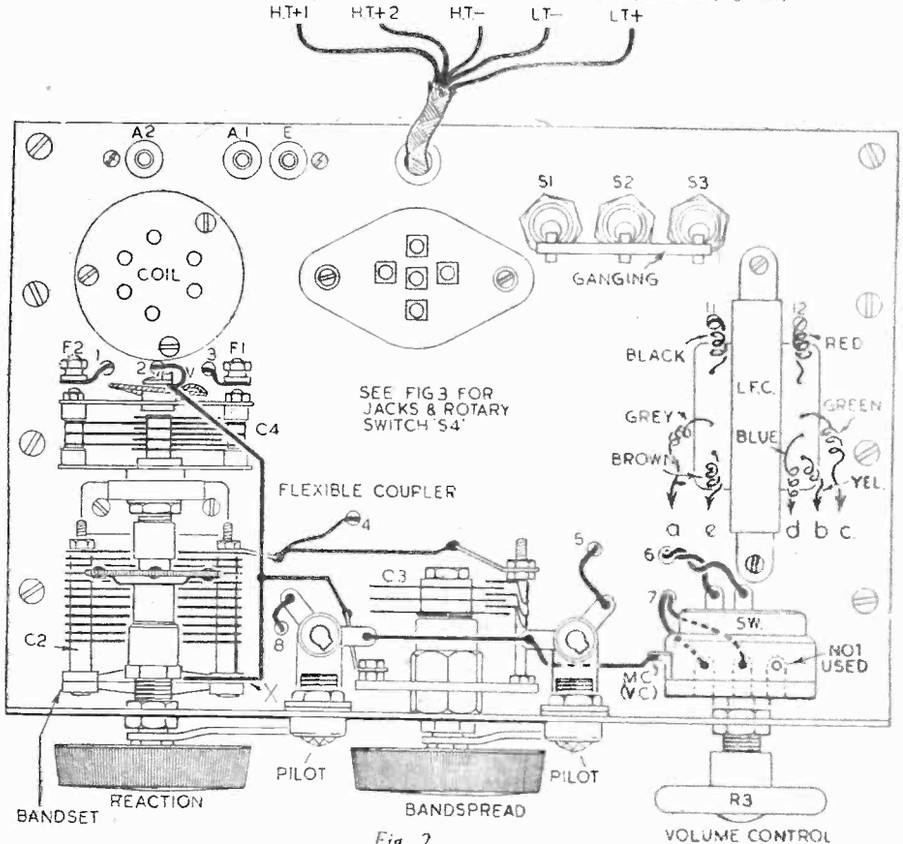


Fig. 2.

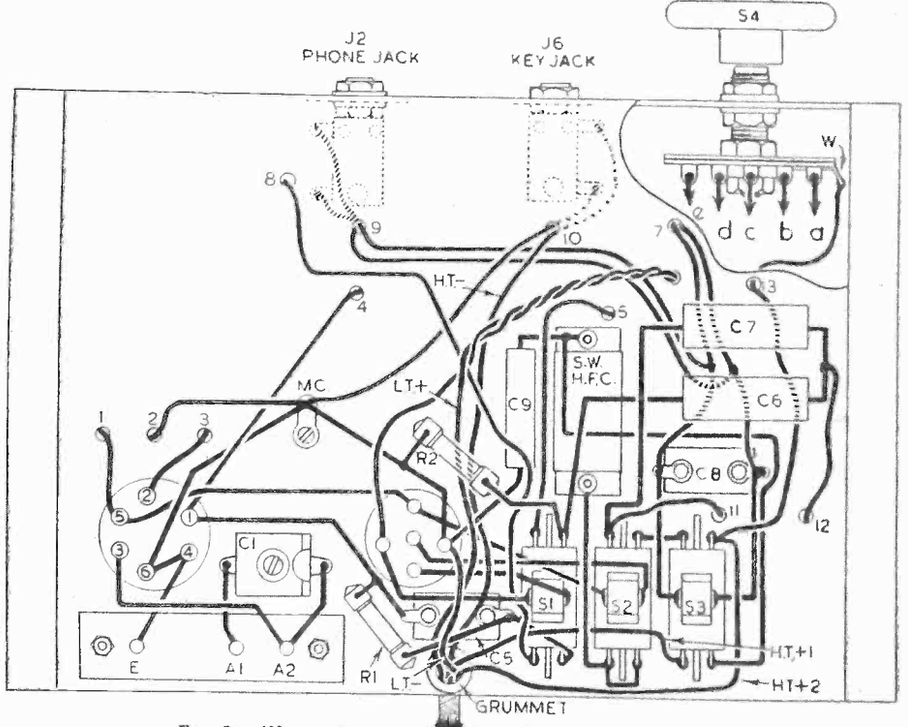


Fig. 3.—Wiring diagram of the complete unit.

PRACTICAL TELEVISION

March 23rd, 1940. Vol. 4. No. 195.

Efficient Mounting

CATHODE-RAY tube television receiver design has progressed very materially both in this country and abroad, and the results of this work have become very evident in the detail of sets which from time to time have appeared in the columns of PRACTICAL WIRELESS. One very marked feature is the considerable reduction in the size of the vision chassis which is called upon to handle the low-input signals from the elevated dipole aerial and amplify these with the minimum of amplitude and phase distortion to a voltage figure which is sufficient to give full modulation between black and white in the cathode-ray tube charged with the responsibility of reproducing the radiated picture in miniature. Coupled with this is the improvement in scanning circuits and the electron beam deflecting equipment, with the result that a number of units can be mounted conveniently on a single removable shelf in the receiver cabinet. The accompanying illustration features a modern example of this practice. A rigid metal chassis is built up to hold the time-base generator valves and transformers, and this part of the apparatus is seen on the left. In the centre is a metal cowl, inside which is the line and frame electro-magnetic deflecting coils, the former having an air core and being strapped to the cathode-ray tube glass neck, and the latter a laminated iron core with wing ends so that any tendency towards trapezoidal shaping in the scanning field can be rectified very readily. On the right of this is the screened box housing the vision receiver proper in a neat, compact form, the reduced size in many cases being made possible by the use of secondary emission valves.

A Neat Device

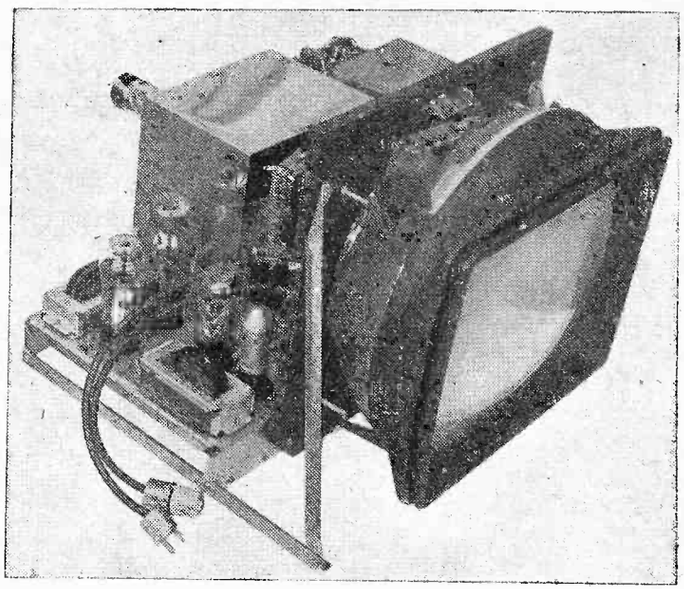
HELD to the front of this metal chassis by screws and bracket arms is a wooden board with a shaped hole through which projects the truncated glass section of the cathode-ray tube. The problem to be faced at this juncture is the efficient mounting of the cathode-ray tube itself so that it is lined up satisfactorily with the deflecting equipment, and shows no tendency to get off centre and so upset the scanning field produced on the fluorescent screen face. As can be seen from the illustration, a very satisfactory solution to this difficulty is to use a moulded rubber cap. This is stretched over the circular face of the C.R. tube and held in tension by four tongues with end holes slipped over L-shaped hooks screwed to the wooden board. The front of this rubber cap is cut out to a rectangular shape which corresponds exactly with the final size of the television picture, and a channel round the outer edge enables this to fit in the cut-out aperture in the front of the wooden cabinet. Both support and masking are therefore undertaken by this single fitting, and the work of assembly is made easier. Furthermore, with an efficient mounting of this nature the work of servicing is made simpler. The whole shelf can be slipped out of the cabinet quite readily after the removal of one or two registering screws, and if a cathode-ray tube has to be renewed it is the work of a few moments to release the rubber mask, remove the tube and replace a new one. Many variants of this form of mounting are possible, but there is no doubt that the whole idea is a marked improvement on the schemes adopted in the early days of cathode-ray tube television receivers.

Satisfactory Synchronising

IT is generally accepted that no matter how good a television picture may be from the point of view of brightness, contrast, detail and gradation, it will fail completely as home entertainment unless properly synchronised, so that it remains quite steady within the cabinet mask. It is for this reason that so much time is devoted by engineers to the synchronising problem in an endeavour to find a foolproof system. Some involve radical changes at the receiving end and others at the transmitting end, and an interesting example of the latter suggests that the line impulses should be radiated on a different carrier wave from the frame impulses. The inventor proposes that the frame impulse signals should be combined with the picture signals, it being arranged that the frame signals modulate the carrier-wave upwards from a given datum level, while the vision signals modulate it downwards from the same datum level. It is said that by this method the framing impulses can be employed for the purpose of automatic volume control in addition to fulfilling their normal function. The line impulses would be combined with the sound carrier wave, as it is claimed that they can be more clearly separated, and are also more immune from the upsetting effects of parasitic disturbances.

A Knotty Problem

WHILE the British authorities have been able to shelve many of the intricate television problems with which they were faced before the outbreak of war provided them with an adequate excuse, the development of the American television service has brought to the fore these same difficulties. It is possible, therefore that the British industry may ultimately profit by making a close observation of the solutions which the Americans will be forced to propound. One of the most acute problems being dealt with by the Federal Communications Commission in the United States is that associated with picture standards. Will a picture dissection of 441 lines with 60 frames per second interlaced to give 30 complete pictures per second be acceptable to the set buying public, and if so, for how long? Fraught with all manner of side issues, engineers and experts are agreed that just as was the case with British television after nearly a year's trial, the picture as seen on the home commercial set does not in any way approach theoretical quality of 441 lines. From the point of view of measured detail the figure seems to be nearer that of a picture of 250 lines, while gradation and contrast are well below the theoretical maximum. It would therefore be unwise to talk of improved picture standards until every avenue has been explored for the purpose of bringing the received picture up to the quality it should exhibit.

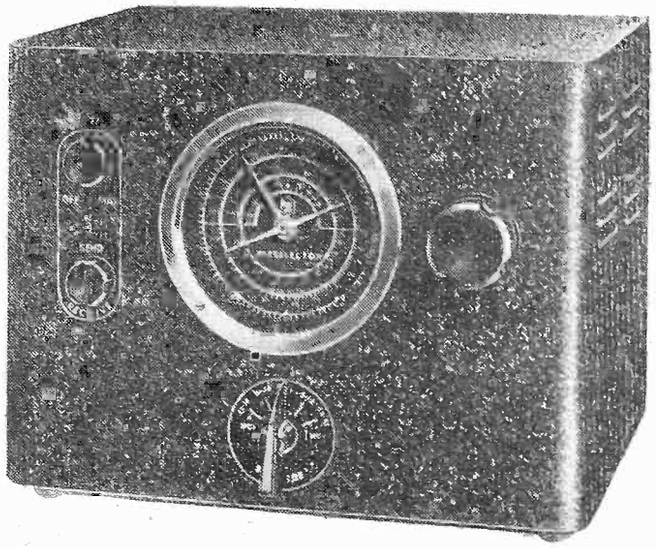


A very good example of a compact television receiver chassis mounting, providing also a first-class support for the cathode-ray tube.

Peto-Scott Pre-selector

WHEN it is desired to increase the range of an existing receiver on the short waves, and at the same time to introduce additional selectivity, a pre-selector is a valuable type of unit to use for the purpose. Normally this consists of a single valve arranged in a more or less standard H.F. circuit and the improvement is quite marked. An interesting unit designed on similar lines, but having additional gain and selectivity by the use of two valves is that shown in the accompanying illustration, and produced by the Peto-Scott Company. A standard two-H.F. circuit is employed, with H.F. transformers in both the input and inter-stage positions. The two valves are the latest "E" series low-noise H.F. pentodes, and a separate mains section is included to make the unit entirely self-contained. It is thus independent of any voltage supplies from the receiver with which it is used. The coil unit is of the standard Peto-Scott type divided into five bands, and covering the range from 7 to 550 metres. The appropriate band is selected by the lower switch, and the two controls on the left are for on-off volume control, and for "send-receiver" when the unit is used in conjunction with a short-wave receiver and transmitter.

The tuning control is the special band-spread mechanical drive which we have reviewed in these pages before. The input terminal socket is wired so that either a single or doublet type of aerial may be used.



The Peto-Scott Pre-selector. Note the bandspread dial.

Test Report

The unit was connected to a standard single aerial and coupled to an eight-valve communications type superhet. When the pre-selector was switched off it was found possible to tune in the higher-powered stations on the receiver without much loss of volume, and then when the pre-selector was switched on a very noticeable improvement was obtained. Apart from the additional gain, the improvement in selectivity was extremely good. Several weak stations which were normally blotted out by powerful stations on adjacent wavelengths, even on the superhet, were separated and brought to comfortable listening volume. The controls on pre-selector and receiver were independent, and sufficiently flat in tuning to remove all difficulty of finding stations. The approximate setting is obtainable aurally by the usual slight increase in background noise, and final tuning is then easily effected by the useful mechanical bandspread dial. Several American transmissions were heard during the early part of the afternoon which could only be found with difficulty on the superhet, and the improved input arising from the two-stage amplifier enabled the signal fed to the A.V.C. section of the superhet to be of such a level that the A.V.C. operated more efficiently, and thus it was possible to hold these stations and follow a programme through where previously it had been lost for quite long periods. The complete screening of the unit prevents inter-action between it and the receiver, and the only thing which was found worth while was to screen the lead connecting the unit to the aerial terminal of the superhet which was used for our test.

The price of this unit is £7 8s. 6d., and the dimensions of the cabinet are 12½in. wide, 9½in. deep and 9½in. high.

"Composers' Records"

LISTENING to the latest "hit" song on your gramophone, have you ever cast a thought back on the composers who sit up late nights thinking them out? This month the Decca Company have brought the actual composers to the microphone in order that they may sing their own songs to you. The series begins with Ross Parker and Hugh Charles, who cram six of their compositions on to one record. They introduce "We'll Meet Again," "Blue Skies are Round the Corner" and "There'll Always be an England," etc.—*Decca F* 7356. They will bring other composers to you each week under the title of "Song Writers on Parade."

How many times have you "known the name of that tune"—and yet been unable to name it? It is not so much over current song hits but over evergreen classics and near classics. A new Decca album contains ten such melodies which have been recorded by Harry Horlick and His Salon Orchestra. The second album to be issued under the same heading, it contains favourite airs as varied as Brahms' "Lullaby" (Wiegenlied, op. 49, No. 4) and the "Chinese Lullaby" from "East is West." This album of five 10in. records is excellent value for money—*Decca F*7239-43.

RADIO IN THE SERVICES

(Continued from page 23)

spindle could be used to move the secondary backward and forward within the primary.

Another method of providing variable selectivity is to place a small winding (generally referred to as a tertiary winding) on the former along with the primary and secondary; it would generally be placed between the two. This winding is not connected to any part of the circuit, but has a variable resistor in parallel with it. Alteration of effective resistance value varies the damping on the tuned circuits and therefore the selectivity.

WHAT would be the probable result if the bias resistor for an output pentode were (a) short-circuited, (b) open-circuited?

If the resistor, which is included between the cathode and H.T.—, were short-circuited, the valve would not be biased. This is because there would be no voltage drop across the resistor. As a result the valve would become excessively hot because of the marked rise in anode current, and would probably be damaged. Additionally, serious distortion would be noticeable.

Should the resistor become open-circuited the receiver would be "dead," because there would be no flow of H.T. current through the valve. It would also be found that the temperature of the glass bulb would be considerably less than usual.

EXPLAIN very simply, with the aid of a diagram, connections for a double-diode valve used as second detector and automatic volume control.

Fig. 2 shows representative connections, although there are many possible variations and modifications. The right-hand anode is used for second detection, and is connected to a centre-tapping on the secondary of the final I.F. transformer, the lower end of which is returned to earth through a load resistor. The diode is a rectifying (or one-way) device, and the rectified (strictly de-modulated) output is developed across the load resistance between the transformer and earth. A volume-control potentiometer is wired in parallel with this to provide the feed to the grid circuit of the L.F. valve. Included also in this circuit is a grid condenser of .01 mfd. and a 50,000-ohm H.F. "stopper" resistor.

The left-hand diode anode is used for A.V.C. and is connected to the anode of the I.F. valve through a .0001-mfd. fixed condenser. H.F. current is applied between the anode and cathode of the diode. As a result, a rectified or D.C. current is produced and is allowed to build up across the .25-megohm load resistor between the A.V.C. anode and earth. From the upper end of this (which is negative in respect of the earth line) a lead is taken to the grid circuits of the controlled valves. In Fig. 2 a .5-megohm decoupling resistor and a .05-mfd. by-pass condenser are shown in the A.V.C. line. Components of similar value to these would be used to decouple each of the controlled valves.

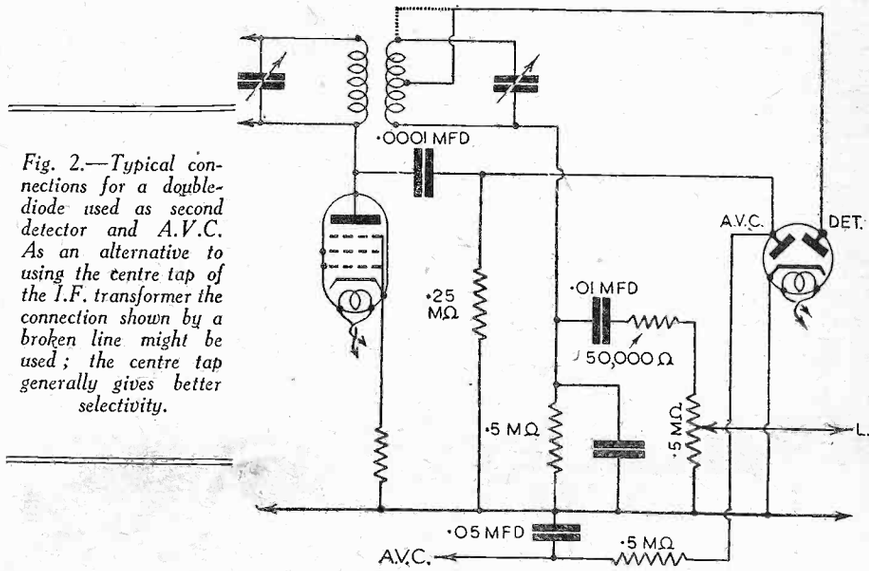


Fig. 2.—Typical connections for a double-diode used as second detector and A.V.C. As an alternative to using the centre tap of the I.F. transformer the connection shown by a broken line might be used; the centre tap generally gives better selectivity.

It should be stressed that the values indicated are approximate only, and might have to be altered to suit different valves and circuits.

C-R. Tube Focusing Refinement

IN order to produce a really satisfactory television picture it is essential that the beam of electrons should be in exact focus at every point of impact on the fluorescent screen. Many refinements are introduced in the electrode assembly in an endeavour to achieve this ideal condition, but frequently this is nullified by the secondary emission of electrons at the final apertured anode. These electrons are released at varying velocities and in consequence are not brought under the same focusing influence as the main electron stream passing at high constant velocity through the aperture. The result of this is evidenced by an enlarged light spot area on the screen, and a measure of distortion due to the irregularity of shape and random electron velocities. It is therefore preferable to adopt any measure which will serve to collect these secondary electrons before they have an opportunity of upsetting the focus of the main beam. One scheme which has achieved a measure of success is to mount on the remote side of the apertured anode a convex-shaped electrode of non-secondary emissive material. This has the main anode potential applied to it, and the secondary electrons passing through the main anode aperture are collected by this electrode. This enables the primary constant speed electrons to progress through the tube's focusing system, whether electro-magnetic or electro-static, and impact on the screen at a sharply defined small area as an intrinsic light spot.

A Morse Oscillator

Details of an Unusual Type of Morse Practice Outfit

IT is very seldom that one finds the opportunity of taking advantage of any of the various circuit differences with which one meets when experimenting, and it is improbable that a practical use will readily suggest itself should an exception be realised. However, if one treats a fault or inconsistency as a definite function, then there is no reason why something may not be made of the condition which can provide merits in other directions. The writer, adopting this idea, decided to make use of parasitic oscillation of the type which we all know so well, and which comes under the category of "microphony."

In the case of parasitic oscillation, which may take the form of a purely electronic condition, a mechanical state governed by resonance, or a combination of both, attempts are invariably made to eradicate or prevent this occurring, but in the application described, the results of speaker-to-microphone feed back is the basis for an audio oscillator for use as a morse practice unit.

The first experiment along these lines consisted simply of back coupling, through the medium of two headphones suitably mounted on a stand, one 'phone being supported on an adjustable bracket as is illustrated in Fig. 1.

By observing the signal intensity in audio output, there resulted another form of parasitic oscillation, this taking the form of electronic feed back, and resulting in a most unpleasant background very similar to that known as threshold howl.

Although this whistle, which resulted through the common core modifying the unit so that it functioned as a small L.F. transformer, was well below the signal strength, it had to be eradicated, and this was simply brought about by earthing the core of the "Transformer" or coil unit, and so a separate terminal (E) was provided as will be noticed in the illustration which shows also the corresponding coil connections to the other terminals.

A good deal of experimenting was carried out in an endeavour to get constant amplitude, and various other arrangements will no doubt suggest themselves. However, the methods adopted by the writer will prepare the ground for readers interested in this scheme.

The next step constituted a return to the double earpiece unit given in Fig. 1, but in this instance one 'phone, "P1," served as the oscillatory unit, embodying the self excitation principle just described, whilst the other 'phone, "P2," comprised an ordinary unmodified earpiece. This latter earpiece was used to convey the audio signals omitted from the oscillatory unit to a pre-amplifier, of the type illustrated in the combined mixer and pre-amplifier recently described in these columns, the output from this amplifier being taken to a pair of headphones.

