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Practical Wireless

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BUILDING THE FERROCART Q.P-P. HI-MAG THREE

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SPECIAL BEGINNER'S SUPPLEMENT, Etc., Etc.

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FOR PUNCH, POWER AND PURITY

ALL ABOUT CLASS B AMPLIFICATION

ROUND *the* WORLD *of* WIRELESS

Rumania's Two Stations

IN addition to the transmitter, which has been operating for some time at Baneasu, near Bucharest, on 394.2 metres (12 kW.) for experimental purposes, a second station—but in this case a mobile one—has been installed on four railway trucks at Blaj (Blasendorf). Its power is 750 watts, and broadcasts of the capital programme are now carried out on 1,920 metres. As Romania is anxious that its wireless entertainments should be heard by listeners beyond its frontiers, it is proposed to erect a 120-kilowatt transmitter on some site not too distant from Bucharest during 1933-34. The wavelength has not yet been definitely fixed, but it is hoped to secure, if at all possible, a channel between 1,200 and 1,800 metres. In view, however, of prior claims to such favourable positions in the long waveband it is hardly likely that authority will be forthcoming from the International Broadcasting Union at Geneva.

Sponsored Wireless Entertainments in Italy

BY arrangement with an American Petroleum concern, the E.I.A.R. will be paid a subsidy for the broadcast of a series of sponsored orchestral and vocal concerts through the Rome, Milan, Trieste and Genoa stations. The income derived from this source will permit the studios to include in these special programmes some of their most famous orchestras, as well as singers and instrumentalists of international repute. The concerts will be given every Monday evening for a period of twelve weeks.

Alternative Programmes for Czecho-Slovakia

UP to the present the Czechs have only used one of the two channels which were originally allotted to them. They have now started tests with a new transmitter on 540 metres. If favourable results are obtained, the present Prague station may use this channel for a National programme, an alternative entertainment to be given on 488.6 metres.

Deutschland Uber Alles !

TAKING as a plea the critical financial situation of artists and musicians throughout the country, the German Reichsfunk commissioner has instructed all studios in his organization to restrict engagements to persons of German nationality. In addition, in order that listeners may know that this is being done, all artists appearing before the microphone, under stage-names or other *noms-de-guerre* must be given their true name in the published programmes.

Galsworthy's "Escape" as Radio Play

AS a tribute to the memory of the author, the B.B.C. will broadcast on April 11th, a microphone version of John Galsworthy's successful play, *Escape*. It was originally projected for transmission at the time of the Dartmoor revolt, but was cancelled at the eleventh hour as being inopportune in view of that unfortunate event.

Gramophone Record Test Case

A WRIT has been issued by The Gramophone Company, Ltd., against Messrs. Stephen Carwardine and Co., Ltd., the well-known caterers of London and Bristol, for performing in public, without authorization at their restaurant in Bristol, an "His Master's Voice" record, of which the copyright is vested in The Gramophone Company, Ltd. This action will act as a test case for all the gramophone record manufacturers to define their rights under the Copyright Act of 1911. The case will be heard at the High Court of Justice in London in due course.

New H.M.V. Record Catalogue

FEW people know that it is still possible to hear a bombardment of the Great War. A gramophone record is still available of the fighting by the Royal Garrison Artillery, near Lille, in 1918. A glance at the new edition of the "His Master's Voice" 400-page record catalogue will reveal even stranger facts. This book has been called "The Musical Debrett," so full of nobility are its pages, for, besides listing over 5,000 records of over 8,000 titles, it is practically a history book of the last decade. The voices of practically all the members of the English Royal family are represented. Their Majesties The King and Queen can be heard speaking on the importance of Empire Day, H.R.H. The Prince of Wales on Sportsmanship, and H.R.H. The Duke of York can be heard explaining the purpose of his annual camp for public schoolboys and working lads. Musicians will be interested to know that Grieg and Saint-Saëns made records of their own compositions. Great explorations of the past are recalled when it is found that Sir Ernest Shackleton and Commander Peary recorded accounts of their exploits. The new 1933 H.M.V. Catalogue is also packed with interesting details, giving biographies and portraits of the world's most famous artists.

Shocking the Ether

IF rumours are to be believed, the super-power, 500 kilowatt transmitter, which the Soviet Government has erected at Moscow Noghinsk, will not operate on a "long" channel as previously reported. Tests have been recently carried out in the middle of the broadcasting band, and there would appear to be a likelihood that the wavelength chosen is one in the immediate vicinity of 350 metres. If so, the advent of a station of this power is likely to cause considerable trouble, and will greatly add to the problems to be solved by the International Broadcasting Union at Lucerne.

Chief Contents:

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

The Radio Fan's Dream Aerial !

FOR the International Exhibition which Paris proposes to open in 1937, the French authorities propose to build a giant tower, 2,200 feet high, as a special attraction. Paris wireless journals suggest that if the scheme matures it should be used as a mast for the aerial of *Radio France*, the giant broadcasting transmitter which on various occasions has been promised to listeners by the State. The existing Eiffel Tower built for the 1889 Exhibition is 984 feet high, and since it was taken over by the military authorities as a wireless station has been equipped with both long and short aerials. The new tower, however, which it is suggested should be called *Le Phare du Monde* (The World's Beacon) would easily hold the record for the height of any building on this earth. Undoubtedly as an aerial mast it would be the radio fan's ideal !

Carillons as Opening Signals

BOTH Madrid EAJ7 and Barcelona regularly relay chimes as an overture to their broadcast programmes. The carillon heard through EAJ7 at midday, 2.0, 9.30 p.m. and midnight G.M.T. is taken from the Home Office buildings at Madrid ; Barcelona EAJ1, at 11.0 a.m. and 9.0 p.m. G.M.T. precedes its transmissions by a chime of bells relayed from the Cathedral.

Stand By For New Swiss Station

THE new 20 kilowatt Tessin broadcasting station on Monte Ceneri, has started its initial tests on 678.8 m. (442 kc/s) thus taking over the channel previously used by Lausanne. All announcements are made in the Italian language ; the studio is situated on the borders of Lake Lugano in the Italian speaking district of Switzerland.

Memories of Zeebrugge Mole

WHEN the B.B.C. relays from Dover the annual Memorial Service to the men of the patrol who fell at the attack of Zeebrugge fifteen years ago listeners will hear the tolling of the bell which the Germans used during the War to warn the inhabitants on the arrival of British aircraft. The Bell was presented by the King of the Belgians and usually hangs in the belfry of Dover Town Hall.

Another Trans-Atlantic Debate

REGIONAL listeners on April 8 will hear a debate between Oxford Union and Columbia College, New York. The subject being "That Democracy has Failed." On this occasion shortwave fans will be given the opportunity of tuning in this broadcast direct from the American transmitters taking the Columbia System programmes.

Barcelona New Call

THE Spanish station of which broadcasts are heard on 252 m. with the call *Barcelona-Catalunya* is not the better known Radio Barcelona but its competitor EAJ15.

INTERESTING and TOPICAL PARAGRAPHS.

The official call letters are frequently given during the evening's programme, namely (phonetic) *Eh-Ah-rhota-Keen-say*. It is owned and operated by the *Radio Associacio de Catalunya*.

Advertising the French Riviera

THE station of Nice Juan-les-Pins, on 250 m., in order to attract tourists and visitors to the French watering places on the Mediterranean coast, broadcasts both German and English publicity programmes at the end of the day's scheduled transmissions. An entertainment with German announcements may be heard every Thursday at midnight.

Where Neighbours Differ

CONTRARY to the policy adopted by the German broadcasting system, the Dutch government has given permission to all political parties to make use of the Hilversum and Huizen microphones to express their views almost nightly between March 27 and April 25, when the General Elections are to take place in Holland. It is stated that on these occasions full liberty of speech will be allowed and the addresses made by members of the political parties will not be subject to censorship.

Their Views On National Anthems

MOST European countries nowadays close down the day's broadcasts by playing their National Anthem ; if there is no orchestra at the time in the studio, a gramophone record is used. In Austria the authorities have decided that the Federal Anthem (The Hymn to the Emperor) shall only be played on Sundays and holidays, notwithstanding the request made by listeners that it should be broadcast nightly. Italian stations play not only the Royal Anthem (Marcia Reale) but also the Giovinezza or Fascist Hymn, daily ; they are never omitted. The Czech broadcasting authorities, on the other hand, have decreed that their hymn is only to be used on special occasions. They are of opinion that it should be treated as a solemn rite and therefore should not be played indiscriminately at the end of the ordinary radio programmes. Which of them is right ?

STARTING YOUNG.

A class in an L.C.C. school listening to a lesson in music by wireless given by Sir Walford Davies. "Practical Wireless" is the refresher course for the expert and the road to easy radio for the beginner.

SOLVE THIS!

Problem No. 28

Jackson built the battery version of the Fury Four, and installed it in a radio-gramophone cabinet. When perfectly satisfied with the radio reproduction, he purchased a pick-up and connected it as shown in the theoretical circuit of this receiver. The correct bias was applied, and a record played through. The result was perfectly satisfactory, and when he had played sufficient records he attempted to tune in the broadcast programme. Nothing could, however, be heard until the pick-up was disconnected. What was the reason for this, and what was the remedy ? Three books will be awarded for the first three correct solutions opened. Address your solution to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark your envelope Problem No. 28. No other correspondence should be included with this solution.

SOLUTION TO PROBLEM No. 27

Owing to the fact that the anode current from two valves in Q.P.-P. varies whilst the signals are being received, the H.T. also varied on Brown's mains unit, and this resulted in the distortion and poor signals.

The following three readers received books in connection with Problem No. 26 :—

R. P. Bishop, The Grammar School, Farnham ; F. G. Bird, Bury House, Town Green, Wymondham, Norfolk ; P. English, 35, Livingstone Road, W. Southbourne, Bournemouth.

Agreement Between Studio and Stage

THE Vienna Studio has concluded an agreement with the Burgtheater in that city by which the broadcasting authorities, in consideration of an annual subsidy destined to assist in defraying costs of dramatic performances, will be entitled to secure the free services of dramatic artists twice weekly for the production of radio plays at the studio. The arrangement is an outcome of complaints made by the theatres to the effect that the transmission of dramatic performances by wireless was affecting the box-office takings.

Loud-speaker *versus* Telephone Earpiece

FOLLOWING a series of tests, the German Posts and Telegraphs administration is proposing to replace telephone earpieces by specially-designed loud-speakers. At the outset these will be supplied to business concerns, public institutions, and other establishments where there is no great necessity for privacy in communications. One great advantage claimed for this innovation is the assistance it affords when messages need transcription, as with the new instrument both hands remain free. The apparatus reproduces at ordinary loud-speaker volume. Similar instruments have been used in the United States for some months.

(Continued on page 50.)

A DUAL WAVE ADAPTOR

By LESLIE W. ORTON

SHORT-WAVE listening is a thrilling pastime, but, thrilling though it undoubtedly is, it can be made more so by the use of a two-detector receiver, or adaptor. To demonstrate this I will outline but two advantages such an arrangement has over the normal adaptors and receivers of the present day.

Firstly, fading may be greatly reduced by receiving the same programme from two different stations, the strength of reception being kept comparatively constant, it being highly improbable that both stations will fade at the same time.

Upon perusing a short-wave list the reader may conclude that there are very few instances where the same programme is "put over" two stations at once. As a matter of fact, there are quite a number of instances where this is done. The Empire stations, VE9DR, Drummondville, W8XK, Pittsburg, and W2XAD and W2XAF at Schenectady give three, of many, such instances.

Another advantage of the two-detector adaptor is in the case of stations testing (when the technical operators speak to each other, as if over a telephone or in conversation in the same room), it being possible to receive both ends of the conversation and not merely one as in the normal arrangements. In the case of trans-Atlantic and other radio-telephone stations, this is not possible, as the British end is inaudible, or nearly so, owing to beam and skip effects. However, as few listeners wish to "eavesdrop," this is no disadvantage.

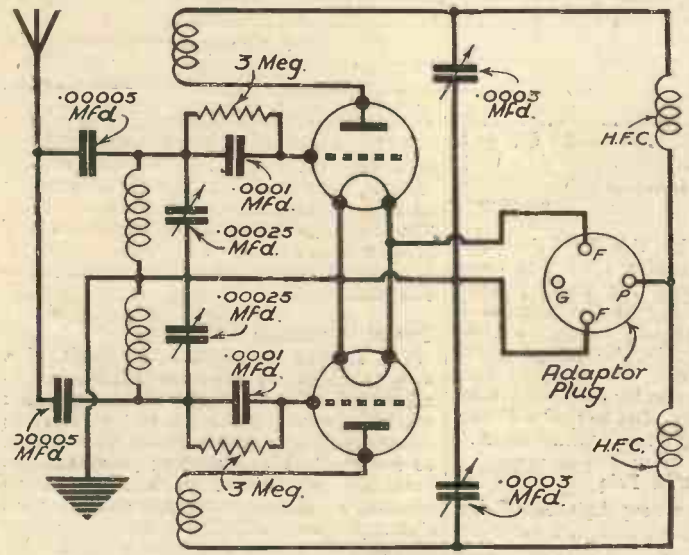


Fig. 2.—The theoretical circuit of the two-detector receiver.

Details of Construction

The construction of the adaptor is simplicity itself. Fig. 1 shows the pictorial layout of one of the two detector stages. Both should be wired similarly, but, although they should be mounted upon the same baseboard, they should not be "crammed" together. Fig. 2 shows the circuit of the adaptor. The reader should wire with this in front of him, and so as to avoid errors, pass a blue or other pencil through each connection as he makes it. In this way no wires will be overlooked and, consequently, the preliminary tests are likely to be satisfactory.

In the diagram the coil shown is a home-made coil, and although any short-wave coil (of reliable make) may be employed, the reader may save expense by constructing his own coils. To do this he should procure a ribbed former, of about three inches diameter, and (commencing with the aerial coil) should wind twelve turns (with No. 18 S.W.G. wire), taking care that they are firmly wound, with about a quarter of an inch between turns. The ends of the coil should be taken to terminals mounted upon the former (Fig. 3.) So as to avoid the necessity of changing coils or employing switches, a clip is so arranged that the coil may be shorted out turn by turn, thus covering a wide waveband.

The reaction coil should consist of about six turns of No. 20 S.W.G. wire. However, as the size of the coil will differ in accordance with the valve employed, etc., I suggest the reader winds on twelve turns and, when the receiver is in operation, take off a turn at a time until the most suitable size of coil is found.

When the adaptor is constructed it can be plugged into any straight receiver. To do this the detector valve of the existing receiver should be taken out and

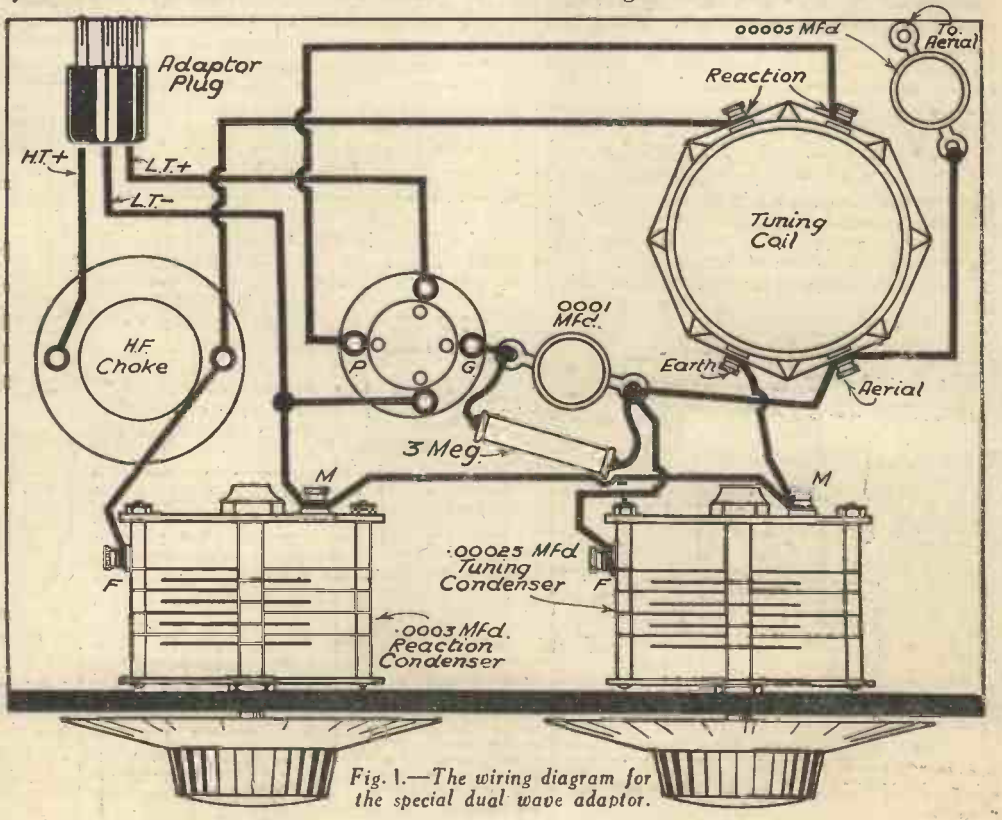


Fig. 1.—The wiring diagram for the special dual wave adaptor.

the plug inserted in the detector socket. Then the aerial and earth should be connected to the adaptor, and the valves inserted in the sockets, when, assuming you have everything correct, you will be ready for a tour around the stations with something entirely new in adaptors.

By the way, for the coil the ingenious Ewebec Coil Formers serve splendidly. They have eleven slots, so that you will have to pile two of the windings or, alternatively, you may use one of the British Ebonite Co.'s solid formers.

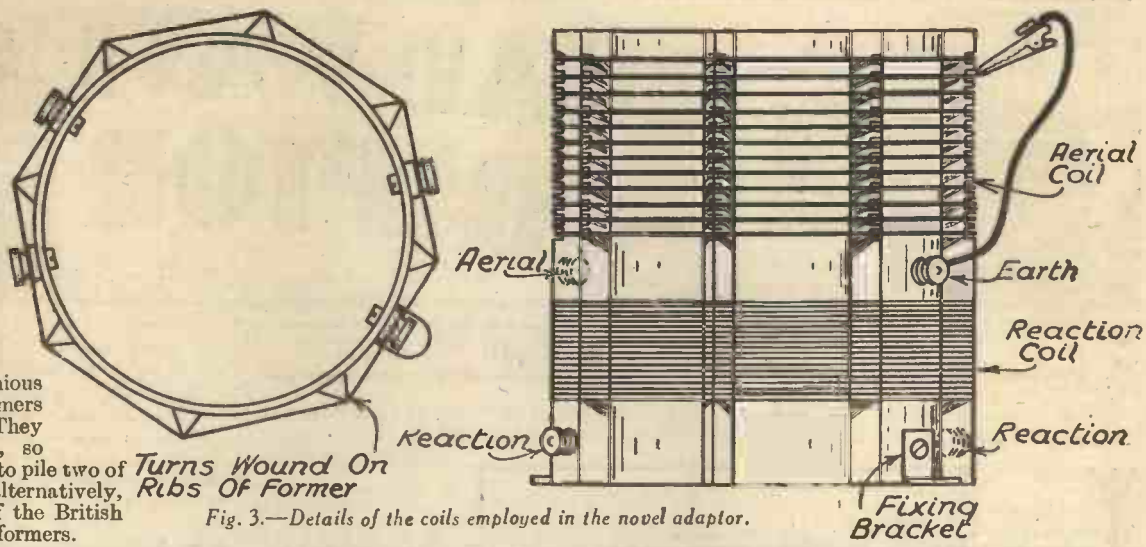


Fig. 3.—Details of the coils employed in the novel adaptor.

Radio Crisis in Jugoslavia

AUSTRIAN papers report that the Jugoslavian Government has cancelled the concessions granted to the Belgrade and Ljubljana broadcasting stations, and that these transmitters are shortly to be taken over by the State. The reason given is that developments of the system as provided by the agreement have not been carried out by the *concessionaires*.

German Ministry of Propaganda

UNDER the direction of Dr. Goebbels, an active member of the Hitler Government, German opinion through the Press, radio, theatre, and "movies" is to be moulded into a solid support of the present political administration. In future all official speeches, State ceremonials, or events of topical interest are to be broadcast by *all* German stations, but so far as possible efforts will be made not to interfere too much with the settled programmes. That the altered character of the German wireless entertainments does not suit all listeners

ROUND THE WORLD OF WIRELESS

(Continued from page 48.)

is already proved by the fact that the Berlin studio has been compelled to open a special department for dealing with complaints. The duty of the appointed officials is to answer all telephone calls and messages in respect of the programmes. During the past week the work in this department has so greatly increased that the staff is to be augmented to deal with the calls received during broadcasting hours.

Wireless and the South Pole

IN connection with a new Antarctic Polar Expedition which will be leaving England this summer, it is reported that special arrangements will be made to equip it with specially-designed short-wave transmitting and receiving apparatus in order that communication may be continuously maintained with the Mother Country. For the final stage of the journey a small portable set will be carried on one of the sledges, thus enabling the advance party to keep in constant touch with the base. The latter will possess a transmitter of greater power which will enable messages from the Polar seas to be flashed direct to England.

Twentieth Century Miracle

AT Nantes (France), as a result of a prosecution a man was condemned to a heavy fine for treating patients by quack methods involving the use of "mysterious electro-magnetic waves hitherto unknown to science." When passing judgment the presiding magistrate, in a reference to broadcast entertainments, stated that although the accused was not authorized to practise, it was a curious fact that the means adopted had actually benefited the invalids. It would be interesting to know the kind of programme recommended by the quack doctor.

PENNY-IN-THE-SLOT RADIO

WHERE a set is frequently in use it often happens that the H.T. battery runs down at a time when funds are rather low. The simple coin-operated switch shown in the accompanying illustrations helps to solve the problem by making it necessary to insert a penny in a slot each time the switch is used.

The device consists of a small tin box which can be fitted in any convenient position either inside or outside the cabinet. In one side of the box, near the top, a slot is cut to just allow a penny to pass through. A strip of thin springy brass is soldered on each side of the slot, inside the tin, to act as guides and to hold the coin in place. To the top of tin, inside, a plunger switch is fixed so that when a penny is inserted in the slot it presses between the switch blades and completes the L.T. circuit. The L.T. negative lead is broken and the ends attached to the terminal screws on the switch, as shown in Fig. 1. A coil spring is fitted below the switch knob, and a new end piece, consisting of a small square block of ebonite, is screwed to the end of the plunger. To switch off the set the plunger is pressed, as indicated in Fig. 2, until the coin drops, thus breaking the circuit.—A. STEVENS (Rosherville).

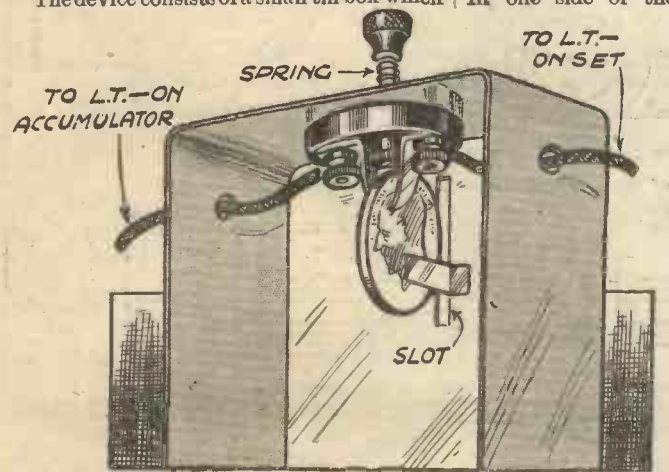


Fig. 1.—A simple coin-operated radio switch showing how a penny completes the circuit.

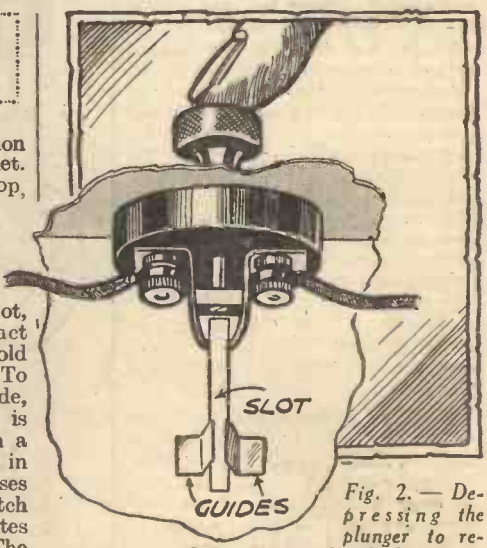


Fig. 2.—Depressing the plunger to release coin and break the circuit.

CLASS B AMPLIFICATION— AND ALL ABOUT IT

Continuing Our Policy of Being First in Dealing with the Latest Radio Developments, Some Further Notes on the Latest Development in Battery Receiver Design are Here Given.

By W. J. DELANEY.

IN PRACTICAL WIRELESS dated February 4th was given an explanation of Push-pull Amplification, together with the modifications known as Quiescent Push-pull and Class B Amplification. The valve manufacturers have been hard at work on this latter method, and preliminary details are now available concerning the practice of this method of supplying the loud-speaker with an output from a battery-operated receiver which is comparable to that normally obtained with a powerful mains-driven receiver. If you refer back to the article above mentioned, you will read how the action of two valves working on the push-pull principle was modified when Quiescent or Class B amplification was employed. With push-pull correctly applied, the two valves work exactly opposite in phase, that is to say, if the grid of one valve receives a certain negative half-cycle of a given signal, the anode current of that valve will fall by a certain amount. The other valve in the push-pull stage will, however, at the same moment receive a positive half-cycle, and the anode current of that valve will accordingly increase by the same amount as the other valve decreased. The effect of this, you will remember, is that the total anode current of the two valves in push-pull remains at a perfectly steady value, and this is roughly double that of each individual valve. A milliammeter in the common H.T. lead should show a perfectly steady needle with this form of amplification, and kicking of the needle will indicate distortion due to overloading or other reasons.

Push-push

In the quiescent (or push-push) method of using the push-pull stage, each valve receives a biasing voltage which reduces the normal anode current to a very low value, and therefore the negative half-cycles of the signal voltage do not have a very marked effect on the anode current. On the other hand, the positive half-cycles cause large increases in anode current, and therefore when the signal is being received the anode current of one valve rises, but the decrease in the partner valve does not balance out and therefore a meter in the common H.T. lead will show the effect of the received signal in the form of a varying upward swing. As an instance, the Q.P.-P. Three-Four which was recently described in these pages gave a steady reading on a meter in the anode circuit of just over 2 mA. when no signal was received, and on very loud passages of music this rose to very nearly 10m A. The aim of push-push (as quiescent push-pull is commonly called) is, therefore, to obtain the lowest reading possible in the output stage without actually introducing distortion, and this results in a saving of H.T. current and an increased output signal strength. However, the following facts must be borne in mind :—

1. Two valves are required.
2. To preserve a balance, the biasing battery must be discharged at the same rate as the H.T. battery.
3. Two pentode valves are needed to give the best from this form of amplification.