The results of this experiment showed that the signal could be considerably attenuated to prevent resonance distortion in the mechanical movement of the diaphragm, thus permitting a more loosely adjusted diaphragm and closer coupling between the unit and receiver earpiece, this providing a more constant pitch.

The most important consideration which arises in this form of oscillation is the ability of the unit to respond to the morse key—and this was obtained by the apparatus used by the writer—but there is no doubt that with a little more critical design on the part of the experimenter, as for example by using separate cores for L1 and L2, a really serviceable arrangement could be evolved. It should be pointed out, in conclusion, that when bringing the input and output 'phones into close proximity, care should be taken that the leads to these earpieces are not near or parallel to each other, and the most favourable results will be obtained by screening these leads, although in early test this was not found to be absolutely essential.

Insulation should be carefully checked owing to the H.T. circuit in which the feed-back coil (the coil connected to the amplifier output terminals), is connected, and it would be preferable for a filter choke output scheme to be adopted in the output stage of the amplifier. Figs. 3 and 4 provide the keying circuit and a diagram of a non-amplifying system where the 'phones P1 and P2 (see Fig. 1) are assembled as a combined signal generator and receiver, using a common diaphragm, the pick-up in P2 being passed on to another pair of headphones.

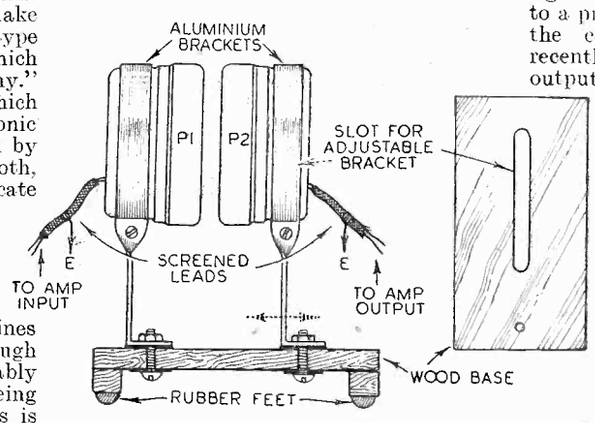


Fig. 1.—The first step in the development of the oscillator.

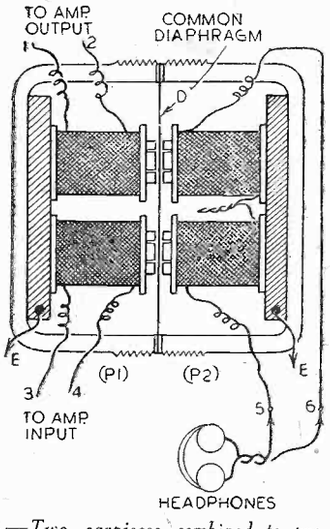


Fig. 3.—Two earpieces combined to provide a similar effect to Fig 1.

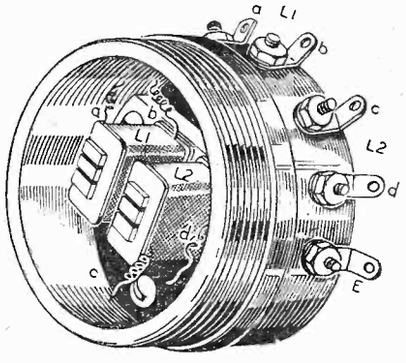


Fig. 2.—How the earpiece was split up and provided with terminals in a further stage of development.

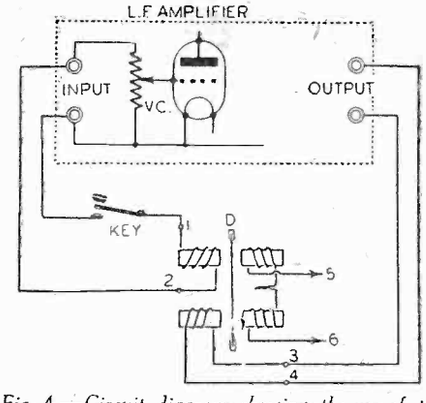


Fig. 4.—Circuit diagram showing the use of the oscillator and keying system.

Modifications

Experiments in this direction necessitated the interruption of the series coil connection in a cheap headphone, each coil connection now being brought out to separate terminals as is depicted in Fig. 2. Now, in adapting this headphone for the dual functions of microphone input and relation to such factors as the flexibility of the diaphragms, the distance between the 'phones and the output power of a simple hook up two-valve amplifier, it was soon realised that the oscillatory condition which, although subject to amplitude variations, could quite possibly be incorporated in a single unit in this way, somewhat restricting the mechanical vibration and thereby obtaining a fairly steady signal.

LATEST PATENT NEWS

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Abstracts Published.

TWO-PART COUPLINGS. — Naamlooze Vennootschap Philips Gloeilampenfabrieken. No. 504866.

A radio receiver adapted for use on A.C. or D.C. mains by means of a converter is provided with a socket plate A, B (Fig. 1) mounted on the back of the set and engaged by a plug member (Fig. 2) engaging rows of contacts III and IV in one position, whereby the mains terminals 9, 10 are connected through the switch 5, and sockets 8, 12, 11, 15 to the set mains supply terminals 12, 15, while in the other position, the plug member is withdrawn, rotated about the shaft M through 180 deg., and engages rows of contacts II, III. In this latter position the mains terminals 9, 10 are connected to sockets 1, 4, connected to a converter, the A.C. output of which is fed back to sockets 2, 3, and thence via sockets 6, 7 to terminals 12, 15. The plug and socket members are so arranged that they can only be engaged in two positions, an indicator showing the kind of input current in use being exposed by the corresponding operation of the plug member (not shown). The switch 5 acts as a mains switch for either position. The device may also be used to switch a supply transformer in and out of circuit according to the A.C. mains voltage available.

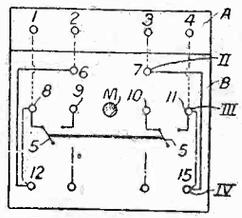

Fig. 1.

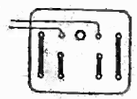
Fig. 2.

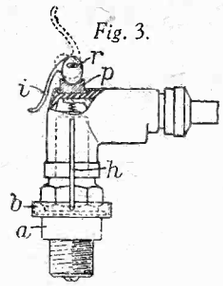

Fig. 3.

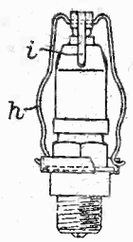

Fig. 4.

TWO-PART-COUPLINGS.—Bosch Ges., R. No. 502058.

A radio-screened sparkling-plug coupling is secured by a spring bail *h* (Figs. 3 and 4), pivoted in a member *b* secured to the casing *a* and tightened in position by a spherically-ended lever *i* rotatable to press in a concave seating *p*. The slot *r* in the lever through which the bail passes is narrower in the middle than at the ends, permitting the lever to be operated at one side or the other of its medial position.

EARTH RODS.—Adie and Nephew, Ltd., C. J., and Fletcher, R. A. No. 502269.

An earth rod has a cruciform, channelled, or other flanged or webbed cross-section and is formed by one or more suitably bent or folded metal strips. As shown in Figs. 5 and 6, a rod is of hollow cruciform

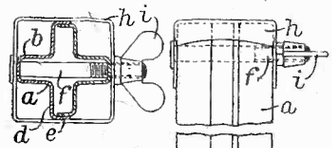

Fig. 6.

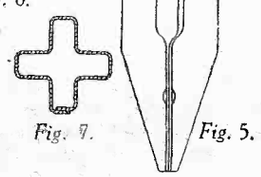
Fig. 7.

Fig. 5.

cross-section and is formed by two metal strips *a* each shaped by rolling, drawing or folding to a tee cross-section. The head *d* of each tee is formed with lips or flanges *e*, the lips or flanges of one tee being arranged within those of the other tee and united thereto by welding or riveting. The lower end of the rod is tapered and the upper end is closed by a cap *h* retained by a bolt *f* and wing nut *i* which serves also as the means for securing the earthing wire to the rod. In a modified construction, the two side portions *b* of the stem of each tee are in contact and the head portions of the two tees are also in contact. In another construction, a rod of **I** cross-section comprises a pair of channel-sectioned strips secured together with the channels outermost. Any of these constructions may be formed from a suitably shaped single meta strip. Fig. 7 shows a rod having a cross-section similar to that shown in Fig. 6 and formed from a single strip.

NEW PATENTS

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Latest Patent Applications.

3561.—Cinch Manufacturing Corporation.—Sockets for thermionic valves, etc. February 26th.

3614.—Condliffe, G. S.—Cathode-ray tube apparatus. February 27th.

3537.—Duncan, E. G., Mayturn, J. A., and Mulparvo, Ltd. — Radio receivers. February 26th.

3428.—Kramolin, L. L. de.—Arrangement for automatic or manual selectivity of tuning control of electric oscillatory circuits. February 23rd.

3557.—Lawson, D. I., Weighton, D., and Pye, Ltd.—Harmonic analysers. February 26th.

3710.—Marconi's Wireless Telegraph Co., Ltd.—High powered electron discharge device. February 28th.

3711.—Marconi's Wireless Telegraph Co., Ltd.—Wireless receiving systems. February 28th.

3712.—Marconi's Wireless Telegraph Co., Ltd. — Coupling devices. February 28th.

3462.—Marconi's Wireless Telegraph Co., Ltd., Cockerell, C. S., Brailsford, J. D., and Cufflin, M. H.—Directional radio receiver systems. February 23rd.

3464.—Marconi's Wireless Telegraph Co., Ltd., Cockerell, C. S., Brailsford, J. D., and Cufflin, M. H.—Plug socket, etc., connectors or racks. February 23rd.

3574.—Philips Lamps, Ltd.—Wireless receivers with bandspread tuning. February 26th.

3645.—Philips Lamps, Ltd.—Manufacture of coils, etc., for electrical purposes. February 27th.

3433. — Standard Telephones and Cables, Ltd., and Earp, C. W.—Radio beacons. February 23rd.

3434.—Standard Telephones & Cables, Ltd., and Earp, C. W.—Mechanical modulator for high-frequency waves, particularly for radio beacons utilising two tones. February 23rd.

Specifications Published.

518210.—I. M. K. Syndicate, Ltd., and Nagy, P.—Television systems, and thermionic valve circuits for use there.

518214.—Marconi's Wireless Telegraph Co., Ltd., and Kaell, O. E.—Electron-discharge tube amplifiers.

518311.—Compagnie Pour la Fabrication des Compteurs et Material D'Usines A Gaz.—Telecinema transmitters. (Cognate Application 21326/38).

518221.—Ferranti, Ltd., Miller, J. L., and Wood, H.—Cathode-ray tubes.

518229.—Cole, Ltd., E. K., and Bradfield, G.—Motor-operated tuning mechanism for radio receivers.

518273.—Belling & Lee, Ltd., Disney, A. L., and Strafford, F. R. W.—Means of suppressing electrical interference by sparking-plugs of internal-combustion engines.

518200.—R.C.A. Photophone, Ltd., and Underhill, J. L.—Potentiometer circuits for controlling voltages for push-pull photo cell circuits, thermionic valves, and similar purposes.

518378.—White, E. L. C.—Thermionic valve circuits.

518390.—Maclarty, B. N.—Thermionic valve amplifiers.

518205.—Holstensson, A. H.—Talking-machines for playing a plurality of records in succession.

518308.—Rudkin, E. P.—Wireless receiving system. (Divided out of 518128.)

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.

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 Five-valve S.W. Set Wanted

SIR,—I have been a reader of your grand paper from the first number, and have built many short-wave receivers from your designs, but I, and many other readers, I think, would welcome a receiver on the following lines: a five-valve A.C. mains short-waver, with 1 untuned H.F. Det., 2 L.F. (pentode output), rectifier, built-in energised speaker, and plug-in coils.—A. G. MARTIN (Bexleyheath).

Back Number Wanted

SIR,—I should be glad if any reader who has PRACTICAL WIRELESS dated Feb. 9th, 1935, which describes the construction of the Universal Hallmark 4, would kindly lend me the copy for a few days.—H. FRANKHAM (42, Harriett Street, Cathays, Cardiff).

Books Damaged in Transit

SIR,—I have just examined an amateur call book and two American text-books, all of the soft-backed variety and supplied by two different sources in this country who import them. Each book has a permanent crease and cracked cover due to being folded for postage. Personally, should I require any American publication I should place my order in the U.S.A., where a request to carefully pack flat is always granted. It is to be hoped that British suppliers will copy those of the U.S.A. The postage would be a little extra, but would assure that such books arrived minus the crease. Considering the prices of some of these publications, which are well worth the outlay, the purchasers at least deserve copies which arrive undamaged.—A. W. MANN (Middlesbrough).

Full-wave Detection

SIR,—Mr. Ford will have his little joke! Your readers will, no doubt, appreciate that it is all a matter of terminology. The arrangement he describes in his letter (your issue, dated February 24th), is, of course, not a "full-wave" detector, but a "push-pull" detector. He will not, I think, doubt the possibility of "push-pull" detection of radio-frequencies. Full-wave detection is, of course, theoretically possible, but since all available detectors are (like everything else in this world) imperfect, none having zero reverse current, they cannot detect (rectify) the "full" wave.—"EMPIRICIST" (Ickenham).

Stations Ankara and Helsinki

SIR,—I would like to report that station TAP on 9.46 mc/s is the only short-wave station in operation in Turkey at the present time. News is given in English at 20.15 B.S.T. to 20.30, and the station closes down at 22.30 B.S.T., QRA "Correspondence Dept.," Radio Ankara, Ankara, Turkey. The station welcomes reports. Helsinki (Finland) can still be heard at 04.00 B.S.T., with news in English.—C. W. HARVEY (Wembley).

Logged on 28 and 14 mc/s

SIR,—I append my log of stations heard here on my o-v-1 (home built), with a number 19 valve as det. and L.F. A twin cable antenna was used, 20ft. long and 30ft. high. 28 mc/s (fone): W1GE; W2IYX, FII; W3HFW, GUF, EVP, HUV; W6RKI; W8FGV, RXY, FXM, FJV, FZZ, QCK, AEM, PUV, DXE, RLT; W9YEL, HRC, DAX, USU, and OQ5AB. All stations heard between 15.00 and 17.30 hours.

14 mc/s (fone): W1JJK, AVK; W2IXY; W4DSY, CLK; W8AF, and ES5C.

The following broadcast stations were also heard: WCBX (13, 16 and 31 metres), WCAB (13 metres), WNBI (16 metres), WRUL, GEA, PIT (19 metres), WGEO, RCA (31 metres) and TGWA (31 metres). I think your paper is excellent, but I should like to see the return of the "Leaves from a Short-Wave Log." column.—R. BROMELL (Solihull, Birmingham).

Exchanging QSL Cards: Radio Saigon

SIR,—I have recently placed a standing order for your very fine paper. I have been very interested in its contents though I do not agree in this matter of exchanging QSL cards. I have been a S.W. listener for four or five years now, but have only about two dozen cards among these being W9XA and W9XUP on 11 m., W9TNP on 75 m., two VQ4's, K6OQE and VK4KH on 20 m. I have also a card from W6NBE. My report was first from Wales. Now, I naturally am very proud of these cards, and would never dream of exchanging them for cards confirming a station I have never heard.

Radio Saigon, Boite Postale, 412, Saigon, French Indo-China

Daily Schedule	Time, G.M.T.
11.35 p.m. to 12.15 a.m.	News in French.
5.05 a.m.	News in French.
5.15 to 5.45 a.m.	Light Music.
11.00 a.m.	News in English and Music.
12.35 p.m.	News in Dutch.
1.0 p.m.	News in French.
1.15 to 2.0 p.m.	Music and Variety.
2.0 to 2.30 p.m.	Paris Mondial (relay).
3.0 to 4.0 p.m.	English Programme.

Subject to change without notice

Wavelengths	
6,116 kc/s.	49.05 metres.
11,780 kc/s	25.40 metres.
1,000 kc/s.	300 metres.

This morning I received a nice card from Radio Saigon, confirming my reception of November 30th last. I enclose this station's programme which may be of interest to other readers.—W. J. PARRY (Bangor, N. Wales).

S.W. Reception Conditions: Proposed Club for Chelmsford

SIR,—I should like to take this opportunity of expressing my sincere appreciation of your excellent weekly. I have been a S.W. fan for about two years now and have gained quite a lot of useful information from this paper. My receiver, an o-v-2, Det. and 2 L.F., works very well *without* an earth, having logged most of the commercial American stations such as WGEA and WCBX. With an earth I find the set acts very peculiarly, signals being very weak, although the earth connection is good. Having no earth connection may seem to tend towards instability, but I find the set very stable under all conditions. I'm afraid S.W. DX is very scarce lately, even the Americans being very evasive at times, although Australia's new short-wave transmitters, VLQ and VLQ2, are certainly holding their own. I should like very much to see the formation of a Radio Club in this district, and I invite anyone who is interested in the proposition to write to me.—D. WATLING, 64, South Primrose Hill, Rainsford End, Chelmsford, Essex.

Proposed Club for Plymouth

SIR,—I would like to exchange views with other local enthusiasts regarding the formation of a Wireless Club in the Plymouth District.—W. F. NOYCE, 46, Clarence Road, Torpoint, Cornwall.

Correspondents Wanted

SIR,—I am at present confined to hospital, and being interested in radio, I would much appreciate a letter from any reader who cares to correspond with me.—EDWARD KIRBY, Ward 38, St. James's Hospital, Leeds.

SIR,—I have been a reader of your fine journal for a number of months, and I find it very helpful.

I would very much like a correspondent, who is interested in short-wave listening. I have a 2-valve S.W. set, and I am using a Telsen dual-range short-wave coil. Wishing your journal every success.—R. WHITELAW, 118, Leamington Road, Coventry, Warwicks.

The 30/- Three

SIR,—I would be glad if any reader who has built the 30/- Three would get in touch with me. I have been a reader of your excellent paper for the last two years, and have found it invaluable.—B. JOHNSTON, c/o A. Adair, 15, Woodhouse Street, Portadown, Ulster.

Prize Problems

PROBLEM No. 392.

JACKSON had a good milliammeter and decided to make up a general-purpose tester. The meter read 1 mA and he worked out the various current shunts and series resistors for voltage readings, and having obtained these he connected them all to the meter and various switches. When completed he made one or two tests of anode current on his set but found that on all the current readings he obtained practically the same reading. He examined the switches and found that these were working correctly. 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. 392 and must be posted to reach this office not later than the first post on Tuesday, March 26th, 1940.

Solutions to Problem No. 391.

When Marshall added his auto-bias circuit he overlooked the fact that the grid-return lead should have been taken to the H.T. negative terminal, but he connected it to earth. Consequently the valve was not biased.

The following three readers successfully solved Problem No. 390 and books have accordingly been forwarded to them: D. M. Webber, Millswood, South Brent, Devon; W. J. Barnsley, 8/27, Garbett Street, Ladywood, Birmingham; C. D. Sergeant, 6, Greenway, Chislehurst, Kent.

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
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/8 " "

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*.

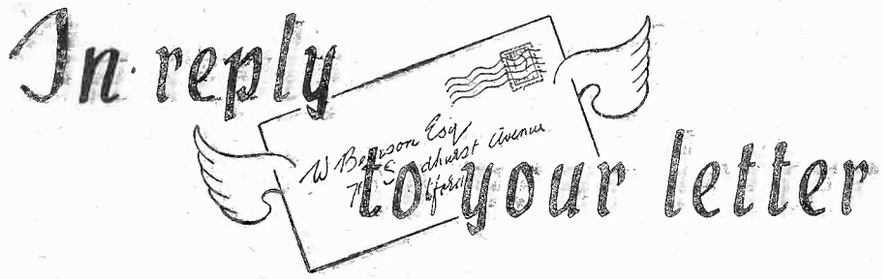
Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS CRYSTAL SETS

	Date of Issue.	No. of Blueprint
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.

	Date of Issue.	No. of Blueprint
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



Oscillator Tone

"I recently put together a small single-valve oscillator for morse practice. I used an old transformer I had and it works admirably except for one thing, and that is the tone. It is rather low and unpleasant and after using it for half an hour or so it begins to bore. Is there any way of varying the tone so that I can get a higher pitch after using it for some time to relieve the monotony?"—H. W. (Feltham).

THE tone is dependent upon the transformer, and if it is an old spare model you could remove some of the laminations of the core in order to raise the tone. If you use the two windings without any core the tone will be very high, and thus by making an adjustable core from pieces of the existing laminations you could provide an easily operated form of tone control. The volume will, of course, fall off as the core is removed, but this should not be of any importance as the H.T. may be raised to compensate.

I.F. Transformer Design

"I recently made up a pair of I.F. transformers, using some data which I found. When completed I wished to try and avoid changes due to moisture or climatic conditions, and dipped the coils in ordinary paraffin wax. I find, however, that I cannot get the two transformers to tune and I wonder if the dipping has had any effect on them. Could you please ascertain this for me?"—W. T. R. (Holloway).

THE data which you used no doubt applied to an air-spaced coil, probably of the honeycomb type of winding. This has a very low self-capacity and with the trimmers which had been specified they would no doubt have been quite in order. When coils are dipped in wax the self-capacity is increased, and in your case you may have omitted to dry out the coils thoroughly first and thus, although impregnated, they may be full of moisture and this will aggravate the effects of the added wax. A smaller padding condenser might be capable of giving the desired frequency range, but if not, then turns will have to be stripped until the desired range has been obtained.

Beginner's One-Valver

"What is the approximate cost of the Beginner's One-Valver, details of which appeared in the issue dated December 23rd, 1939? Also, what sort and type of valve is used in this set?"—A. G. W. (Truro).

THE approximate cost to-day would be about 25s., but owing to price fluctuations it is not possible to quote an exact figure. A suitable valve would be the Cossor 210 HF.

Short-wave Station Addresses

"Could you recommend to me a book containing the addresses of short-wave broadcast stations? How much would a copy cost and where would I have to send to obtain it?"—D. H. (Gildersome, nr. Leeds).

WE do not know of any book which contains only a list of short-wave stations, but a very comprehensive list of such stations and addresses has been included in our latest book, the "Short-wave Manual." This may be obtained from this office, price 5s., or by post for 5s. 6d.

Making a Microphone

"When looking through my spares box I came across a single headphone and the idea came to me as to whether I could possibly make a microphone out of it. Could you help me in this matter?"—T. H. D. (Monkwearmouth).

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.

THE earphone alone is unsuitable as a mike as it would be very insensitive. There are several methods of improving it, however, and one of the simplest would be to fit a much thinner diaphragm. This should then preferably be mounted at the end of a small horn or sound collector to provide greater movement, but in general the magnet system does not lend itself to a very good type of microphone, although for experimental purposes you can find quite a lot of interest in it.

Medium-wave Coil

"Could you please let me have the method of making a medium-wave coil for a home-made one-valve receiver?" — A. McC. (Kilrea, Co. Derry).

A SUITABLE coil was recently described for our simple one-valver. A coil former of cardboard about 2½ or 3ins. in diameter is needed and for the grid winding you need about 45 turns of 22 or 24 gauge, double-cotton-covered wire. At the end of the coil former, and separated by about ½in. wind another small coil of thinner wire, say 28 or 30 gauge, and use 35 turns. This coil must be in the same direction as the grid winding. The end of the latter and the beginning of the second winding should be joined together and are connected to earth. The second winding is for reaction and the end is joined to the reaction condenser. The tuning condenser is connected across the grid winding. For an aerial coupling coil you can wind a further coil of 20 turns on a strip of paper, wound over the grid winding at the earth end, connecting the lower end of this to earth. Alternatively, the aerial may be joined through a small variable condenser (maximum capacity .0002 mfd.) to the top of the grid winding.

Servicing

"I wish to improve my knowledge of wireless service repairs in up-to-date sets. I thought you might publish a book on this, but if not what course would you advise me to take?"—G. C. (Slaithwaite).

WE publish a very good book on the subject, entitled "The Practical Wireless Service Manual." This covers every phase of the subject, including modern superhets, and costs 6s. from any newsagent or by post from these offices at 6s. 6d.

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.

A. B. (Ayr). Write to the Premier Radio Company, whose advertisements appear in these pages.

S. W. B. (Edgware). All the points raised by you have been covered in various articles, but we regret that we cannot insert your general request in our correspondence columns.

H. S. (Croydon). We replied to your letter of February 20th, but it has been returned by the Postal Authorities marked "Unknown."

C. B. R. (Prestwich). We cannot give you constructional data of the coil, but it may be obtained direct from Messrs. Bulgin, of Abbey Road, Barking.

L. H. (Slough, Bucks.). Messrs. Electradix may be able to supply you, but we cannot give any idea as to the price.

W. P. (Market Drayton). The coil is not now obtainable, having been withdrawn by the makers.

I. D. (Bushbury). We think the condensers are obtainable from Radiomart or from Webb's Radio.

J. A. G. (Bilton Grange). A total of 66 volts would be ample.

C. F. (Huddersfield). We can supply designs for various types of receiver, and details will be found in our Blueprints page.

K. T. (Bletchley). The transformer should not be of higher ratio than 5 to 1.

L. R. (Devizes). Couple the two coils through a non-inductive 1,000 ohm resistor.

G. T. E. (Barnet). Neither of the valves is obtainable now. We suggest a good modern A.C./D.C. type of valve.

N. E. (Perth). The transformer is quite suitable, although you may have to fit a bleeder to obtain an improved current drain.

R. A. (Cardiff). We cannot supply a diagram in this particular case. We do not know of any source from which it could be obtained.

T. W. (Maldon). The makers will assist you if you write to them and explain the matter.

R. E. G. D. (Oxford). The alternative parts mentioned would not prevent reception. We think, therefore, that you have made some mistake in the wiring.

A. M. (Kenilworth). We cannot advise the fitting of the switch mentioned. We cannot suggest modifications without further details of the receiver.

G. R. C. (Houghton Bank). A battery and 'phones in series will enable you to check the windings. I.P. may be taken as equivalent to Plate or Anode terminal and O.S. equivalent to Grid. The S terminals are the secondary and the P terminals primary.

W. M. (West Lothian). The only people who could supply details are the designers, the General Electric Company, Ltd.

J. W. S. (Sittingbourne). You will have to add further decoupling, or modify the H.T. supply lines so that a single output is taken from the mains unit.

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

COMBINED OSCILLATOR AND RECEIVER

(Continued from page 31.)

will result, it is not to be recommended, since with a heavier anode current and in an oscilliatory condition, the emission of the valve is affected.

The Lay-out

Now with regard to the component lay-out. From the cover illustration and in conjunction with the wiring diagram, Figs. 2 and 3, it will be noticed that a symmetrical appearance is obtained whilst allocating the left-hand portion of the chassis for the receiver circuit, with the right-hand portion for the audio oscillator components.

It will be seen on referring to Fig. 2, that the band-set condenser C2 is located underneath the reaction condenser, and this is pointed out since the earth connection to this condenser, indicated by X, may not be quite clear otherwise.

In the chassis illustrated, a different key jack was employed from that quoted in the list of components, this jack being located directly under the 'phone jack but on the underside of the chassis; however, as this was the original experimental lay-out, it has been realised since that the 'phone and key jacks quoted would be more conveniently mounted as depicted in the under-chassis diagram Fig. 3, which shows these jacks in dotted lines for convenience in following the wiring, but as will be realised on checking the component lay-out with the diagram of measurement Fig. 4, these two jacks are located above chassis and fitted to the front panel.

When wiring this switch it should be noted that turning the knob in a clockwise direction brings about a step-by-step increase in the inductance of the choke, as will be seen on checking the leads "a" to "e."

The switches S1, S2, and S3 are ganged by soldering a 1¾in. length of $^{5}/_{32}$in. diameter brass rod to the slotted toggles.

The drilling details given in Fig. 4 are for the components only, since this will prevent confusion which could arise in including the drillings for through-chassis connections; and as the relationship of the wiring holes numbered from 1 to 13 is clearly defined in Figs. 2 and 3, it is only necessary for the constructor to provide these holes as close to components as possible, conforming to the wiring diagram.

Holes 9 and 10, however, indicated in Fig. 3, are not included in Fig. 2 for the reason mentioned concerning these two jacks.

The runners for the chassis should be about 1¾in. deep and comprise any form of wood strip, measuring 6in. long by at least ¼in. thick, and to finish off, these should be rounded at the edges.

The 'phone jack J2 and the rotary switch S4 are fitted with fibre embossed washers to insulate them from the metal panel, consequently the holes marked "F" in Fig. 4, will require slightly enlarging, by filing after drilling, to accommodate these washers.

It will be seen in Fig. 3 that the wiper contact of S4 is indicated by "W," and although not mentioned previously when referring to holes 9 and 10, hole No. 13 is similarly treated, being shown only in the under-chassis diagram.

In conclusion it should be pointed out that whilst there is marginal adjustment in H.T., it will be found that 60 to 72 volts will be ample for H.T.+1, with 9 to 12 volts for H.T.+2.

RECEIVERS AND COMPONENTS

(*Continued from page 40.*)

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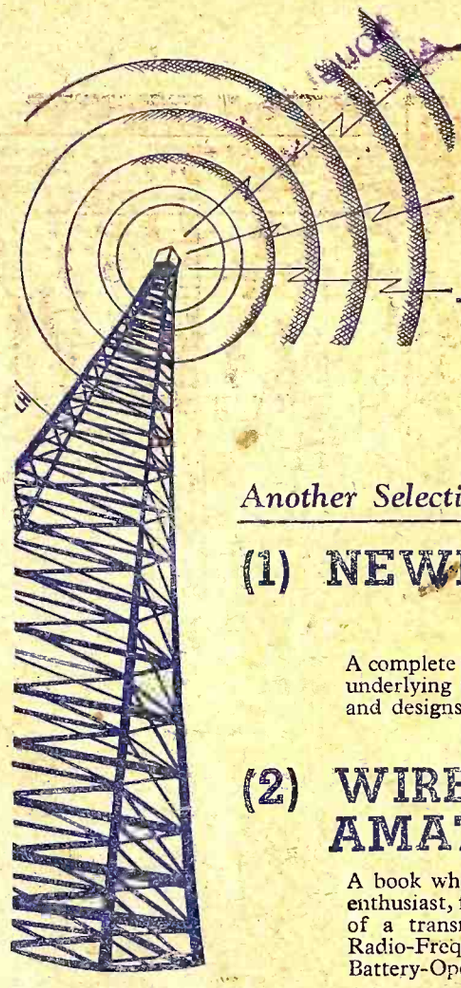

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READING A THEORETICAL DIAGRAM—

See page 42.

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Edited by F. J. CAMM

Vol. 16. No. 393.

Practical Wireless and PRACTICAL TELEVISION

3D.

EVERY WEDNESDAY

Mar. 30th, 1940.

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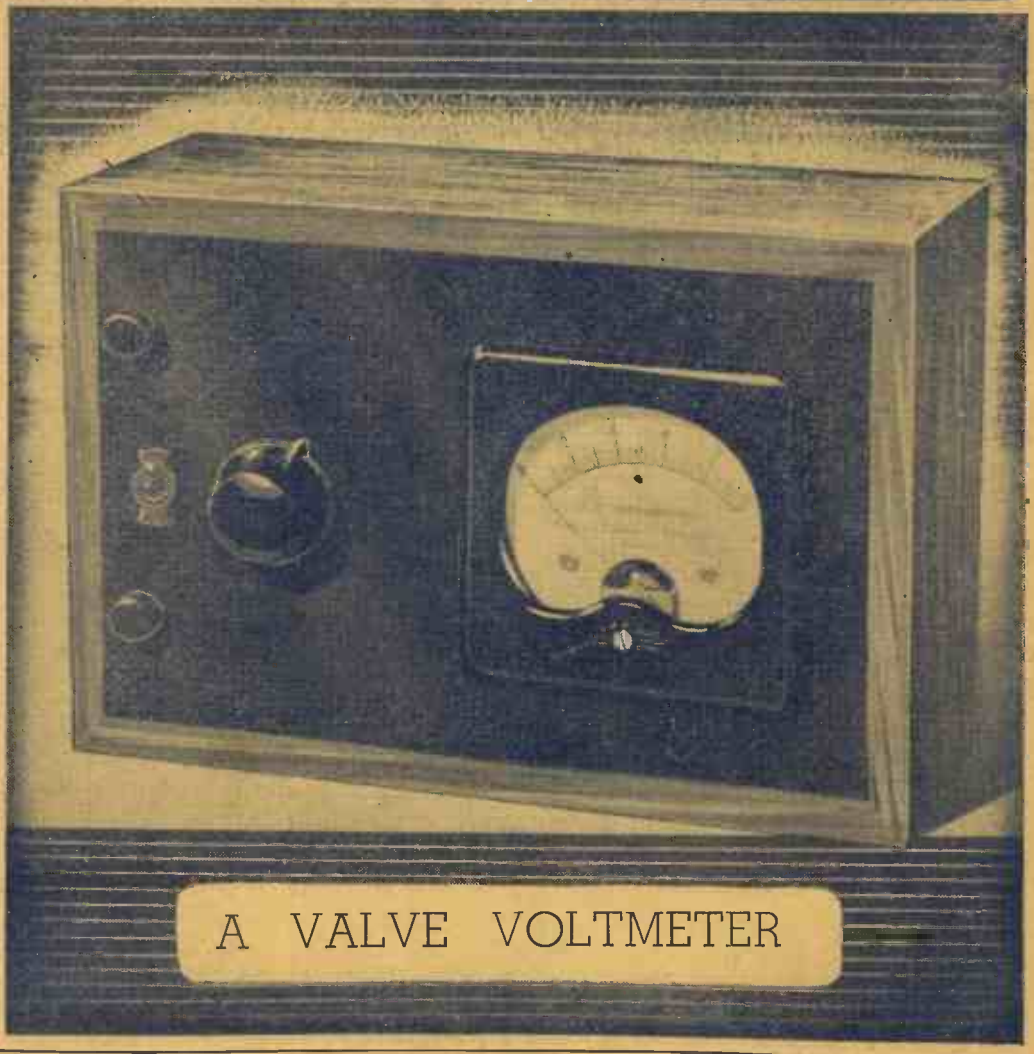

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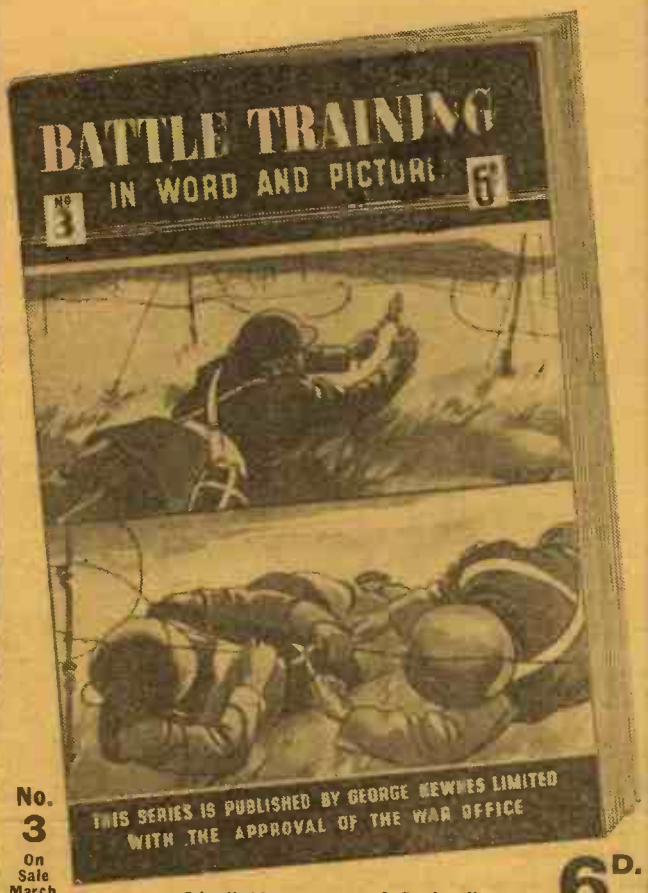

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ROUND THE WORLD OF WIRELESS

Measuring Output Voltages

MANY constructors are content simply to build a receiver or amplifier and if it sounds good enough to leave it alone. On the other hand, many experimenters prefer, when a receiver or amplifier has been completed, to measure various facts about it. For instance, its A.C. output; voltage gain; noise level, etc. There are various other factors which may be ascertained, although in many instances rather elaborate apparatus is required for the purpose. However, a good A.C. voltmeter will enable quite a number of measurements to be made, and in this issue we describe a simple meter of this type which may be used to measure the output and in the article is also explained how the noise level may be measured. Although not normally needed, it is quite an interesting process to make these measurements and, apart from them, the ability to see on a meter needle just what changes are effected in output when certain modifications are made to a receiver, will be found greatly to increase the interest of experimenting. Haphazard changes will be avoided and changes in output which might be due to some peculiar local condition or even a modification in the transmission will also be avoided.

National Anthems

THE B.B.C. announces that a special recording of the British, French and Polish National Anthems is being made by the B.B.C. Orchestra. It is intended that this recording shall be broadcast nightly at the end of the Home Service programme (12.15 a.m.); on Sunday nights it will be heard before the 9 o'clock News and it will also be broadcast on special occasions. The starting date will be fixed as soon as the record has been prepared.

"I Am a Jew"

THE tragedy of a Jewish family in Berlin during the Nazi terror which swept Jews out of their jobs and thousands of them into concentration camps, is the subject of a play called "I am a Jew," which is to be broadcast on March 28th. This play, which will be produced by Howard Rose, is a translation by Geoffrey R. Edwards from the German of "N.N." It tells the story of a Jewish ex-ray specialist and his family. Set in the autumn of 1938, it shows how the Professor is forced to leave his great work in a Berlin hospital and how the family life not only of the Professor but also of his children is completely broken up. It is a terrible story of the shattering effects of Nazism on a number of people, working and contributing of their best to communal life, as the scientist is doing, simply for the crime of being a non-Aryan in Nazi Germany.

"Yorkshire"

GEOFFREY BRIDSON is busy touring Yorkshire in search of material which should make a fine feature in the "Old Country" series. In his programme on "Yorkshire," which is to be broadcast for the Forces on March 30th, Geoffrey will bring all sorts of people from that county to the microphone; hardy dalesmen to talk of how they are getting over the winter; and a farmer from East Yorkshire; while the industrial West Riding will also be represented. Naturally, it will be impossible to stage a show about Yorkshire without some reference to sport, and Geoffrey is hoping that his listeners with the Forces will be able to hear the voice of some prominent member of the Yorkshire cricket club.

Recital from the North

TWO Northern artists are to give a recital on March 29th in the Home Service programme. They are Dorothy Donaldson, the Huddersfield soprano, who has sung at Covent Garden and toured with the D'Oyly Carte Opera Company abroad; and Sydney Errington, of Leeds, the well-known viola player. Mr. Errington is a member of the Hallé Orchestra.

"Art Thou Not Romeo?"

"ART Thou Not Romeo?" is the title of a "Green-Room" comedy by P. H. Burton to be broadcast on April 3rd in the Home Service programme. This programme will contain versions of the famous Balcony Scene written in the manner of Noel Coward's "Private Lives," Eugene O'Neill's "Strange Interlude" and Bernard Shaw's "Man and Superman." The production will be by T. Rowland Hughes.

A.R.P. workers enjoy their leisure moments listening to broadcasts received on a G.E.C portable receiver.

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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.

Reading a Theoretical Diagram—2

Further Details Concerning the Reading and Application of the Shorthand of Radio

By L. O. SPARKS

BEFORE proceeding further with the examination of the various signs, it would be advisable to consider the actual components. The beginner should take the first opportunity of becoming familiar with the general shapes and markings of the components commonly employed in a receiver. The amount of experience that can be gained will, of course, depend on the amount of gear in the spares-box, but even if the stock is very low one should always be able to get a good general impression of the various parts by studying the plan-wiring diagrams which appear in these pages from time to time. It should not be difficult for anyone to recognise a variable condenser and trace out the connections to the fixed and moving vanes. For our purpose, it is sufficient to assume that there are two distinct types, namely, those employing air as the dielectric and those which use various forms of insulating material such as mica or bakelised paper.

Coils

Modern coils are easily recognisable by the size and shape of the screening can, number of terminals or connecting leads and weight. One common snag which appears to exist to a very great extent with this component is the fact that a reader gets hold of one or two coils for which he does not know the correct connections. While vast numbers appeal to the Query Service for help in this direction, it must be appreciated that unless the maker's name and the type number of the component can be given, it is impossible for the coil to be identified and help to be given. Owing to the huge number of coils produced, if the maker's name is visible, it is usually worth while communicating with them, as they can invariably supply a printed connection chart, unless the coil is very old.

Most H.F. chokes of modern design are housed in a small metal screening can, although, of course, there are many types without such screening, but it should not be a difficult matter to recognise them, as they are quite light, small, and only fitted with two terminals.

Transformers and Chokes

L.F. transformers, however, are often housed in cases of different material and shape, but again, these are invariably fitted with four marked terminals for an ordinary L.F. coupling component or five terminals for push-pull, Q.P.P. and Class B units. These items, owing to their iron core, are naturally rather heavy when compared with coils or condensers. The normal markings are Plate or Anode and H.T. positive for the primary, and G or grid and G.B. for the secondary. On some of the early components the terminals were often marked O.P. and I.P. for the primary and O.S. and I.S. for the secondary.

L.F. chokes might seem to be similar in shape to some transformers, but they can be recognised by the fact that only two connections or leads are provided. Mains transformers are about the heaviest components in radio, and as these are invariably fitted with quite a number of terminal sockets, all usually clearly marked, or with colour-coded leads, no difficulty should be experienced in recognising them.

Switch Types

Switches are one item which are made in many different styles or patterns, but if they are subjected to a careful examination it is not a very difficult matter to determine their type and possibly the purpose for which they are intended. The symbols for the most simple types are shown in the list to which reference was made last week. The most common is, perhaps, the one on the extreme right, which indicates a three-point on-off switch so widely used for wave-changing or breaking the supplies from the H.T. and L.T. batteries. The small circle shown in the centre is intended to represent the movable contact, and it should be noted that this is sometimes indicated as a small black triangle.

The other signs are really self-explanatory, but it is advisable to become familiar with what might appear to be the two simplest, namely, the last two signs, which show how to draw wires when they are joined together, and when they cross over but do not make any contact with each other. Failure to remember these two simple items might result in disastrous results to a receiver.

As stated last week, practice is the only method of becoming perfect so far as remembering and applying the signs, and it is up to every beginner to look upon all theoretical diagrams as material provided for such practice.

Practice Circuit

To this end, a three-valve circuit, plus valve rectifier, is shown above, and although it is not as simple as most beginners would like to choose for their initial efforts, it is not so difficult as it might appear at first sight.

The circuit is a normal three-valver, using an H.F. pentode for the H.F. stage, which has its output transformer coupled to an ordinary triode detector. The output from this valve is fed into a triode power output valve via an ordinary L.F. transformer. The fourth valve is a full-wave rectifier which receives its operating voltages (A.C.) from the secondaries of the mains transformer. The third secondary winding on this component provides the heaters of the three valves with their required voltage and current.

This particular circuit embodies almost all the symbols, and it should therefore provide excellent practice. As already mentioned, the coils are built up from the standard inductance sign, while the H.F. choke in the anode circuit of the detector should be readily recognised.

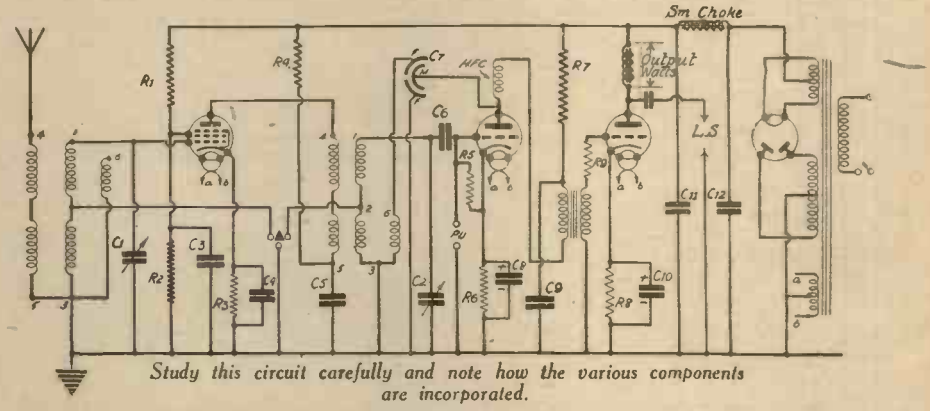
Ordinary and differential variable condensers are shown, and the wave changing makes use of a three-point switch which we have just discussed. The L.F. components, and there is an L.F. transformer, two L.F. chokes, and a mains transformer, are clearly indicated by their characteristic symbols. It will be noted that some of the fixed condensers are marked positive and negative. When these signs are shown against the symbol for a fixed condenser it indicates that they are of the electrolytic type which have to be connected with their polarity correct.