There are other considerations, but these three points are the most important.

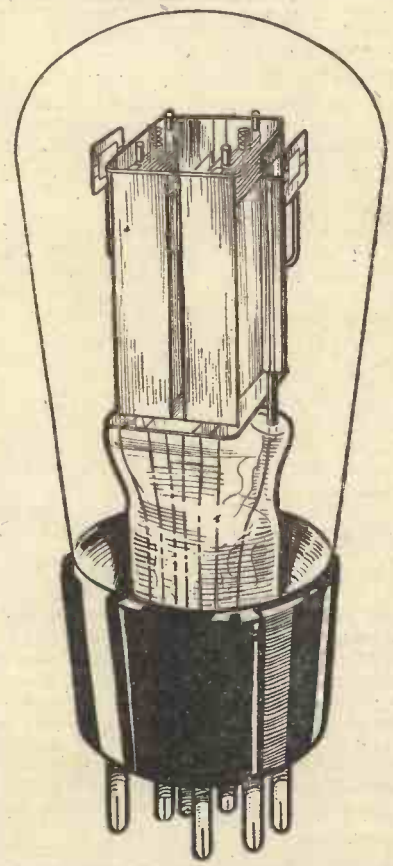


Fig. 3.—The new Cossor 240 B valve with 7-pin base for Class B amplification.

Class B

The method of amplification which is now known as Class B amplification, employs the same fundamental principle as quiescent push-pull, but owing to certain factors it does away with *all* the drawbacks. Before I can fully explain the method it would, perhaps, be as well to just go over once again the method in which an amplifying valve works. Fig. 1 shows the normal anode-current grid-volts curve of an amplifying valve, and the correct biasing point is just under 6 volts. As the signal voltage varies between 3.5 volts and 7.5 volts, the anode current varies from just under 1.5 mA. to just under 4.5 mA. In other words, a decrease of 1 volt in grid volts results in an increase of nearly 2 mA. in anode current, whilst the increase of 1 volt on the grid decreases the anode current nearly 2 mA. This is the essential of true amplification, and if the signal applied to the grid is so large that the changes in anode current are not equal on both positive and negative half-cycles, then distortion is taking place. In Fig. 2 the signal, shown as a wavy line at the bottom of the graph, runs, on the right, beyond the zero line, and the result of this is to cause what is known as "grid current" to flow. As you probably know, the glowing filament gives off a stream of electrons, and these pass across from the filament to the anode, across the grid. When the signal consists of negative impulses the electron flow from the filament is repelled, but when a positive variation is applied to the grid the electron flow is not only augmented, but the following thing happens. With a weak positive impulse the effect will be simply that the normal filament emission will pass across to the plate. If the positive impulse is

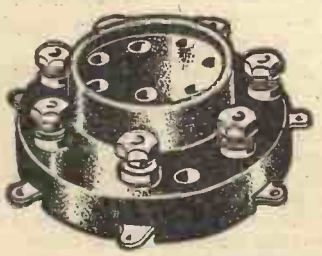
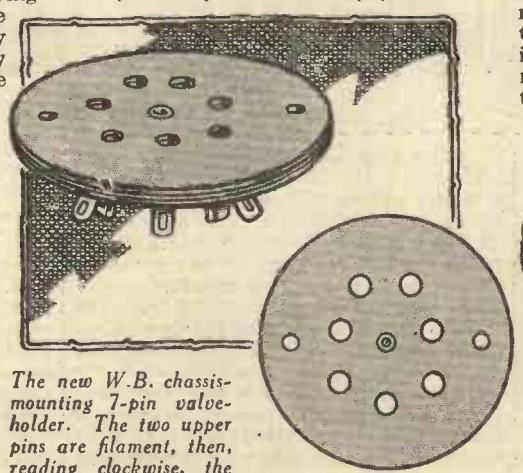


Fig. 4.—The W.B. baseboard mounting 7-pin valve-holder.



The new W.B. chassis-mounting 7-pin valve-holder. The two upper pins are filament, then, reading clockwise, the others are the anode, grid, grid, anode, and a blank.

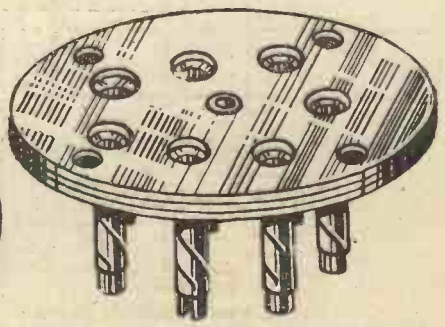
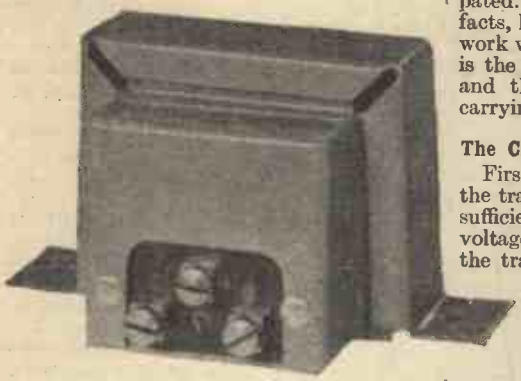


Fig. 5.—The Clix chassis-mounting 7-pin valve-holder.

above a certain value, however, the flow will be so great that many electrons will accumulate on the grid. When this state of affairs comes about the accumulation on the grid must be disposed of in some way, and in a valve arranged as a grid leak detector this accumulation leaks away to earth through the grid leak. In an L.F. valve arranged in the output stage, however, this current (which is known as "grid current," and is extremely small) must not on any account be permitted, owing to the distortion which it introduces. This grid current commences to flow when the valve becomes very slightly positive,



The Benjamin driver transformer.

and as the grid gets more positive the current increases at a much greater rate than the change in "positiveness" of the grid. The effect, therefore, is that the tops of the positive peaks are cut off, as shown in Fig. 2.

It is usual to include a transformer secondary winding between the grid of the output valve and earth, and the passage of even a small current through this winding results in a voltage difference across the ends of the winding. The ordinary L.F. transformer has a step-up ratio, which means that the primary winding (which is included in the anode circuit of the preceding valve) is smaller than the secondary winding, and this step-up ratio is usually about 4 to 1. The primary winding has to be sufficiently large to offer the requisite impedance to the valve with which it is used, and consequently the secondary winding will be of such a size that the resistance will probably be round about 10,000 ohms. From Ohms Law we know that a current flowing through such a winding will produce a voltage drop, which means that there will be a certain dissipation of energy which is not turned to any account. (A resistance, in ohms, multiplied by a current in amps., gives voltage drop. Voltage dropped multiplied by current passed, in amps., gives wattage dissipated.) Now, in view of the above facts, how can a valve be employed to work with grid current flowing? That is the feature of Class B amplification and the following is the method of carrying it out.

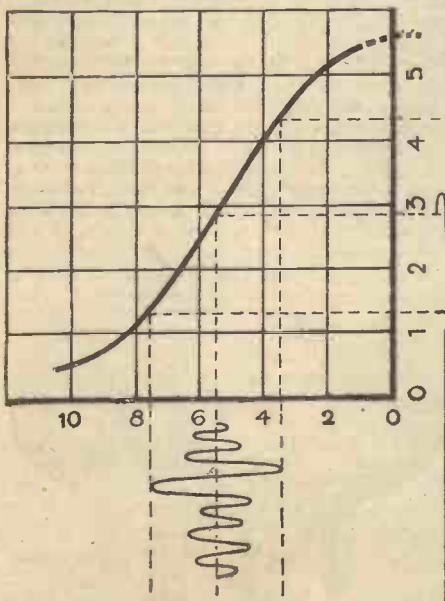


Fig. 1—The curve of a valve biased to give even amplification. The lower line gives grid volts, and the right-hand line gives anode current.

The Class B L.F. Stage

First of all, the secondary winding of the transformer must be wound with a sufficiently low resistance to avoid the voltage drop across it, or in other words, the transformer must supply sufficient energy to overcome the useless dissipation. This means that a step-up transformer cannot be used. Instead, the transformer must be designed to operate in the reverse direction, and therefore must have a step-down ratio—actually a ratio of 2 to 1 is found suitable. In addition, the secondary winding must have a resistance not exceeding about 500 ohms. This secondary winding must be centre-tapped as in normal push-pull work, but the energy supplied to the secondary must be of a high order, and therefore this transformer must be a substantial component, wound with thick wire, and the valve feeding this transformer must be of the small power type. The anode currents of the two Class B valves must be combined in the usual push-pull manner, and therefore a centre-tapped output transformer is also required. By the way, the input transformer for this method of amplification is called the "driver" transformer, and the valve feeding is known as the "driver." No grid bias is, of course, required, and we therefore can effect a saving of this component. Class B goes further than this, however, and the valve makers have found that the two valves may be combined in one glass envelope, and this greatly simplifies manufacture and naturally results in a saving to the purchaser. The actual valve is illustrated in Fig. 3, and it will be seen to consist of two complete sets of valve elements arranged side by side, and to enable connection to be made to these, a new type of valve-base has had to be designed. This employs seven pins, and these are arranged as shown in Fig. 4, which illustrates the new W/B 7-pin valveholders. In Fig. 5 is illustrated the new Clix socket, which has been produced for this particular type of valve, and this incorporates the new Clix patented floating principle. The sockets float between two panels of insulating material, and are keyed into a third centre plate. From the sample which we have examined we notice that the three plates are clamped together in such a manner that the sockets are able to move to such an extent that they are able to receive accurately the valve-base which is plugged into the holder.

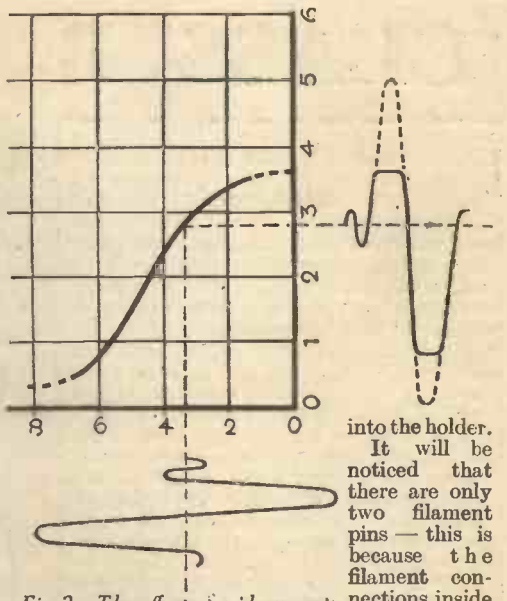
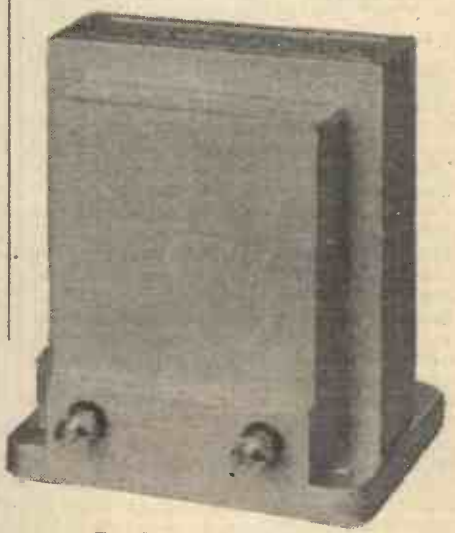


Fig. 2—The effect of grid current shown in diagrammatic form.

It will be noticed that there are only two filament pins — this is because the filament connections inside the valve are common to both filaments. With a steady anode current of about 10 mA., an undistorted output of about 2,000 milli-watts should be obtained. The points to remember are that the driver valve must be of the small power type so as to deliver sufficient energy to the transformer; and the output transformer feeding the loud-speaker should be designed to offer the correct load for the double Class B valve. The advantages of Class B over Quiescent Push-pull are, firstly, saving in cost, as only one valve is required in place of the two Pentodes used for Q.P.-P.



The Lotus driver transformer.

Secondly, no grid bias battery is needed. Thirdly, no matching has to be done. And, lastly, the output is increased.

The Lotus and the Benjamin

Above is shown two of the new Driver transformers. The Lotus transformer has a primary inductance of 30 henries, and the secondary resistance is only 100 ohms for each half (200 ohms in all). This has been specially designed to work with the Cossor valve, using a Cossor 215 P. valve as the driver. The price of this transformer is 11s. 6d. The Benjamin component costs 10s. 6d., and the secondary has a resistance of approximately 150 ohms per section.

THE ABC OF SELECTIVITY—2

In this Article the Author gives more Useful Information about the Design and Construction of Selective Tuners. Also Details of a Home-made Band-pass Filter

By W. B. RICHARDSON

I STATED in the last article that, from the point of view of selectivity, the single tuned circuit had its limitations, and that when these were reached the only recourse was to employ more tuned circuits. In fact, other things being equal, the selectivity of a receiver is roughly proportional to the number of tuned circuits it contains.

Now comes the question of how these circuits are to be arranged—what type of coupling to use, how tight it shall be and so on. Last week I opened up the subject by giving an example of how an extra tuned circuit might be added to a three-valver of the det. and 2 L.F. type, and mentioned that the coupling should be loose. The reason for this can best be seen by reference to Fig. 1. Here are reproduced a number of response curves obtained from an actual tuner in which the coupling between the two coils was varied from tight to very loose.

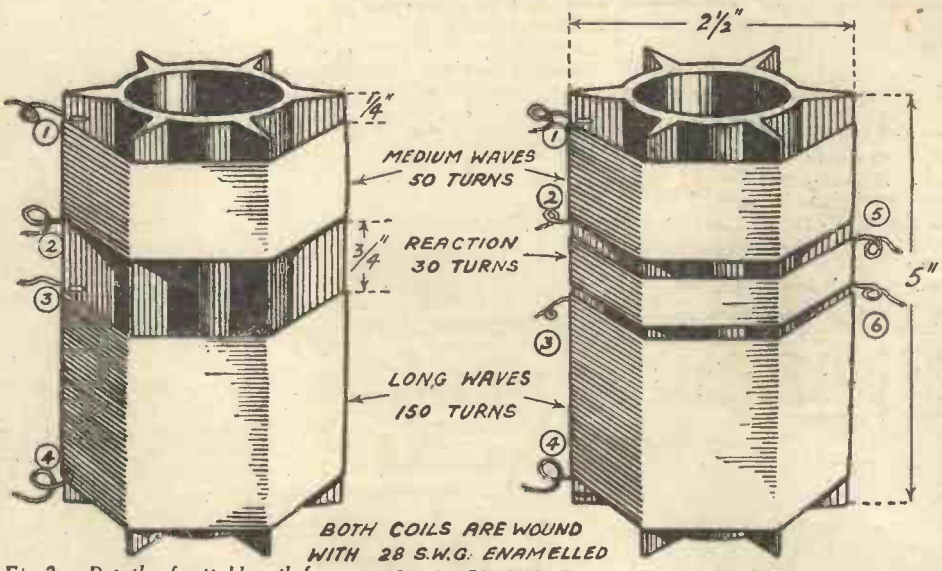


Fig. 3.—Details of suitable coils for a home-made band-pass tuner.

Effects of Varying the Coupling

The outstanding thing which this graph reveals is that an increase in coupling beyond a certain point does not give an increase in signal strength. It does not increase the *height* of the curve, but merely alters its *shape*. From a pointed peak it first becomes a squarish one, then it develops a dip in the middle and finally it resolves itself into two distinct humps which get wider apart as the coupling nears its maximum.

Now what does this mean in practice? Well, it simply means that if you place the two coils close together or closely couple them in some other way, you will be able to receive any station at two different settings of the tuning condensers. Naturally, from the broadcast listener's point of view, this is highly undesirable. However, as the coils are moved farther apart so the two different settings will gradually draw nearer until they merge into one. The signal strength will remain the same. Moving the coils still farther apart will give very sharp tuning, and beyond this the signal strength will begin to fall off.

The degree of coupling for maximum selectivity combined with sensitivity is that which gives a curve like (*e*) (Fig. 1.) Quite often tuners are designed to give such a curve, and under favourable conditions, especially if a modicum of reaction is used, they will give the proverbial "knife-edge" selectivity.

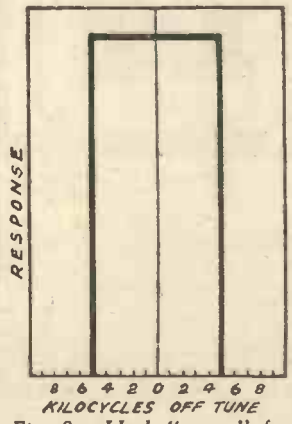


Fig. 2.—Ideal "curve" for a band-pass tuner.

Selectivity *versus* Quality

Unfortunately, very sharp tuning introduces another problem—that of quality. It is common knowledge nowadays that an ultra-selective tuning circuit will give less response to high notes than to low. This is explained by what is known as the side-band theory. According to this the result of modulating continuous waves is equivalent to the transmission of a band of waves. That is to say, that instead of the transmission being confined to one particular frequency it occupies about ten adjacent frequencies. In order to receive all of these our receiver must not be too selective, otherwise some of the side-bands will be lost. The absence of the sidebands results in the characteristic attenuation of the high notes just mentioned.

There are two methods of overcoming this difficulty. One is to retain the super-selective circuit and to compensate for the loss in the higher part of the musical scale by amplifying the high notes more than the low, and the other is to use tuned circuits giving a square peaked resonance curve.

With the former method the compensation is carried out in the low-frequency stages by means of a tone control. Sometimes this is arranged to give a fixed degree of compensation such as is provided by the Varley intervalve transformer D.P. 35, or, better still, a variable control is fitted. If much use is made of reaction then a variable control is very desirable. You will readily appreciate that since the degree of selectivity varies according to the amount of reaction employed, so the degree of compensation should also be variable. Then whatever the reaction setting happens to be, whether at zero when receiving the local station or at maximum when tuned to a distant foreigner, a movement of the tone control will enable the best overall response to be obtained. Of course, the second method of obtaining quality with selectivity is dependent on the use of the well-known band-pass type of tuner.

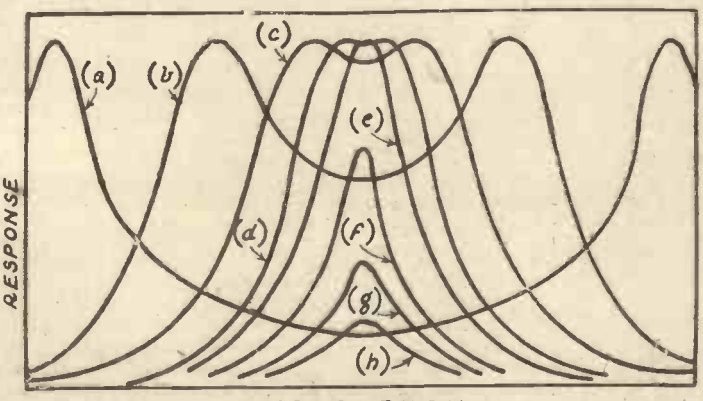


Fig. 1.—Resonance curves of a coupled circuit with various degrees of coupling.

Why Band-Pass Filters are Used

Let me say right away that there is nothing mysterious about a band-pass filter. It is not even a new idea, for

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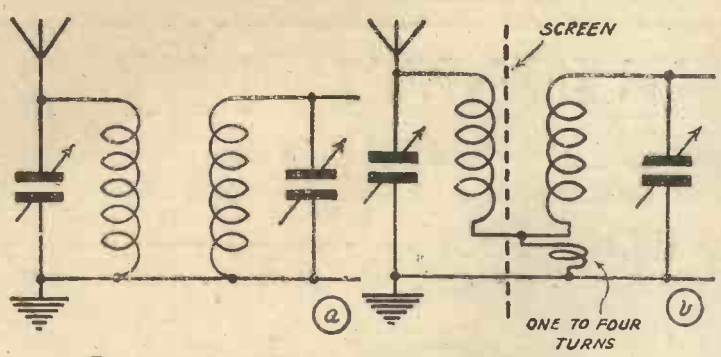

Fig. 4.—Two methods of inductively coupling two circuits.

(*Continued from page 53.*)

band-pass and band-stop filters, etc., have been known for years. A band-pass filter as used for broadcast reception is simply two tuned circuits with the coupling between them so arranged as to give a square top to the resonance curve like curve (*d*) in Fig. 1. The object is to secure a response over a small band of frequencies just sufficiently wide to include the sidebands of the transmitted wave, but no wider. The curve in Fig. 2 shows the ideal to be aimed at. It gives a maximum response for ten consecutive kilocycles and no response outside this band. With such an arrangement stations more than five kilocycles on either side of the one to which the receiver is tuned would give absolutely no response and therefore cause no interference. Naturally, such a curve is unattainable in practice, but one very nearly approaching it, such as that of (*d*) (Fig. 1) is quite easily secured.

Methods of Coupling

Now for the practical details. Obviously, two tuning coils are required. These should be as near identical as possible. Absolute matching, however, is not essential if separate tuning condensers are used, and in this connection the home constructor will be pleased to learn that it is quite easy to make a good band-pass tuner with home-made coils. Particulars of a pair of suitable coils for such are given in Fig. 3. I shall refer to these again later.

The next question is what kind of coupling to use. There are a variety of ways of arranging this. Firstly, there is the inductive method, two different versions of which are shown in Fig. 4. With circuit (*a*) the two coils are placed a certain distance apart so that their fields

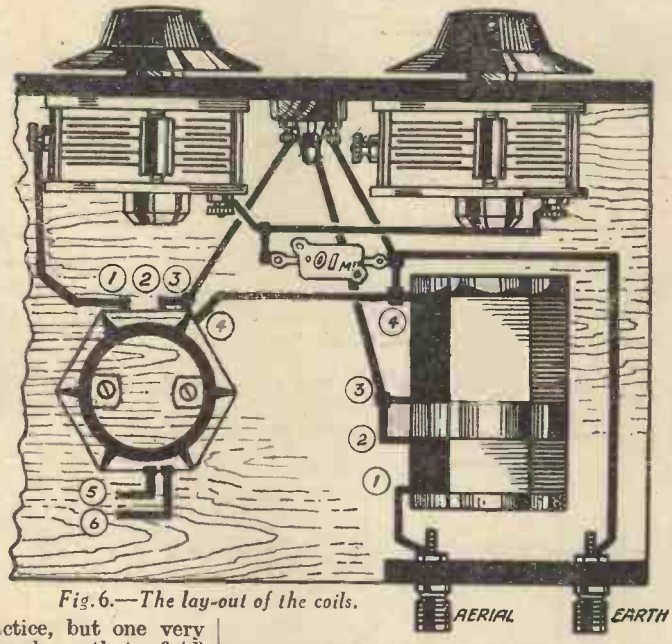

Fig. 6.—The lay-out of the coils.

interact, the degree of coupling depending on how far this distance is and the angle they are placed in respect to one another. With circuit (*b*) the two coils are either placed at right angles some distance apart or else completely screened one from the other, the object of both methods being to entirely eliminate all interaction. A pre-determined amount of coupling is then introduced by winding a few extra turns (one to four is usually sufficient) round the end of one of the formers. One end of this small inductance is joined to the bottom ends of the two coils and the other goes to earth. It will be seen that these few turns are common to both coils, and this is how the necessary coupling is obtained. Varying the number of turns varies the coupling. With one or two turns the tuning is very selective and of the sharp peaked variety, but as the turns are increased it begins to assume the true band-pass character with a squarish peak.

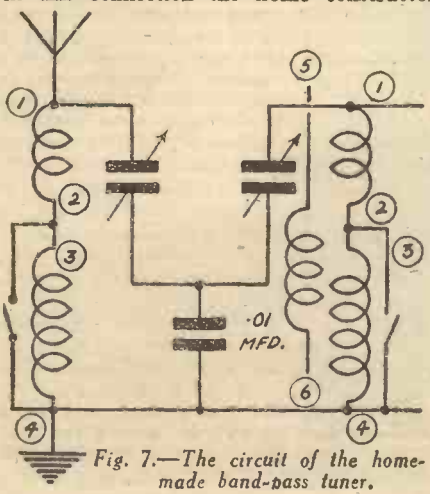

Fig. 7.—The circuit of the home-made band-pass tuner.

Coupling With a Condenser

The second method of coupling is the capacitative, that is to say, a condenser is used. Here, again, there are a number of different circuits to choose from. Fig. 5 shows three of them, (*a*) and (*b*) being the most common. Here the coils are arranged so that there is no magnetic coupling between them, but there is, however, a condenser in series with the two tuning condensers and, therefore, common to the two circuits. This provides the necessary transference of energy from one circuit to the other. The value of .01 mfd. shown is about right for a "square" peak. A larger value will reduce the coupling and so make the tuning peak sharper, while a smaller value will increase the coupling.

Circuit (*a*) is the simpler arrangement, but suffers from the drawback that the rotors of the tuning condensers are not at earth potential. This does not matter in a simple pre-detector filter in which two separate tuning condensers are used, but where there are other tuned circuits to follow, all of them to be ganged, it cannot very well be used. Circuit (*b*) is then adopted. This overcomes the difficulty by interchanging the positions of the condensers and coils so that the condenser spindles are now earthed. With this arrangement, however, a resistance R has to be included, otherwise there is no means of biasing the grid of the following valve.

The Mysterious Resistance

The presence of this resistance is a puzzle to a large number of people. They think it has some mysterious function with the band-passing connected with the circuit. This is properties of quite wrong. It is true it may upset the circuit if it is of unsuitable value, but it is not part of the filter arrangement in the same sense that the coupling condenser is. What it is there for is to provide a return path for the grid. Without it the grid would be left "in the air," as there would be no connection to earth except *via* a condenser. In fact, it serves much the same purpose as the grid-leak used in resistance-capacity coupling or in detection.

The value of R is not really critical. The only essential condition is that it should not be so low as to virtually short-circuit the coupling condenser. Any resistance from 1,000 ohms to 2 megohms will do, but as higher values

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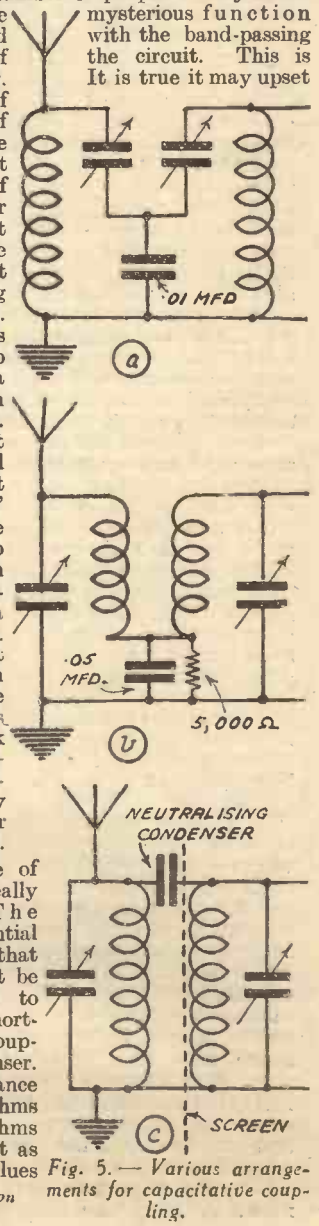

Fig. 5.—Various arrangements for capacitative coupling.