Simple Decoupling

Quite a lot is heard nowadays of decoupling and grid-stoppers. The former consists of a resistance and condenser combination while the latter is usually a resistance only. Their objects are common; they endeavour to prevent H.F. currents from getting through into adjacent stages. Simple anode decoupling is shown in the detector and H.F. anode circuits, the resistance R7 and the condenser C9 and R4 and C5 forming the decoupling arrangements. A grid-stopper is shown between the grid terminal of the L.F. transformer and the corresponding terminal of the output valveholder. It is marked R9.

If the circuit is examined diligently, quite a lot of useful information can be gleaned, as all the connections shown are perfectly orthodox, but, of course, the values of the various resistances will depend on the valves employed.

Beginners would do well to try to draw the circuit from memory, and then check their efforts against the original, taking particular care to note whether the various voltages, etc., are applied to the correct electrodes of the valves or their associated components.



Study this circuit carefully and note how the various components are incorporated.

Radio in the Services

A Refresher Course for the Radio Mechanic—3

By Frank Preston

Those making application for enrolment as radio mechanics are required to pass a test. Success in this may mean immediate promotion. In this third article are given some further questions of a type which may be asked—it is not suggested that any of them have been asked—along with what can be considered suitable replies. Preliminary sets of typical questions and suggested replies were given in the last two issues.

WHAT simple tests would you apply to an L.F. transformer suspected of being faulty?

There are three main tests to be applied: continuity of primary winding, continuity of secondary winding, and insulation between windings and between core and windings. In some instances it might also be desirable to check the approximate resistance of the windings since there may be a short-circuit between one or more sections of them.

The simplest tests of all can be made by using a pair of 'phones (or a P.M. speaker) and a small dry battery; a grid-bias battery is suitable. First the 'phones should be placed in series with the battery, after which one lead from the battery would be connected to, say, one primary terminal of the transformer. The second 'phone lead would then be touched against the second primary terminal. If the windings were intact a "plop" would be heard as the circuit was completed and broken. That is, there should be two distinct "plops." If there were only one, or if the noise was faint, the transformer could probably be considered defective.

Precisely the same test could be applied to the secondary, and the same method of deduction employed. Other tests would be made in the same way between the windings and between windings and core. In these cases, there should be only a very faint "click" as contact is made. If the noise is loud there is probably a short-circuit. Resistance tests would normally be made by using a resistance bridge, but a rough check would be possible by using an H.T. battery and a milliammeter. At first a very low voltage would be applied, but this could gradually be increased, if necessary, until a mid-scale reading was obtained. The resistance of the primary and secondary windings should be in the region of 1,000 and 10,000 ohms, respectively, for the average small transformer, but very wide variations occur in the different components in use.

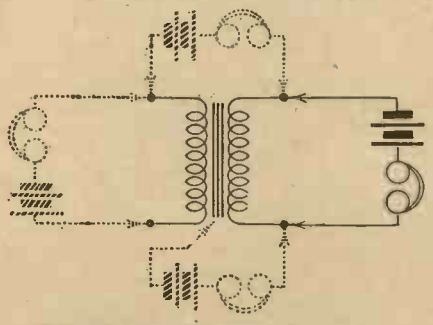
Is wattage dissipation the same as power output, as applied to an output valve?

No, the two are entirely different. Wattage dissipation is found by multiplying together the applied anode voltage and anode current (in amperes), whilst power output is a measure of the L.F. wattage developed across the output load. The wattage dissipation is always considerably greater than the maximum undistorted power output. In many cases the proportion is about four to one, but there is no constant factor.

Explain briefly the differences between an H.F. and an L.F. choke, and explain in few words how each operates.

An H.F. choke has a comparatively low inductance—an average value is 300,000 micro-henries—whilst the inductance of an L.F. choke is more often in the region of 25 henries. The different characteristic is accounted for by the comparatively few turns of wire, on an air core, in the case of an H.F. choke, and the use of a far greater number of turns, on an iron core, for an L.F. choke. (This is only a generalisation, since it is possible, although very unusual, to have a low-inductance non-core choke or a high-inductance air-core choke.)

They both function in a similar manner, but one is for use in low- or audio-frequency circuits, while the other is used in high-frequency, or radio-frequency, circuits. Each offers an impedance to the currents in the circuit, so that a voltage is developed across it. Thus, it can be said that chokes of both types act in a similar manner to a resistor in a D.C. circuit. There is much more that could be written on this subject, for the exact behaviour is best studied in conjunction with the particular circuit in which the component is used.



Method of testing a faulty transformer

Give two methods of determining the required wattage rating of a resistor for use in a given circuit.

When the value of the resistor was known, and also the current passing through it, the minimum safe wattage rating would be found by multiplying the square of the current in amps. by the resistance in ohms. For example, suppose a bias resistor is required for a valve which passes 30 mA. H.T. current, and the resistance required is given as 500 ohms. The wattage rating would be 30/1,000 times 30/1,000 times 500, which is 900/1,000,000 times 500 or 9/20 watt. Obviously, the nearest "round figure" value is ½ watt.

Were it known that a decoupling resistor passed 20 mA and "dropped" 180 volts. the required wattage rating would be found by multiplying the current in amps. by the voltage drop. In this case the answer would be 20/1,000 times 180, or 3.6 watts.

What instruments, in addition to a multi-range meter, would you consider desirable when testing superhet receivers?

The most important would be a modulated oscillator, which could be tuned to the intermediate frequency. By feeding into the first, second or subsequent I.F. transformer a steady signal, accurate stage-by-stage tests could be made. The modulated oscillator would also provide an accurate method of carrying out any alignment which might be found necessary.

An output meter would also be valuable, if not essential, when making final adjustments for alignment. This is because the ear is by no means a sensitive organ for the purpose of comparing volume levels.

Explain the difference between wavelength and frequency, and give a simple rule by means of which one may be converted into the other.

Wireless waves travel at the same speed as light (about 300,000,000 metres a second) and always travel at precisely the same speed. Thus, if the wavelength were 1,000 metres there would be 300,000 "waves" a second. The "waves" are more correctly described as cycles, so it may be seen that a wavelength of 1,000 metres is the same as 300,000 cycles, or 300 kilocycles per second. This is generally expressed as 300 kc/s.

From the above example, it will be seen that wavelength in metres can be converted to frequency in kilocycles per second by dividing the wavelength into 300,000. Thus 300 metres is equivalent to 1,000 kc/s, and 20 metres is equivalent to 15,000 kc/s. The frequencies corresponding to short wavelengths are often given in megacycles (millions of cycles), so 20 metres would be given as 15 megacycles—or more correctly, 15 megacycles per second.

Frequency can be converted into wavelength by dividing the number of kc/s into 300,000, or the number of megacycles into 300. This can easily be verified by working backwards with the examples given above.

What do you understand by frequency-changing, as applied to a superhet?

The expression is self-explanatory, for it refers to the process of changing the frequency of the received signal to a different frequency, which is more convenient for amplification purposes. Thus, in most modern superhets, the frequency of the received signal (whatever it may be)

(Continued on next page)

An Improved Press-button Device

Details of a Press-button Receiver with Automatic Change-over to Manual Tuning

MANY present-day wireless receivers are provided with a control for continuous manual tuning, as well as with push-buttons for selecting one or other of a number of pre-determined stations. In some such cases pressing in a push-button effects the correct setting of the variable condenser by purely mechanical means, while in others the condenser is moved to the required position by means of a motor.

The various push-buttons are usually interlocked together in such a way that any button which is pressed is held in its depressed position, but may be released by the act of pressing any one of the remaining buttons; an extra press-button is provided which, when operated, will release any station-selecting button that is held down, and thus condition the receiver for manual tuning.

Confusion is likely to arise if an operator fails to actuate the extra press-button before attempting to operate the manual control, and there is also the possibility of the receiver being damaged.

Interlocking

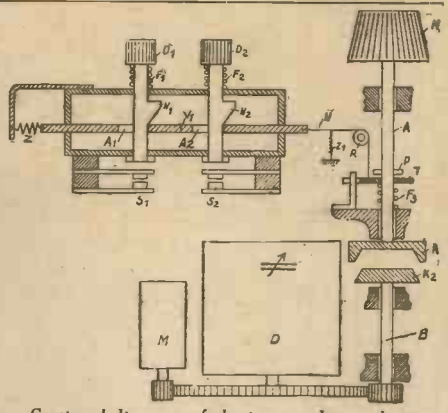
This difficulty may be overcome, and the necessity for the extra press-button avoided, by interlocking the press-buttons and the manual control together in such a way that any station-selecting button which is depressed is released automatically when an initial movement is imparted to the manual control.

An example of such an arrangement is shown in the accompanying illustration, in which the press-buttons D1 and D2 may be actuated selectively to cause the receiver to select one or other of two pre-selected stations, while the control knob K may be operated for continuous manual tuning.

The control circuits of the motor M include any well-known form of station-selecting switch (not shown), which is mechanically coupled to the tuning condenser D, and the switches S1 and S2. One or other of the push-buttons D1 and D2 may be depressed against the pressure springs F1 and F2 respectively, to actuate switch S1 or switch S2, and thus complete a circuit of the motor M and cause the tuning condenser to be driven to a pre-selected tuning position. The projections N1 and N2 on the plunger of the press-buttons are adapted to engage in the holes A1 and A2 of the interlocking strip V1, which is permanently drawn to the side away from the projections by means of the spring Z. On depressing, say, push-button D1, the interlocking strip is pushed to the right against the force of the tension spring Z so that the previously depressed push-button D2 is released, whereas on the other hand the projection N1 of the push-button D1 thenceforward holds the latter securely in its depressed position.

Manual Control

The spindle A carrying the manual control knob K is adapted to be coupled by the clutch K1, K2 to the spindle B, which is geared to the tuning condenser D. The spindle A may be displaced axially against the pressure of spring F3 to close the clutch and then rotated while depressed to operate the condenser D. On the spindle A is seated a disc T, which is freely rotatable with respect to the spindle and is itself secured against undesired rotation, and is pressed against the spring F3 by means of the connecting disc P, and consequently



Sectional diagram of the improved press-button device explained in the article.

participates in the axial motion of the spindle A. The disc T has secured to it a cord N which on depressing the spindle A pulls the locking strip V1 to the right and thus releases any press-button which may have been held depressed. A tension spring Z1 maintains under permanent tension the cord N which is led over the roller R.

The arrangement described has the additional advantage that the press-buttons cannot be operated while the shaft A is clutched to the shaft B for manual tuning.

Alternative Methods

Other methods for releasing the press-buttons automatically prior to a manual tuning operation can readily be devised. For example, the shafts A, B, and the clutch K1, K2 may be replaced by a single shaft permanently coupled to the condenser D, and the control knob K, which is formed of insulating material, may be provided with a pair of contacts such as slip rings arranged in the circuit of a valve; the anode circuit of the valve will include an electro-magnet which, when energised, causes the latching member to move to the right for the purpose of releasing any depressed button, and the grid circuit of the valve will include a high resistance, and will be fed with a strong negative bias voltage.

The arrangement will be such that when the slip rings are connected together through the hand of an operator, the negative biasing voltage will be diverted from the grid of the valve, thus permitting current to flow through the anode circuit and energise the electro-magnet.

The mere act of grasping the manual control knob will thus cause the receiver to be conditioned for manual tuning.

RADIO IN THE SERVICES

(Continued from previous page)

is changed to about 465 kc/s, on which frequency the I.F. amplifier is designed to work.

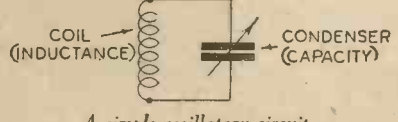
This is brought about by "mixing" the received signal with other oscillations. The two sets of oscillations, at different frequencies, are said to "beat" together, with the result that the resultant frequency is equal to the difference between the two.

Thus, if the frequency of the signal to be received was 2,000 kc/s and the I.F. amplifier was tuned to 465 kc/s, the oscillator frequency would have to be either 2,465 kc/s or 1,535 kc/s; in practice the higher frequency is almost invariably employed.

The oscillator, whether it is one section of a frequency-changing valve or a separate valve, can be considered as a miniature transmitter. Its tuning circuit is ganged and aligned with that of the first detector, or input, circuit so that it is always tuned to a frequency of 465 kc/s (or any other I.F. desired) above that to which the input circuit is tuned.

What is an oscillatory circuit?

This is simply another name for a tuning circuit, which comprises inductance and



A simple oscillatory circuit.

capacity, generally in the form of a coil with a variable condenser connected in parallel with it.

Wide World Magazine

IT'S very easy for us in these days to accept without question all the blessings of radio. A traveller just back from Australia reports that about two years ago he walked into a house some four hundred miles from the railhead, and saw a man seated in a chair working an arrangement of cycle-pedals as if for dear life (yet not travelling an inch), and talking into a little black box. Throughout the interior of Australia there are dozens of such low-powered short-wave wireless telephones with which settlers keep in touch with base stations. Readers will probably be interested to read "Wireless in the Wilds" in the April issue of the famous WIDE WORLD MAGAZINE—an article which does more than describe these little "pedal while you talk" sets. The WIDE WORLD incidentally is a grand magazine to send on to anyone in H.M. Forces.

ON YOUR WAVELENGTH

By Thermion

Radio and Motoring Offences

I SEE that in America, the land of original, if quaint, ideas, they are using radio to inform a motorist when he is disobeying the traffic regulations or exceeding the speed limit. Most American cars are fitted with radio, and it is suggested that it should be made compulsory for every car in that country to be fitted with a radio set. Thus, the policemen on control duty (in America they are mounted in a high tower at control points; they are afraid to come down!) would operate a low-powered radio transmitter so that when he spotted a motorist over the white line or passing the traffic lights he could mutter "Gertcha! wotheyelldyerthinkyerdoin! Stop on the nearside kerb." It is only fair that each car should also be fitted with a low-powered transmitter, and a small P.A. outfit on the roof of the car, so that the motorist instead of muttering unheard curses about pedestrians would be able to make his thoughts heard. He would be able to tell them to clear out of the way 100 yards ahead, and thus would dispense with the need of a motor horn.

Soldiers' Humour

IT is not always easy to raise a smile in these days, but, as in the last war, it is always obvious that our artists have risen nobly to the occasion. Some of those famous over twenty years ago are still with us, and readers will find the work of the leading humorous artists of the day every week in *The Humorist*. The good humour of the British soldier is proverbial, for he is always ready to crack a joke himself, and to laugh at those of his fellows. *The Humorist* reflects this spirit in every issue. It gives us the lighter side of the war—cheering those at home, and bringing a real weekly tonic to every camp and mess all over the world where English is spoken.

Weak Reception

GENERALLY speaking, the cause of weak reception can be traced in many ways, but there are a few individual tests which are sometimes necessary. The most important of these is to measure the anode current of each valve in turn. A milliammeter is required for this purpose, and one showing a full-scale deflection of 10 milliamps is most convenient. Measure the anode current to each valve by breaking the connection between H.T.+ and the anode component (resistance, transformer primary, choke, etc.). The current passing can then be compared with that given on the maker's instructions sheet for the particular H.T. voltage used. Remember that it is the voltage between the anode of the valve and H.T.+ which counts, and not the total battery voltage. Too low a current indicates (1) too much grid bias, (2) run-down accumulator, (3) defective valve. In the case of all-mains receivers it might also indicate that the rectifier valve is losing its emission, but the H.T. voltage would then be low. An unduly high anode current indicates (1) insufficient grid bias (probably a burnt-out resistance if an all-mains set), (2) a break in the grid circuit, (3) valve oscillating, or (4) if an S.G. or pentode, screen voltage too high. To check for (3) touch anode terminal with damp finger; the current will change if valve is oscillating. If the anode current fluctuates when signals are not being received there must be a bad contact in either anode or grid circuit. To check, first short-circuit the anode components in turn to find which, if any, is wrong. Then do the same with grid-circuit components. When the anode current to every valve is normal and yet reception is impossible, it is fairly safe to assume that a component in either the grid or anode circuit is short-circuited.

Intermittent Reception and Crackling

THESE two forms of trouble are often confused one with the other, so it might be well to explain the difference. Intermittent reception, that is when signals come and go without there being any noises, is generally caused by a fault in the aerial or tuning circuits, whilst cracking is more often due to a bad contact in an anode circuit. The method of testing anode-circuit components has been dealt with previously, and the tests described apply in this case. If the crackling can be provoked by lightly tapping the panel it is quite clear that a connection must be loose, but if it is unaffected by this treatment a transformer or similar component is probably defective. In the former case make sure that all the valves fit tightly in their sockets and that the pins are clean. Also take the same precautions in respect of the high-tension wander plugs. Crackling noises are very frequently caused by a run-down high-tension battery or by a faulty cell. A new battery would, of course, put things right, but a temporary remedy might be effected by connecting a 2-mfd. or 4-mfd. condenser between H.T. negative and one of the positive tappings. Intermittent reception is often caused in a very sharply tuned set by the aerial lead-in blowing to and fro and so changing its capacity to earth. The same effect would be noticed if some wires or components were free to move inside the set. Although this particular form of trouble is most common in short-wave receivers, it does sometimes occur in broadcast instruments.

Other Common Faults

ANOTHER cause of much exasperation is low-frequency reaction. This sometimes manifests itself as a constant whistle which accompanies all reception, and sometimes as a peculiar spluttering noise commonly referred to as "motor boating." It is more common in older sets, and becomes particularly troublesome when the high-tension battery begins to run down. The fault can often be cured by the well-known method of fitting a decoupling resistance in the detector anode lead and by-passing this with a 2-mfd. condenser.

When two transformer-coupled L.F. valves are employed, the trouble can often be remedied by reversing the leads to the secondary terminals of the second transformer. Sometimes the howling is caused when the speaker is near to the set, by intercoupling between the loudspeaker leads and the first valve. In that case, the remedy is to connect a .002 mfd. fixed condenser across the loudspeaker terminals or to employ metal-shielded wire for the speaker leads. In the latter case the metal screening should be connected to earth or high-tension negative. Yet another way of preventing the howling is to connect the first L.F. transformer to the grid of the L.F. valve through a non-inductive resistance of any value about 100,000 ohms. A similar kind of trouble to that just dealt with is frequently caused by a "microphonic" detector valve. The detector valve is sensitive to vibration, and when it receives a slight jar, a "ring" or "hum" is heard in the speaker. If the speaker is near the valve the vibration set up by the diaphragm causes the valve to vibrate still more. This process goes on indefinitely, the sound increasing meanwhile. The cure in this case is to use an anti-microphonic valve-holder and to wrap the valve in thick felt. Instead of felt, a good result is often obtained by sticking a lump of plasticine on top of the glass bulb.

The Bleater of Bremen

IN Bremen there's a "Bleater,"
Who nightly makes us grin,
The Broadcasts which he gives are most amusing;
Lord Haw-Haw he is known as,
And his object's pretty plain,
And the motives which inspire him not confusing.

He is surely not a fit 'un
To strike terror in the Briton,
All the blather which he bleats we ridicule;
So whenever "Hans" or "Carl"
Begins his nightly snarl
We grin and say "Hello! That Haw-Haw fool!"

Does he think, poor fool, we're blind,
And don't know what lies behind
All the piffle and the rubbish which he spouts?
About sunken ships still floating,
With exaggeration gloating,
Rot like that will never fill our mind with doubts.

Let him boil and froth and bubble,
He is wasting all his trouble,
For the Briton's not so easily dismayed;
Let him rave until he's ill,
For we shall receipt the bill,
With our signature "John Bull": To show it's paid!

"TORCH."

Comment, Chat and Criticism

Paderewski

A Brief Resumé of the Career of the Great Pianist by our Music Critic, Maurice Reeve

IN his eightieth year, and recently elected President, or Speaker, of the exiled Polish Diet, Paderewski presents a remarkable figure. He was actually engaged last winter on a tour of the United States when he suffered a breakdown in health, and returned to Europe, and to his conquered native land. Both there and here many countrymen of his wept on learning the news that this most famous of living Poles would probably never play again; whilst many more knelt at the station to kiss his hand. Sure proof of the esteem and affection in which he is held.

Sympathy for the sufferings and outrages committed on the soils of the countries recently conquered by our "stop at nothing" enemies, inevitably takes our thoughts towards those gallant peoples' famous sons, and most particularly their musical geniuses.

It is passing strange that Germany's two chief victims of aggression—Poland and Czecho-Slovakia—should be two of the most musically gifted peoples in Europe. It is a case of Greek meeting Greek, but I intend to include accounts of the lives of two very famous Czech musicians—Dvorak and Smetana—in the belief that my readers will be interested.

Paderewski has had an astonishing career. Born in Podolia in 1860, he was, like Chopin and Sibelius, the subject of an alien government. In fact, his father was exiled to Siberia for activities in connection with Polish independence. His mother was his first teacher, and he gave his first concerts on a tour of Poland in 1876–77. He was appointed a professor at Warsaw Conservatoire from '78 to '81 and by 1887 had completed his own studies in Vienna under the greatest of all piano teachers—Leschitizky. He then proceeded to make his debut in the great European capitals, reaching London in the winter of '90–'91, and New York in '91–'92. On this tour of America he gave 117 concerts.

Sensational Debut

His debut was sensational It is not possible to quote the critiques verbatim, although I have them by me. No one ever aroused such a controversy or diversity of opinions. He was condemned out of hand for vices—playing with one hand after the other, and for the hardness of his tone in the loudest passages. Such crashing and smashing had never been heard before (he used to cut through the felts of the largest concert grand in twelve months); in fact, his whole style was thoroughly unorthodox. The first piece he ever played in London was Mendelssohn's Prelude and Fugue in E minor, and in the chorale he is said to have shaken the very foundations of the old St. James' Hall. Incidentally, the first of his three recitals, which constituted his first London appearance, was sparsely attended; but the third was packed out, and gave him a profit of £400 on the series.

It was the poetry he infused into his readings, together with the fire and passion that pervaded everything he played, which won the critics and conquered the public so that, in spite of much adverse comment on technical points, they always concluded by saying "here is a great pianist who will conquer the world."

They did not exaggerate. From that day until a very few years ago he was far and away the greatest drawing power in the pianistic world, and only matched in all music by one or two of the greatest operatic stars. His earnings must easily create a record—he has taken over two and a half million pounds at the box office. And as a younger man he received three-figure fees for social functions.