CIRCUIT DIAGRAMS SIMPLIFIED *for the* BEGINNER

This Short Article Explains How Circuit Diagrams *Can Easily be Understood.*

By FRANK PRESTON, F.R.A.

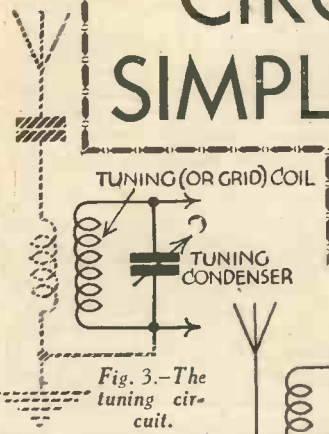

Fig. 3.—The tuning circuit.

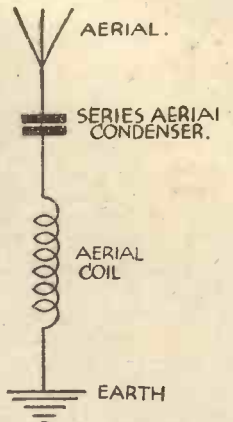

Fig. 2.—The aerial-earth circuit.

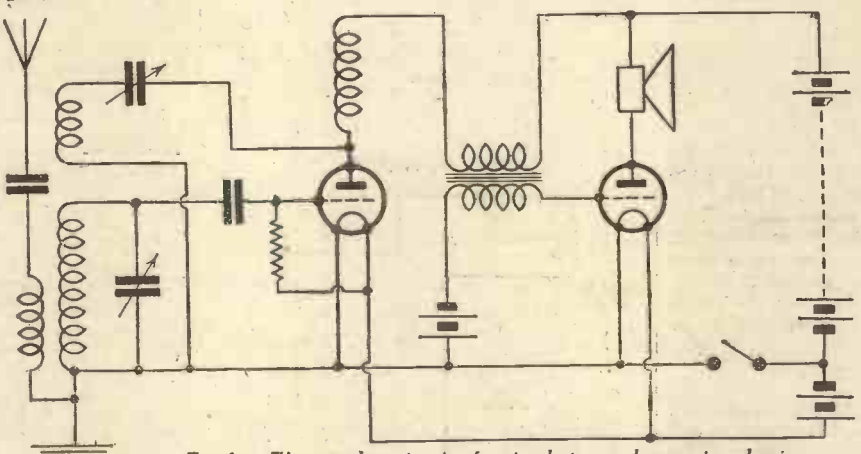

Fig. 1.—The complete circuit of a simple two-valve receiver having detector and low-frequency valves.

THE word "circuit" is frequently employed in wireless work and, being used in so many forms, is very often misunderstood by the beginner. We generally refer to a collection of signs and symbols such as that shown in Fig. 1 as a circuit diagram—in this particular instance the diagram represents a two-valve receiver—but it really consists of several subsidiary circuits all inter-connected to form the whole. In electrical and radio practice the general simple definition of a circuit is "the path of an electrical current," and if we were to analyze the diagram of Fig. 1 we should find at least half a dozen paths through which electrical currents travel. It is by studying all these separate circuits that the more experienced radio man can form accurate conclusions in regard to the capabilities of the set represented. To the beginner, however, the diagram conveys absolutely nothing and he probably looks upon it as being "Greek," "double-Dutch," or something worse. But once an idea of the general "make-up" of a circuit diagram has been grasped, the whole thing takes on a different light and becomes not only instructive but extremely interesting. That we might quickly learn to appreciate the value of the many diagrams which we meet let us pull to pieces the complete circuit of Fig. 1 so as to isolate the various complementary ones.

The Aerial-earth Circuit

First of all we have the aerial-earth circuit shown in Fig. 2, which in this case consists of the aerial, a small fixed condenser, a coil of wire and the earth lead. Oscillating currents forming the signals being received pass backward and forward thousands, or even millions, of times a second through this circuit and cause a "magnetic field" to be built up around the coil. It might at first appear that the condenser would prevent the passage of current—and so it would if the current were constantly flowing in one direction, as does that from a battery, but in this case it is of such a nature that it is able to "jump" across the plates of a condenser just as easily as it flows through a length of wire. Without stopping to consider the theory surrounding the functioning of the aerial circuit we will pass straight on to the second, or tuning, circuit.

Tuning Circuit

This is shown in heavy lines in Fig. 3, and is seen to consist of a coil and variable condenser. The coil is situated near to that in the aerial circuit and therefore comes within its magnetic field. In consequence the oscillating currents passing through the aerial coil are "induced" into the second one. For our present purposes we can consider that the induced currents are precisely the same as those flowing through the aerial circuit, and the same as we should get if the aerial and earth leads were joined to the tuning coil itself. It is the purpose of the tuning circuit to select the oscillating currents forming the signal we require to receive and to reject all others. This it is able to do if the variable condenser is suitably adjusted by altering the amount of overlap between the fixed and moving vanes.

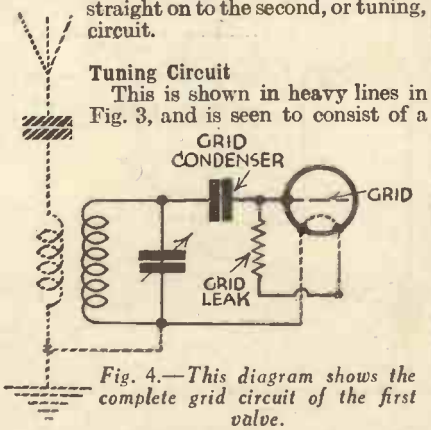

Fig. 4.—This diagram shows the complete grid circuit of the first valve.

The tuning circuit forms a part of the complete grid circuit which embraces all those components and wires between the filament and grid of the first (detector) valve, and shown in dark lines in Fig. 4. The additional parts included in this circuit are the grid condenser, grid leak and the grid of the valve itself.

Filament Circuit

The next "path of an electrical current" is that known as the filament circuit and comprising the filaments of both valves, a battery switch and the low tension battery or accumulator; it has been added to the parts of the set previously considered, in Fig. 5. This filament circuit is somewhat easier to understand than the others since it carries direct current only. When the switch contacts are closed current flows from the negative accumulator terminal through both valve filaments (which are connected in parallel, by the way) and back to the positive terminal. The action of the current is to heat the thin wire filaments and so make them able to give off a stream of electrons, as we shall see later, when the high tension circuit is completed.

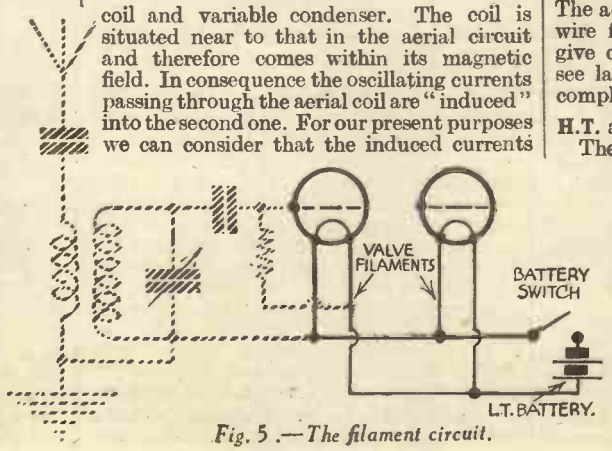

Fig. 5.—The filament circuit.

H.T. and Anode Circuits

There are really two high tension circuits—one to each valve—and that of the detector valve is shown in Fig. 6. This includes the high tension battery, valve, high frequency choke and transformer primary winding. Current passes round the circuit from the high tension negative terminal to the valve filament; from there to the plate, or anode, of the valve (in the form of an electron stream), passing through the grid; from the anode back to high tension

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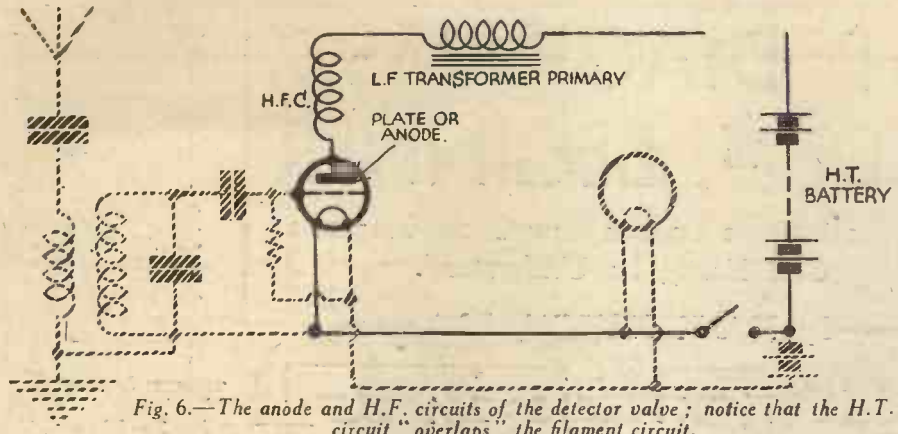


Fig. 6.—The anode and H.F. circuits of the detector valve; notice that the H.T. circuit "overlaps" the filament circuit.

(Continued from page 55.)

positive through the H.F. choke and L.F. transformer. It will be noticed that the high tension and filament circuits overlap to a certain extent, since one pole of both H.T. and L.T. batteries are connected together and to one side of the valve filament. The complete high tension circuit is often still further divided and we speak of the components and wiring between the anode of the valve and high tension positive as the anode circuit.

The Reaction Circuit

Next we can consider the reaction circuit, shown in Figure 7, which includes a coil of wire and a variable condenser. It is the object of applying reaction to feed back from the anode to the grid circuit some of the high frequency currents which have been amplified by the valve. By so doing the currents are again amplified and the final signal strength is thus made greater. The reaction coil is situated close to that in the grid circuit and so the magnetic fields of both "overlap." As a result high frequency current flows from one to the other just as it passes from the aerial to the grid coil. The amount of current which may pass back from the anode to the grid circuit is governed by the capacity of the reaction condenser and, therefore, by varying this the degree of feed-back (or reaction) can be controlled by the operator.

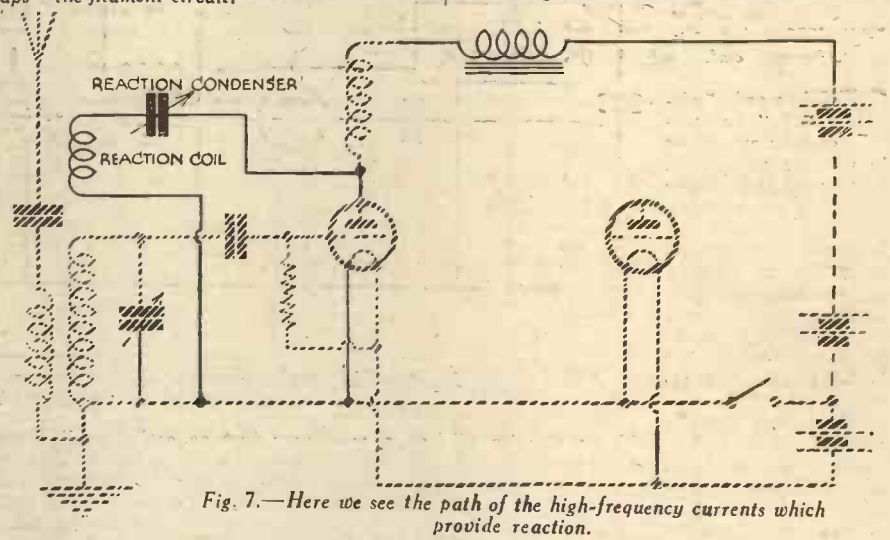


Fig. 7.—Here we see the path of the high-frequency currents which provide reaction.

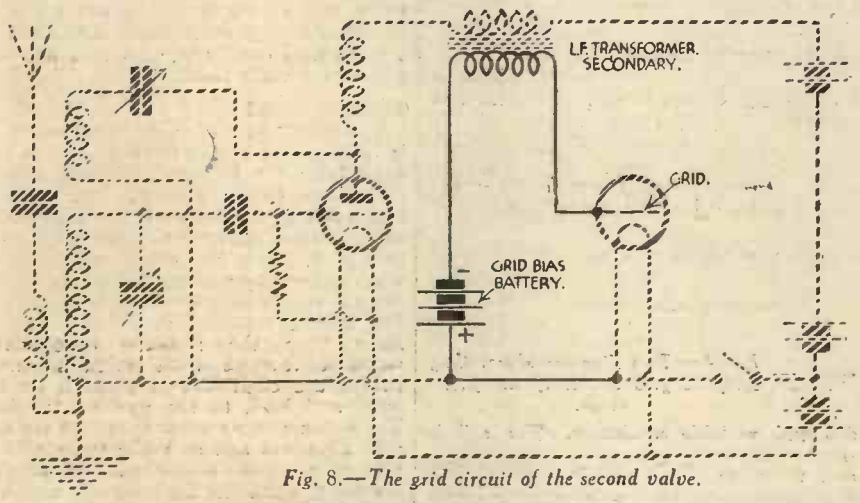


Fig. 8.—The grid circuit of the second valve.

The L.-F. Grid Circuit

We have now examined all the various circuits of the detector valve and may pass on to the grid circuit of the low frequency amplifier. This is shown in the diagram of Fig. 8, and is seen to contain the secondary winding of the L.F. transformer, a grid bias battery and the grid of the second valve. Alternating signal currents passing through the primary winding of the transformer are "induced" into the secondary. Since the secondary contains a greater number of turns than the primary the voltages between its ends are greater than those across the primary, and the transformer is said to amplify, or step-up, the signals.

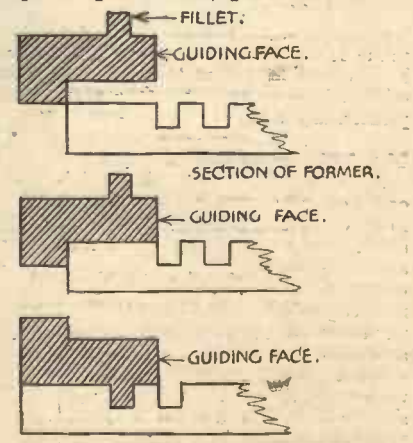
Output Circuit

The last circuit in the series, generally referred to as the output circuit, contains the anode of the second valve, the loud-speaker windings and the wires connecting these together and to the high tension supply. It is here that the low frequency oscillating currents are made to actuate the loud-speaker and so to produce sound vibrations of similar frequency to themselves.

In this short article we have dealt with our subject very briefly, but it is hoped that sufficient has been said to enable the beginner to view the many circuit diagrams he may encounter in rather a new light. We also hope that he may acquire the habit of "disentangling" diagrams which at first appear complicated, and studying each portion separately, for it is only by doing this that their value can fully be appreciated. Remember that any circuit, no matter how complicated or advanced, can always be sub-divided into the portions we have mentioned.

SIMPLE SLOTTING GAUGE

HERE is a dodge which is very useful when slotting ribbed formers. The gauge or template is chipped and filed (to suit the slots and spacing decided on) out of a piece of $\frac{1}{16}$in. brass or sheet iron. Place it against the end of the former, and saw or file the first slot, treat each rib in the former the same way. Then turn the template upside down, place the fillet in the slot cut, and you have a second guiding face which will keep the pitch of the slots constant. Another idea is to use two or three hacksaw blades in the frame at once.



—W. ROWLANDS (Dalton-in-Furness).

OPERATING & ADJUSTING the ALPHA Q.P.-P. THREE

How to Obtain the Very Best from the Receiver Which Was Described in These Pages Last Week.

IF you carefully examined the theoretical circuit of the Alpha receiver which was published on page 15 of last week's issue, and compared this with the circuits which we have already published dealing with Quiescent Push-Pull, a certain point probably made itself apparent. We refer to the fact that no separate tappings are provided for the priming grids of the two Output Pentode valves. There is, however, a reason for this. In the previous articles on this form of L.F. amplification you will have read how the grid bias is applied to the valves, and then the voltage applied to the priming grids is adjusted so that the minimum of anode current is passed. After this, the valves are said to be matched, and all that has to be done is to reduce the grid bias, or instal some form of resistance across the biasing battery so that the discharge of this battery is at approximately the same rate as the H.T. battery. This preserves the balance of the Pentode valves and provides the most economical method of maintaining the set. However, many readers do not like the idea of having to make these preliminary adjustments, added to which is the difficulty, with many readers, of obtaining the necessary meter for ascertaining the current passed by the valves. This trouble has, however, been removed in the Alpha, by the simple expedient of connecting the priming grids direct to the H.T.2 tapping. In this way the H.T. applied to the anodes of the Pentode valves is the same as that which is applied to the priming grids, and although this results in a slightly greater current consumption, there is no adjustment of any sort to be carried out.

Setting Up the Receiver

In view of this point, therefore, the installation of the receiver is no more difficult than that which accompanies an ordinary two or three valve receiver. Into the clip at the rear edge of the baseboard, insert the 16-volt grid bias battery. The positive end of the battery should be on the right, that is to say, nearest the tuning condenser. The grid bias plug, which is joined to the metal casing of the variable condenser, and which is marked G.B.+, should be inserted in the end of the battery. The plug marked G.B.P.U. should be inserted in the 3-volt tapping, and the remaining plug should be inserted in the end of the battery nearest the L.S. terminals. That is, the 16-volt negative tapping. The 120-volt H.T. battery and the L.T. accumulator should be stood on the upper shelf, and the leads from the loudspeaker taken down to the L.S. terminals on the rear of the lower baseboard. There are only three plugs to be inserted in the H.T. battery, one being inserted in the socket marked H.T.—, the plug marked H.T.2 being inserted in the opposite end of the battery at the socket marked 120. The plug which bears the mark H.T.1 should be inserted in the socket marked 60 volts for the time being, and this may be adjusted at a later point in the installation. The two spade terminals are next joined to the correct accumulator terminals, aerial and earth leads are connected up, and the receiver is ready for its preliminary test.

Testing Out

Pull out the on-off switch, keeping the reaction condenser with the vanes open, and turn the knob on the tuning coil so that the central band of wavelengths is covered. Carefully rotate the tuning condenser. No whistles or shrieks of any sort should be heard, as this is turned from its minimum to its maximum position. If a whistle or shriek or any similar sound is heard, there is some fault with the receiver, and it should be switched off and the wiring carefully checked over. The small condenser mounted against the aerial and earth terminals should, of course, for the time being be adjusted so that the moving vanes are completely in mesh with the fixed vanes. If the tuning condenser may be rotated over its full scale with no objectionable noises, you may proceed to the next part of the operation in the knowledge that there is nothing serious wrong with the wiring. Advance the reaction condenser until a rustling is heard from the loudspeaker. With the other hand carefully turn the tuning condenser. When a loud chirp is heard, reduce the reaction and carefully tune backwards and forwards over a distance of about two degrees in the spot where the chirp was heard. Reduce the reaction until speech or music is heard at this point, and if it is a local station it should be quite loud. If possible, get a weak station, and try to obtain it about the centre of the tuning dial. Now rotate the small knob and see if the strength of the station can be increased. If you find that this knob has to be turned to its maximum position in one direction or the other, without being able to bring the signal up to its maximum, rotate the star wheel which is situated on the right-hand side of the condenser near the baseboard. When the best position has been found, the receiver is correctly adjusted and is in its most sensitive position.

LIST OF COMPONENTS FOR THE "ALPHA" Q.P.-P. THREE

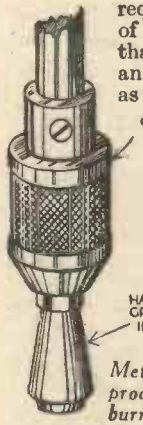
1 2-gang .0005 mfd. Variable Condenser with escutcheon. (Polar.)
2 .0003 mfd. Precision Condensers. (Lissen.)
1 .01 mfd. Fixed Condenser. (T.C.C. Type S.)
1 1 mfd. Condenser. (T.C.C. Type 50.)
1 2 mfd. Condenser. (T.C.C. Type 50.)
1 .02 mfd. Condenser. (T.C.C. Type M.)
1 1,000 ohms 1 watt resistance. (Erie.)
1 20,000 ohms 1 watt resistance. (Erie.)
1 80,000 ohms 1 watt resistance. (Erie.)
1 50,000 ohms 1 watt resistance. (Erie.)
1 100,000 ohms 1 watt resistance. (Erie.)
1 Q.P.-P. Transformer. (R.I.)
1 Q.P.-P. Output choke. (R.I.)
2 5-pin valve holders. (Clix.)
1 4-pin valve holder. (Clix.)
1 Coil Unit. (Hambling.)
1 On-off Switch. (Busco.)
6. Terminals, marked E, A, L.S., L.S., Pick-up, Pick-up. (Belling Lee.)
6 Wander Plugs, marked G.B.+, G.B.1, G.B.2, H.T., H.T.+1, H.T.+2. (Clix.)
1 7-way Battery Cord. (Bulgin.)
2 L.T. Spade Terminals. (Clix.)
1 Grid Bias Clip. (Bulgin.)
2 Belling-Lee Terminal Blocks.
2 Coils Glazite.
2 Valves Pen 220A. (Mazda.)
1 Valve 215 S.G. (Mazda.)
1 Alpha Cabinet. (Hambling.)
1 Panel 14in.×8in. (Becol.)
1 Plywood Baseboard 19in.×7in.
1 120-volt H.T. Battery. (Lissen.)
1 16 volt. G.B. Battery. (Lissen.)
1 L.T. 2-volt Accumulator. (Lissen.)
1 Q.P.-P. Moving Coil Speaker. (Ormond No. R/494 C.T.)

THE HALF-GUINEA PAGE

Radio Wrinkles FROM READERS

Producing a Burred-finished Effect on Metal Sheets

THIS burred effect can easily be produced on a metal panel or chassis in the following manner. A hardwood plug, shaped as in sketch, in the grip of an ordinary chuck, is all that is required, beyond the making of an abrasive. I have found that finely-powdered glass from an ordinary electric bulb answers as well as any carborundum or emery powders. In use the work to be treated is coated with a film of oil and the abrasive mixture then finely sprinkled on. The brace is then used as if drilling several holes but requiring a few twists only for each operation. A drilling stand is very convenient for the work as the metal to be treated need only be slid along, ensuring uniformity in producing the burred effect. If an ordinary hand brace is used, it can be gripped in a vice by the fixed handle.—H. J. NICHOLSON (Liverpool).



Method of producing a burred finish on metal panel.

A Dual-unit Speaker

THE accompanying sketches show a novel form of loud-speaker which I constructed some time ago, and which has given very pleasing results. The speaker consists of two units fitted in one cabinet, and connected in parallel, this arrangement covering a much wider range of frequencies than either would do if used separately. The extent to which the upper frequencies are increased by this arrangement is strikingly brought out if the horn unit is temporarily disconnected. Many people, who have heard this speaker, remark on its clearness and purity of tone. It will be seen from Fig. 2, that one unit operates a cone and the other a wooden horn. Fig. 1 is a general view of the speaker, and Fig. 3 is a rear view with the back of casing removed. —H. C. LOADER (Oldham).


Fig. 1.—General view of a dual-unit speaker.

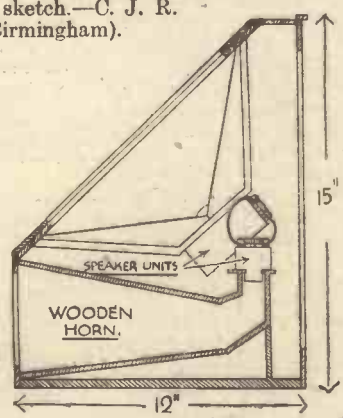


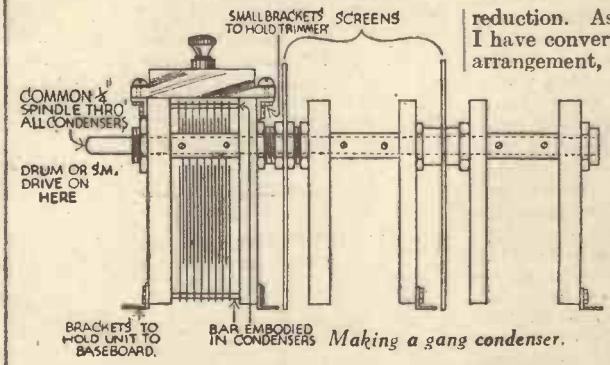
Fig. 2.—Sectional view of speaker.

THAT DODGE OF YOURS!

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

Gang Condensers

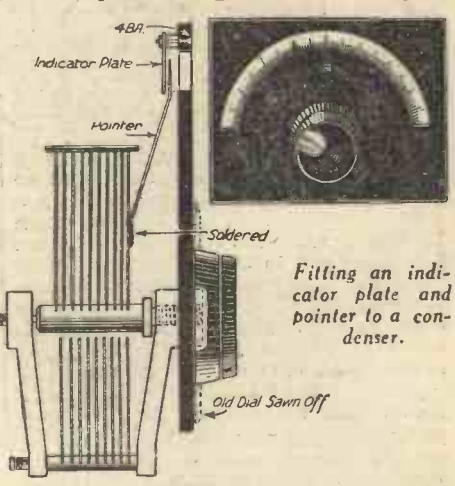
HERE is a cheap but efficient way to make your own gang condensers. There is a condenser on the market in which the rotor spindle is removable without upsetting the rotor. This spindle is held by two grub screws in the hollow centre piece to which the moving vanes are fixed. Thus, by removing the spindle and securing a piece of ¼in. steel of suitable length, 2, 3 or 4 condensers may be mounted on one common spindle. Trimmers may be mounted on top of each condenser, as shown, and should be of the pre-set type of .00001 to .000005 mfd. capacity. I have made a number of these units and the maximum error between any two condensers has never exceeded two degrees on the tuning scale. The trimmers have always proved quite ample to give excellent matching with all rotors set in line. Screws are easily inserted as shown in sketch.—C. J. R. (Birmingham).



Making a gang condenser.