Triumph succeeded triumph, tour followed tour. In America he always travelled in a private Pullman, which was drawn up in the sidings at his various stopping places so that his practice could proceed without interruption. His New York recitals had to be transferred to Madison Square Garden, as Carnegie Hall was quite incapable of holding the vast crowds which flocked to hear him.

Compositions

Paderewski is also a notable composer, and has many distinguished works to his credit, including an opera, "Manruh," produced in 1902; and a symphony, first heard in 1909. His "Minuet," of course, is one of the most widely known and often heard compositions ever written.

During one of his early American journeys he founded the Paderewski fund of 10,000 dollars, the income of which was to be used to foster native American composers. Several first-class compositions have won it from time to time.

The writer first heard him in Queen's Hall in 1909. He did not play in London again till 1914, when he made two appearances. His return in 1923, after the Great War, mellowed by sorrows and his wonderful hair silvered by time, was an unforgettable experience. He gave three recitals then.

He spent most of the war years of '14-'18 in America, marshalling the large Polish population there behind the cry for an independent Polish State, and touring, he raised huge sums to help the cause. He developed oratorical gifts of a high order. There is little wonder that, when victory came, the newly constituted Polish Republic offered him its first Presidency. He accepted, and music lost him for three years.

At Versailles

He completely won over President Wilson and the American delegation at Versailles, who were, throughout the conference, together with the French, the warmest supporters of a Poland aggrandised beyond its true ethnographical boundaries. The opposition of Lloyd George and the British plenipotentiaries was insufficient to thwart these large designs in all but minor details. Lloyd George speaks in the monumental work "The Truth About the Peace Treaty" of how "this charming artist beguiled the peace conference." And again, of how "Paderewski spoke with an emotional fervour which, from a man of his genuine and unselfish patriotism, was moving." That this work now lies in utter ruin must fill the great pianist's old age with well-nigh overwhelming sadness.

Paderewski has always been a prince of munificence, and many are the causes which have benefited through his magic fingers. One of the most notable gifts was six recitals which he gave in England in 1926, the entire proceeds of which he handed over to the British Legion. That in the Albert Hall yielded £6,000. The late King George V awarded him the insignia of a K.C.B.E. He also possesses that of a K.C.M.G. given him after the war.

But when all is said and done, it is as a pianist that Paderewski's name will live on—the most distinguished, the most daring, and the most compelling of his time. He started off with most of the attributes that any young man would wish to possess as a means to acquiring fame. He always presented a magnetic personality. Lean and spare, he invariably wore a long frock coat with a soft flat collar, and big bow tie. His expression spoke the very soul of the man: absorbed in his art but never too much so to be unaware of the spells he bound. A small moustache and imperial added to the dignity of his appearance. But his crowning glory was what we might call a huge mop of red hair which has been immortalised in portraits by Burne Jones and others. He also possesses all the platform tricks, and no artist of his time could hold a packed house in such a fever of excited expectancy, waiting for his appearance—usually ten to fifteen minutes late.

A Great Showman

Volumes could be written of his playing. It was superb. No pianist has ever managed to tug at the heart strings as Paderewski did. And it is this quality which gives him his title to greatness. Great showman that he was, he never once broke the bounds of good taste or good musicianship. He unbared the very soul of the piano. Until the advent of another Pole, Horowitz, in our own day, no more arresting or original Chopin playing had ever been heard. He could roar like the lion or coo like the dove. At one moment he would take the music by the scruff of the neck and wring the very life out of it. Then, before you knew where you were, he was the most ardent and plaintive of suitors, dwelling over every note, and culling the last drop of essence from the beautiful music.

Liszt is reputed to be the greatest of all pianists. It was he, certainly, who set the piano on its career of triumph, and who raised it, executively, to its present position of pre-eminence in the concert world. Paderewski may be considered as the finest fruit borne by that succulent tree. And although we have said good-bye to Paderewski the pianist, no better wish could be offered him in his old age than the speedy resurrection of the country which he loved so well.

D.C. Heater Circuits

Principles of Wiring of the Filament or Heater Circuits for D.C. Mains Receivers

ALTHOUGH, under the Grid System, many districts have now been converted from D.C. to A.C., there are still many places which have only D.C. supplies available. The D.C. receiver is not, therefore, very popular, but many readers are interested in the design of this type of equipment, and it is in the filament or heater arrangements that the main difficulties occur. The H.T. supply may be

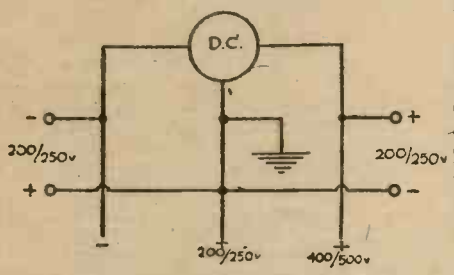


Fig. 1.—Showing the arrangement of the three-wire supply system.

regarded more or less as standard, but in place of the transformer winding delivering four volts at so many amps. for A.C. heaters, the D.C. heater circuits have to be supplied from the mains through dropping resistances, and D.C. valves have various voltage ratings. If a large, undistorted output is required, the lack of available high-plate voltages can be overcome by using two pentodes in parallel, by which means an output of some two watts can be obtained with high-tension voltages of only 180 volts or so.

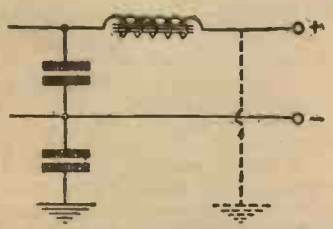


Fig. 2.—If the smoothing choke is in the earthed mains lead its efficiency is reduced.

D.C. Distribution

It is preferable, for a start, to enter into a short explanation of the method in general use of distributing D.C. Current is generated by the power station at twice the potential actually supplied to the consumer (i.e., if your input is 230 volts, then the current is generated at 460 volts). This generated output is separated into two branches by what is known as the "three-wire" system, the method being shown clearly in Fig. 1.

It will be seen that one side of the mains is always earthed, but not necessarily the negative side. Usually, on one side of the street, the negative leg is earthed, and on the other side, the positive. It will be clear from Fig. 2 that if the smoothing choke happens to be in the earthed mains lead (whichever side it may be), then the smoothing efficiency is being seriously reduced owing to the fact that the choke is being partially short-circuited by the smoothing condenser and the earth condenser, which are in series. Therefore, when designing a set or mains-unit for use on D.C. mains, it is essential first to ascertain which side of the main is earthed, and then take care to see that the smoothing choke is in the other lead. If you omit to take this precaution, the chances are that you will hear practically nothing but hum!

In commercially designed D.C. receivers, it is, of course, necessary to provide for adequate smoothing regardless of which side of the main is earthed, and, consequently, it is the usual practice to insert a choke on each side, with a 4 mfd. condenser shunted across before the chokes. In this way, smoothing efficiency is assured, as, of course, one of the chokes must be doing its job properly even if the other is partially short-circuited.

Types of D.C. Valves

Now, there are three types of valves which can be used in an "all-mains D.C. set," as the manufacturers put it! First, the ordinary battery valves; secondly, the indirectly heated D.C. valve; and thirdly, the low-voltage (6.3 volt) so-called universal valves, which can be used on either D.C. or A.C.

We will take first a three-valve set designed for D.C. mains using ordinary battery valves—S.G., det. and power. Assuming that the first two valves are 2-volters and the last one a 6-volter, we must first decide by what means we can obtain filament current at the correct voltages.

As we cannot step down the voltage by means of a mains transformer, as we would in an A.C. set, all we can do is to dissipate the unwanted two hundred volts or so in the form of heat through a suitable resistance. Reference to Fig. 3 will show that the filaments are wired in series and not in parallel as in a battery-driven set. The valve filaments possess, of course, ohmic resistance, and being in series with the smoothing chokes and the mains resistance, form part of what is virtually a "potential divider," across the mains. This is clearly shown in Fig. 4, this circuit merely being that in Fig. 3 drawn in another way.

Mains Resistance

The mains resistance must, of course, be of such a value that it will allow only the required filament current to pass, no more and no less. (Incidentally, as the filaments are wired in series, the voltage ratings are of no importance except for calculating resistance values, but in order to avoid excessive use of shunt resistances, they should all require the same filament current). Assuming, for our set, the valves are rated at .1 amp., then in order to pass this current from 250-volt mains, we should have to use a resistance having a value of 2,500 ohms $\left(R=\frac{\text{Voltage}}{\text{Amps.}}\right)$, but as the filaments and chokes have ohmic resistance, we must decide what actual total resistance they have and deduct it from our required total resistance of 2,500. The manufacturers

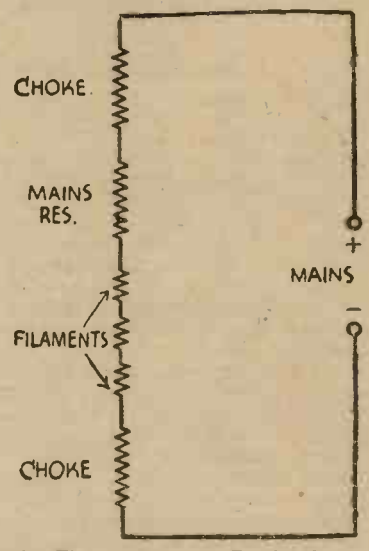


Fig. 4.—The circuit given in Fig. 3 is here shown in simplified form.

of the choke will, of course, advise you of the choke resistance, or it can be determined by a suitable measuring instrument, such as the "Avometer"—they may very probably have a resistance of 200 ohms each, which we will assume is the case. Now for the resistance of the filaments. We use for this purpose the Ohms Law formula already given., i.e., $\text{Res.}=\frac{\text{Voltage}}{\text{Current}}$, which, in the case of a 2-volts .1 amp. valve, becomes $\text{Res.}=\frac{2}{1}=20$ ohms. Equally, the 6-volt filament resistance will be 60 ohms. Therefore, the total filament resistance is 100 ohms, plus the total choke resistance of 400 ohms, being 500 ohms, which we must

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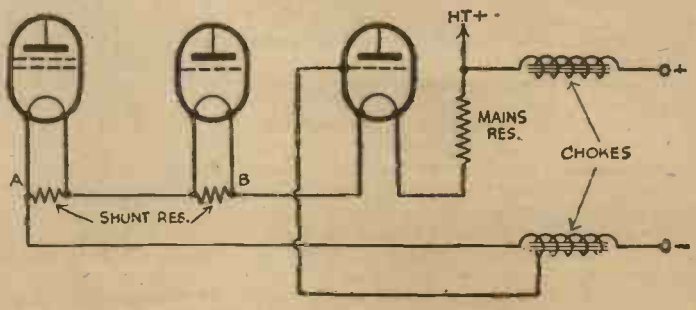


Fig. 3.—The filaments of D.C. valves are wired in series.

D.C. HEATER CIRCUITS

(Continued from previous page)

deduct from the total resistance of 2,500 ohms.

Consequently, the correct value in this case for the mains resistance is 2,000 ohms. The next point requiring explanation is the necessity for the two "shunt" resistances which are shown in Fig. 3, connected directly across the filaments of the first two valves. It will be appreciated that as the anode current of the last valve passes down the filament lead it must also pass through the filaments of the other two valves, unless we provide for it an alternative path. The shunt resistances are this alternative path, allowing the anode current to pass round the circuit, but not through the two valve filaments. As the first two valves are of the 2-volt type, it will be clear that a potential difference of 4 volts will exist between points A and B, and assuming the anode current of the last valve to be 20 milliamps, the value of the shunt resistance is arrived at by dividing the voltage difference by the current, thus:

$$\frac{4}{.02} = 200 \text{ ohms.}$$

A further point to be borne in mind is that the filament of various valves of the same type, even though the average rating will be 20 ohms (in the case of the 2v. .1 amp. type) may, individually, vary quite considerably, and may be anything between 18 and 22 ohms. Consequently, if a valve has to be replaced for any reason, a voltmeter should be connected across the filament terminals to ensure that it will actually be running at two volts. Obviously, if the filament resistance of the replacement valve is less than that of the original valve, the total resistance in circuit will be permitted to flow, and the valve may be overrun, causing it to lose emission more quickly than it normally would. On the other hand, if the new valve has greater resistance, then less current will flow, and the valve will be slightly overrun, causing perhaps distortion and generally unsatisfactory results. Furthermore, it will be appreciated that any fluctuation in the mains voltage will cause a similar fluctuation in the voltages applied to the filaments, which are not, of course, designed to withstand any such fluctuations, and in order to avoid premature deterioration due to this cause a special regulator lamp can be connected in series with the mains resistance, which will take care of a considerable mains voltage fluctuation permitting only the correct voltage to enter into the filament circuit.

Providing for Grid Bias

Grid bias must, of course, be provided for, and fortunately this is a simple matter as the voltage-drop across any ohmic resistance in the negative side of the filament circuit can be utilised for the purpose. As has already been pointed out, the resistance of the filaments causes a potential difference of 4 volts between points A and B in Fig. 3, and, therefore, if the grid return lead is taken to point A, the grid of the output valve will automatically be 4 volts negative in respect to the filament—in other words, 4 volts bias is being applied to the last valve.

As the valve will in all probability require more than 4 volts, a further small resistance can be connected in the negative lead, which will give the necessary further voltage drop and, consequently, more bias, or alternatively, as the negative choke possesses resistance, a portion of the choke winding can be tapped off and used for obtaining further bias, as shown in Fig. 3.

Now, indirectly heated D.C. valves differ from the battery valve, in that whereas in the latter the filament is also the cathode, in the former the cathode is a separate element which encloses a separate heating element called the "heater." When the heater is connected to an irregular supply it becomes hot, and transmits its heat to the cathode, causing it to emit electrons in a steady stream. Obviously, if the heater—fed from an irregular supply—were itself allowed to emit, the electron stream would fluctuate in sympathy with the fluctuation of the supply current, thus causing considerable hum. As this type of valve is designed for an irregular filament-heating current, there is obviously no point in smoothing this supply, and therefore the smoothing chokes are connected in the H.T. circuit only, and not in the L.T. circuit as in the case of battery valves. This difference is apparent from Fig. 4, which shows the skeleton circuit of a three-valve set using indirectly-heated valves. The heater circuit is connected directly to the mains (through H.F. choke, perhaps, as will be explained later), but a break-down resistance must still be used, its value depending, of course, on the characteristics of the valves used.

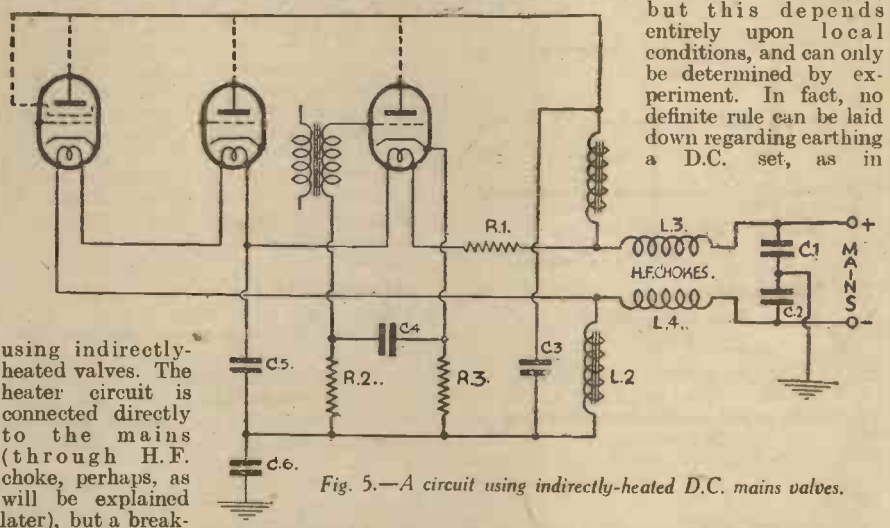


Fig. 5.—A circuit using indirectly-heated D.C. mains valves.

Screening the Detector Stage

As the current in the heater is unsmoothed D.C., stray couplings are likely to be present, the results being particularly unpleasant in view of the fact that the H.F. ripple found on D.C. mains is usually at a much higher frequency than that found on A.C. mains. The detector stage is always the most troublesome in this respect, but the difficulty can be minimised either by wiring the heaters in such a manner that the detector valve is last in the negative end of the chain, or if this is not practicable, a 2-mfd. condenser can be connected, with entirely satisfactory results, between the detector heater and the negative or earth-line as shown in Fig. 5. The detector stage is also particularly prone to hum pick-up, etc., and it is usually advisable to carry out the wiring of this in "screened" wire, or, in exceptional cases, it might even be found necessary to enclose the entire detector stage, with its associated components in a separate screening-box; earthed, of course.

Another difficulty frequently encountered in such a set is the presence of H.F. currents superimposed on the mains which, if allowed to get into the receiver, may cause reduced selectivity, modulation hum, etc. The smoothing chokes are, of course, designed to deal with low frequencies and, consequently, they do not offer much opposition to these unwanted currents, and, the only satisfactory method of keeping these out of the set is to use a special high-frequency choke in each mains lead before the L.F. smoothing chokes, as shown in Fig. 5. An earth wire connected between two 1 mfd. condensers shunted in series across the mains may be advantageous, but this depends entirely upon local conditions, and can only be determined by experiment. In fact, no definite rule can be laid down regarding earthing a D.C. set, as in some instances the earth connection tapped on to the mid-point of the two condensers may be better than the ordinary earth connection through a condenser to the negative side of the set; or in some instances the set will operate much better with no connection to earth at all! It will be appreciated that one side of the mains is already earthed by the supply company, but even if the negative main is not earthed, a very large capacity exists between this main and earth, which is effectively in parallel with the smoothing choke, rendering the use of a local earth unnecessary. If an earth wire to the negative side of the set is used, it must be remembered that this side of the set is in direct connection with the supply main and, consequently, it is essential to isolate the mains from earth by utilising a fixed condenser as shown in Fig. 5. Reverting for a moment to the matter of keeping out H.F. currents, it may be mentioned that this subject assumes particular importance in the case of a superheterodyne set. H.F. currents in such a circuit may be responsible for introducing whistles throughout the tuning range, these whistles being of a nature such as would render the set almost entirely useless.

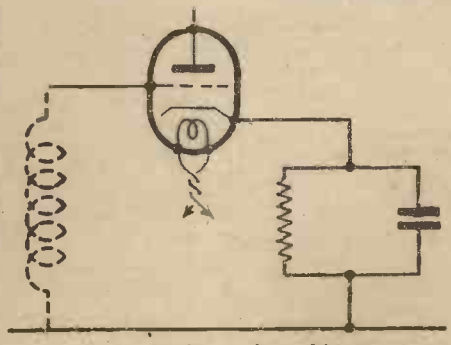


Fig. 6.—Automatic bias is obtained by a resistance and condenser in the cathode lead.

As in A.C. design, automatic grid-bias can be arranged for by connecting resistances in the cathode leads as shown in Fig. 6. As the anode current of the valve must pass through any resistance in its cathode lead, voltage is developed across the resistance and a difference in potential exists between each end of it. Therefore,

(Continued on page 53).

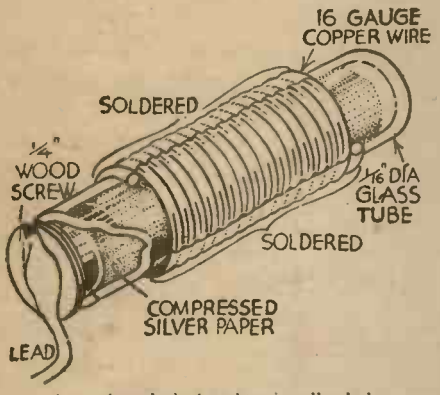
Practical Hints

Small Condenser Construction

WHILST experimenting with small condensers and resistances, I hit upon the idea illustrated. It will be seen that the only requirements for the construction of a number of condensers of different values are as follows:

(1) A few short lengths of different gauge bare copper wire.

(2) A length of glass tubing (internal diameter, $\frac{1}{16}$in. approximately).



A novel method of making small tubular condensers.

(3) Some silver paper, and a few $\frac{1}{4}$in. wood screws.

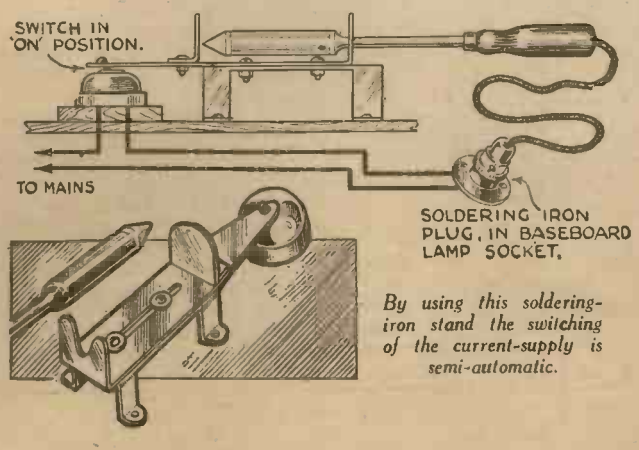
When the silver paper has been compressed—by the aid of a nail or a strand of 16-gauge wire—heat the tube and silver paper until red hot, care being taken to see that it does not bend or warp, allow it to cool and complete by winding the wire and soldering same—to short all the turns together. The screw constitutes one method of contacting with the solidified silver paper.

Great care should be exercised when compressing the paper to ensure that no cut fingers are sustained through slipping. —R. W. SMITHSON (Bournemouth).

A Switching Stand for a Soldering Iron

THE accompanying sketch shows a device which I have made and find most useful. It operates the switching of the current to my electric soldering iron simply by the removal or replacement of the iron itself.

It will be seen by the sketch that when the iron is replaced the point is pushed against the projecting plate and so switches on the electricity. If the operator desires to switch off, the iron itself engages in the "V" slot in the plate and by pulling same the switch is thrown in the off position. The device should be firmly mounted upon the soldering bench and the sliding plate well greased so as to ensure its easy action.—G. W. ARNOLD (Ilford).



By using this soldering-iron stand the switching of the current-supply is semi-automatic.

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 iii of cover.

A Sliding Meter Rack

IN my radio "Den" I make a point of keeping the test bench absolutely clear and independent of the table where I carry out constructional work, and in this way I find that my work is facilitated, whilst it is better from the experimental point of view.

The test bench is therefore set against one wall, and as the shelves are well away from this, the room at the back of the bench is allocated usually to test gear, which invariably seemed to get in the way as the bench is not very wide.

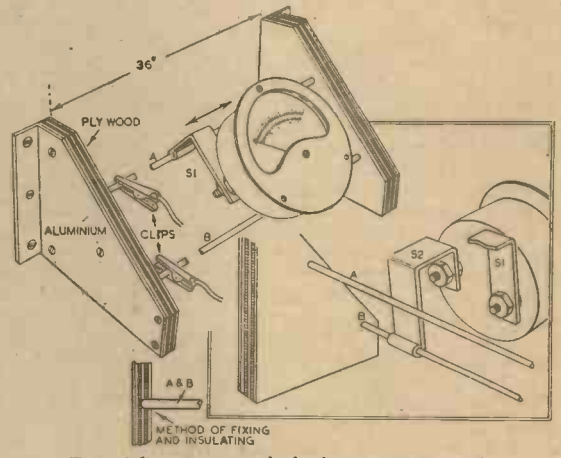
To get over this trouble, I decided to construct a meter rack which could be used for more than one meter, keeping these out of the way, although making it possible for them to be commissioned at a moment's notice, and brought up to the apparatus with which they are to be connected. The resulting arrangement is shown in the accompanying sketches.

On referring to these sketches, it will be seen that two brass rods A, B (obtainable from a well-known stores) are fitted between plywood end mounting pieces, these end pieces being secured to the wall by aluminium brackets of home construction.

To fit the meters to the rods so that they may be moved along easily, at the same time affording a good contact with the rods, a few angle slides were formed from 16-gauge aluminium, as shown by S1 and S2 in the inset.

Contact is made to the brass rods by crocodile clips, consequently any number of connections may be made, and I have found this very convenient when it has been necessary to include H.F. chokes in series with these leads for various tests.

To ensure that the rods are insulated from each other, the wood supports are only drilled through sufficiently to hold the rods in place after taking into consideration the resilience due to the length of the fitment. This is also indicated by a small diagram insert. — S. L. FENTON (Pinner).



This sliding meter rack facilitates testing work.

Experimental Valveholders

WHEN trying out experimental circuits, much time may be saved, and a better layout obtained, if the valves are used without the usual valveholders. By leaving the valves in their packing boxes, upside down, connection to the valve legs may be carried out by means of flexible leads fitted at the end with sockets. Quick changes and mobility are the main features of this idea.—G. SANDERS (Hendon).

A VALVE VOLT

A Simple Unit which May be Use Audio Outputs

By W

IT has already been mentioned in these pages that for really accurate measurements of very weak voltages a valve voltmeter is necessary. This consists of a simple triode valve with L.T., H.T. and G.B. applied. When these voltages are at a certain level no anode current will flow, and thus a milliammeter included in the anode circuit would show a zero reading. Modification of the grid-bias would, however, result in a change in the anode current, and if the modification consists of a reduction of the grid-bias the anode current would increase. This, then, is the principle of the valve voltmeter, and the instrument may be used, with certain modifications, for measuring an audio voltage output on exactly similar lines. For this, the input to the voltmeter is connected to the output terminals of a receiver under test, and the anode current of the voltmeter is set to zero by means of an adjustment of the H.T. or G.B. Then when a signal is tuned on the receiver the applied audio voltage will have the same effect as a modification in the grid-bias voltage, and accordingly the anode current will change. If the meter is suitably calibrated in voltage readings, then it will be possible to see the exact output, and also to see the effects of improvements which are made when circuit alterations or modifications are made.

The Circuit

The input to the voltmeter has to be isolated in order to use it for the tests mentioned, and this is easily carried out by including a fixed condenser in each lead. A value of 1 mfd. will be found suitable for this purpose. The valve should be of the small-power or good L.F. type, that is, one which has a reasonably steep slope in the anode-current grid-volts curve. The H.T. may be quite low, a total of 12 volts being sufficient in many cases. The exact value may be found on trial with the particular valve you decide to use. In order to adjust the H.T. and obtain a suitable zero-setting when using the instrument, a potentiometer is connected across the H.T. supply, and to prevent the H.T. draining away through this control an on/off switch is included in series with it. This switch is part of a two-pole switch, the other section of which is used to switch off the L.T. supply when the instrument is out of use.

The meter included in the anode circuit should be of a sensitive type reading a maximum of 1 or 2 mA, and in the instrument which is depicted on our cover this week, and for which wiring details are given on this page, a 1 mA meter was employed. The total reading will, of course, depend upon the valve, and the range of H.T. voltage which is employed.

Layout

The entire instrument was included in a small home-made cabinet measuring approximately 7½in. by 5in. An ebonite panel was provided, and a small baseboard fitted, on which the valveholder and fixed condensers were mounted (Fig. 2). Battery cords were fitted so that external batteries could be used, although there is no reason why the batteries should not be included inside the case if so desired. The potentiometer is mounted at the side of the meter, and a pair of input terminals are mounted on the edge of the panel, with the two-pole switch fitted between them. The layout is not critical, and provided that the main essentials already mentioned are adhered to, the unit may be mounted in any desired form.

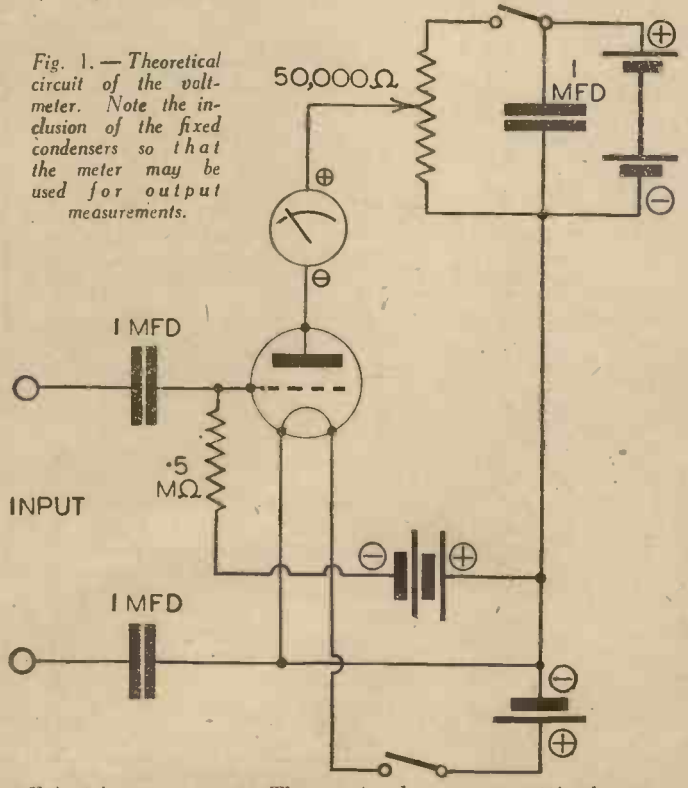
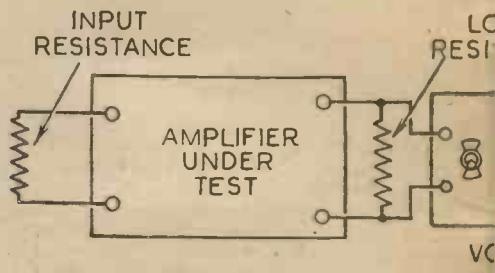


Fig. 1. — Theoretical circuit of the voltmeter. Note the inclusion of the fixed condensers so that the meter may be used for output measurements.

Calibration

The first stage after completing the instrument is to calibrate the dial, and for this purpose the unit must be joined to a reliable voltage source (A.C.). A mains transformer fed from the A.C. mains may be used, and preferably the outputs from the transformer should first be checked with a good A.C. voltmeter. If, however, a really well-made transformer is employed the outputs may be taken as reasonably accurate. Adjust the meter to a zero setting by means of the potentiometer, and then connect the low-voltage transformer terminals to the input terminals on the meter and connect the transformer to the mains. The meter needle will rise, and a careful note should be made of the exact setting. Next use another secondary winding, or alternatively use the centre-tap, and one end of a winding, and from the voltage which this should give, again make a note of the current reading. In this way it will be possible to draw up a small calibration curve or chart, showing



the exact current readings for a given A.C. input. With the lower voltage inputs the H.T. should be adjusted to a higher value, and it should be remembered that the H.T. applied to the valve and the voltage applied on the input side of the voltmeter are very closely tied up. Thus, when measuring very small A.C. voltages, such, for instance, as you might require to do when testing the output of a gramophone pick-up, you should increase the H.T. A few moments test with the instrument, using different H.T. voltages, and by testing various items will enable you to see exactly how it works and what voltages are necessary for various ranges. It should be understood, of course, that the meter readings which are used are in volts, not in milliamps, although this is the normal meter scale.

When an ordinary transmission is tuned in the needle will fluctuate with the signal, and thus to obtain accurate measurements to enable improvements in a circuit to be ascertained, a constant frequency must be used, and this may quite easily be obtained by using a constant frequency record, or if the H.F. section is being adjusted then a signal generator must be employed. If the latter is not available, and adjustments are to be made in the H.F. section of a receiver, the only satisfactory plan will be to tune in to a station and only use the "silent" periods in the transmission for the test purposes, as these will provide a steady current reading. Many other uses will occur to the constructor of this particular form of valve voltmeter, provided that it is borne in mind that the input circuit is designed for A.C. The omission of the two fixed condensers will convert it into a D.C. instrument, and as a further refinement a potentiometer may be connected across the G.B. battery so that this may also be adjusted in conjunction with the H.T. control.

Measuring Noise Level

Incidentally, for those who are so inclined, the voltmeter may be used to

˜METER

d to Measure

J. DELANEY

measure the noise level of an amplifier. For this purpose a non-inductive load resistance is connected across the input terminals having a similar resistance to the microphone or other component which is normally connected there. A similar resistance is then joined in place of the loudspeaker, this resistance also being equivalent to the normal load used with the amplifier. If now the amplifier is switched on a reading will be obtained on the meter. Knowing the

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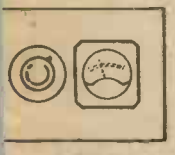


)LTMETER

Fig. 3.—How to connect the meter for measuring the output.

rated output of the output stage the ratio of the noise level may be expressed by the formula:

$$\text{wattage output} = \frac{\text{noise volts}^2}{\text{load resistance}}$$

Taking an example, suppose our amplifier has 100 ohms output impedance and is rated at 30 watts, and that the meter indicates .03 volts.

$$\text{Therefore 30 watts} = \frac{.03}{100^2}$$

and volts $= \sqrt{3{,}000}$ or 55 approximately. This may then be expressed in decibels by using the following formulæ:

$$\text{db} = 20 \log_{10} \frac{.03}{55}$$

$$= 20 (\log .03 - \log 55)$$

$$= 20 (\bar{2}.4771 - 1.7404)$$

$$= 20 (-1.5229 - 1.7404)$$

$$= 20 (-3.2633)$$

$$= -65.266 \text{ db}$$

which means that the noise level of that particular example is 65.266 below the rated full output of the amplifier.

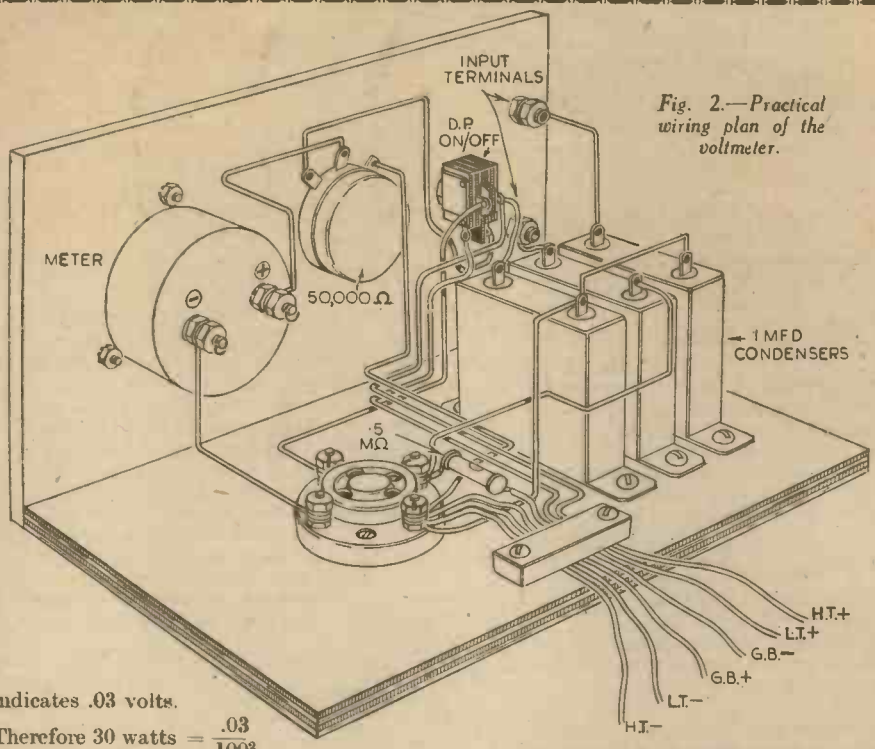


Fig. 2.—Practical wiring plan of the voltmeter.

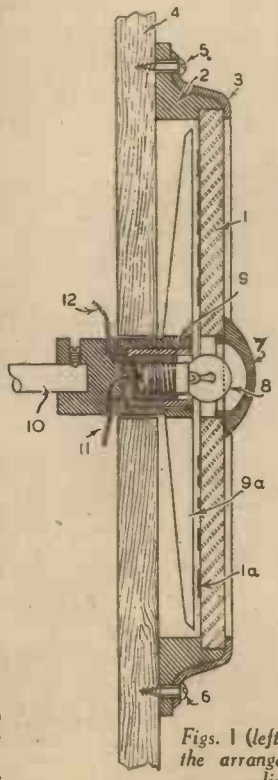
EDGE-LIT TUNING SCALES

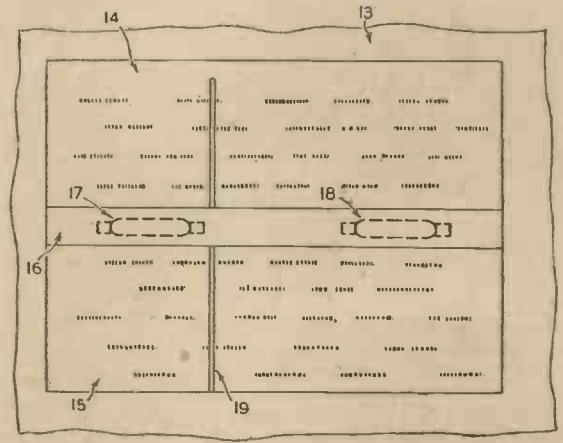
TRANSPARENT edge-lighted panels, for the tuning indicators of radio receivers and for other purposes, which are illuminated by total reflection of light within the panel are quite common to-day. Usually, the lamps are arranged round the outer edges of the panel so that only a relatively small proportion of the light from each lamp is utilised, unless means is specially provided to direct substantially all the rays through the edge of the panel. In the case of large panels, it may be difficult to maintain the intensity of the illumination uniform all over the panel.

These drawbacks may be overcome simply and cheaply by arranging the lamp or lamps in an aperture or apertures within the panel itself, or in the case of two panels by arranging the lamps between the panels instead of round the edges. In this way, more light from each lamp is utilised and, for a given light intensity, less lamps are needed.

A section of a circular dial for a radio receiver, arranged in this way, is shown in Fig. 1. in which a glass disc 1 is provided with a central aperture, and is arranged between a spacing ring 2 and a bezel ring 3, and secured to the cabinet of the receiver by screws 5, 6. The aperture in the glass, which accommodates a single lamp 8, is provided with a shade 7. The lamp 8 is carried by a holder which is mounted in an aperture in the hub 9 of the pointer 9a. Leads 11 and 12 to the lamp may engage sliding contacts on the hub or, as in the example shown, they may comprise flexible conductors.

In the present case, the pointer is mounted directly on the tuning condenser spindle 10. The shade 7 is detachable to render the lamp accessible from the front of the receiver.





Figs. 1 (left) and 2 (right) show the arrangement of the edge-lighted dial.

Station Names

The station names and/or other markings 1a are, of course, etched or otherwise formed on the back of the dial in a manner such that light escapes through the markings and causes them to appear illuminated.

Although a circular dial has been illustrated, rectangular or other shapes may also be employed, and, provided that the surface area is not too large, they can be illuminated effectively by a single lamp.

Fig. 2 shows an example of a tuning indicator for a radio receiver which is provided with a pointer 19 that moves in a straight line. The glass tuning scale is bounded by the cabinet wall 13 and is divided into two rectangular panels 14 and 15, separated by a gap which is covered by a strip 16 of opaque material.

Strip lamps 17, 18, are arranged in the gap between the plates, so that the panels are illuminated by total reflection of light within the glass. The strip 16 is readily detachable to permit access to the lamps from the exterior of the cabinet.

PRACTICAL TELEVISION

March 30th, 1940. Vol. 4. No. 196.

A Deflecting Consideration

WHEN dealing with the deflecting conditions of an electrostatically-operated cathode-ray tube there are two important points to consider. First of all comes the question of whether the individual plates of each separate pair are truly parallel to one another, and then it must be ascertained whether the two pairs of plates are really mutually at right angles to one another. For many purposes the degree of accuracy attaching to these two factors is the limiting item in deciding the suitability of the tube for the work involved, and very rigid tolerances are set so as to enable the designer of the apparatus incorporating the tube to be sure of the accuracy of working. Many attempts have been made to approach this question of uniformity of electrostatic field between deflecting plates so as to meet special cases, and although the new ideas as a rule add to the complication of the electrode system as a whole, it is often found that this is justified by the improved results obtained. A typical example of this is furnished by the deflecting system design whereby each pair of parallel plates is replaced by two pairs of right-angled shaped plates, which when mounted in position form a hollow box through which the electron beam passes, with a narrow slot in the centre of each side to ensure that the plates are not touching one another. In addition to this, four wire electrodes are positioned inside the array, and by suitably arranging the potentials applied to both plates and wires the distribution of the electrostatic lines of force is such, that within a square area in the centre, the deflecting field is straight and uniform. The adjustment of such an arrangement is somewhat critical, and would be applicable only to those cases where this uniformity is absolutely essential for accurate working.

View Finding

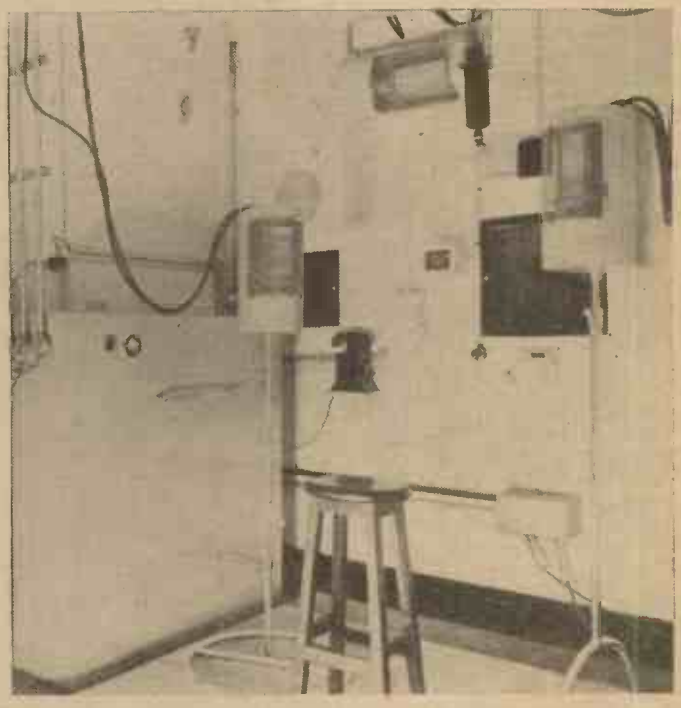
WHEN using an electron camera, either in the studio or for external scenes, the operator seated on the dolly truck is able to follow exactly whatever action is taking place by confining his attention to the optical image formed on his view-finder. It is arranged that this picture is exactly the same size as that focused on to the signal plate of the television camera, and this simplifies all adjustments, and ensures that the field of view and focus is kept correctly. Originally, this view-finder picture was upside down, so that the operator had to reverse everything mentally, but subsequent improvements in the optical arrangements produced a picture which was the correct way up. It has been found in practice, however, that cases arise where the optical scheme does not prove satisfactory. For example, under conditions of inaccessibility of the scene, those occasions where fog is prevalent or infra-red light is to be employed, and to meet these cases it has been suggested that the operator performs his camera task with the aid of a cathode-ray tube monitor. This tube is arranged to be fed with signals derived from the camera signal plate, so that the scanned picture so reproduced is a replica of that radiated by the station. Synchronisation difficulties do not arise, for it can be arranged that camera and tube are fed with deflecting currents derived from the same time-base generator source. Furthermore, the scheme lends itself to remote control, enabling the operator to be separated from his camera, when such a course is found to be expedient as a result of the type of transmission being undertaken.

Photo-electric Cell Technique

THE development of the various forms of photo-electric cells is proceeding apace, in order to fit in with the new demands of industry consequent upon the adjustment of production methods designed to serve war needs. Because of their constancy of action and consequent interchangeability, vacuum type cells are employed wherever possible, but the increased output provided by the gas-filled cell makes it ideal for certain purposes. The filling of inert gas provided in these cells plays its part in magnifying the original photo-electric current because of the ionisation by collision process, whereby the atoms of gas and primary electrons undergo numerous impacts within the glass-walled space, and so release secondary electrons which add to the primary stream. In this connection it must not be overlooked that the ionisation process is not instantaneous, and in consequence this type of cell has a somewhat restricted frequency characteristic, generally of the order of 10 kilocycles per second. Another point to be considered is that the voltage applied between cathode and anode is rather critical. If too high, and the cell is subjected to comparatively intense illumination, a glow discharge will occur inside the cell, and this will tend to destroy the photo-electric surface. It is interesting to recall that in the very early days of low definition television, the gas-filled cells then being employed were purposely "flashed" before a transmission started so as to ensure that they were functioning satisfactorily. This rather drastic treatment may have served its purpose, but made the service replacements more frequent. Provided the absolute quantity of light is not being measured, however, these cells are admirably suited for the detection of light changes and have been employed quite extensively in talking-film equipment, being mounted on the sound head to serve equally well in either variable density or variable amplitude modulation.