Converting a Condenser Dial

THERE must be a number of constructors who have single-tuned sets utilizing slow motion tuning condensers of the hollow spindle type with the ebonite dial mounted on the face of the panel, the centre spindle being used for the gear reduction. As these dials look out of date I have converted my set to a more modern arrangement, as shown in the sketch. First, take a piece of bare 18 gauge copper wire to make the pointer and bend it into shape to come near the panel at the indicator end. Flatten the end to be soldered to give increased surface for soldering, and then flatten the indicator end to give a "hair line" reading—this end can finally be blacked with lacquer. A semi-circular strip is cut from the panel and the indicator plate is spaced from the panel with washers. Sizes, of course, depend on the space available. The "solder" can be obtained in tube form from most ironmonger's shops.—G. H. DRIVER (Manchester).



Fitting an indicator plate and pointer to a condenser.

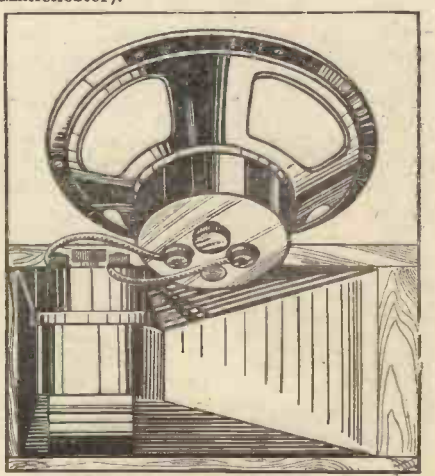
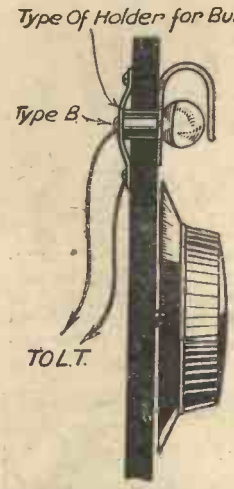
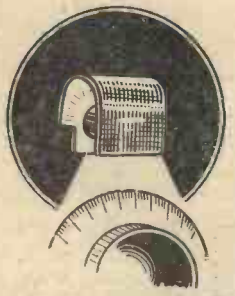


Fig. 3.—Rear view with back of casing removed.





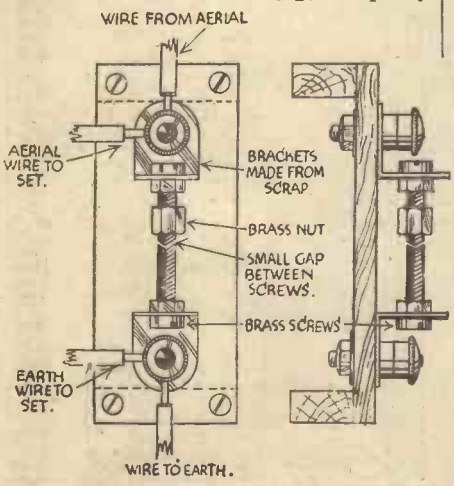
A novel method of fitting a dial light.

A Neat Dial Light

HERE is a little gadget for use as a pilot light on sets that have no aperture, and cannot be illuminated from behind the panel. A hole is bored in the panel large enough to take a B-type holder. The shade can be made from a thin piece of tin secured to panel by inserting the bulb, the hole being just the size to take the screw on bulb. If current consumption is to be considered a slight twist of the bulb in one direction or another will extinguish or light the lamp.—F. G. PRICE (Birmingham).

Simple Earthing Device

A NEAT and efficient earthing device can be made quite simply from scrap material. Two brackets are made from strip brass and a hole is drilled in both sides of them, one to take a brass screw and the other to secure it to an ebonite strip by means of a terminal. The brass screws are fitted in the brackets by lock nuts, which allows the gap between the two points to be finely adjusted. The ends of the screws are filed to a point, or one can have a point, and the other a V-groove filed into it, as shown in the illustration. Before these points are adjusted, another nut, the same pitch thread as the screws, is run on one of them. The screws are adjusted until a thin piece of paper can be just passed between them. This small gap lessens the chance of damage being done to the set when accidently left unearthed during a thunderstorm. To earth the aerial in the usual manner, run the nut down the screw until it is across the gap, and partly screwed on the other screw, thus making a mechanical and electrical earth connection. — A. WHEELER (Bristol).



An aerial earthing device made from odds and ends.

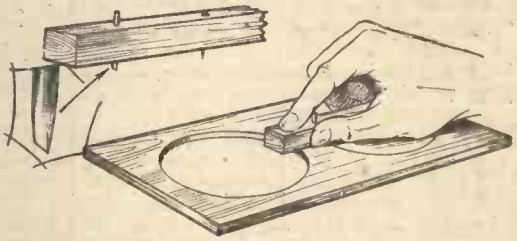
Cutting Device for Circular Holes

THIS simple tool which is easily made is very handy for cutting holes up to any diameter in panels or baffle boards. The parts required are a piece of wood about ½in. square and of convenient length; one round nail and one flat joiner's nail. To make the tool, drive the round nail in the middle of the bar of wood, and drive in the flat nail at a distance equal to the hole to be cut. For a 7in. hole this distance would, of course, be 3½in. Now take your plain baffle board and place flat on a bench, and bore a true hole as vertical as possible in the centre of the board. Needless to say, the flat nail should be driven into the cutter bar, across the length, and not with it. The end of this nail must be sharpened with a fine file on both sides, and kept sharp or it will not cut properly. With the cutter just showing its point, drive the round nail into the hole in the baffle board, and describe a circle. With slight pressure only, this will make a comparatively clean cut. Now repeat the process, after driving the cutter a little deeper, and so on, until the cutter has cut half way through the board. Take out the tool, turn over the board, and repeat the process, and in a short time the centre disc will come away clean, and will not require much sand-papering.—T. PILKINGTON (Wigan).

A Novel Ammeter

MANY amateurs who possess a milliammeter would, no doubt, welcome a higher reading ammeter. The one illustrated in Fig. 1, consists of a solenoid wound on a 1in. cardboard former. Down the centre of the coil passes a 4BA brass rod tapped at one end and fastened to an ebonite or wooden base to which the coil is fastened by an angle bracket. The moving portion is a piece of soft iron, with centre hole to clear the 4BA rod, on which it slides. The iron is held in place by a weak compression spring. When a current is passed round the coil the iron moves to the field of maximum intensity, but is counterbalanced by the spring. The movement depends on the current because the intensity of the field varies directly as C. The movement is recorded on the scale by a pointer soldered to the top of the iron. It is necessary to calibrate the instrument by comparing with a standard ammeter. The scale is not regular but depends on the permeability of the iron, etc. Range may be varied by strengths of the springs.

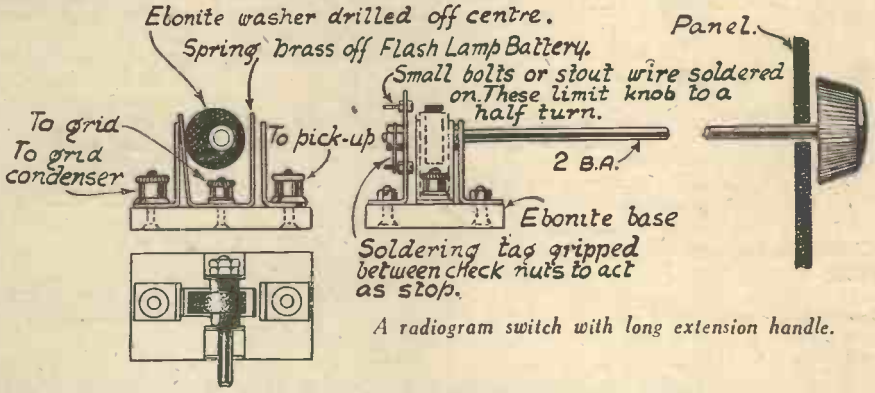
Fig. 2 shows another form in which the compression spring is replaced by two of the expansion type.—J. P. SAVAGE (Liverpool).



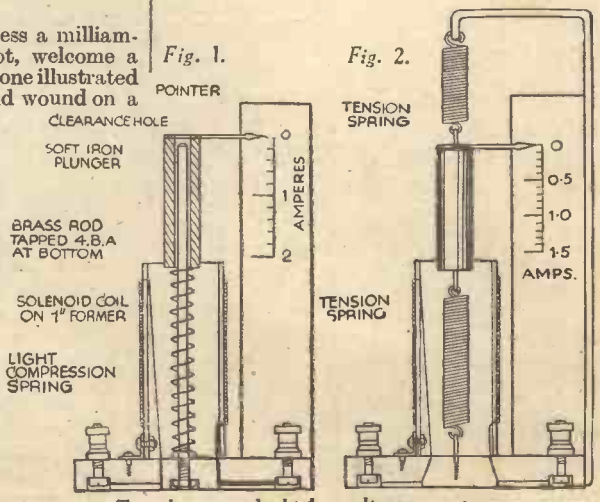
Cutting large circular holes in a baffle board.

A Radiogram Switch

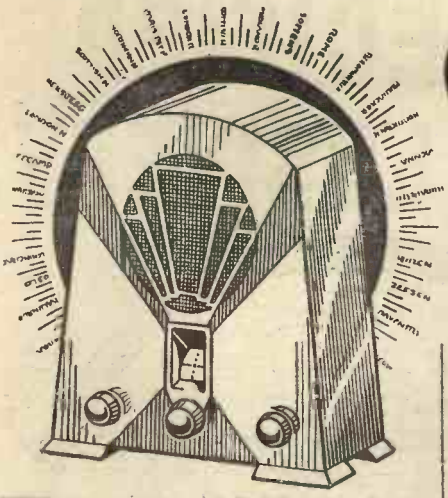
TO obviate the use of long grid leads, which are necessary with ordinary radiogram switches, I made the switch shown in the accompanying sketches. With this switch short leads can be used, as it can be screwed down to the baseboard close to the grid terminal of the valve-holder. There is no hand-capacity effect, as the operating knob is on the end of a long spindle which passes through the panel. Details of construction are clearly shown in the sketches.—P. T. BURN—(Wallsend-on-Tyne).



A radiogram switch with long extension handle.



Two home-made high-reading ammeters.



OUR VIEWS ON RECEIVERS

THE ATLAS LAMBDA RECEIVER

THE latest entry to the cheap battery set market is the three-valve receiver produced by Messrs. H. Clarke & Co. (Manchester), Ltd. This is a remarkable little receiver, having the appearance of a really expensive set, as will be seen from the photograph reproduced on this page. The cabinet work is of a high standard and is not of the usual three-ply which is usually associated with a cheap set. The actual cabinet is seven-ply wood, which not only gives a substantial article which will stand mishandling, but will not warp and fall to pieces through extremes of temperature, to which it might be subjected in some situations. The receiver portion of the set is enclosed in a metal chassis housed in the lower portion of the cabinet, whilst the loud-speaker, which is of the permanent-magnet moving-coil type, is fitted to the upper part of the cabinet. A small shelf maintains the chassis in position and also serves as a support for the batteries. Clearly identified battery cords are fitted to the receiver, and the terminals are mounted on ebonite plates bearing bold white letterings. So much for the actual appearance of the receiver.

The Circuit

The circuit employed in this receiver is of the screen grid, detector and small power type, and is made up in the following manner. Small inductances are wound on paxolin tubes, and these are spaced away from the metal chassis by means of brass distance pieces. The long-wave section of the inductances is of the honeycomb type of coil, and this is affixed on the coil former at some distance from the medium-wave coil. A series aerial condenser is included, and the control for this projects from the rear of the chassis in the form of a 2in. ebonite rod. For connection to the anode of the S.G. valve a heavily-armoured flexible lead is used, and this is anchored to the metal chassis and passes right across to the opposite side of the receiver, where it makes connection with the secondary coil. This is arranged on the chassis in the same manner as the aerial coil, and is naturally well separated from it. In between the two sets of coils is disposed the two-gang condenser, and this is of the totally enclosed type, and being earthed serves as an effective screen between the inductances. The two-gang condenser is of the type having a separate concentric knob for trimming purposes, and this enables the two halves of the condenser to be correctly matched at any part of the scale, independent of the reaction or setting of the pre-set aerial condenser. The detector valve is transformer-coupled to the output valve, and the loud-speaker is connected direct in the anode circuit of this valve. Gramophone pick-up terminals are fitted to the rear of the chassis, and a small on-off switch is mounted directly by the side of these so that there are no long grid leads to produce hum, instability or other faults. To facilitate connection to the various points in the receiver, small fibre strips are fitted to various parts of the chassis, and soldering tags are eyeletted to these so that the connections may be made after the chassis is bolted up. This is a very good point, as it ensures that really sound connections are made, and that the chassis may be easily assembled before the final connections are made. There is thus little likelihood of a fault arising after wiring has been completed. The loud-speaker is provided with a matching transformer, and this is ready wired to the L.S. terminals on the chassis.

The Atlas Lambda Three-valve Battery Model.

Results Obtained

The valves employed are of Marconi manufacture, the H.F. stage being occupied by a V.S.2, the detector valve is an H.L.2, whilst the power stage is taken by an L.P.2. The maintenance of the set is therefore very cheap, the total H.T. consumption being under 6 milliamps. For grid bias purposes only a 4.5 volt battery is required, whilst the output from the L.P.2 valve, correctly matched to the loud-speaker is ample for normal purposes. Tested on a small outdoor aerial in the heart of London, the two local stations were received at really good volume. The selectivity was very good, and there was a good clear section between the National and the Regional. The Northern Regional and the Midland Regional also offered good signals, which were greatly improved upon when used in conjunction with a good aerial and earth system. On the long waves, Daventry and Radio-Paris provided the best signals, although four other stations were clearly audible on the loud-speaker. With an indoor aerial the results were naturally not so good, but there were sufficient stations available to provide entertainment value on any evening, although naturally with such a modest arrangement one could not expect volume sufficient for dancing, for instance. When used as a gramophone record amplifier, by means of a good pick-up connected to the appropriate terminals, the results were excellent. The volume was sufficient for all ordinary purposes, and on some records, the volume control attached to the pick-up had to be called into use. The quality, on both records and radio, was extremely good. When it is borne in mind that this is a cheap receiver, produced for a cheap market, and which is cheap to keep in order and to operate, the results are certainly excellent, and we have no hesitation in recommending this receiver to those to whom such an outfit appeals.

NAME: Lambda 3-VALVE RECEIVER.
MAKERS: H. Clarke & Co. (Manchester), Ltd.
CIRCUIT: Screen Grid, Detector, Small Power. Two-gang tuning condenser, with dial calibrated in wavelengths.
CONTROLS: Three—Tuning condenser, Reaction condenser and wave-change switch (combined with on-off switch).
REMARKS: Very good all-round results, giving a number of stations at good strength on the permanent-magnet moving-coil loud-speaker which is incorporated in the cabinet.
PRICE: £9-15-0.

If you are collecting our Free Gift Data Sheets you require our Self-Binder. See page 64.

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for our

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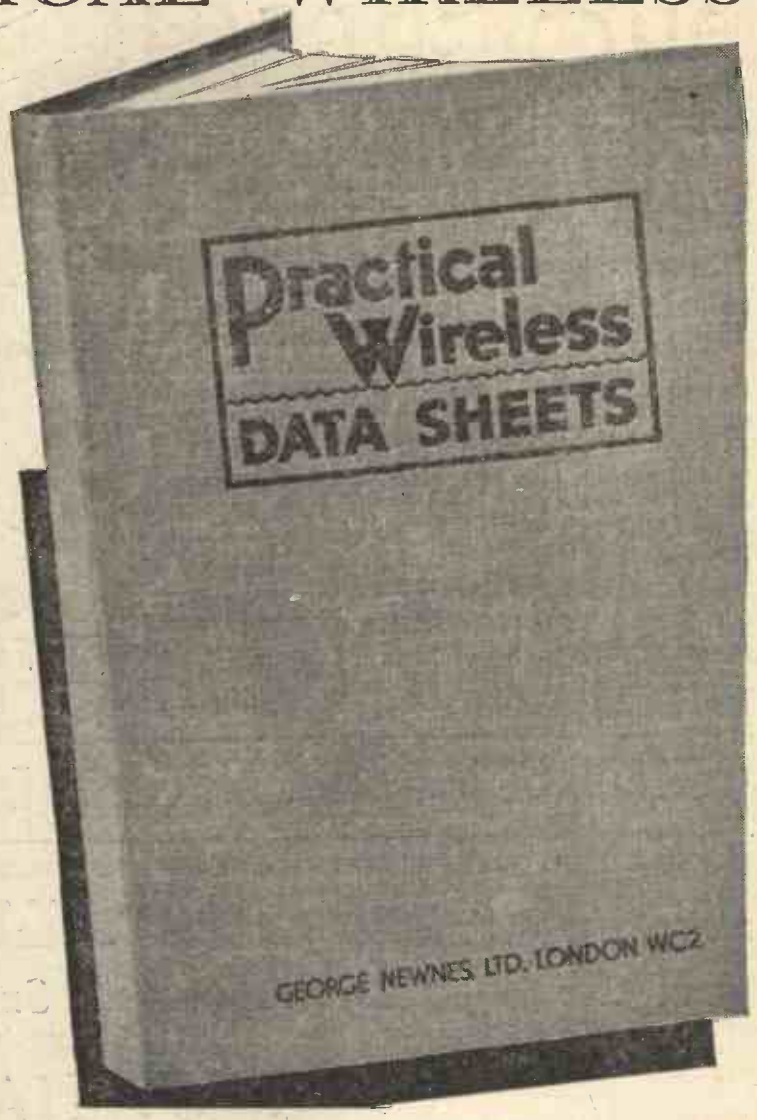

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The PRACTICAL WIRELESS DATA SHEETS LOOSE-LEAF Binder as illustrated here measures 11in. by 8in. and has a stout linen-covered stiff-board cover specially made to stand hard wear, having a special flap with cloth hinges and enamelled press-button fitting for speedy insertion and removal of the Data Sheets which are specially "holed" to fit. There is an extremely useful manilla gusset pocket on the inside back cover for holding loose sheets, newspaper clippings, notes, and other odds and ends.

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THE FOLLOWING DATA SHEETS HAVE ALREADY BEEN ISSUED:

Data Sheet No. 1—Accumulator Charging	Dec. 17th, 1932
Data Sheet No. 2—Coils & Coil Winding	Dec. 24th, 1932
Data Sheet No. 3—Resistances	Dec. 31st, 1932
Data Sheet No. 4—Mains Transformers	Jan. 7th, 1933
Data Sheet No. 5—Wire and Wire Gauges	Jan. 14th, 1933
Data Sheet No. 6—Chokes, H.F. & L.F.	Jan. 21st, 1933
Data Sheet No. 7—Condensers	Jan. 28th, 1933
Data Sheet No. 8—Battery Eliminators	Feb. 4th, 1933
Data Sheet No. 9—Screws & Screw Threads	Feb. 18th, 1933
Data Sheet No. 10—Battery-Operated Valves	Feb. 25th, 1933
Data Sheet No. 11—Mains Valves	Mar. 4th, 1933
Data Sheet No. 12—Handy Formulae	Mar. 11th, 1933
Data Sheet No. 13—Terminals, Plugs & Fuses	Mar. 18th, 1933
Data Sheet No. 14—Loud-speakers	Mar. 25th, 1933

Those new readers who are desirous of completing their files of these Data Sheets may have those already issued for 2d. each from the address given above.

Notes on COLD VALVES

Further Notes on This Interesting Development

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

IN the issue of PRACTICAL WIRELESS, dated March 18th, I discussed briefly some of the principles involved in the Westector or "cold valve," the component which has been developed for use in high and intermediate frequency circuits, so that when desired, it can replace the detector function of a grid detector, or that of a diode detector. In effect, at least as far as its use in high-frequency circuits is concerned, the Westector performs a similar function to the crystal detector of early radio days, two examples of which are shown in Fig. 1. With a crystal detector, however, there was a very marked limit to the magnitude of the signal input it would handle efficiently, coupled with the necessity of "catwhisker fiddling" or alternatively adjusting the operating point by means of a battery-fed potentiometer, although both these nuisances were overcome with the permanent type detector shown in Fig. 1.

Straight Line Detector

With the new component we have the advantages of the crystal detector, namely neither heater current nor anode current is required—this latter fact removing the need for smoothing the anode supply normally required for a valve detector, but in addition, it behaves as a true straight line detector with high input voltage values, namely 24 or 36 volts, according to the type employed. Of course, there is no form of amplification, but there are many cases where that is not of material consequence. Naturally, care must be taken to ensure that the "Westector" cannot be connected to any form of battery or eliminator supply, as the resulting current may bring about its destruction and necessitate replacement, and in addition the user must see that the component is joined round the right way in the circuit. A plainly marked red moulding indicates which is the positive end of the component, and it is essential that a D.C. conducting path be provided on the input side.

A reference to Fig. 2, will show exactly what is meant. Here we see the "Westector" arranged for a radio or high-frequency input with a transformer coupled low-frequency output. This is somewhat similar to Fig. 5 of the March 18th issue, a tuned grid circuit providing the D.C. conducting path, while the connection for automatic volume control is also indicated. Bear in mind that when used as a radio frequency detector, the unit should be preceded by a low impedance, high mutual conductance screened grid valve, a high-frequency pentode or a medium impedance triode. When acting as the detector in superhet receivers, however, that is, working at intermediate frequencies, then an ordinary screened grid valve is quite satisfactory. The same remarks, of course, apply when full wave detection is used as shown in Fig. 3.

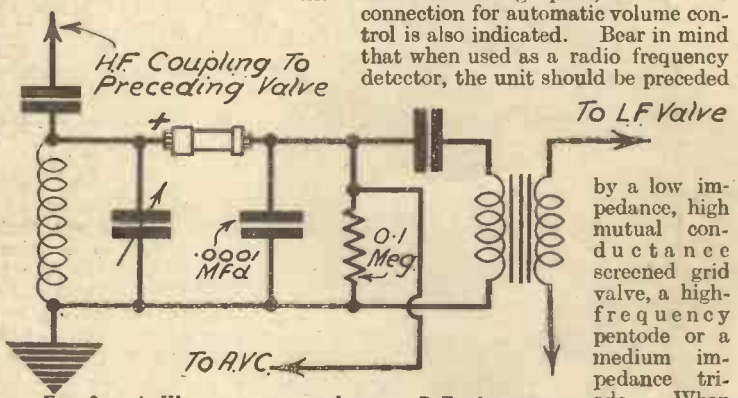


Fig. 2.—A Westector arranged as an R.F. detector.

Fig. 1.—A piece of crystal used for detection, and a permanent crystal detector employing this material.

Delayed A.V. Control

Now an additional note dealing with automatic volume control. In Figs. 2 and 3, this is effected by feeding back the rectified carrier (arranged negative with respect to earth) to the grids of the preceding valves in the conventional manner. In many cases, however, a "delayed" automatic volume control is to be preferred and this is shown in Fig. 4. Here an auxiliary rectifier renders the control inoperative on signals whose strength is below a certain pre-set value. This pre-set value, corresponding in practice to weak and moderately weak signal strengths, is set up on a potentiometer situated in the H.T. negative return lead.

(Continued on page 79.)

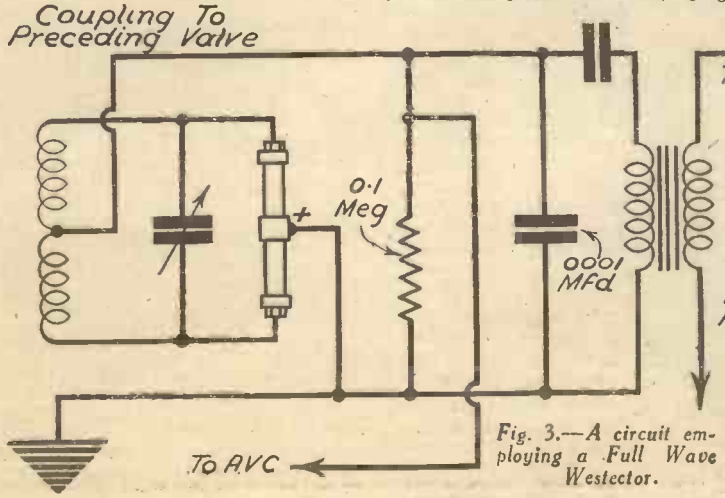


Fig. 3.—A circuit employing a Full Wave Westector.

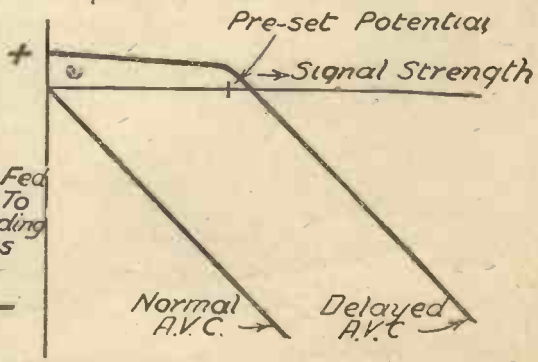
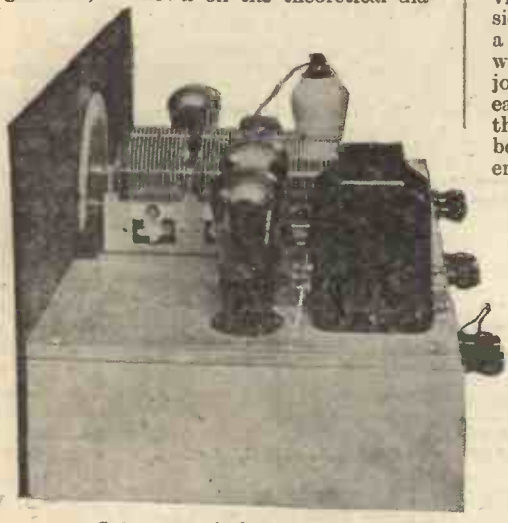


Fig. 5.—How the delayed automatic volume control differs from normal A.V.C.

The Fer Hi-M

CONSTRUCTIONAL DETAILS OF THE NEW SUPER-SEL

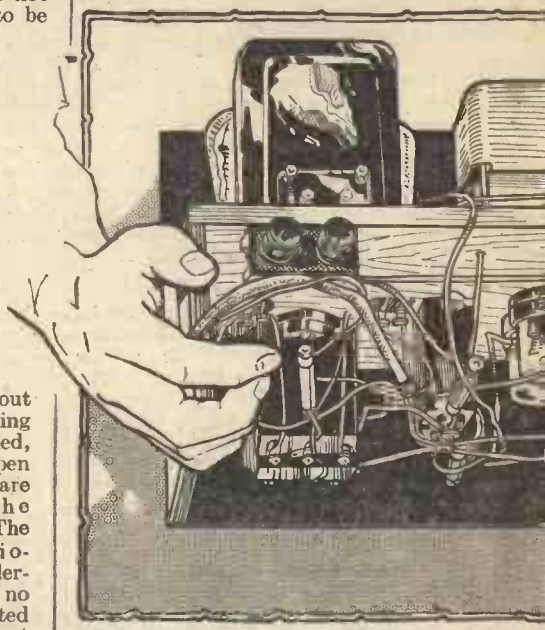
IN last week's issue of PRACTICAL WIRELESS the preliminary notes of this receiver were given, and the complete instructions for wiring up and operating were given in brief form for those who wished to go ahead with the complete receiver. In order, however, that those who cannot wire a receiver from a theoretical circuit may be assisted, the following notes are written, and these should be followed in conjunction with the practical wiring diagrams given on page 68. It would, perhaps, be as well to point out here one or two apparent discrepancies in the wiring diagram, theoretical circuit and list of components. First of all, the coupling condenser between the anode of the screen grid valve and the detector grid coil, is shown on the theoretical diagram (published last week) as a .001 mfd. condenser, whilst in the wiring diagram on page 68 this is shown as .0003 mfd. These two values are the limits between which the correct value should be selected. For general results .001 will be found best, but in some particular cases the smaller value will be found to be just as effective. In the view of the underside of the baseboard, a fixed condenser with a capacity of .002 mfd. is shown joined from the H.F. choke direct to the earth terminal. This will not be found in the list of components, and it need not be included unless reaction is found to be erratic in its adjustment.



Side view of the new receiver.

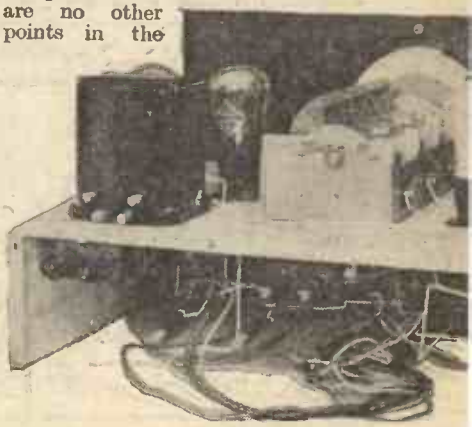
Soldered Joints

If you examine the underside view of the baseboard wiring on page 68 you will see that two leads are joined to terminal No. 7 on the coil nearest the panel. Terminal 5 on the next coil also receives two wires, as does terminal 1 on the same coil. If you prefer it, only one wire need be joined to these terminals, and the second wire should be soldered to a bared portion of the wire a little way from the coil screen. This is the preferable method, as there is then no risk of one of the wires squeezing out when the fixing screw is tightened, as might happen when two loops are clamped under the screw head. The Luxus potentiometer requires soldered connections, as no screws are mounted on this component for the purpose, and as some soldering must be done, it is just as well to carry out the junction of wires by the same means. If you examine the wiring you will find one or two points where the wiring may be simplified by means of soldered joints, and the construction is also easier to carry out by this means. For instance, the choke on the underside of the baseboard has three wires joined to the right-hand terminal. One wire may be taken straight from the moving vanes of the reaction condenser to the fixed .002 mfd. condenser, and the lead to the choke soldered to this lead, with the lead from the anode terminal of the detector valve soldered to a point a little lower down the wire. This method is, of course, just as efficient, and provided you can really solder well, is to be preferred. There are no other points in the



FOR LIST OF AND WIRING *See Pag*

The Ferrocart Q.P.-P. in the attractive Peto-Scott F.J.C. Consolette Cabinet.

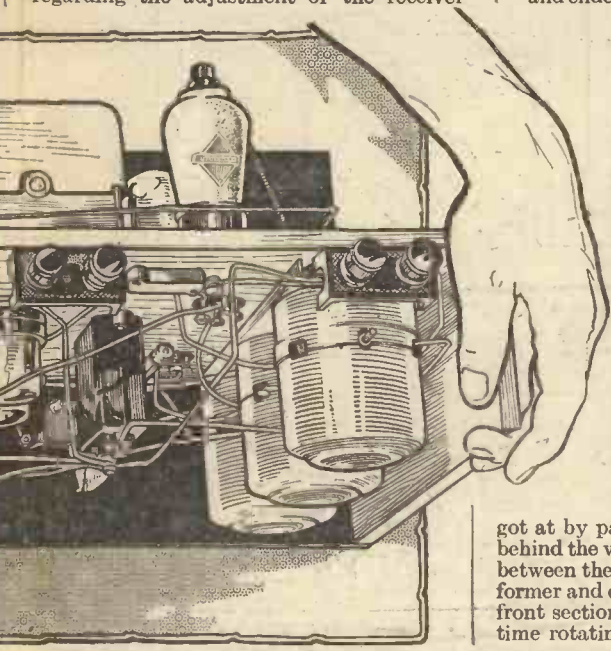


Rear view of the new "Practical Wireless" recei Ferrocart coils.

rocart Q.P.P. lag Three

OUR NEW RECEIVER EMPLOYING ECTIVE TUNING COILS

actual construction which need be mentioned, and therefore the following notes regarding the adjustment of the receiver should be studied.



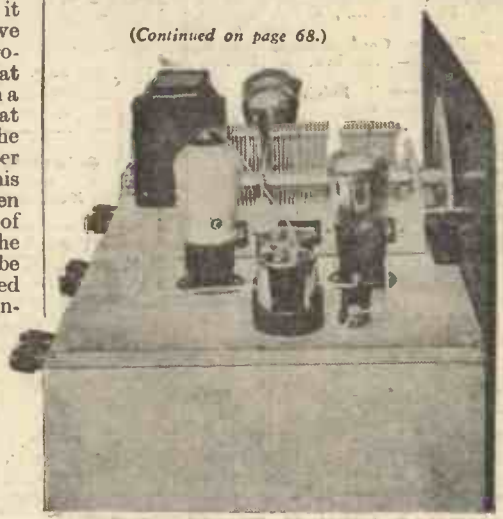
COMPONENTS DIAGRAMS e 68.

ver, employing

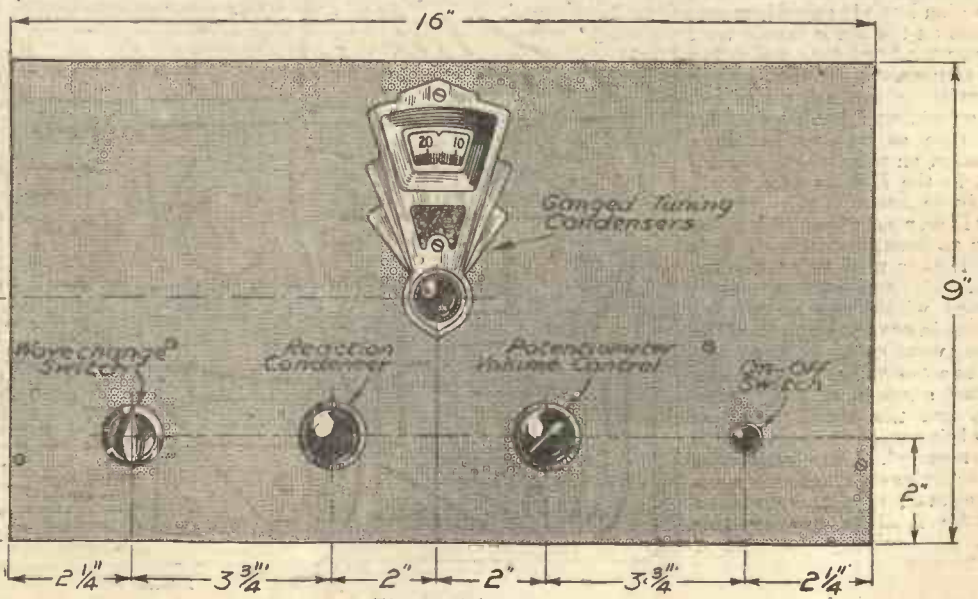
Trimming

When first brought into use it is highly probable that nothing will be heard as the dial is rotated from one end of the scale to the other. The reason for this is as follows. The three circuits employed in the receiver are very sharply tuned. Each coil is accurately matched to its neighbour, and each section of the condenser is accurately matched. The connecting wires between the coils and condenser, together with the other wires which are joined to these, results in extra stray capacities being introduced, and these will upset the balance between these circuits until a suitable compensation has been made. For this purpose small trimming condensers are mounted on the right-hand side of the gang condenser and these should be adjusted in the following manner. Turn the switch to the medium wave position, and advance the reaction control until the set oscillates. Now turn the tuning control until you get a whistle or shriek. At once slacken off the reaction and endeavour to tune in the station. It might be found that this can be done fairly easily, especially if it happens to be your local station working only a few miles away. If it should be a far distant station, however, it may be found impossible to resolve the signal, and therefore the procedure should be carried out at some other part of the dial. When a station is finally obtained, so that speech or music is intelligible, the three sections of the condenser should be trimmed, and for this purpose you should obtain a wooden screwdriver, or a similar strip of thin wood. Looking down on the set from the front there will be found three small screws disposed along the side of the gang condenser nearest the two output valves. These two valves have been arranged on the baseboard so that the first and second adjusting screw may be easily got at by passing the screwdriver in front or behind the valves. Insert the screwdriver in between the two valves and the output transformer and carefully turn the trimmer on the front section of the condenser, at the same time rotating the tuning knob over two or three degrees on each side of the point where the station was originally tuned in. If it is found that the strength of the station can be increased, obtain the maximum position on this trimmer, and then proceed to the next one. Carry out this procedure with each trimmer, but do not screw all the trimmers right in. If you do, the minimum wavelength which can be received on the set will be raised and this will restrict the tuning range. The operation is not difficult, but should be carefully carried out, as the reception of weak, or distant, stations will depend upon the accuracy with which the three circuits are balanced. When you think you have carried out the operation carefully, tune in a station at the very bottom of the medium waveband and see if any adjustment of the trimmers will increase the strength. Then do the same at the top of the medium-waveband, and finally carry out the procedure on the long waves at two points on the scale. A point should be found where at all these places the adjustment of the trimmers either backwards or forwards results in a falling off in strength. The receiver is now trimmed

(Continued on page 68.)



Remote side view of this new receiver.



The panel layout.

LIST OF COMPONENTS

THE FERROCART Q.P.-P. HI-MAG. THREE.

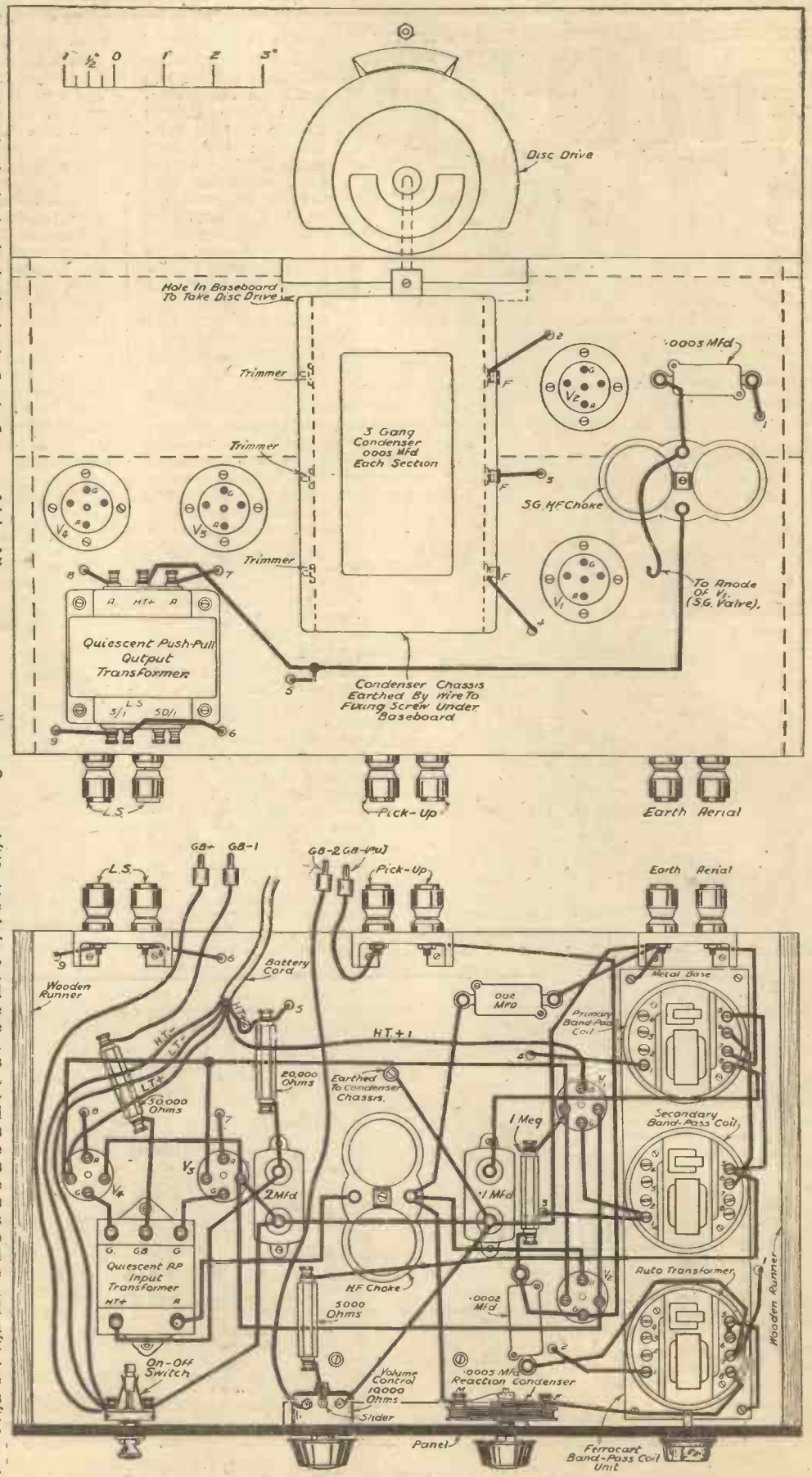
1 Set Ferrocart Coils. Colvern.
1 Three-Gang Condenser Assembly. Brit. Radiophone.
4 4-Pin Valveholders. Clix.
2 L.M.S. screened H.F. Chokes. Graham Farish.
1 Q.P.-P. Input Transformer, Type D.P. 36. Varley.
1 Q.P.-P. Transchoke, Type D.P.38. Varley.
1 .0002 fixed condenser, Type 670. Dubilier.
1 .1 mfd. fixed condenser, Type B.B. Dubilier.
1 .001 mfd. fixed condenser, Type 670. Dubilier.
1 2 mfd. fixed condenser, Type B.B. Dubilier.
1 20,000 ohms resistance (Ohmite). Graham Farish.
1 50,000 ohms resistance (Ohmite). Graham Farish.
1 5,000 ohms resistance (Ohmite) Graham Farish
1 10,000 ohms Potentiometer, Type B. Luxus. Preh.
1 One Megohm Grid Leak. Graham Farish.
1 .0005 Reaction Condenser. Lissen.
1 On-Off Switch, Type S. 83. Bulgin.
3 Terminal Mounts. Belling Lee.
6 Terminals, Aerial, Earth, Pick-up, L.S.—, and L.S.+. (Type H). Belling Lee.
3 Wander Plugs (G.B.+, G.B.1, G.B.2). Clix.
1 5-Way Battery Cord (H.T.1, H.T.2, H.T.—, L.T.—, and L.T.+). Belling Lee.
2 Coils "Quickwyre." Bulgin.
1 220 V.S.G. Valve
1 210 H.F. " } Cossor.
2 220 P.A. "
1 Plywood Baseboard 12in. by 9in.
1 Peto-Scott F.J.C. Consolette Cabinet.
1 120-volt H.T. Battery. Lissen.
1 15-volt G.B. Battery. Lissen.
1 2-volt L.8. Accumulator. Lissen.
1 R. and A. "Challenger" Speaker.

(*Continued from page 67.*)

and there will be no need to touch the trimmers again.

Operating the Receiver

The actual operation of the receiver is extremely simple, and of course, is "one-knob tuning." That is to say, the central tuning knob is simply rotated and the stations are tuned in one after another. If a signal is rather weak, and you wish to intensify it, the reaction knob is called into use. The knob on the left is simply used to change the band over which the receiver tunes, whilst that on the right switches the set on or off. The remaining knob controls the volume as well as having a slight effect on selectivity. For instance, in the London area it will probably be found that when this knob is in its maximum position, the London stations are too loud. This control is then used to reduce the volume. If, however, two stations are heard within one degree, as does occur in one or two parts of the medium waveband, this control should be adjusted to slightly reduce the signal strength of the wanted station, and the reaction control used to bring up the signal strength to that required. The selectivity of these particular coils is of such a degree, however, that there will be very little need to employ this method of obtaining separation of a station, and it is only in one or two parts of the country where it will be found necessary to use these controls in this manner.



Top and sub-baseboard wiring of the Ferrocart Q.P.-P. Hi-mag Three.

The BEGINNER'S SUPPLEMENT

Conducted by JACE

HOW YOUR SET WORKS

Part 6—*Conclusion.*

HAVING studied the working of our typical three-valve set stage by stage it now remains for us to make a final examination of the receiver as a whole. For this purpose I want you to look at the three diagrams given here. Fig. 1 is the theoretical or "circuit" diagram, Fig. 2 is a pictorial representation of Fig. 1, but showing the actual parts instead of using symbols, while Fig. 3 is a perspective view of the set as it would ordinarily appear.

This last diagram is included to remind you what the set looks like in its assembled form and to show the disposition of the various parts, otherwise it does not help much towards understanding how it works. Figs. 1 and 2 are provided for that purpose, as they show clearly all the connections which are normally partially concealed by the chassis; I shall therefore confine my explanations to these two diagrams.

A Résumé

Let me say right away that we are not going to wade slowly through the whole of the various processes again, but rather are we going to make a quick résumé of the functions of the different parts and at the same time clear up those one or two little points which, for the sake of clarity, I omitted to deal with previously.

You will remember that, in referring to Figs. 1 and 2 in part 4 of this series, I pointed out that there were one or two little modifications shown there which had not appeared in previous diagrams. These I promised to explain later on. Well, I propose to do that now. You need not consult your back copies, since Figs. 1 and 2 shown here include the part of the circuit I referred to.

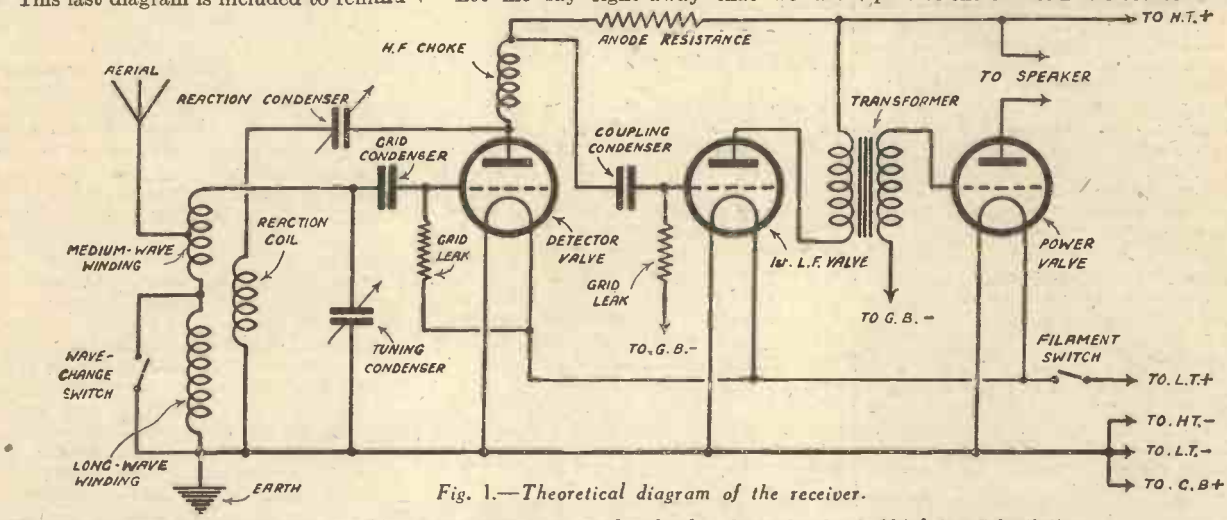


Fig. 1.—Theoretical diagram of the receiver.

Obtaining Selectivity

First of all look at the top left-hand corner of either Fig. 1 or Fig. 2. Here you will see the aerial connected to the aerial coil. You will notice it is not connected to the end of the coil as it was

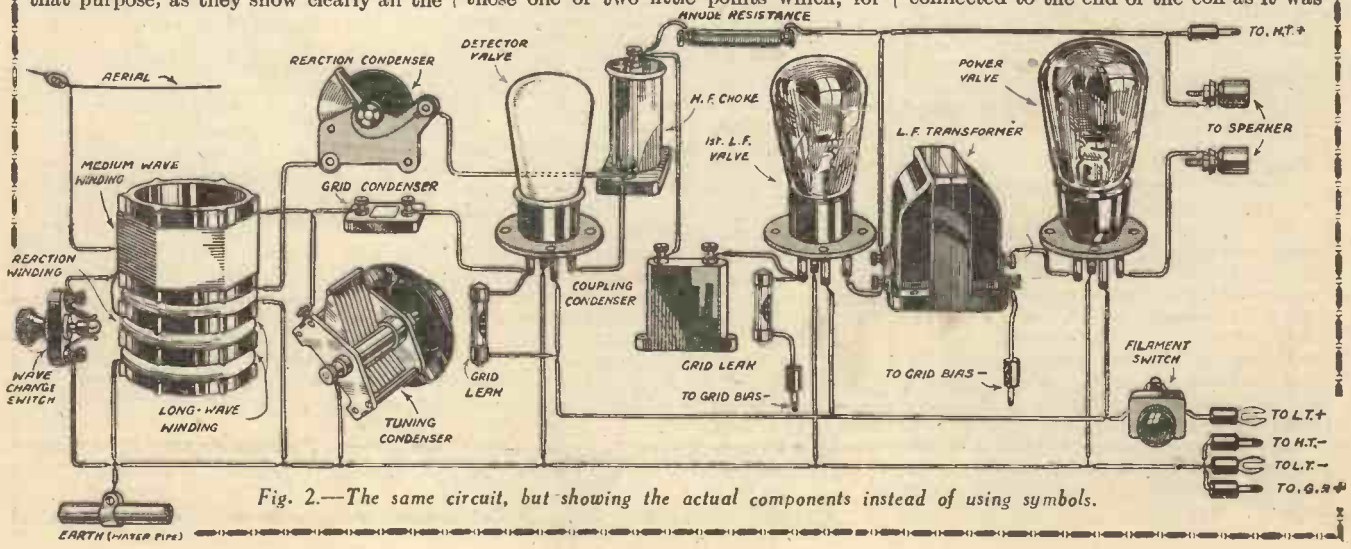


Fig. 2.—The same circuit, but showing the actual components instead of using symbols.

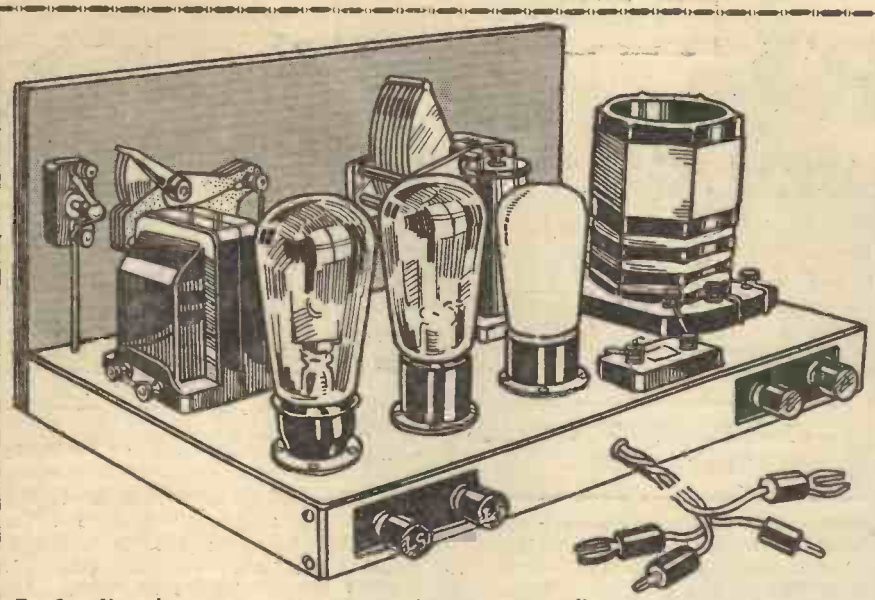


Fig. 3.—How the various parts are mounted on the "chassis" to form the complete receiver.

shown to be in Fig. 10 of the first article of this series, but is joined to one of the turns about half-way down the coil. This is done in order to obtain what is known as *selectivity*.

If the aerial were joined direct on to one end of the coil and the earth on to the other we should get *flat* or *non-selective* tuning. This means that if we tuned-in a station the setting of the tuning condenser would not be at all critical. Of course, there would be one particular position of the condenser at which signals would be loudest, but if we turned the knob several degrees either one way or the other we should still hear the station slightly. In other words our aerial circuit would still resonate slightly.

Naturally this would not matter in the least if we only wanted to receive one station, but if we wanted to tune in to another one which was sending out waves of nearly the same length as the first station there would be trouble. Imagine what would happen! On turning the knob or dial of the tuning condenser from the position where the first station was in tune, the sound would not suddenly cease but would still be audible, although gradually diminishing in strength, as we moved the dial farther and farther. As the second station would be transmitting on a near-by wavelength we should not have to move the dial through many degrees before we were in tune with that station. But the first station would still be audible.

Stations Overlapping

You may have experienced this sort of thing with your own set, especially when listening to a distant or weak station separated from a powerful local transmitter by only a few degrees on the dial of your tuning condenser. The powerful station could be heard on either side of its proper tuning point and so interfered with your reception of the weaker station. Well, one very popular method of overcoming, or at any rate partially overcoming, this deficiency, is to connect the aerial not to the "top" end of the tuning coil, but to one of the turns somewhere between the two ends —hence the arrangement shown in Figs. 1 and 2.

Three Coils in One

Another point you will notice is that the aerial coil is wound in two sections. It is a *dual-range coil* as mentioned in part 3. The upper section will tune to the medium waves (above 200 to 500 metres) and the lower to the long waves (say, 1,000 to 2,000 metres). Incidentally this lower section is again split up by being wound in two parts. Actually it is really one coil, but half of it is wound in one set of grooves and half in another. When we wish to tune to the long waves the switch marked "wave-change switch" is left open so that the medium and long-wave coils act virtually as one large coil. For reception on the medium waves this switch is closed and so cuts the lower coil out of action, leaving only the medium-wave coil in use. Between the medium and long-wave coils is the reaction coil.