Practical Applications

WHEN using the high vacuum type of photo-electric cells there are certain factors which have to be observed, depending upon the particular use to which individual cells are to be applied. Modern technique has shown that in a vast majority of cases it is preferable to employ vacuum type cells complete with secondary emission multiplier, as this reduces very considerably the amount of auxiliary apparatus required and ensures a large output with a high signal to mush ratio. One point which is frequently overlooked is the necessity for providing complete electrostatic screening for the cell, and potentiometer unit, which provides the voltages to the individual multiplier stages. At the same time the screening must not obscure the light which has to activate the photo-electric cathode surface. An example of how this can be carried out in practice when large-surfaced cells are to be used is furnished in the accompanying illustration. A metal shield surrounds the cell except for a fairly close-meshed grid placed at the front.



An interesting example of the form of screening undertaken when using large cathode-ray photo-electric cells for television purposes.

Radio Traffic Control

A NOVEL plan to bring traffic signals into cars in the form of distinctive tones corresponding to the "stop" and "go" lights, may in time make an auto-radio a legal requirement on every one of the nation's 30,000,000 cars, according to the men behind the plan in America.

In its present form, this traffic-control system uses the existing car radio tuned to 550 kc/s, thus making the system immediately available for the 6,000,000 cars now equipped with auto-radios, though eventually a special small set would be employed with fixed tuning to the highway safety-signal frequency.

By the use of this system the driver, instead of letting his attention wander from the roadway in his search for traffic signals in unfamiliar territory, would hear a pleasant low tone as long as the lights ahead were green. When "red" comes on, in all cars on that section of the roadway an interrupted high note would be heard, like a crossing signal. If desired, relays could be installed which would switch on the car instrument board. Cars thus equipped and operating over a test section of New York City highways were described over the NBC Blue network recently.

Recorded Messages

The small highway transmitting unit, which may be mounted on a telephone pole or a traffic-light stanchion, makes use of a magnetic tape sound recording device by which continuous repetition of a traffic bulletin or a safety message may be broadcast. A distinctive sign placed on the street or highway in advance of a given radio zone calls attention of motorists to the radio system which they are approaching and tells them the frequency to which to tune their set.

By means of this device, traffic can be re-routed to secondary thoroughfares from crowded highways, preventing jams before cars have a chance to pile up; drivers can be warned of speed limits or of emergency in case of fire or accident; doctors can be paged on the road or pedestrians can be warned of an impending change in traffic lights. The robot can give oral warning of such impending changes to drivers and pedestrians also.

This new highway traffic control system using auto-radios is being developed by William S. Halstead and S. K. Wolff, whose laboratory is in the RKO Building, Radio City, New York, in collaboration with Dr. McClintock, director of the Yale University Bureau of Street Traffic Research.

D.C. HEATER CIRCUITS

(Continued from page 48)

by taking the grid-return lead to the bottom end of the cathode resistance, the grid is automatically negative in respect to the cathode to the extent of the voltage dropped across the resistance. A small condenser—usually 1 mfd.—should in each case be shunted across the cathode resistance in order to provide a low-impedance path to earth for any unwanted H.F. or L.F. currents which may be present in the circuit. The formula for calculating cathode resistance values is:

$$\frac{\text{Grid-bias voltage required}}{\text{anode current in milliamps}} \times 1{,}000.$$

In the case of a valve requiring 10 volts bias with an anode current of 15 milliamps, the formula becomes:

$$\text{Resistance} = \frac{10 \times 1{,}000}{15} = 666 \text{ ohms.}$$

Universal Valve for A.C. or D.C. Mains

The third type of valve, namely, the "universal" low-voltage valve, is a form of indirectly-heated valve, the heater of which is designed to work directly from any supply, whether A.C. or D.C., either with a mains transformer or alternatively by means of a breakdown resistance, thus permitting the construction of a receiver which will operate from either D.C. or A.C. mains without serious complications. Such a receiver is, of course, an attractive proposition to a constructor who, although now on D.C., shortly expects to be changed over to A.C., but it is not essential to use the special universal valve—ordinary indirectly heated D.C. valves can be used. The only unconventional point is the rectification of the supply for anode current when the set is connected to A.C. mains. This is, however, quite a simple matter if it is borne in mind that a metal rectifier offers very low resistance to current passing one way, and, consequently, very little voltage drop will occur through this component with direct current passing through it. Under these conditions, the rectifier is naturally only an "ornament," but in any event, it does not prevent the passage of D.C. and does not reduce, to any appreciable extent, the voltage available for the anode circuits. When the set is connected to A.C., however, the rectifier comes into its own and converts the alternating current to a pulsating unidirectional current which, after smoothing, is suitable for the anodes of the valves. It will be appreciated that in such a circuit the smoothing must be exceptionally comprehensive, partly due to the fact that only half-wave rectification is employed. It is necessary to point out that a "universal" receiver of this type does not comply with the various electrical regulations when connected to A.C. mains, as in the absence of the usual mains transformer the set is, of course, connected directly to the mains.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 35

WOOD SCREW PROPORTIONS

TWIST DRILLS FOR WOOD SCREWS

No. (or) size) of Screw.	Diameter of Neck or Shank.	For Wood or Metal.		With Side Lips and Centre for Wood only.	
		No., etc.	Diameter.	Size.	Diameter.
1	.066	Stubb's Wire Gauge Drills. 51	.067	—	—
2	.080	46	.081	—	—
3	.094	41	.096	—	—
4	.108	35	.110	—	—
5	.122	30	.128	1/8	.125
6	.136	28	.140	—	—
7	.150	23	.154	5/32	.156
8	.164	18	.169	—	—
9	.178	14	.182	3/16	.187
10	.192	9	.196	—	—
11	.206	4	.209	7/32	.218
12	.220	1	.228	—	—
13	.234	B	.238	—	—
14	.248	E	.250	1/4	.250
15	.262	H	.266	—	—
16	.276	K	.281	9/32	.281
17	.290	M	.295	—	—
18	.304	O	.316	5/16	.312
19	.318	P	.323	—	—
20	.332	R	.339	11/32	.343
21	.346	S	.348	—	—
		T	.358	—	—
22	.360	U	.368	3/8	.375
23	.374	V	.377	3/8	.375
24	.388	X	.397	—	—
25	.402	Z	.413	13/32	.406
26	.416	27/64	.421	—	—
27	.430	7/16	.437	7/16	.437
28	.444	29/64	.453	—	—
29	.458	15/32	.468	15/32	.468
30	.472	31/64	.484	—	—
31	.486	1/2	.500	1/2	.500
32	.500	33/64	.515	1/2	.500

All dimensions in parts of an inch.

No. 36

STANDARD WOOD SCREWS

No. of Screw Gauge	Diameter. Dec.	A In. Approx. Fraction.	B In.	C In.	Slot. Width	Slot. Depth
0	.05784	1/16	7/64	1/32	1/64	1/64
1	.07100	5/64	9/64	3/64	1/64	1/32
2	.08416	5/64	11/64	3/64	1/64	1/32
3	.09732	3/32	3/16	3/64	1/64	1/32
4	.11048	7/64	7/32	1/16	1/32	1/32
5	.12364	1/8	15/64	1/16	1/32	1/32
6	.13680	9/64	17/64	5/64	1/32	3/64
7	.14996	5/32	19/64	5/64	1/32	3/64
8	.16312	5/32	21/64	3/32	3/64	3/64
9	.17628	11/64	23/64	3/32	3/64	3/64
10	.18944	3/16	3/8	7/64	3/64	1/16
11	.20260	13/64	13/32	7/64	3/64	1/16
12	.21576	7/32	7/16	1/8	3/64	1/16
13	.22892	15/64	29/64	1/8	1/16	1/16
14	.24208	1/4	31/64	9/64	1/16	1/16
15	.25524	1/4	33/64	9/64	1/16	1/16
16	.26840	17/64	17/32	5/32	1/16	5/64
17	.28156	9/32	9/16	5/32	1/16	5/64
18	.29472	19/64	19/32	11/64	5/64	5/64
19	.30788	5/16	39/64	11/64	5/64	5/64
20	.32104	21/64	41/64	11/64	5/64	5/64
21	.33420	21/64	43/64	3/16	5/64	5/32
22	.34736	11/32	11/16	3/16	3/32	3/32
23	.36052	23/64	23/32	13/64	3/32	3/32
24	.37368	3/8	3/4	13/64	3/32	3/32

No. 37

Density of Solids and Liquids

Aluminium	2.58 g.	per cub cm.	161.1 lb. per cub. ft.
Copper	8.9 g.	,, ,,	555.4 lb. ,, ,,
Gold	19.3 g.	,, ,,	1205 lb. ,, ,,
Ice	0.9167 g.	,, ,,	57.2 lb. ,, ,,
Iron	7.87 g.	,, ,,	491.3 lb. ,, ,,
Lead	11.0 g.	,, ,,	686.7 lb. ,, ,,
Mercury	13.596 g.	,, ,,	848.7 lb. ,, ,,
Nickel	8.80 g.	,, ,,	549.4 lb. ,, ,,
Platinum	21.50 g.	,, ,,	1342.2 lb. ,, ,,
Sea Water	1.025 g.	,, ,,	64.0 lb. ,, ,,
Silver	10.5 g.	,, ,,	655.5 lb. ,, ,,
Tin	7.18 g.	,, ,,	448.2 lb. ,, ,,
Tungsten	18.6 g.	,, ,,	1161.2 lb. ,, ,,
Uranium	18.7 g.	,, ,,	1167.4 lb. ,, ,,
Water	1.000 g.	,, ,,	62.4 lb. ,, ,,
Zinc	7.19 lb.	,, ,,	448.6 lb. ,, ,,

No. 38

Wire and Sheet-metal Gauges—1

Number of Gauge	British Imperial Standard or English Legal Standard		American or Brown & Sharpe		Birmingham or Stubs Iron.		Gold and Silver (Birmingham)		Lancashire Steel Pinion Wire.	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
7/0	.500	12.70	.46	11.68	.454	11.53	.004	0.101	.227	5.757
6/0	.464	11.78	.409	10.388	.425	10.787	.005	0.127	.219	5.558
5/0	.432	10.97	.364	9.24	.380	9.65	.008	0.203	.212	5.380
4/0	.400	10.16	.324	8.23	.340	8.63	.010	0.254	.207	5.257
3/0	.372	9.44	.289	7.338	.300	7.62	.013	0.330	.204	5.181
2/0	.348	8.83	.257	6.527	.284	7.21	.016	0.406	.201	5.105
1/0	.324	8.23	.229	5.808	.259	6.578	.018	0.457	.199	5.048
1	.300	7.62	.204	5.19	.238	6.04	.020	0.508	.197	4.997
2	.276	7.00	.182	4.62	.220	5.59	.023	0.584	.194	4.927
3	.252	6.40	.162	4.11	.203	5.156	.025	0.635	.191	4.845
4	.232	5.89	.144	3.66	.180	4.57	.028	0.711	.188	4.777
5	.212	5.38	.128	3.24	.165	4.187	.032	0.812	.185	4.697
6	.192	4.88	.114	2.89	.148	3.753	.035	0.889	.182	4.620
7	.176	4.46	.101	2.565	.134	3.40	.039	0.990	.180	4.57
8	.160	4.06	.090	2.28	.120	3.04	.042	1.066		
9	.144	3.66	.080	2.03	.109	2.768	.045	1.143		
10	.128	3.24	.071	1.79	.095	2.413	.048	1.219		
11	.116	2.94	.063	1.625	.083	2.108	.051	1.295		
12	.104	2.642					.055	1.397		
13	.092	2.336					.059	1.499		
14	.080	2.03					.063	1.600		

No. 39

Wire and Sheet-metal Gauges—2

Number of Gauge	British Imperial Standard or English Legal Standard		American or Brown & Sharpe		Birmingham or Stubs Iron.		Gold and Silver (Birmingham)		Lancashire Steel Pinion Wire.	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
15	.072	1.828	.057	1.447	.072	1.828	.047	1.193	.178	4.513
16	.064	1.625	.050	1.27	.065	1.65	.051	1.295	.175	4.457
17	.056	1.422	.045	1.14	.058	1.473	.057	1.447	.172	4.367
18	.048	1.219	.040	1.016	.049	1.244	.061	1.549	.168	4.263
19	.040	1.016	.035	0.889	.042	1.066	.064	1.625	.164	4.161
20	.036	0.914	.031	0.787	.035	0.889	.067	1.701	.161	4.085
21	.032	0.812	.028	0.711	.032	0.812	.072	1.828	.157	3.988
22	.028	0.711	.025	0.635	.028	0.711	.074	1.879	.155	3.937
23	.024	0.61	.022	0.558	.025	0.635	.077	1.955	.153	3.886
24	.022	0.558	.020	0.508	.022	0.558	.082	2.082	.151	3.835
25	.020	0.508	.017	0.431	.020	0.508	.095	2.413	.148	3.753
26	.018	0.457	.015	0.381	.018	0.457	.103	2.616	.146	3.702
27	.016	0.406	.014	0.376	.016	0.406	.113	2.87	.143	3.626
28	.0148	0.376	.012	0.304	.0148	0.376	.120	3.04	.139	3.528
29	.0136	0.345	.011	0.284	.0136	0.345	.120	3.04	.134	3.401
30	.012	0.304	.010	0.254	.012	0.304	.126	3.193	.127	3.217
31	.010	0.254	.009	0.203	.010	0.254	.133	3.378	.120	3.04
32	.0092	0.234	.008	0.199	.009	0.226	.143	3.633	.115	2.917
33	.0084	0.213	.007	0.177	.008	0.203	.148	3.753	.112	2.79
34	.0076	0.193	.006	0.152	.0076	0.192	.148	3.753	.110	2.743
35	.0068	0.172	.0056	0.142	.005	0.127	.158	4.013	.108	2.743
36	.0076	0.193	.005	0.127	.004	0.101	.167	4.237	.106	2.692

No. 40

Wire and Sheet-metal Gauges—3

Number of Gauge	Lancashire Steel Wire Letter Gauge.		London or Old English		Morse Steel Wire Gauge for Drills.		Music Wire Gauge. English.		Music Wire Gauge. Washburn & Moen.	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
7/0									.008	0.203
6/0									.009	0.228
5/0									.010	0.254
4/0									.011	0.279
3/0									.012	0.304
2/0									.013	0.330
1/0									.014	0.355
1	Z	10.48	.454	11.53	.228	5.783	.011	0.279	.015	0.381
2	Y	10.26	.425	10.787	.221	5.60	.012	0.304	.016	0.406
3	X	10.07	.380	9.65	.213	5.406	.013	0.330	.017	0.431
4	W	9.90	.340	8.63	.209	5.309	.014	0.355	.018	0.457
5	V	9.56	.300	7.62	.204	5.207	.015	0.381	.020	0.507
6	U	9.34	.284	7.21	.201	5.105	.016	0.406	.021	0.533
7	T	9.09	.259	6.578	.199	5.048	.017	0.431	.023	0.584
8	S	8.83	.238	6.04	.196	4.972	.018	0.482	.024	0.609
9	R	8.60	.220	5.59	.194	4.921	.020	0.508	.025	0.635
10	Q	8.43	.203	5.156	.191	4.845	.022	0.558	.027	0.685
11	P	8.17	.180	4.57	.189	4.798	.025	0.635	.028	0.711
12	O	8.02	.165	4.187					.029	0.736
	N	7.85	.148	3.753						
	M	7.62	.134	3.40						
	L	7.44	.120	3.04						
	K	7.26	.109	2.768						

Suppressor-grid Reaction

Observations on a New Type of Circuit

WITH suppressor-grid injection being so widely used in varying forms of circuit application, for example H.F. modulation and keying in transmitters (peace time), coupling for a separate oscillator, gain control, etc., the majority of readers will be conversant with the basic principles involved.

The suppressor grid was originally introduced for the purpose of preventing instability arising through electrons "bumping" off the anode and returning to the control grid, but in the inevitable course of experimenting which followed, the above variety of uses soon evidenced the further advantages to which this grid could be put.

It will, no doubt, have been noticed how, in previous articles appearing in this journal, the screen grids of both H.F. and L.F. pentodes were used as a means for signal injection and reaction, but in recalling these methods to further example the trend in circuit development, the principles adopted with the screen grid should not be confused, theoretically, with the suppressor-grid scheme about to be described, the fundamental difference being evident on considering the action of the screen grid on the characteristics of the valve, particularly in respect of the conversion gain.

As the gain is immediately dependent on the ratio of screen grid to anode current, other factors being consistent, a potentiometer is thus frequently employed in the S.G. feed to control the gain; consequently, whilst there are definite advantages to be had by using the screen grid as a means for negative feed-back, it will be apparent that a well developed circuit is necessary to warrant the method, since the signal amplitude is then dependent on the combined factors of gain control and reaction sensitivity.

From this one can readily see the merits offered by a circuit where the advantages of screen-grid reaction can be obtained with the independence of the two functions—gain and sensitivity.

The Reaction Circuit

Now, glancing at the circuit given in Fig. 1, which also gives in skeleton form the theory of the suppressor-grid form of reaction, the first noticeable feature is the absence of any E.M.F. at this grid, the reaction circuit consisting purely of the usual magnetic coupling with series reaction condenser to a conventionial tuned (leaky) grid circuit. Considering this arrangement, it then becomes apparent that the original purpose of the suppressor grid is partially met by the path to earth which this circuit presents to the unwanted electrons leaving the anode.

Although there is no attractive influence to the electrons emitted from the filament or cathode by the usual H.T. supply, sufficient feed-back results to provide a magnetic flux in the reaction coil which will interact with the grid coil, thus bringing about the increase in sensitivity due to negative resistance.

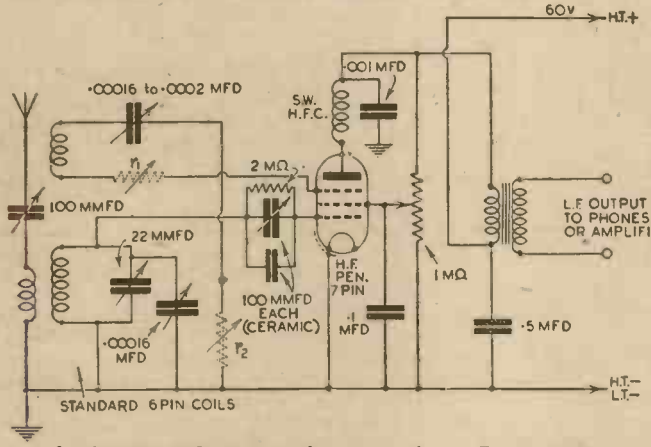


Fig. 1.—Circuit diagram showing in skeleton form the theory of the suppressor-grid system of reaction.

In an endeavour to reach either the positive influence of the anode or a path to earth, many of the electrons collect on the suppressor grid and flow through the reaction circuit, the rest reaching their goal, the anode, but all this being governed by the screen grid circuit and potential. It should be mentioned here that in the tests standard plug-in coils were used and standard components.

It follows then from these preliminary notes on the scheme adopted in Fig. 2, that should the reaction coil be directly connected to earth by either discarding or shorting the reaction condenser, the maximum flux density is obtained in relation, of course, to the applied anode and screen voltage, thus it will be seen that should a variable resistance be inserted in this circuit, with or without the reaction condenser, and in either positions indicated by r1, and r2, the sensitivity of the reaction can be "refined," the two controls so provided being then furnished with suitable dials for the purpose of more precise logging.

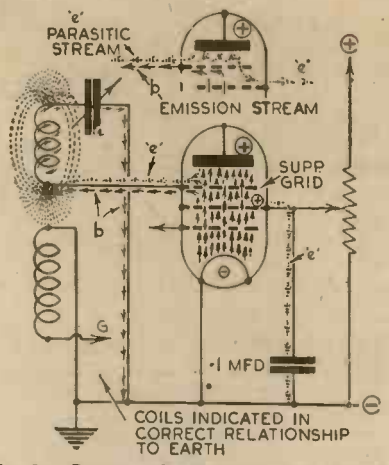


Fig. 2.—Diagram showing the path of electrons in the suppressor-grid system of reaction.

Readers may care to try out various values of resistance and capacity, and the values of r1 and r2 are, therefore, optional, 50,000 ohms being a satisfactory value for the circuit given in Fig. 1.

Obtaining Stability

The next point in the design concerns the question of feed-back and hand-capacity effects in so far as this arrangement compares with the more usual reaction circuits. Owing to the absence of a direct H.T. load to the suppressor grid, the tendency for feed-back through this medium is removed, the inter-electrode capacity providing the only way in which this might be brought about, consequently with a reasonable element of decoupling, and, in the case of circuits where there is a good component of H.F., carefully determined screening, etc., 'phone lead capacity effects will prove less likely than in a more conventional anode or even screen-grid reaction circuit.

With regard to smoothness of reaction control, it can be said that, in view of the suppressor-grid circuit having essentially the same principle as any other form of magnetic coupling, the conditions which govern the degree of interaction are the same; therefore, it is only fair to state here that no particular advantage was noticed in this respect. However, as it is proposed at a later date to detail fully the construction of a receiver in which this scheme is embodied, the writer will have in the meantime, an opportunity for determining more closely this consideration in conjunction with one or two other rather interesting circuit functions connected with H.F. gain and negative feed-back tone control.

In a receiver which is designed for accurate logging, any controls which assist in this direction, however many they may be, with, of course, discretion, are to be desired, so it will be apparent that in T.R.F. circuits, an H.F. pentode with or without variable-mu characteristics can be made to fulfil to a very appreciable extent this requirement.

W.R.H.

New Applications of the Heptode

Some Applications of the Valve to Detection and A.V.C.

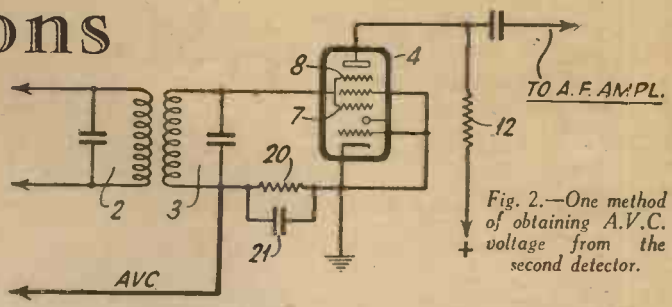


Fig. 2.—One method of obtaining A.V.C. voltage from the second detector.

THE heptode valve, with its many electrodes, lends itself to a great variety of uses, some of which are described below.

Referring to Fig. 1 of the accompanying diagrams, there is shown the final transformer 1 of a superhet, primary and secondary circuits 2 and 3 are each resonated to the I.F. value. The second detector embodies a valve of the heptode type, and is represented by the numeral 4. The valve has a cathode 5, an anode 6, and grids which are arranged in succession in the electron stream flowing between cathode and anode.