While on the subject of the coil (the term "coil" is often used to indicate the whole unit, comprising the medium-wave, the long-wave and the reaction coils) I must explain that in Fig. 2 the connections from other parts of the set are shown going straight to the windings. This is done to make the connections quite clear, but in practice they are usually taken to terminals on the flange or base of the coil as in Fig. 3.

Purpose of a "Choke"

Following on from left to right in Figs. 1 and 2, we come to the tuning condenser. The arrow drawn through it in Fig. 1 indicates that it is a variable condenser. Then comes the grid condenser, the grid-leak and the detector valve. We have already studied the working of these so we will pass on to the *H.F. choke*. This component, which you will see is connected between the plate of the valve and the anode resistance, has not been shown before, so I will explain what it is and why it is there. It is really a small coil something like a tuning coil, but smaller and containing many turns of fine wire. Its purpose is to direct some of the current from the plate of the detector valve through the reaction condenser and reaction coil, instead of allowing it to pass through the anode circuit. This is the simplest explanation of its function, but it is really not quite so straightforward as this, as the current it is dealing with is of rather a complex nature. I will endeavour to explain it a little more fully, but if the next two paragraphs look a bit too technical you can easily skip them. In advance I warn you I am going to talk about high-frequency and low-frequency currents.

The current from the plate fluctuates at both high and low-frequencies. I know this sounds horribly technical, but I will try and explain what it means. You will remember that under the influence of the incoming wireless waves, currents are set up in the aerial circuit. These move backwards and forwards very quickly, from which comes the term *high-frequency*. However, when speech or music is being broadcast, these currents vary in strength. Sometimes a *large* current flows first in one direction and then in the other, then perhaps the next moment only a *small* current will flow. This variation in strength occurs at a comparatively slow rate compared with the actual oscillations backwards and forwards, hence the term *low-frequency*.

By means of the grid in the detector valve the plate current is made to vary, in a similar way. As we saw when studying the action of the valve earlier on, the plate current rises and falls with each individual surge of the aerial circuit current in one direction, although it is unaffected when it moves in the reverse direction. This rise and fall is, of course, at a high-frequency like the movements of the aerial circuit current which induced it. Also, like the aerial current, the *amount* of each individual rise and fall varies, this variation being at *low-frequency*. There are, therefore, both high-frequency and low-frequency variations in the plate current. Of course, it is still only one current flowing in one direction, but due to the two distinct rates of fluctuation it is often spoken of as though it consisted of *two* currents —high-frequency currents and low-frequency currents. From many points of view this is a convenient way of looking at it.

"Well, what has all this got to do with the H. F. Choke?" you may ask. The answer is that the choke allows the low-frequency currents to pass unhindered but "chokes" back the high-frequency currents. The low-frequency currents pass on through the anode resistance while the H.F. currents not being able to get through the choke, have to go *via* the reaction condenser and coil. They are there used to boost up the incoming signals as we saw in part 3.

A Double Function

Incidentally the high-frequency choke serves a double purpose. Not only does it direct the H.F. currents to the reaction circuit where they are wanted, but it also keeps them from the grid of the next valve where they are not wanted. It is the low-frequency variations, or as they are sometimes called the "speech" frequency variations which we want to amplify, and which we

(Continued on page 88.)

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WITH FULL SIZE diagrams and constructional notes SEE PAGE 1075 PRACTICAL WIRELESS, FEB. 25th ISSUE.

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KIT "A" Complete Kit of Parts including *ready-drilled panel*, but *less* Valves, cabinet and meter. CASH or C.O.D. Carriage Paid, £3/19/6. 7/6 Deposit and 11 monthly payments of 7/3. **7/6**

KIT "B" As Kit "A" but with Valves, *less* cabinet and meter. CASH or C.O.D., Carriage Paid, £6/18/0. Delivered, Carriage Paid, on First Payment of **12/6** Balance in 11 monthly payments of 12/6.

KIT "C" As Kit "A" but with Valves and Table Cabinet *less* meter. CASH or C.O.D., Carriage Paid, £7/13/0. Delivered, Carriage Paid, on First Payment of **14/-** Balance in 11 monthly payments of 14/-.

KIT "D" As Kit "C," but with Consolette cabinet *less* meter and speaker. CASH or C.O.D., Carriage Paid, £8/3/0. Delivered, Carriage Paid, on First Payment of **15/-** Balance in 11 monthly payments of 15/-.

GUARDIAN Q.P.P. METER
10/- Extra. Add 11d. to each monthly payment.

FERROCART Q.P.P. HI-MAG THREE

KIT "A" Author's Kit of First Specified Components including ready drilled panel and assembled and drilled plywood chassis, less valves, speaker and Cabinet. CASH or C.O.D. Carriage Paid, £8/7/6. Delivered, Carriage Paid, on First Payment of **15/4** *Balance in 11 monthly payments of 15/4.*

KIT "B" as Kit "A," but with Valves. Delivered, Carriage Paid, on First Payment of **19/-** Balance in 11 monthly payments of 19/-. Cash or C.O.D. Carriage Paid, £10/8/6.

KIT "C" As Kit "A." Complete with valves and cabinet, but less speaker. Delivered, Carriage Paid, on First Payment of **21/-** Balance in 11 monthly payments of 21/-. Cash or C.O.D. Carriage Paid, £11/8/0.

Battery Shelf and Speaker Baffle 3/6 extra, or add 4d. to each payment.

EXCLUSIVELY SPECIFIED

PETO-SCOTT OAK CONSOLETTE CABINET (Type F.J.C.), 19/6.

KIT-BITS *Selected C.O.D. Items. You pay the postman. We pay post charges over 10/-.*

	£	s.	d.
1 PETO SCOTT Red Triangle Panel 16 x 9" ready drilled		6	0
1 COLVERN Set Ferrocart Coils	2	10	0
1 BRITISH RADIOPHONE Three-Gang Condenser Assembly, type 344, with Dust Cover & Disc Drive	1	13	0
1 VARLEY Q.P.P. Input Transformer, type D.P.36		17	6
1 VARLEY Q.P.P. Transchoke, type D.P.38		10	6
1 Plywood Chassis 16 x 10 x 3½" assembled and ready drilled for valve holders		3	6

Set of Specified Valves, £2/1/0.

FURY FOUR

Battery Model.

KIT "A" Author's Kit of specified parts, including *ready drilled panel*, but less valves and cabinet. Delivered, Carriage Paid, on First Payment of **12/-** Balance in 11 monthly payments of 12/-. CASH or C.O.D. Carriage Paid, £6/10/0.

KIT "B" As Kit "A" but with valves, less cabinet. Delivered, Carriage Paid, on First Payment of **17/3** Balance in 11 monthly payments of 17/3. CASH or C.O.D., Carriage Paid, £9/7/6.

KIT "C" As Kit "A" but with valves and Peto-Scott American Type Cabinet with lift-up lid. Delivered, Carriage Paid, on First Payment of **18/6** Balance in 11 monthly payments of 18/6. Cash or C.O.D., Carriage Paid, £10/2/6.

PETO-SCOTT CO., Ltd., 77, City Road., London E.C.1.
Telephone: Clerkenwell 9406/7.
West End Showrooms: 62, High Holborn, London, W.C.2. Telephone: Holborn 3248.

Dear Sirs, Please send me CASH/C.O.D./H.P. .....

for which I enclose £.....s.....d. CASH/H.P. Deposit.

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STRICT PRIVACY GUARANTEED—WE DEAL WITH YOU DIRECT

Rear view of our first superhet—the Supersonic Six.

INTRODUCING—

THE SUPERSONIC SIX

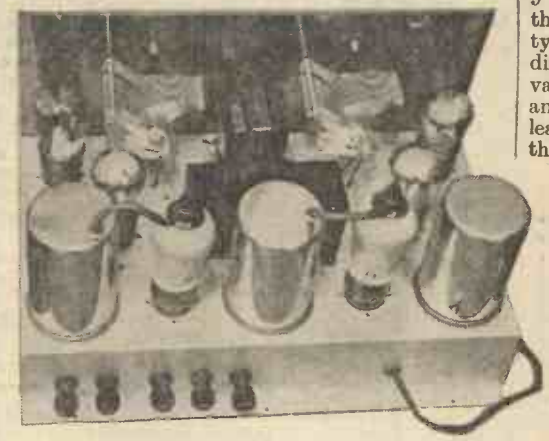
OUR FIRST SUPER-HET

A Six-valve Super-heterodyne, Wiring Diagrams and Constructional Details of which will be Given Next Week

By F. J. CAMM

THE selectivity problem almost daily grows more acute. Those readers situated well outside the swamp areas cannot realize how difficult it is for listeners situated beneath the aerial of some high-powered transmitter to receive and separate programmes. The only solution from their point of view is either a one-station receiver or a superhet. Hundreds of readers wrote to me just after I published details of my Fury Four asking whether it would be selective within five miles of their local station. Quite frankly, it would not. I promised those readers, however, that I would shortly publish details of a cheap yet highly efficient superheterodyne which would cure their troubles. I have been too busy with the Fury Four to publish this information before, but in order to satisfy those demands this week I give preliminary details of it. Its salient features are high sensitivity, high selectivity, only two tuning controls, low battery consumption (12 to 15 milliamps), distortionless volume control, automatic grid bias, and it functions extremely well with a frame aerial. As with the Fury Four, I am not over-stating the case when I say that this, the first superheterodyne receiver to be published in PRACTICAL WIRELESS, is a star performer.

The first detector functions on the anode bend principle of rectification, and the signal input is derived from the frame aerial. Local oscillation from the oscillator valve (incorporated into a new type of circuit evolved to keep the oscillator current down to a very low figure) is introduced into the frame aerial circuit via the centre tapping on the aerial itself. The beat frequency of 126 kilocycles obtained by heterodyning the incoming signal with the oscillator is transferred to the grid circuit of the first intermediate frequency amplifier by means of the special band-pass transformer. A further stage of intermediate frequency amplification is given by the fourth valve and the second transformer. The signal is passed to the second detector by means of another transformer, and finally transferred to the pentode output valve by means of the low-frequency transformer. Automatic bias for the oscillator valve and the pentode is obtained by means of the voltage dropping resistances. Volume control is obtained by varying the bias applied to the variable-mu intermediate frequency valve by means of the potentiometer.



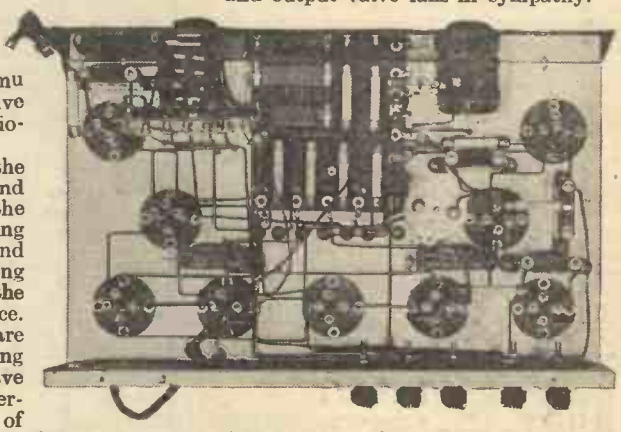
Another view of the Supersonic Six.

A strong feature of the receiver is the clean and symmetrical panel layout, the right hand dial is for tuning the frame aerial circuit, and left-hand dial is for tuning the oscillator circuit to the correct frequency difference. The remaining controls are the knob for controlling volume, and the on-off wave change switch, which performs the three functions of switching the set off when in a centre position to the medium wave when turned anti-clockwise, and to the long waves when turned clockwise. This switch and the oscillator coil form a single unit. Note that this set is erected on an aluminium chassis which can be obtained with valve-holders already mounted in position from Messrs. Wright and Weaire.

The high degree of selectivity that can be obtained from this set is due primarily to the use of the special I.F. transformers. These are designed to operate on the band-pass principle, and have a tuning curve 9 kilocycles in width. It should be noted that these transformers are made in two types; with pigtail lead for connection direct to the anode of the variable-mu valves—List No. O.T.2 (for positions T_2 and T_3 in the circuit), and without the lead—List No. O.T.1 (for position T_1 in the circuit). The use of a frame aerial gives the user a great advantage from the selectivity point of view.

The H.F. choke in the second detector anode circuit is important and forms, in conjunction with the .001 by-pass condenser, a filter circuit to eliminate the H.F. component from the L.F. output of the detector.

Automatic grid-bias is an innovation somewhat new to battery sets and possesses one great advantage over the convenience of not having a grid-bias battery to worry about; as the H.T. battery runs down, the grid-bias to the oscillator and output valve falls in sympathy.

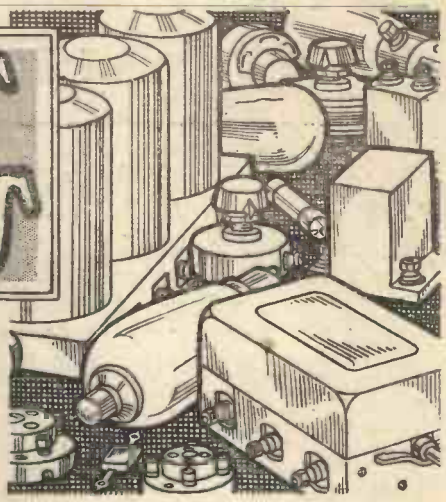


Sub-baseboard view of the Supersonic Six. Note the clean lay-out.

LIST OF COMPONENTS

1 Paxolin Panel drilled 14 in. by 8 in.; (Peto-Scott)
1 Aluminium Chassis; drilled 14in. by 8in. (Peto-Scott)
1 Oscillator Coil and Switch unit with window dial and knob. (Wearite)
1 I.F. Transformer. (Wearite type O.T.1)
1 I.F. Transformer. (Wearite type O.T.2)
1 H.F. 10 Choke. (Bulgin)
1 Special 8 mfd. condenser block. (T.C.C.)
2 0.1 mfd. condensers, type 65. (T.C.C.)
1 0.0002 mfd. condenser, type 34. (T.C.C.)
1 0.0003 mfd. condenser, type 34. (T.C.C.)
1 0.002 mfd. condenser, type 34. (T.C.C.)
1 0.01 mfd. condenser, type 34. (T.C.C.)
1 Special Resistance Unit. (Dubilier)
1 1 meg. Grid Leak. (Dubilier)
1 500 ohms Grid Leak. (Dubilier)
1 20,000 ohms 1 watt Resistance. (Dubilier)
2 40,000 ohms 1 watt Resistance. (Dubilier)
1 1 amp fuse. (Microfuse)
1 25,000 ohms volume control. (Watmel)
1 Hypernik L.F., 3-1, Transformer. (Lissen)
2 0.0005 variable condensers with slow motion dial, type No. 2 S.M. (Polar)
5 Terminals (2 L.S. and Aerial 1, 2 and 3) (Belling Lee)
1 Centre tapped frame aerial. (Eelex)
8 4-Pin sub-baseboard valve-holders. (Clix)
1 5-Pin sub-baseboard valve-holder. (Clix)
1 4-way Battery Cord (H.T.+., H.T.—., L.T.+., L.T.—., (Belling Lee)
1 P.M. 4 Mansfield Moving Coil Speaker. (W. B.)
6 Cossor Valves, 210 H.F., 210 L.F., 220 V.S.G. (2) 210 DET., 220 P.T.
1 Lion 120-volt H.T. Battery.
1 Ediswan 2-volt 40-ampere hour Accumulator.

REVIEWS of LATEST KITS

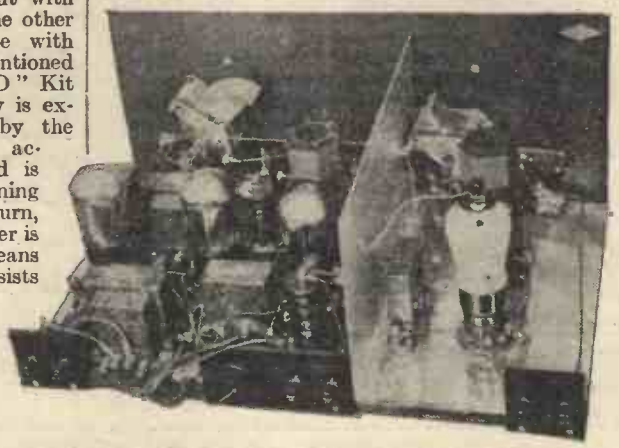


THE Peto-Scott Company have just submitted to us one of their new kits bearing the above title. As this explains, it is a four-valve set employing quiescent push-pull in the output stage, and the claims are: treble output, mains quality and volume with batteries. The kit is most attractively marketed in a carton containing all the separate parts in various divisions, and is made up in four different types. Kit "A," for instance, is the complete set of parts for the receiver, including a ready-drilled panel, but with no valves, cabinet or meter. At the other extreme, Kit "D" is complete with cabinet, valves, etc. The first-mentioned kit costs £3 19s. 6d., whilst the "D" Kit costs £8 3s. The actual assembly is extremely simple, and is assisted by the large sheet of instructions which accompanies the kit. The baseboard is covered with foil to assist in screening and provide a common earth return, whilst the H.F. stage of the receiver is separated from the remainder by means of a vertical screen. The circuit consists of a screen grid valve, detector valve, and two pentodes in the output stage. The coupling between S.G. and detector valves is of the normal parallel-fed tuned anode arrangement, with coils wound on small diameter, air-spaced formers. The two wavebands are provided in the usual way by short-circuit, one section of the winding for use on short (or medium) waves. The detector valve has the primary of the Q.P.-P. transformer connected direct in the anode circuit, and is provided with a resistance across the primary for reasons which have already been pointed out in these pages in the articles on Q.P.-P. The anodes of the output valves are coupled by means of an output choke which is provided with four separate output tappings, so that the impedance may be correctly matched to the particular loud-speaker, which is employed with the receiver. The remainder of the circuit is quite straightforward, except, perhaps, for the introduction of a potentiometer across the grid-bias battery to ensure that this is discharged at the same rate as the H.T. battery and so maintain the balance between the Q.P.-P. valves.

THE PILOT GUARDIAN 4-VALVE Q.P.-P. KIT

Assembly

The assembly of the receiver is extremely simple, and according to the instructions, the panel should first be assembled, a task which can be completed in less than half an hour. The baseboard components are next screwed down, and the screen is left until last. The complete assembly, ready for wiring, may be carried out within an hour, so that there is nothing tedious or difficult about the work. All screws are provided, and a penknife, screwdriver and pliers are the only tools required. Wiring, as with any receiver, is a job which must be carried out intelligently, and the large sheet accompanying the kit explains the wiring, in stages. For instance, the first point to be wired is explained thus: "1. 'E' terminal to F— of Valveholder V.1." This detailed method of explaining the wiring is carried out right through the set and therefore no wireless knowledge of any sort is required to enable it to be completed. The balancing of the pentodes is also very clearly explained, and although a meter is suggested to enable the current readings to be obtained, this may no doubt be easily obtained for the purpose of adjustment. Messrs. Peto-Scott supply two meters for the purpose, one at 10s. and one at 7s. The details given for matching are very complete, and, of course, once carried out there is no further need to touch them.



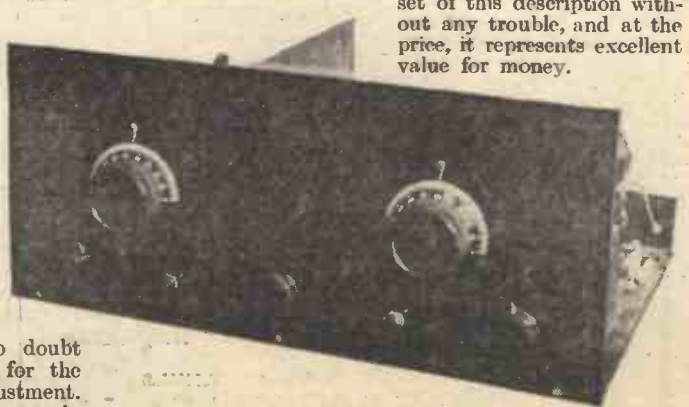
Rear view of the Peto-Scott Guardian 4-Valve Q.P.-P. kit assembled.

The wavebands covered by the receiver are 200 to 600 and 1,000 to 2,000 metres. The provision of a small adjustable condenser in the aerial lead enables the selectivity to be adjusted.

The panel also contains a reaction condenser, an adjustable anode coupling condenser, in addition to the two tuning condensers. With the left-hand condenser fully in mesh, the selectivity is poor, and signal strength is greatest. The central knob also varies the selectivity, and the combination of these two knobs will enable the receiver to be adjusted for practically any locality. Tested in the centre of London, in a bad district, quite a number of stations could be tuned in on the loud-speaker, and on the London stations the volume was fully up to what is expected of pentodes in quiescent push-pull. A moving-coil loud-speaker was fully loaded, and gave more than sufficient volume for the home. The adjustment of the two condensers, already referred to, enabled a very complete control of selectivity to be obtained.

Gramophone pick-up terminals are provided on the rear of the baseboard, and, as there is no switch, the pick-up must be fitted with a switch at a convenient point on the motor-board.

The kit is certainly a very good proposition for those who wish to build up a set of this description without any trouble, and at the price, it represents excellent value for money.



Panel view of the Peto-Scott Guardian 4-valve Q.P.-P. kit.

LATEST KITS TESTED

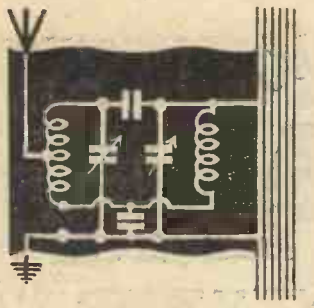
KIT—Pilot Guardian 4-valve Q.P.-P.

MAKERS—Peto-Scott Co., Ltd.

PRICE—Kit "A," £3. 19s. 6d.; Kit "B," £6 18s.; Kit "C," £7 13s.; and Kit "D," £8 3s.

CIRCUIT—Screen grid H.F., detector, two pentodes in quiescent push-pull. Provision for gramophone reproduction.

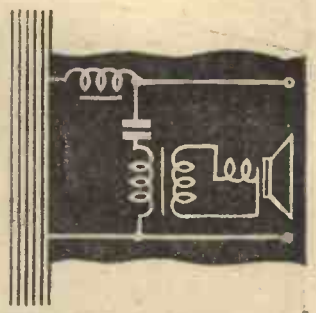
REMARKS—Splendid results at full-room strength from many stations. Quality of reproduction very high. Economical to maintain. The kit may be purchased on hire purchase terms if desired.



RADIO RAMBLINGS

By JACE

Jottings from my Notebook



"Cheap" Receivers

A FRIEND of mine recently "fell" for one of those cheap receivers frequently advertised by some of the large Departmental Stores in the daily Press. He thought he had secured a wonderful bargain in obtaining a four-valve all-mains set for ten guineas, and was most annoyed when I told him that he had made a foolish purchase. Anyhow, the set duly arrived, and on connecting up it worked—but oh! what quality (?), and what mains hum! Distant stations could be brought in, but only very few of them were free from interference by the "local" about fifteen miles away. I do not say that this set is typical of all the cheap sets advertised, but very few are worth buying. Most of them are nasty, jerry-built affairs, entirely without a guarantee of any value, and when anything goes wrong it is practically impossible to have repairs done, partly because the components are inaccessible and partly because the average dealer and repairer has no knowledge of the receivers. Even if he had, it is scarcely likely that he would care to associate himself with an instrument he knew to be "shoddy."

Half or Full-Wave?

I AM often asked whether it is better to employ full-wave or half-wave rectification in an A.C. mains set or eliminator. Theoretically, a full-wave rectifier is more efficient, but the difference between the two systems in this respect is not very great in practice. A more important consideration is that of mains hum, and when the supply is at a frequency of 50 cycles, hum is often less pronounced when rectification is on the full-wave principle. The reason is that the D.C. "ripple" is then at 100 cycles, and the smoothing circuit is rather more effective in consequence. It might appear that the same argument would apply in the case of 50-cycle mains, but there is another little point to consider. A 25-cycle hum (such as would be produced by half-wave rectification) is not so easily detected by the ear, nor so well reproduced by the loudspeaker, whereas a 50 cycle note is much more conspicuous. The main objection to half-wave rectification is that a more efficient smoothing circuit is required and thus either larger chokes or more condensers are necessary.

Short-wave "Transmitters"

I RECENTLY ran up against a rather peculiar form of interference that might be new to some readers. A very sensitive short-wave super-heterodyne was in use, and whilst listening to Schenectady (W2XAD) on 19.56 metres, we were nearly deafened by a horrible mixture of "crackling and fizzling" noises. This went on for a minute or so, and then suddenly disappeared without any alteration having been made to the set. Having had similar experiences before, I at once suspected that the noises had been caused by the ignition system of a motor-car, and inquiry revealed that a neighbour had just arrived home in his Morris Minor. Incidentally, every type of car has its own "wavelength," and can be tuned-in fairly accurately. For instance, the "wavelength" of an Austin Seven is about 18 metres, of a Morris Cowley, 22 metres, and of motor-buses and lorries, generally in the region of 40 metres. The larger vehicles can often be heard even on the broadcast bands, as many readers who live near a main road will know only too well.

Non-corrosive Flux for Soldering

IF you have ever attempted making your own transformers or coils, using very fine wire, you will have found sooner or later that it is often desirable, if not necessary, to solder the hair-like wire to a terminal or to some other wire. When doing this you must be careful not to use a flux that has any corrosive action, for the smallest amount of corrosion will quickly eat through the very small cross section of the wire. A good non-corrosive flux can be easily made by dissolving powdered resin in ether. Ether can be generally obtained from any good chemist, but you must take good care not to bring it near a naked light as it is highly inflammable. Use as little flux as possible in all soldering operations and see that the soldering iron is well tinned before you start.

Variable Mu Valves

IT is astonishing the number of people who overlook the advantages of the variable Mu valves when replacing an ordinary screened grid H.F. valve in their set. It is not possible to find a better form of volume control and still retain all the old characteristics of the old valve. The introduction of this type of valve calls for only a slight change in the circuit. The grid return is taken to a potentiometer having a resistance value of about 30,000 ohms. This component is connected across a grid bias battery of the nine-volt type. In order to get a perfectly equal reduction of volume a potentiometer of the Lewcos or Colvern graduated type should be chosen. It will be noticed, in districts where strong signals from a local high-power station have to be dealt with, that there is no falling off of quality when the volume is reduced to the merest whisper. One of the greatest troubles with H.F. valves is the introduction of cross modulation, and it will be noticed when using this new type that this is reduced to a minimum if not entirely cut out, as it should be if the right type of circuit is used. I should mention a special switch is required in the L.T. circuit to break the circuit when this new addition is made. The connections are shown on the characteristic curve sheets.

Empire Broadcasting

THOSE of my readers who are living overseas, perhaps in one of the great Dominions or Crown Colonies, are now looking forward with a great amount of interest to the time when they will be able to hear News and Concerts from the heart of the Empire. The new station at Daventry is now ready for testing purposes, and before many days are past it may be taken for granted this station will be giving a twenty-four hour service which will enable every part of the world to receive a programme during their evening hours, and in many cases all day long. Doubtless a great number of people are in a quandary of how, and in what way, the best advantage can be taken of this new service. They may wish to know which is the best set, or circuit, to use, or what kind of an aerial is most suited to their particular needs. Well, we folks at home are ready to do our bit by way of helping you, and anyone who cares to write Jace, enclosing a stamped addressed envelope, or post office stamp coupon, to PRACTICAL WIRELESS, Southampton Street, Strand, London, W.C.2, will receive advice in this direction. We people in the Mother Country are hoping that the innovation will bring happiness to all who are lonely, and longing to be in touch with home though separated by thousands of miles of sea or land.

The Mount Everest Expedition

The Westland Wallace machine used for the Mount Everest flight.

PIONEERS OF RADIO–1

A. F. BULGIN & CO., LTD.

In the belief that readers will be interested in the development of those firms who have done pioneer work in Radio, we shall from time to time, under this title, give details of those early firms whose enterprise and vision are largely responsible for the development of Wireless.

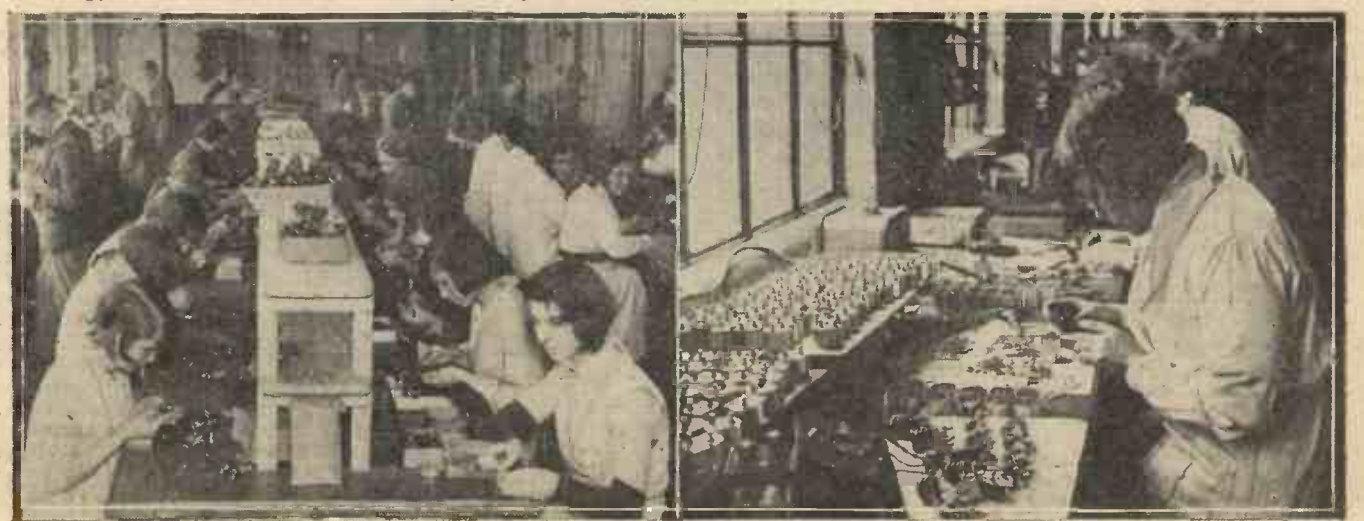
WIRELESS firms come and wireless firms go. Fortunately the basis of a successful industry is not created by the birds of passage who do no pioneering but live, limpet-like, upon the work of others. In almost every case these parasitic appendages to the radio trade (all industries have them) have a short life and not often a gay one, which is, after all, fortunate for those firms such as A. F. Bulgin and Co., Ltd., of Abbey Road, Barking, whose works I recently visited. There is not a wireless constructor who does not know the name. There can scarcely be a constructor who has not used a Bulgin component. They have been in the wireless component industry from the very start of broadcasting, and only a firm with the ideals and outlook of A. F. Bulgin and Co., Ltd., could have successfully survived the vicissitudes through which the radio trade has passed.

A sound reputation for quality and reliability gradually acquired is a far better thing than the forced and somewhat spurious, if short, reputations enjoyed by what I may call the radio jumpers. For the firm of Bulgin knows not the name of junk. There is no need for any radio constructor to use junk when components of the Bulgin calibre are available for the same price, and in many cases below. You cannot all do as I did and visit the works. Fortunately, this famous firm has an excellent shop window in its splendid catalogue, one of the best (and it always has been) issued by the radio trade. It is a text-book, and I recommend all readers of this paper to send the 2d. necessary for a copy. PRACTICAL WIRELESS specifies Bulgin components because in our laboratories we know that they are trouble-free and of impeccable quality. My visit, therefore, to Abbey Road, Barking, was not to satisfy any misgivings on that score, but I must say I was extremely surprised at the extent of the factory, the methodical layout of the plant, the meticulous testing and re-testing, the careful inspection which characterizes this firm's products. Enthusiasm is notoriously infectious, and the human catalyst in the case is Mr. A. F. Bulgin himself, who radiates enthusiasm and exudes energy.

The works of A. F. Bulgin & Co., Ltd.

I was not surprised to find that practically everything is made on the premises, and that special machinery has been created inside the firm to produce its components. Their tool-making department is a revelation in ingenuity, and there is little wonder that when the completed products leave the factory they are one hundred per cent. perfect. It is seldom that a Bulgin component has to be returned because of some defect in material or workmanship. I watched the manufacture of chokes, switches, jacks, indicators, resistances, valve-holders, spaghetti resistances (electrically spot welded at the ends)—there is scarcely a radio component which is not manufactured in the factory. Their catalogue indicates ten years' intensive effort in the production of high-class components. You can examine any Bulgin component and find some little improvement which places it in the first class.

The testing laboratory, under the able direction of a wireless authority, assisted by a band of skilled enthusiasts, is there to test, to guide, and to design. They watch every development and have a lively ear and eye for the requirements of the home constructor. My visit revealed that this is a factory where satisfied customers mean far more than fat dividends. Piloted round the factory by Mr. A. F. Bulgin, I was so interested that we even forgot to stop for lunch, and I shall seek another opportunity of re-visiting and making even closer acquaintance with a firm which bids fair to be in existence as long as radio lasts. A little point: you will notice that an identification slip is in the box containing a Bulgin component. That is proof that the component has passed the rigid tests to which I have referred, and it is also your safeguard. I would repeat, an illuminating visit.—F. J. C.



These illustrations show merely a part of the assembling and testing benches.

'WARE WIRELESS WIRES

Bad Reception is Sometimes Due to Bad Wiring. By "CYNIC"

THE radio enthusiast usually is fairly well versed in many of the most important principles of design and construction. He realizes, for example, the necessity of making good joints and connections within his set, of carefully screening high-frequency circuits and of spacing out components and wires. And then, as likely as not, he breaks all these rules when making the final connections to aerial and to earth, and to batteries or mains unit. By so doing he loses many of the advantages he would otherwise gain from his good design and careful workmanship. This is not the most serious part of the business, however, for loss of efficiency is the just punishment for his carelessness. The main trouble is that his poorly made connections usually are extremely untidy and unsightly into the bargain, they upset the lady members of the family and bring radio into disrepute with housewives in general.

Mend Your Ways

If, therefore, you are one of the number who, either by ignorance or casual untidyness, are doing untold harm to our hobby as well as curtailing your own enjoyment, it is your plain duty to mend your ways. What usually happens is that a new set is designed carefully and built up, and is completed one evening about ten minutes before the local station is due to close down. In his anxiety to run at least a preliminary test, a set of jury connections is rigged up by the excited constructor, such as we have shown in Fig. 1. Rough adjustments to the set are made, the receiver is tested out, found O.K. and put into service forthwith. It is fully intended that the "temporary" connections shall be replaced, squared up and made presentable, but somehow or other the job is put off and a disreputable garland of odd wiring remains to disfigure the sitting room.

Apart from the distressing appearance of untidy wiring, which is quite obvious and needs no further emphasis, very serious losses and technical troubles may arise due to shoddy connections. These may be divided into a number of classes, each of which is worthy of consideration. The first class comprises losses of efficiency due to bad metallic connections and high resistance generally. We have often seen temporary aerial and earth connections made with a number of short lengths of flexible cable or other wires twisted together. Possibly, as a jury expedient for an urgent test, such connections proved fairly satisfactory, but after a period, especially if subjected to movement and handling—to which trailing wires and festoons of connections are liable during the routine cleaning of a room—connections become loose and of high resistance. There will be losses in signal strength possibly voltages will be set up, across poor joints by which, if there is any coupling between the wires and some external source of interference, such as electric light wiring, hum, low-frequency oscillation and other parasitic noises will be multiplied.

A Case in Point

As a case in point arising from haste, let me cite the occasion when a friend of mine called me in to help him ascertain why his wireless reception was so poor. He possessed a three valve receiver which had given good service prior to moving into his new house. In the new situation the only station he could receive was the "local" one, and these signals were far from being up to anticipated strength. Added to this the tuning position for the station was quite different from what it should have been.

Fig. 1.—A set of jury connections usually is rigged up by the constructor in his haste to make the initial test.

Naturally, a very thorough overhaul of the set and auxiliary equipment was made, but here a blank was drawn as everything was quite in order. During the course of conversation, however, I learned that the new aerial had been erected with 7-22 enamelled copper wire. This had been well insulated with the usual porcelain insulators, while the earth consisted of a buried copper plate. In spite of the assurance that this side of the installation was beyond reproach, I took steps to examine the aerial and earth switch, and the respective earth and aerial wires were removed from the switch terminals.

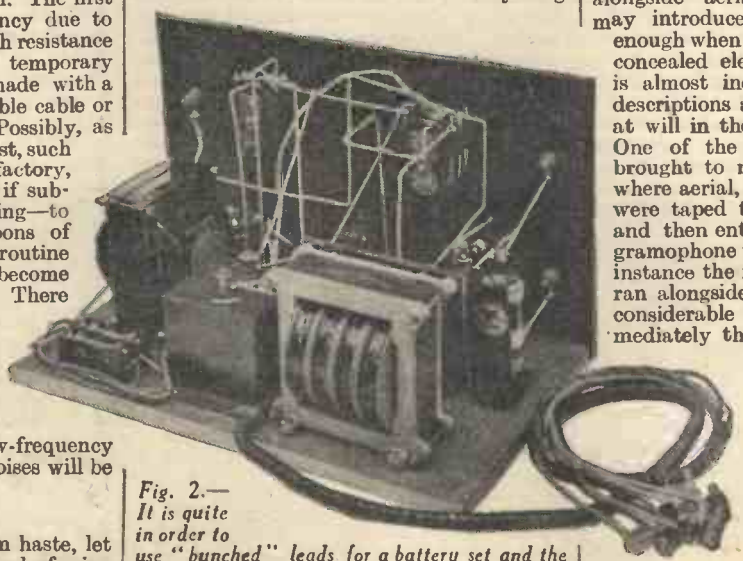


Fig. 2.—It is quite in order to use "bunched" leads for a battery set and the neat effect is shown here.

The trouble at once became apparent. In his haste to get the set working at the earliest possible moment my friend had to admit that the aerial had been erected hurriedly, and he had omitted to remove the enamel insulation from each of the seven individual wires forming the continuous aerial and down lead. This had effectively insulated his aerial from the switch terminal, but it was only the work of a few moments with a piece of sandpaper to remove the offending enamel, reconnect and all was well again.

The First Rule

Poor connections and joints in battery leads will result in cutting down the filament or heater current leading to low emission from the valves and poor performance both by way of volume and quality. Odd bits of thin wire or flex led to accumulators speedily corrode and ultimately contact is broken.

The first rule for the external connections to your set, therefore, is—use good quality insulated wire of ample section, and let each lead be one continuous length without joints. If, for economy's sake, you must join up two shorter lengths, make a good long twisted joint, and then solder it if at all possible, afterwards insulating the joint with good tape.

Another series of troubles is due to "bunched" leads. If several cables carrying the different currents employed in a radio receiver are arranged close together side by side, especially over a considerable distance, mutual induction between the circuits will take place, and the current in one circuit will be modulated by the changes in current in another circuit. Thus, a wire carrying A.C. mains current, either as the supply to an eliminator or low tension A.C. heating current, if run alongside aerial, earth or H.T. leads, may introduce serious hum. It is bad enough when such induction occurs due to concealed electric light wiring, but hum is almost inevitable when leads of all descriptions are allowed to trail or hang at will in the neighbourhood of the set. One of the worst instances that was brought to my notice the other day was where aerial, earth and A.C. mains wires were taped together for over three feet and then entered the cabinet of a radio gramophone through one hole. In another instance the flexible lead for a table lamp ran alongside the earth wire and caused considerable hum, which was cured immediately the lamp wire was moved.

Annoyance and Danger

There are, of course, many wires which it is perfectly safe to bunch. In a battery-operated set there is no harm in running both high tension and low tension leads (and G.B. leads, if this battery happens to be external to the set) in one composite cable such as is shown in Fig. 2, which illustrates an output stage unit. Do not adopt this practice, however, in a mains set. The heater wires must be kept away from all other wires, and should be of thick twisted flexible, preferably metal screened.

(*Continued on next page.*)

'WARE WIRELESS WIRES

(*Continued from page 78.*)

So much for the technical disadvantages of badly-arranged wiring. There are, in addition, other points calling for equal consideration. Trailing wires are a source of considerable annoyance and even danger. They are apt to catch in people's feet, either tripping them up or pulling the receiver, batteries or speaker down on to the floor and resulting in considerable damage either to the apparatus itself or to carpets due to spilled acid. Then again, a long supply lead from a distant plug or lamp holder, used for an A.C. mains set or an eliminator, is not only inconvenient because it necessitates a journey to the opposite side of the room when it is required to switch the set on or off, but should it become disconnected or broken may cause a short circuit, blowing the house fuses and possibly causing other damage.

When installing a mains set it costs very little extra to have a plug fitted in a convenient position near the receiver so that a short and neat flexible wire is all that is necessary for connecting the set to the mains. At the same time, it is best to have an independent switch fitted at the plug point if no switch is incorporated in the set, as it is highly inconvenient as well as somewhat dangerous, to manipulate a live plug in an obscure and inaccessible corner every time it is required to switch the set on or off.

Out of Sight

We now come to the problem of neatening the external wiring to the set. It should be a golden rule that all wires must be, so far as is practicable, out of sight as well as short, and of ample section. Such wires as earth lead, loud-speaker extensions and so forth, can be fastened to picture rails or skirting boards with insulating staples, and will then be inconspicuous and safely tucked away. Battery leads, however, present something of a problem which is, moreover, bound up with another, namely that of where the batteries are to be located. No stretch of imagination can make an accumulator and a high tension battery objects of beauty, yet they are essential and must be accommodated fairly close to the receiver.

If the set is a radiogram, or is housed in a capacious cabinet, there will probably be room for the batteries inside. If not, there are several alternatives. It is sometimes possible to have a small pedestal cupboard specially for "the wireless" when the set and loud-speaker can stand on the top and the batteries may go inside. In other cases, the receiver may be located within a few feet of an existing cupboard wherein room may be found for the batteries. Many sitting rooms, however, are without such convenient features and some attempt must therefore be made to camouflage or conceal the unsightly if necessary batteries.

One scheme is to make a battery box big enough to hold all the batteries and to place this in the most inconspicuous position available near the set. Possibly it may be hidden behind some other piece of furniture. In such a case it should be possible to run the connections from the set to a point a few inches from the battery box, neatly fastening the wires to the wall or skirting and leaving just sufficient slack for the connections. Or the box may be fitted with terminals and plug connections inside to permit run down or exhausted batteries to be removed without disconnecting the main wires.

Failing any method of concealing batteries, they should be placed adjacent to the wall, and as out of the way as possible, with the wires run to them from the set in the neatest manner. A wooden block with suitable plugs and sockets fitted close to the batteries may terminate the permanent wiring, the actual connections to the batteries being made by plugs and flexible leads.

THE COLD VALVE

(*Continued from page 65.*)

Then at greater signal strengths than that corresponding to the pre-set potential of the potentiometer, the control becomes fully operative and reduces the signal to the proper level.

This effect is shown in simple diagrammatic form in Fig. 5, where it is possible to make a comparison between the two methods. In passing, it should be noted that the resistance value of the potentiometer shown in Fig. 4, should be such that the total voltage drop across it, due to the total anode current, is about 10 volts.

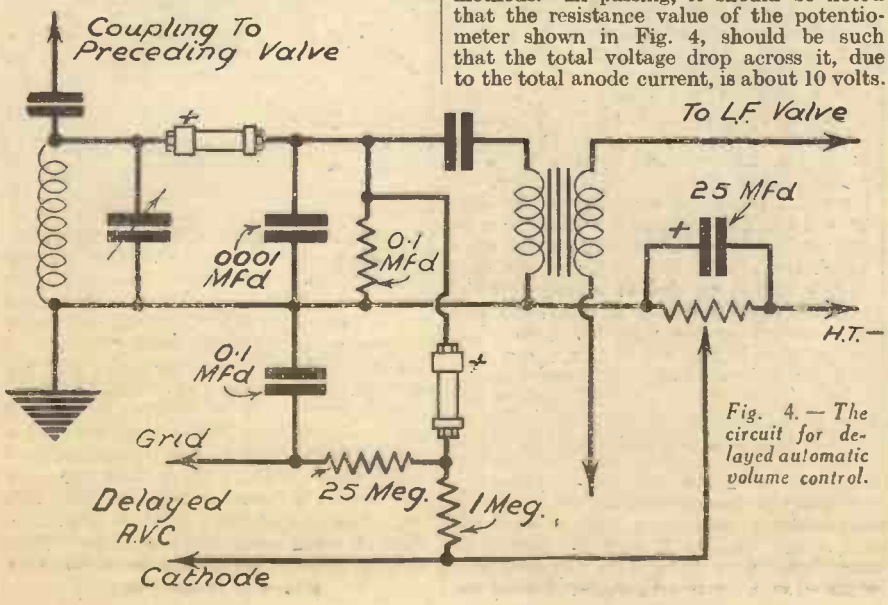


Fig. 4.—The circuit for delayed automatic volume control.

SHORT-WAVE SECTION

THE EELEX CONVERTER

SHORT-WAVE

The Eelex short-wave 8-pin reversible coil and base.

WE have several times drawn attention to the fact that a short-wave adaptor and a short-wave converter are totally different pieces of apparatus, and it would perhaps not be out of place to once again point out just what this difference is. Both pieces of apparatus employ a single valve, together with a coil. In the adaptor, however, a grid leak and condenser are also included, so that the circuit of an adaptor is simply that of an ordinary single valve detector, with the coils so chosen that it tunes to the short-waves only. The output circuit of this adaptor is supplied by means of a four-pin plug, and this is fitted with pins of the same size, and with the same displacement as a normal valve base. To use the adaptor, the detector valve is removed from a normal broadcast receiver and the plug of the adaptor is inserted in the valveholder in place of the detector valve. The latter is inserted in the holder in the adaptor, and the effect of this is that the adaptor becomes the tuning side of the normal broadcast receiver, with amplification carried out by the L.F. stages of this receiver. Obviously, if the broadcast receiver employs one or more H.F. stages, these are not brought into operation with the adaptor, and the complete arrangement therefore consists of a detector valve plus L.F. stages. The converter, however, is a much more elaborate piece of work. It still employs a valve and coils, together with the four-pin output plug arrangement. The method of connection employed in the converter, however, makes the valve act as a detector *plus* an oscillator valve, and the effect of this is that a signal received by the aerial and passed into the converter has its frequency changed to some value which is fixed by the design of the coils. If now this is coupled to a receiver which employs high-frequency stages, these may be adjusted to the wavelength to which the original signal was changed, and they may be employed to carry out amplification of this new signal frequency before passing the signal on to the detector valve for rectification and subsequent L.F. amplification. Such an arrangement is obviously much more efficient than a single detector and L.F. arrangement.

The Converter Chassis

The Eelex Converter, manufactured by Messrs. J. J. Eastick and Sons, employs this arrangement, and this is a most efficient piece of apparatus, being entirely self-contained. There are many readers, however, who do not wish to add another cabinet by the side of their existing receiver, and yet who would like to take advantage of this method of obtaining long-distance short-wave signals. The converter chassis illustrated on this page is the solution to their problem, and Messrs. Eastick are to

The Eelex short-wave converter chassis.

be congratulated in putting this useful accessory on the market. It consists, as can be seen, of a bakelite base, fitted with valve-holder sockets, coil sockets, a change-over switch and terminals. Inside the base are the other necessary components, and all the wiring, a cover being fitted to prevent damage or the accumulation of dust. The chassis may be screwed to the baseboard, or on the inside of a cabinet, of the normal broadcast receiver, and connected up to provide the superheterodyne short-waver, with the added advantage that the small change-over switch shown on the left of the chassis may be brought into operation to convert the apparatus, when desired, into the normal broadcast receiver. An additional single-pole change-over switch, a small variable condenser, and a reaction condenser are also needed to complete the converter circuit, but as the chassis only costs £1 15s. the conversion is not an expensive proposition.

Special Coil

Attention must also be drawn to the novel form of tuning coil which is used with this chassis. It is shown separately, with its base, and it will be seen that eight pins are used on this coil. The arrangement of the pins, however, permits of the coil being placed on the base in two different positions. The coil, which is the same as that used in the converter, covers two separate wave-bands, one from 15 to 30 metres, and the other from 28 to 60 metres. To change the range, the coil is simply removed from the base, given a turn and replaced in the alternative position. This removes one of the great defects of short-wave work, and enables the losses introduced by switches to be done away with. The coil, with base, costs 7s. 6d., and a .0002 mfd. tuning condenser is required to cover the two wave bands mentioned.

MY OPINION! By the Editor

"Practical Wireless,"
8-11, Southampton Street,
Strand, W.C.2.

My Corner

THE vast amount of correspondence I receive each day often raises questions which are the better for being aired. Hence this new weekly corner. The title is not meant to be provocative—and if you disagree with my opinions, you may rely upon equal prominence being given to the opposite point of view. Our policy is a simple one—service to the reader, and the leading position now occupied by PRACTICAL WIRELESS indicates that the policy is not only *right*, but that it was *wanted*. Our contents are *practical*, free from guff and unhampered by trade interests. I merely mention this in case *you* are a new reader and have missed earlier announcements.

Knobs

MILLIONS of words have been indited about knobs, and the problem of whether a wireless set should have one or many is still unsolved. I can sympathise with the nonplussed reader. He has been accustomed to advertisements which tell him to drink more milk, drink less milk, eat more fruit, eat less fruit, eat less meat, eat more meat, to spend more, to save more (truth in advertising, eh ?), and now wireless adds to the confusion. At one moment experts tell him that the future radio set will only have *one* knob, and then they produce designs with half a dozen or more ! Take *my* word for it—only a very few sets in the future will have "one-knob control" unless the public is prepared to have one-station receivers. Almost every listener has a different viewpoint; some are nomads, others are complacent stay-at-homes—ethereally speaking. Hence —the knobs !

Summer-time Radio

WIRELESS constructors in the past have been encouraged to make their hobby seasonal. A certain section of the Press has spoon-fed them with designs for a few months, and left the summer season alone, save for a few sparkling literary diapasons from alleged journalistic wags. PRACTICAL WIRELESS is going to show you how to enjoy radio the whole year round. Open-air radio will form a strong platform in our policy, and *real* outdoor radio at that !

Our Specifications

A READER who evidently has become accustomed to the parenthetical catalogue of the entire component industry which nowadays goes under the name of specification, recently sent me a letter complaining of a "whistle" in the "Fury Four" he had constructed. He applied to me, under my personal guarantee, to help him. Investigation showed that *he had not used one single component specified*. I went to enormous trouble to get the "Fury Four" right, and this reader (I hope there are not others) wastes a lot of money and time getting it wrong !

Another reader adhered to the specification and then *added* to it, thus upsetting the balance of the whole circuit.

F. J. C.

BINDING CASES AND INDEX FOR VOL. 1 OF "PRACTICAL WIRELESS."

Regular readers of PRACTICAL WIRELESS who are anxious to keep their copies in a permanently consultable form, will be interested to know that binding cases, title page and fully cross-referenced index will be available shortly at the nominal price of 2s. 6d. (by post 2s. 10d.). The index separately will cost 4d., post free. Volume I of PRACTICAL WIRELESS comprises twenty-six issues, commencing with No. 1 (dated September 24th, 1932) to No. 26 (dated March 18th, 1933). The illustration shows the really attractive style of binding case supplied. It is of rich royal blue art book cloth, boldly lettered on the shelf and front side with Peerless Silver Leaf. These binding cases and semi-annual indexes have been produced for the convenience of the reader so that he can readily turn up the particular article to which he wishes to refer. Postal orders should be addressed to:

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The Bound Volume of "Practical Wireless."

THE ABC OF SELECTIVITY

(Continued from page 54).

sometimes cause a slight hissing background to reception it is usual to use from 1,000 to 5,000 ohms.

The circuit (Fig. 5 (c), is not very much used, but I have included it in case you would like to try it. As the coupling condenser is across the "top" end of the coils it must be very small indeed, otherwise the coupling will be too great. About 2 micro-microfarads will be required. By using a neutralizing or trimming condenser of about .00004 mfd., and with a very low minimum capacity, you can vary the coupling until a suitable value is arrived at.

Pros and Cons

Now let us see what are the comparative merits of inductive and capacitative coupling. Well, first of all they each have opposite characteristics. For instance, with inductive coupling the tuning is more selective but less efficient on the long-wave end of the tuning range, while with capacitative coupling the tuning is sharper and the signals somewhat weaker on the lower end of the tuning scale. On the face of things, therefore, it would appear that the ideal arrangement would be a combination of the two systems and, indeed, many commercial designs do actually use a mixed coupling. However, there are certain cases where either purely capacitative or purely inductive coupling is most suitable. To give but one example: Where other tuned circuits follow which are more selective on the long-wave end the use of capacity coupling, which is more selective on the short-wave end, would be the best, as it would then compensate for the deficiency in the other circuits.