Grids 7 and 8 are strapped together and are connected to the high potential side of the input circuit 3; the cathode 5 is at ground potential, as is the low potential side of the input circuit 3. The grid 9, adjacent the cathode, is connected to earth, while the fourth grid 10, disposed between grids 7-8, is also earthed. The electrode 11, which is actually a rod, functions as the anode of a diode rectifier for producing A.V.C. bias. The anode 6 is connected to a positive potential point, of approximately +250 volts, of a current source (not shown); the anode circuit includes the load resistor 12 having a magnitude of approximately 0.5 megohms. The audio voltage developed across resistor 12 is transmitted to the following audio amplifier 13 by the coupling elements 14.

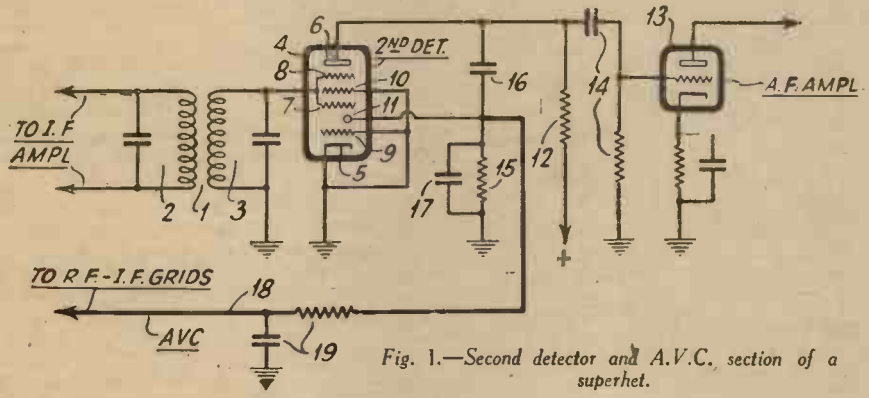


Fig. 1.—Second detector and A.V.C. section of a superhet.

A.V.C. Bias

The A.V.C. bias may be provided by feeding the amplified carrier energy to the diode rectifier comprising anode 11, cathode 5 and load resistor 15. The condenser 16 has a low impedance to currents of I.F. carrier frequency, and is connected from anode 6 to anode 11. The load resistor, connected to ground from anode 11, has developed across it a direct current voltage whose magnitude varies directly with the amplified I.F. carrier amplitude. The I.F. by-pass condenser 17 shunts resistor 15, and lead 18 functions as the path for impressing the voltage across resistor 15 upon the signal grids of the signal transmission valves feeding the detector. Such prior valves can be the tunable radio-frequency amplifiers, the first detector, and one or more of the I.F. amplifiers. The A.V.C. circuit includes filter network 19 for suppressing pulsating voltage components in the A.V.C. bias. The A.V.C. circuit functions to vary the amplification of the pre-second detector valves in a sense to maintain the I.F. carrier amplitude at the input circuit 3, substantially constant over a wide range of carrier variation at the signal collector.

Functioning as a Rectifier

Considering now the operation of the detector, let it be assumed that grids 9, 11, and 10 are free. In this state of the detector valve, no anode current flows unless the electrodes 7-8 are at a positive potential with respect to the cathode. Hence, when the electrodes 7-8 are zero, or negative, in potential no anode current flows. This means that the valve 4 then functions as a rectifier, because anode current only flows during positive half-cycles of the input waves. Since the electrodes 7 and 8 consist of open mesh, or are open wire cylinders, electrons which are attracted by these electrodes pass through the openings of the electrodes to the anode 6. Thus, the current which electrodes 7-8 draw from the input circuit may be kept low and the input impedance comparably high. It will be observed that during the positive half-cycle the voltage of electrodes 7-8 is sufficiently positive to attract the electrons close thereto. Since the anode potential is considerably higher than that of electrodes 7-8, the electrons come under the influence of the anode, and are attracted into the anode circuit. The voltage developed across resistor 12, by the anode current flow therethrough, may be made to be substantially larger than the applied input voltage, by choosing a sufficiently higher control-grid—anode transconductance between anode 6 and electrodes 7-8. If the magnitude of resistor 12 is high (of the order of 0.5 megohms) the anode voltage across the resistor bears a linear relation to the input voltage. In this way there is provided a linear detector having gain.

Increasing Detector Gain

Now if the fourth grid 10 is earthed, the voltage across resistor 12 per applied input volts may be increased; that is to say, the gain of the detector is increased. The explanation for this action may be stated to be as follows. When electrodes 7-8 are positive, a virtual cathode is established between grids 7 and 10. This virtual cathode varies in intensity, and is equivalent to placing an input voltage in the cathode circuit. Another way of viewing the action is to consider grid 10 as accelerating the electrons towards the anode 6, since the grid 10 is positive with respect to the virtual cathode. The positive potential on grid 10 is provided by contact potential, and also by the potential difference between anode 6, grid 10 and the cathode.

Still further gain may be had by earthing the first grid 9. Contact potential, as well as the potential difference between anode grid 9 and cathode, establishes grid 9 at a positive potential with no input signal. The slightly positive grid 9 (approximately 1 volt) draws electrons from the cathode 5; the electrons pass through the mesh of grid 9, and accumulate between electrode 7 and grid 9. This produces a virtual cathode state. The positive potential on electrodes 7-8 attracts electrons so that anode 6 can then attract the electrons. Hence, it will be seen that each of the earthed electrodes acts to draw electrons towards the anode 6. The total effect is an increased audio voltage across load resistor 12; the relation between input voltage and the latter being substantially linear.

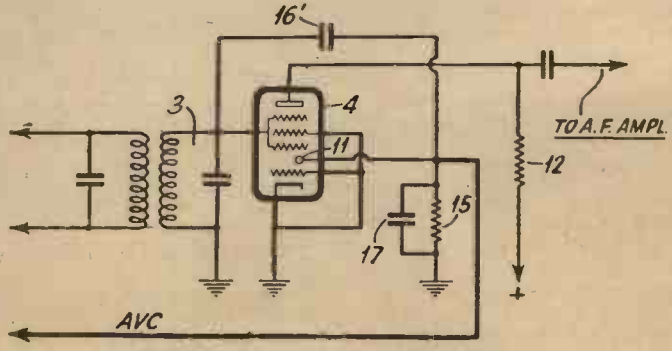


Fig. 3.—In this arrangement the I.F. currents are fed through condenser 16¹.

(Continued on page 60)

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).

10-Metre DX

SIR,—I am a very keen short-wave listener, and I log many calls on the amateur bands. On Sunday, February 18th, I was amazed at the number of amateur 'phone stations which could be heard on 28 mc/s from the 6th and 7th districts of U.S.A.

Between 17.00-18.30 (G.M.T.) I heard the following: W6LES, 6RK, 6CQQ, 6MYS, 6QXA, 6LVX, 6LSN, 6QNW, 6TSF, 6REE, 6NVU, 6RK; 7FTV, 7EKR, 7BKD, and 7HLB.

DX conditions at the week-ends have been very good for the last two or three weeks, and I have also logged XE1AM, 1GG; LU1DO, LX1UU, K4EZR, K6ROJ, 6OQM; HI2P, 2K, 7G and NY4AD.

My RX is a Sky Buddy, and the antenna is an indoor one, about 25ft. long. I would like to hear from any other reader interested in 10-metre work.—J. M. GRAHAM, Kames Villa, 2, Kelvinside Terrace West, Glasgow, N.W.

A Radio Club's Shack

SIR,—I enclose a photograph of the transmitting section of the Clayesmore Radio Club, taken before the outbreak of war. The apparatus consists of a 4-valve (including rectifier) receiver, and short-wave superhet converter in the rack. The 6L6G C.O. and modulator is on the right. All this was constructed by 2CGD.

One of our late members, John Davies (2CRW), whose card figures prominently on the wall, is now serving as a wireless operator in the R.A.F.—A. W. G. WILSON (2CGD) (Iwerne Minster, Dorset).

Full-wave Detection

SIR,—Regarding the letter of Mr. D'Arcy Ford on the above subject, I would refer him to Section D 24 of the Admiralty Handbook of Wireless Telegraphy, 1938, Vol. II, where he will find a description of the *working* of two types of H.F. full-wave rectifiers. The description is followed by remarks on the definite advantages of the circuits—coupled as usual with certain disadvantages principally as to power consumption and matching of the valves.

Further, if I remember correctly, I have seen mentioned in an older text-book a copper oxide rectifier (commercial) designed expressly for medium-frequency full-wave rectification.

I would also mention that no theoretical grounds could be stated for the *impossibility* of H.F. full-wave detection. It is certainly not normally necessary in practice—hence its disuse.—THOMAS P. TAYLOR (Cambridge).

A DX Log from West Bridgford

SIR,—In view of the improvement in DX conditions now being experienced, I enclose my log for the last few weeks:

14 mc/s 'phone and C.W.: PY2NO, 7VB; YV5AK, ABY; ZC1A, PK1OG, EK1AF, KA1AF, CW, LB, LZ, ME; UK3AH, UE3KQ, KX, U3BC, BP, BX, DQ; U4AL, AM; UK5KW, U5YH, U8ID, U9ML.

7 mc/s C.W.: W1, 2, 3, 4, 8; W5HUC, MH; 6NNV, 9BRD, BVS, CDU; HH2PB, 3DN; CM7AC, MV; K4ESH, PY2BE, 4BR; U3GI.

Thanking you for a very fine weekly paper, and trusting that you will be able to continue to keep "ham" radio alive during these difficult times.—JOHN D. A. HALL (West Bridgford, Notts).

A corner of the Clayesmore Radio Club's shack, taken before the transmitter was dismantled.

Impedance of H.F. Transformer Primary

SIR,—May I call attention to the impression that might possibly be conveyed to a really earnest student of wireless who is not content with skimming the surface, but wants to get down to fundamentals (alas, there are very few of them) by a statement regarding the impedance of the primary of an H.F. transformer, in a recent article. There would be a very large rise in its impedance at the resonant point, compared with that of the coil by itself. I append a calculation, based on a case which might easily happen in practice, to show what this rise can be. If we assume a primary of 50 microhenries, having a series H.F. resistance of, say, 4 ohms, coupled to a secondary of 200 microhenries with an H.F. resistance of 10 ohms, the coupling factor being 70 per cent., we have the data for calculating the increase. In this case the inductive reactance of the primary at a wavelength of 300 metres is 314 ohms.

With the secondary figures, and the coupling factor as given, there will be thrown back into the primary from the secondary, at 300 metres, a *resistance* of 19,320 ohms in round figures. To this must be added the four ohms H.F. resistance of the primary, which is in phase with it. We have now over 60 times the impedance of the coil by itself, to be added to its inductive reactance, to make the total impedance, and, what is more, one being inductive reactance and the other a resistance, they must be added vectorially (in quadrature), and this means only an ohm or two—I needn't work it out—difference caused by the impedance of the primary coil itself, compared with what is reflected from the secondary. It is quite evident that the impedance of the primary itself is in comparison quite negligible.—A. O. GRIFFITHS (Wrexham).

Back Numbers Wanted

SIR,—May I inquire through your paper whether any local readers have any issues from Volume 13 (except Nos. 327, 324, 322, 319 and 316) which they would like to dispose of? I intend to have Volumes 13, 14 and 15 bound as soon as possible and I will call for any back issues as soon as I receive an address.

Again I would like to extend an invitation to all neighbouring short-wave fans to call on me sometimes for a chat, as I am now homo for good. (See PRACTICAL WIRELESS for October 14th, 1939.).—W. G. ANDREWS, 17, Lingfield Road, Broadgreen, Liverpool, 14.

Correspondents Wanted

SIR,—As an old reader of your excellent paper I want to get a training in Morse, and I should like to get into touch with any interested reader in this locality who is willing to give me a helping hand to attain a degree of proficiency.

The formation of a local Morse Club, or radio club, appeals to me and I should be pleased if any readers interested would communicate with me.—M. J. TAYLOR, 38, Caerphilly Road, Cardiff.

Prize Problems

PROBLEM No. 393.

MARSHALL had an S.G., Det. Power receiver which had worked quite well except for a rather poor tonal response. After reading a few articles on the subject he decided to fit a tone-control, and he had read that this could be included in the detector anode circuit. He therefore obtained a 20,000-ohm resistor, and joined this across the detector output circuit, connecting one end to anode and the other to earth. When he switched on, however, it failed to function as he expected. 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. 393 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, April 1st, 1940.

Solution to Problem No. 392.

When Jackson connected up his shunt and series resistances for his multi-meter he confused the connections and had the voltage series resistances across the meter, and accordingly there was very little difference to the actual meter reading.

The following three readers successfully solved Problem No. 391 and books have accordingly been forwarded to them: J. Smith, "Rose Cottage," Fiskerton, Notts.; G. A. Doherty, 12, Hillview Avenue, West Kirby; L. Smith, 17, Dryden Grove, Acocks Green, Birmingham.

Practical Wireless

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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

Mains Interference

"I obtain my electricity from the local supply system, the house being about 100 yards away from the overhead system. In damp or foggy weather the cables cause very bad interference with my all-mains commercial receiver. The interference comes through the mains, not the aerial, as crackling continues when both aerial and earth have been removed. I am told that there is no cure for this, but if there is I should be very grateful if you would let me know what it is."—J. S. (Lincoln).

THE fact that the trouble only occurs in bad weather would tend to indicate poor insulation which would give rise to radiated interference not interference via the mains. In that case, and bearing in mind the proximity of the mains cables, the removal of aerial and earth might not be conclusive proof that the interference is not radiated, as it could be picked up on the actual wiring of the receiver, or even on the loudspeaker leads. In such a case the only effective cure is to enclose the entire receiver in a metal box, or alternatively to line the cabinet with thin metal foil and earth this. If the interference is mains borne, then a standard suppressor consisting of a condenser network across the mains input leads should prove satisfactory. Messrs. Belling Lee can supply suitable apparatus of this type.

Centaur Three

"Could you please inform me where I can obtain coils for the Centaur Three, they are of the Unigen type, and also the Metaplex baseboard?"—A. C. (Enfield).

THE Unigen coils are produced by Messrs. Wright and Weaire, of 740, High Road, Tottenham. The Metaplex baseboard is a Peto-Scott product.

Removing A.C. Ripple

"I should be glad if you would tell me of an effective method of getting rid of a bad A.C. ripple in a current. The E.M.F. is only small and an L.F. choke does not suit. The current goes to the filaments of some battery valves so I must have it a lot smoother than it is at the moment."—P. P. (Kenton).

IN general it is not practicable to attempt to operate the ordinary type of 2-volt battery valves from an A.C. supply. The thin filament responds to the slightest variation in the supply and thus hum is almost impossible to remove. A very high inductance choke would probably cut down the ripple to negligible proportions, but a perfectly smooth D.C. supply must be used if you wish to obtain hum-free reception with 2-volt type valves.

Using Old Panels

"I have one or two old sets at home in which ebonite panels were employed. I am thinking of building some new receivers and should like to use up the old panels, but I should not use all the holes on them. I believe there is some material sold for filling up these holes and should be glad if you could tell me its name and where to get it."—S. R. (Harringay).

THE usual material is Chatterton's Compound obtainable from any good electrical dealer. Alternatively, if the panels are of the polished type you could use ordinary heel-ball. If there are many holes, or you wish to use fresh ones which may run close to the old ones, it may be desirable to use a very thin piece of ebonite on top of the existing panel and this would avoid filling holes and yet would still give you a thick substantial panel.

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.

Filament Resistance

"I am trying to make up a small portable in which I shall use ordinary 2-volt valves, but I wish to use a large pocket-lamp battery for the supply. This gives 3 volts, I understand, and I should like to know what resistance I must include in order to drop the supply to 2 volts."—C. V. (Reigate).

THE valves will, we assume, be connected in parallel in the ordinary way. This means that you need 2 volts at so many milliamps to feed them, the total current depending upon the particular valves in use. The value of the resistance can be calculated by dividing the difference between the supply and the filament voltage rating by the total filament current in amps. This may be expressed as follows:

$$\text{Resistance (ohms)} = \frac{\text{Supply volts} - \text{rated volts of the valves}}{\text{Total filament current in amps.}}$$

American Valve Data

"I have been given an American valve which I have been told is quite in order. I should be glad if you could give me the characteristics of this particular valve, the number of which is 6E5. I do not know the maker's name."—H. E. T. (Lowestoft).

THE 6E5 is an electron-ray or cathode-ray tuning indicator. It is of the 6.3 volt .3 amp type.

Modulated Oscillator

"When looking through a catalogue recently, I saw reference to a modulated oscillator. Could you explain briefly what this is and how it is used."—W. S. R. (Cardiff).

THE apparatus is used for receiver test purposes and consists of some form of oscillating valve. If a valve is made to oscillate and the output is then connected to the aerial-earth terminals or to any part of the H.F. side of a receiver, the oscillation will be passed from stage to stage and in such a form it is suitable for testing the noise level in a receiver and several other factors. It is useless, however, for ganging or lining-up purposes, and also for testing the L.F. sections of a receiver. Accordingly, some form of modulation has to be employed and this breaks up the valve oscillation so that an audible, or L.F., note is obtained. It is possible to make an oscillator self-modulating.

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.

F. H. (Musselburgh). The component mentioned was a special wave-trap device designed for a periodical not now on the market, and we regret that we have no details of the special receiver, and therefore cannot assist you in obtaining working results.

E. W. (Radford). You cannot combine the units and we have no details of the outputs of them now available. The makers may still be able to assist you.

J. A. C. (Tottenham). The book will be issued in due course. It is not yet ready.

R. G. (Plymouth). The set was the A.C. Leader 3, and a blueprint is still available, number PW.35C. Details were reprinted in our issue dated January 7th, 1939, but the original numbers are now out of print.

V. S. (Birmingham). As the set is an American commercial model we think it desirable for you to get into touch with Webb's Radio who may be able to replace the faulty part and suggest the cause of the other trouble.

H. H. R. (Liverpool, 18). The device is merely a standard sensitive receiver with a frame aerial. Two separate readings are necessary to obtain a true direction.

R. C. (Moorgate). We have no details now available regarding the coils.

J. R. (Clacton). At least 66 volts would be required. You might obtain oscillation down to 36 volts, but it is doubtful.

K. E. R. (Bedford). The second valve cannot be connected in push-pull owing to its totally different characteristics. Both valves must be as nearly alike as possible.

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

Notes from the Test Bench

Home-made Dials

MANY home-made receivers or items of test equipment are often marred so far as concerns their final appearance by amateurish-looking dials. Rough markings on thick paper never look well, and it is worth while spending a little time in getting a really good-looking scale or dial and some of the following ideas may be turned to account in this direction. Photographic prints may be made in very good black and white from celluloid protractors or similar scales, or from well-drawn or typed figures or letters on thin white paper. It may also be possible in some cases to cut out letters and numbers from magazines or periodicals printed on art paper, and thus to build up quite a presentable scale.

D.C. Supply

WHEN changing from an A.C. supply to a D.C. supply some experimenters experience a difficulty in knowing how to adapt the mains unit or mains section of a receiver. In general all that is normally required is to cut out the rectifying portion. This leaves the smoothing section consisting of a choke and two condensers (one on each side of the choke). The choke must be left in circuit to provide smoothing for the D.C. mains which are not generally smooth enough to permit of their use without some such device. The only point to be watched is that the receiver or mains section was not previously designed to have an output in excess of 250 volts. Accumulators should of course, have to be used for the heaters.

NEW APPLICATIONS OF THE HEPTODE

(*Continued from page 56.*)

Modifications

The detector amplifies the I.F. carrier amplitude of A.V.C. action in Fig. 1. It is also possible to derive A.V.C. bias from a resistor 20 connected between the low potential end of input circuit 3 and the earthed cathode. This is shown in Fig. 2. An I.F. by-pass condenser 21 is connected across the resistor 20. Upon the electrodes 7-8 assuming a positive potential, current flows through resistor 20 developing a direct current voltage across it for use as A.V.C. bias. The electrode 11 is left free in such case. Otherwise the detector circuit functions as in Fig. 1.

The arrangement in Fig. 3 differs from that in Fig. 1 only in that the I.F. carrier energy is applied to diode anode 11 through condenser 16^1. The latter is connected between the high potential side of input circuit 3, and the anode 11. The detector operation is otherwise the same as explained previously in connection with Fig. 1.

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

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

RECEIVERS AND COMPONENTS

(*Continued from page 60.*)

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.

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.

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.

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, Littlehampton.

COULPHONE Radio, 22, Grimshaw Lane, Ormskirk. Collaro A.C. Motors, 12" turntable, 27/6; with pick-up, 42/6. Rola G.12 energised speakers, 52/6. P.M. 65/-. Brand new goods. 1½d. stamp list.

THE largest range of Radio and small Electrical Switches and everything for discerning amateurs, experimenters and dealers. Standardised by leading Wireless Manufacturers—Bulgin, Barking.

FREE ADVICE BUREAU

COUPON

This coupon is available until April 6th, 1940, and must accompany all Queries and Hints.

PRACTICAL WIRELESS, 30/3/1940.

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 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.

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

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Complete motor and pick-up. Auto-stop and start	52/6
A.C./D.C. Model	77/6

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Will fit any fone-arm	5/3

ANOTHER SPECIAL OFFER
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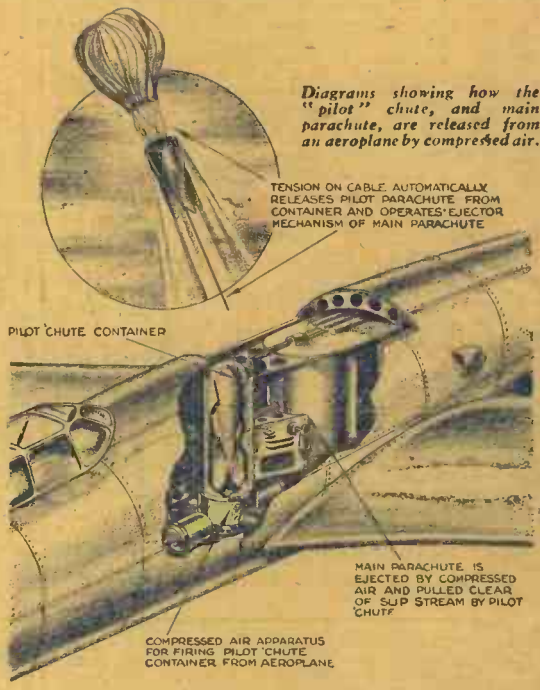

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