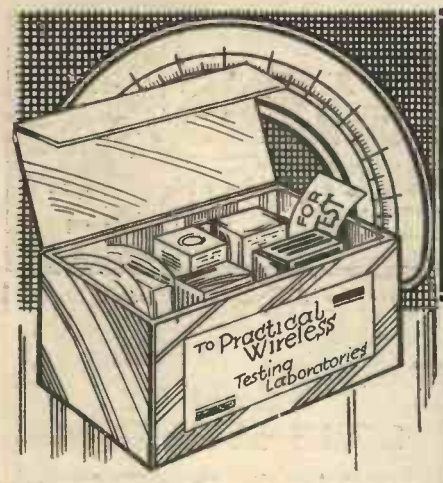
Still another method, which I ought to mention before leaving the subject of couplings, is that in which a resistance is used. It is of the order of 100,000 ohms and is connected between the top end of the two coils in the same way as the condenser in Fig. 5 (c). This arrangement is employed in a certain patented tuner, and as regards the maintenance of a constant degree of selectivity and sensitivity over the whole tuning scale it is ideal, since with a resistance the degree of coupling is constant for all frequencies.

How to Make a Band-pass Tuner

Those readers who would like to try out the advantages of band-pass tuning with an ordinary det. and 2 L.F. type of set, but who do not wish to go to the expense of a bought unit, might care to construct the two coils shown in Fig. 3. The coils should be mounted with their axes at right angles, and should be at least 3in. apart, as in Fig. 6, so as to ensure negligible inductive coupling. Coupling is then provided by means of the .01 mfd. condenser shown. The circuit is given in Fig. 7. A .0003 mfd. series aerial condenser is used, and by careful adjustment of this the two tuning condensers, which, of course, should be of the same make and type, can be made to track together over practically the whole scale.

Those of an experimental turn of mind will no doubt want to try the effects of slightly different coupling-condenser values, and also the production of a mixed filter by altering the angle of the coils and so introducing a certain amount of magnetic interaction. In the case of a mixed filter a larger condenser, say, about .05 mfd., will be necessary.

Before concluding I must say a word or two about reaction with band-pass filters. To screw up the reaction to the limit in a set employing this type of tuning is to defeat the whole object of the design! This is because too much reaction tends to destroy the true, square-peak character of the response curve and to make it pointed. Of course, it will increase selectivity and sensitivity (providing the circuits are properly tuned), but will introduce sideband cut-off—the very thing the B.P. filters are intended to prevent.



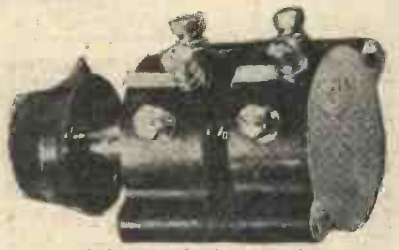
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

BULGIN DUAL CONTROL

THE illustration below shows the new ganged volume control manufactured by Messrs. Bulgin. These controls are rated at 3 watts, are wire-wound, and a novel feature is the inclusion of a metal back plate, which is not connected to any part of the apparatus. It may thus be earthed to provide a shield. The shafts of these controls are of the standard ¼in. thickness, so that any standard knob will fit. The units are obtainable in any values, and the prices of the individual resistances, from 500 to 100,000 ohms, vary from 3s. 6d. to 4s. 6d. A further model is made which is fitted at the end with a quick-make-and-break switch, and this will find a number of applications in the normal receiver.



Bulgin ganged volume controls.

TELSEN BAND-PASS COILS

THE illustration gives a good idea of the new Telsen band-pass coil units which are now obtainable in several forms. That which is illustrated is the standard input band-pass unit suitable for use in the aerial circuit. The medium wave-coil is wound at the upper portion of the air-spaced former, whilst the long-wave coil is pile wound in the slots at the lower end. No actual connections are made in the coils, and, as a small separate inductance is included, it is possible to use these coils for any form of band-pass coupling. The inductance of the medium-wave winding is approximately 160 microhenries, whilst for the long waves a value of 2,170 microhenries is provided. The wavelengths covered are from 200 to 560 metres and from 740 to 2,100 metres, assuming the use of .0005 mfd. tuning condensers. The units are complete with base plate and switch rod, and, in addition, a neat escutcheon, fixing screws, etc., are provided.

The new Telsen band-pass coils.

RIVERSIDE ELECTRIC CLOCKS

MANY listeners already possess clocks of the synchronous type, operated from the electric-light mains. There are many others, however, whose houses are not fitted with the electric supply, and who would like a clock which requires no winding or other attention. The Riverside clock operates by means of a small grid-bias battery which will last for months. It is a very accurate time-keeper, and the current consumption is extremely small. The front of the clock is provided with a flange, so that a small hole may be cut in the front of a wireless or loud-speaker cabinet, and the clock held secure by means of the clamping bolt supplied with it. The front is nickel plated, and a small screw in the centre of the glass enables the hands to be adjusted when desired. The price is only 12s. 6d.

EELEX TEST PRODS

IN our issue dated March 18th we commented on the Eelex test prods, and mentioned that the price was 2s. We now understand that this was an error, and that the price should be 1s. 9d. each. Will readers kindly note this?

GRELCO LAMP ADAPTORS

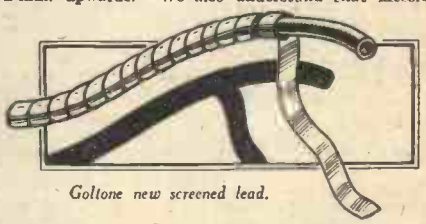
IN the article on a Radio workshop which recently appeared in our pages, one or two ingenious methods of obtaining more than one electric light supply from a single socket were shown. We are now informed that Mr. E. J. Clarke, of 70A, Norton Road, Wembley, Middlesex, has obtained a number of these adaptors in a commercial form. Samples which have been submitted to us prove very interesting. One form, in brown bakelite, consists of a "V" shaped moulding having two pins at the lower point of the "V" and two sockets on each end of the opposite side. It may, therefore, be plugged into a normal 5-amp point and two separate leads taken from the opposite side. This would allow, for instance, a lamp and a soldering iron, or any other combination desired. Another adaptor is shaped something like a lettter "M," and is provided with three sets of sockets and one set of pins, so that three different articles may be used from the one point. Owing to the angle of these pieces, normal round top plugs may be used without any risk of one adaptor fouling another. Naturally, where a large number of items are required on the same point, one adaptor may be inserted in the other. The price is only 1s. 6d. Another form of adaptor has an ordinary bayonet lamp-holder at one end, whilst the opposite end is finished to enable it to plug into a normal lamp-socket. At either side of the moulding are two sets of sockets which take the normal 5-amp two-pin plug. This also will be found very useful in the workshop.

FOTOS VALVES

WE have received samples of the Fotos vales for test, and these are now manufactured in this country. The valve chosen for test was Type BD 9, which is a power valve. The impedance is 3,600 ohms, and the amplification factor is 9. The valve is rated to take up to 200 volts H.T., and the filament consumption is .32 amps. at 2 volts. With a slope of 2.5 mA/v., this is a very good valve, and tested in a normal three-valve receiver gave very good results both from the point of view of quality and volume. The price is only 6s. 6d. H.F. valves are obtainable from 5s., and detector valves from 5s. 6d.

GOLTONE ARMOURED SLEEVING

THE new type of screening lead now produced by Messrs. Ward & Goldstone is shown on this page. Instead of the usual plaited wire sleeving, this new material consists of a thin strip of tinned copper wrapped in spiral form round ordinary varnished tube of the systoflex type. The adjacent turns of the copper are allowed to touch, so that the effect is a perfectly continuous metallic surface. The advantages claimed for this particular idea are: greater flexibility; easy baring of the end for connection purposes; no wire ends to pierce the inner tube and cause short-circuiting; and, finally, it is much simpler to complete the earth connection. All that has to be done for the purpose is to unwrap the end few inches as shown in the sketch, and take the copper to the nearest earthing terminal. We understand that the material will be available in yard lengths in sizes from 2 mm. upwards. We also understand that Messrs.



Goltone new screened lead.

Ward & Goldstone have now introduced a department to deal with the question of interference elimination. We have already commented upon their interference chokes, screened aerial leads, etc., and in view of the number of individual cases which arise, in which the listener is in doubt as to what course to pursue to remove some form of interference, the department referred to has now been introduced. A further component which has just been produced is the screened H.F. choke shown in the lower right-hand corner of this page. This is the type S.H.F., costing 4s., and is intended for use in the anode circuit of H.F. valves. It has an inductance of 250,000 microhenries, a D.C. resistance of 550 ohms, and has many applications in H.F. stages. The current-carrying capacity is approximately 50 mA.

MAGNUM SHORT-WAVE ADAPTOR

WE have received details of a new Magnum product from Messrs. Burne-Jones & Co., Ltd. This is actually a super-het converter, although it bears the name usually associated with ordinary short-wave adaptors. As such it must be employed, of course, with receivers which already employ an H.F. stage. The converter is complete with two coils covering the wave-bands of 18-30 and 40 to 80 metres and battery cord, at which the price is £2 5s. If purchased complete with valve, H.T. and L.T. batteries, the cost is £3 3s. As the Converter employs its own separate H.T. and L.T. supply, it is entirely self-contained and may, therefore, be used with any receiver possessing an H.F. stage, and it may be either battery operated or mains operated, English or foreign. Two leads are provided for connection to the aerial and earth terminals of your present receiver and the latter has to be adjusted to the long waves, whilst the adaptor is used to tune in and heterodyne the desired signals. In view of the fact that the existing receiver is employed as an intermediate frequency amplifier, it must be remembered that the unit will not function with receivers which are designed to cover only the medium wave-band.

Goltone screened H.F. choke.

Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by his correspondents.

"Doing a Great Service"

SIR,—After taking your fine paper, PRACTICAL WIRELESS, since its commencement, I feel I should be doing an injustice to the fine Editorial and Technical staff behind it by not at least showing a little appreciation. I have been an experimenter this last ten years, and have had brought to mind a number of successes and failures in the past by reading twelve years of Radio Progress. I have not to refer very far back to the time when the majority of commerical components were entirely out of the reach of my pocket, and one had to resort to making their own. We had no PRACTICAL WIRELESS, and no Data Sheets in those days, and most information I derived from pamphlets issued as adverts by Radio Manufacturers. How PRACTICAL WIRELESS would have been appreciated in those days, with its fine constructional articles. But to-day, it is doing a far greater service to the ever-growing number of enthusiasts, by dealing with most advanced radio in an elementary way. I have read with great interest the article, Is Reaction Necessary? by Mr. H. J. Barton Chapple. It is a fine example of the practical value of the contents of your fine paper. Wishing PRACTICAL WIRELESS, and Staff every Success.—H. B. PEGRAM (Bootle).

The Development of Tuning Coils

SIR,—May I prefix my remarks by saying that I believe your staff to be really first-class men in Radio and that no comment of mine is made in any disparaging sense, but just an adverse criticism by an onlooker.

H. J. Barton Chapple has taken up many valuable pages during the past few weeks ruminating on coils, etc., that have been consigned many moons ago to the museum. May I humbly suggest that he uses his very facile pen and extensive knowledge in getting down to brass tacks on present-day problems in concrete form. Take the issue for February 25th, two pages are used on the (sic) New Development in Coils that was in principle used to my knowledge over a dozen years ago. See Dr. J. A. Fleming's book, "The Thermionic Valve in Radio Telegraphy and Telephony," page 231, paragraph 2. His suggested method of tuning I saw used at GED thirteen years ago. Now for Constructive criticism. When you publish details for constructing your really efficient coils, etc., why do you not at the same time include the figures you have had under consideration in order to give us the finished product?

For example:—

What governs your choice of a particular former, wire, and number of turns.

How do you arrive at the L.C. required, and what correction factors do you use when taking into account distributed or self capacity and the mutual induction present when aerial coil and reaction coil are used? What is the dynamic resistance—in short, sir, tell us *all* about it. Or do you only use abacs?

H.F. Chokes that are efficient on 20 to 2,000 metres, what per cent. H.F. energy will be "passed over" on the 15 m.c. band due to the *Capacity* from *Terminal* to *terminal* plus the winding? I have seen but little information published. You have got almost a corner in Radio brains—please don't hoard them.—ALBERT L. BEEDLE (Balham, London, S.W.).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT a new type of valve base is being developed, and that it will be provided with seven pins, in place of the customary four.

—THAT for Class B amplification no grid-bias of any sort is required.

—THAT apparatus is obtainable which enables gramophone records to be broadcast from one room to another, and picked up by your receiver in the same manner as wireless.

—THAT such apparatus is termed a Modulated Oscillator, and employs only one valve.

—THAT the resistance for a variable-mu type of valve should preferably be of the "graded track" type so as to provide more even control of volume.

—THAT the voltage across a grid-biasing resistance should not be measured, but should be calculated from the current flowing through it.

—THAT when the coupling components of a band-pass filter are short-circuited, no signals should be obtained.

—THAT if signals are obtained under the above conditions, it points to the fact that stray couplings exist.

NOTICE.

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

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

[*Mr. Albert L. Beedle has rather misread the article on coil development to which he refers. Of course, the* principle *is old, we* all *know that, in fact, I gave readers due credit by stating in passing "the use of iron or magnetic cores for coils is by no means new." What is new, however, is the* commercial *application of this principle in a form which can be used by the radio man so that its advantages are not outweighed by its disadvantages. That this has been a difficult task is borne out by the fact that so many years have passed since the idea was first mooted before a really practicable product has become possible. The same remarks apply to the method of tuning to which I referred—old in principle, yes, but new inasmuch as it has only now become really possible, hence the justification for being new.—H. J. Barton Chapple.*]

A Reader's Thanks

SIR,—Many thanks for the very useful and handsome binder, which I duly received under your very generous gift scheme. It is just the thing for the amateur who wishes to keep his data sheets handy yet compact. The pocket which is provided is a very useful asset. I for one hope you will continue with further gift schemes as far as possible, also with handy gadgets and useful tips, as such are always appreciated by the average reader and enthusiast. Wishing you every success in the future with such an excellent paper.—JAMES D. MENZIES (Merton Abbey).

A Satisfied Reader

SIR,—Although only a new recruit in the intricacies of wireless, I hope you will allow me to thank you and your staff for the weekly budget of information published in the valuable and well-edited paper, PRACTICAL WIRELESS. I have taken the paper from No. 1 and shall have them bound at the end of the volume. I would also like to convey my great delight and amazement at your wonderful book of knowledge, the "Wireless Encyclopædia." Its clear and precise way of explaining the terms of all the subjects dealt with should make it invaluable to all beginners and amateurs.—F. G. WEBSTER (Worksop).

"Many Hours of Interesting Reading"

SIR,—Please accept my thanks for the Wireless Constructor's Encyclopædia, which I have just received. I am surprised at the quality and quantity of its contents, and am looking forward to many hours of interesting and useful reading. It makes a good companion to your estimable periodical PRACTICAL WIRELESS, with which I have spent many pleasant hours at sea. Wishing you every success.—THOS. H. LUMSDEN, Chief Engineer, s.s. *Teakwood* (West Mersea).

(*Continued on page 86.*)

PRACTICAL LETTERS

(*Continued from page 85*)

The "Fury Four"—Excellent Results

SIR,—It may interest you to know that we have built the "Fury Four" from the circuit diagram first published together with the two photographs shown. We think that the set will evoke much interest, the layout and the results being excellent. We have demonstrated all the sets designed in your periodical, and intend to continue doing so.

We must certainly compliment Mr. Camm for his unprecedented action in personally guaranteeing his own circuit, which others have never attempted to do. With every good wish.—R. DANEBY, OLYMPIA RADIO LTD. (Bolton).

A Reader's Appreciation

SIR,—I am writing to express my appreciation of your paper in general, and in particular the article on Making a Dual Cone Loud-Speaker, by T. Stevens, in the No. 9 issue. I made up this loud-speaker, not expecting much, as I have read such articles before, but I was astonished at the results on the first test and heartily endorse all the author said about it. The results are all that could be desired, the depth of tone is excellent, and the bass is there without the attendant boom attached to most moving-coil speakers. I am using a balanced armature unit which is several years old, but, nevertheless, the results more than justify the trouble in making it up.

Wishing PRACTICAL WIRELESS every success.—HERBERT H. TOOTH (Salop).

RADIO CLUBS & SOCIETIES

BEC RADIO SOCIETY

On Thursday, March 2nd. Mr. S. Stevens, B.Sc., gave a lecture on the "Westector" to members of the Bec Radio Society at Bec School, Beechcroft Road, S.W.17. Commencing his lecture, Mr. Stevens briefly outlined the principles of rectification at power frequencies, and then dealt with the application of metal rectifiers in connection with measuring instruments. Following this, members were treated to a lucid explanation on the subject of leaky grid rectification, during the course of which a series of entirely new lantern slides dealing with the chief points were displayed. The merits of Diode detection and the advantages following the inclusion of a "Westector" unit in such circuits, and in superheterodyne circuits, and as a means of providing automatic volume control, were each considered separately. The meeting concluded with the Westinghouse film on "Metal Rectifiers" being shown. Hon. Sec., Mr. A. L. Odell, 9, Westway, Grand Drive, Raynes Park, S.W.20.

THE CROYDON RADIO SOCIETY

The Society enjoyed an informal debate on "Are Short Waves Worth While?" at a recent meeting. It was soon realized that, although some did and others did not like short waves, the young members showed their approval of them in no uncertain manner. For instance, Mr. F. Betteridge spoke as an expert, for he had recently achieved fame by the demonstration of his unique short-wave set to the Society. He considered that short-wave reception was comparable to that of the medium waves ten years ago, and wondered if in ten years time reception on twenty metres would be as universal as on the medium wave band to-day. Certainly, its apparatus would be simpler, he maintained. The meeting ended with a lively discussion on the pros and cons of short waves. Hon. Sec., E. L. Cumbers, 14, Campden Road, South Croydon.

BURTON-UPON-TRENT AMATEUR RADIO SOCIETY

A very interesting evening was spent by the members of the Burton-upon-Trent Amateur Radio Society on March 7th, when Mr. P. W. S. Valentine gave a lecture on L.F. amplification. The lecture was illustrated by means of a twin two-stage amplifier with interchangeable components, so that by means of frequency records it was easy to judge the difference in response in different forms of L.F. coupling by means of quick switching from one amplifier to the other. The Society would welcome new members, and all applications should be sent to the Hon. Sec., W. A. Mead (G5YY), "Addiscombe," Burton Road, Branston, Burton-on-Trent.

PROPOSED CLUB FOR BLACKPOOL

It is proposed to form a Radio Club in Blackpool, and any interested readers residing in this town are invited to write to Mr. G. F. Howard, 43, Cumberland Avenue, Blackpool.

THE SIDCUP AND DISTRICT RADIO AND TELEVISION CLUB

At a meeting held on March 8th, the President, Mr. E. W. Higgs, M.Inst.B.E., presided whilst a talk on "Television" was given by Mr. E. G. H. Mobsby. The following week, Mr. T. W. E. Towers lectured on "Elementary Principles of Magnetism and Electricity," and demonstrated several effects with the aid of an electroscope, induction coils, and magnets. This was followed by a lecture on "Quiescent Push-Pull" by Mr. B. T. Wednure, who explained the system very thoroughly. Intending members are cordially invited to communicate with the Hon. Sec., T. W. E. Towers, 22, Crombie Road, Sidcup, Kent.

SLADE RADIO

A lecture on "Dual Speaker Equipment" was given by Mr. G. T. Peck at a meeting of the above Society held last month. He first of all described the set which had been designed for his own particular requirements, and which was capable of receiving any one of six stations at will, all of them free from interference and giving a reasonably good output. This comprised H.F., Det. and L.F. with battery valves, remote control of station selector being incorporated. Details were given of the special selector switch, which dealt with four circuits each six times, and also how the effects of the switch are cut out from the output. A full description was also given of the separate amplifier, which included two separate rectifiers, after which the two speakers were dealt with. A demonstration showed that these gave excellent reproduction of both gramo and radio. Full details of the Society may be obtained from the Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

KETTERING RADIO AND PHYSICAL SOCIETY

Fifty members of the Society assembled on March 6th to hear an excellent lecture on "Empire Broadcasting," by Mr. F. X. J. Abraham, A.M.I.E.E., A.M.R.E., a B.B.C. engineer. Details of the establishing of the Chelmsford Station (G5SW) was given, followed by a description of the new Daventry transmitters and their aerial systems. Details of the methods employed by the B.B.C. to relay American programmes proved highly interesting. "By using three aerials spaced two miles apart," said the lecturer, "we have found it possible to obtain 90 per cent. intelligibility of the American signals with very little fading. On March 13th, Mr. Alan Hutchen, chairman of the Society, delivered a highly interesting address on "Electric Clocks," with references to the various uses of Broadcast Time Signals. Hon. Secs.: Mr. R. J. Pankhurst (G5YF), 9, Shakespeare Road, Kettering, and Mr. Thomas H. Hall (BRS1018), 59, Tresham Street, Kettering.

THE SOUTHALL RADIO SOCIETY

On Tuesday, March 14th, an interesting lecture on "Television" was given by Mr. L. Swan. He explained

(*Continued on page 88*)

WIRELESS TERMS TRAVESTIED—3

Faulty Spaghetti.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE.

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

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

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

THE A.C. "FURY FOUR"

"I have been examining the diagram of the A.C. version of the 'Fury,' and there are one or two points which are not clear to me. First of all, how is the Pentode valve biased? I see that this is of the directly heated type, and there is thus no cathode lead into which to insert the bias resistance. Secondly, where is the radio-gram. switch inserted. It does not appear on the panel."—(S. K. L., Leigh-on-Sea.)

The biasing resistance for the Pentode valve is inserted in the centre tap of the heater winding. It forms the connection from the heater winding to H.T.—. The loud-speaker returu lead is joined direct to the centre-tap, and, therefore, the circuit of the last valve is made up by the anode components, the bias resistance, and back to the filaments. Obviously, therefore, the anode current of the last valve flows through the resistance, providing a suitable voltage drop. This is the only method of biasing an output valve of the directly-heated type, in view of the absence of a cathode. The radio-gram. switch is fitted on the motor-board, at the side of the turntable, and it is inserted, as shown on the theoretical circuit, in one lead of the pick-up.

BATTERY "FURY FOUR"

"I have made up the "Fury Four," and the volume and quality are all that can be desired. I get dozens of stations with ease, and the quality is better than I have ever heard with a battery set. I have completed a gramophone section for this, but I find that the following difficulty arises. When I first joined up the pick-up as shown on the diagram, I had, of course, to apply grid bias to the valve. I adjusted this until the signals from the record were practically as good as the radio signals, and I was highly delighted with the gramophone side. This was early in the day. When evening came I tried to get the wireless signals, but nothing would come through. After trying one or two wires, I suddenly thought of the grid bias, and when I removed this pick-up bias, in came the wireless. Is this right? I should like to know whether it denotes a fault."—(W. J., Bromley.)

The pick-up is joined to the detector valve, and, naturally, this must not have any negative bias in order to operate as a grid rectifier. Therefore, if you wish to leave the pick-up permanently connected, you must insert an ordinary on-off switch in one of the leads, in order that the bias may be disconnected when using the receiver on radio.

HOUSE LIGHTING SWITCHES

"I am suffering from a rather peculiar trouble, and I should like to hear what you suggest is the cause. Whenever a light in my house is switched on there is a peculiar scratching noise from the loud-speaker. This goes on all the time the light is on. Whilst trying to find the cause the other night, I went round the house switching on all the lights one after another. I found, to my surprise, that when every switch was on, the noise ceased. What can this be? Is there any cure?"—(R. H., Broxbourne).

The usual cause of scratching noises from lighting switches is poor and dirty contacts. The fact that the noises ceased when all the lights were on probably is due to the fact that the total load on the mains reduced slightly the voltage and so acted as a sort of ballast across the mains and caused the arcing at the switch contacts to stop. Switch off the mains and remove the covers of all switches, and carefully clean the small contact points. If necessary bend them so that they make better contact. After some use these contacts do open slightly, and this is especially the case with cheap switches. When all cleaning has been done, switch on the mains, and watch each switch contact point (with the cover removed) and if you see any trace of blue sparks when the switch is operated, switch off at the mains again, and look to the point where the sparking occurs. You should soon be able to remove your trouble by this means, but remember not to touch the switch until the mains switch is in the off position.

TESTING AN ELIMINATOR

"I have a D.C. eliminator which I tested with a —— Meter, and to my surprise each tapping shows a drop of approximately 30 volts. Can I take the readings of this voltmeter as being correct, or should they be tested with a moving coil instrument. If tested with a moving coil instrument would the voltage drop be as great as 30 volts? I am anxious to increase the power of my set and I do not want to damage the valves in any way through running too much H.T."—(E. C. D., Clapton, E.5).

The meter which you are using is of the moving iron type and consumes far too great a current to enable it to be used for testing the output from a small mains unit. The voltage tappings are provided by means of resistances inside the unit, and according to the current flowing through these resistances, so the voltage is reduced from the total output of the smoothing section of the unit. As the average valves, used on these tappings, will only be taking two or three milliamps, the drop will be small. As, however, your meter probably consumes 30 milliaups or so, the drop is very much greater. You must, therefore, to get accurate readings, use a voltmeter with a resistance of about 1,000 ohms per volt.

D.C. RADIO-GRAM. TROUBLES

"I have a three-valve radio-gram. working from D.C. mains, and I occasionally get a plop when signals fade and then another plop and signals return to full strength. Also I wish to deepen the tone of my moving coil speaker. On the transformer there are five wires, do I have to connect a condenser to these. If so, which ones? My pick-up is earthed to the same earth as the set. Should this be so? I fancy it makes the pick-up live, as I have had several shocks from it."—(E. W. G. J., Christchurch).

The fading of signals accompanied by a plop suggests that one of the grid connections in the receiver is faulty. Therefore, examine all grid connections, grid leaks, etc., and make quite certain that the grid pin of the valves is making good connection in the sockets. If a grid battery is employed, make certain that this has not run down. The tone of the speaker should be good enough, if it is correctly matched. You can connect a fixed condenser across the leads which go to the output valve of the set, and the value should be chosen to give you the tone you desire. The pick-up should be earthed to prevent hum, but if you find that you are getting shocks from it, we would suggest that you have not got a fixed condenser in the earth lead. Examine the wiring of the set, and you should find, between the common negative lead of the set and the earth terminal, a large condenser of 2 mfds. or so. If this is not the case, obtain such a condenser and attach it to your cabinet. Take a wire from the earth terminal to one side of the condenser, and attach the earth lead to the other side of the condenser. This is a precaution which should always be taken in receivers operated from D.C. mains.

INSUFFICIENT POWER

"I have a splendid little two-valve set, employing a detector valve followed by a power valve. I get London stations through beautifully, and can just hear the Midland. When I want to get the Northern and some foreign stations, I can hear them faintly on the speaker, but when I turn the reaction, before the signals are really loud enough to hear, the set goes pop and the signals are gone. What is wrong with it? I should like to bring in these stations a bit better as they are too weak to listen to as it is."—(R. D., Highgate).

We think your trouble is due to the fact that you are trying to receive stations which are beyond the range of your receiver. If you have a moderate aerial, and the receiver is reasonably efficient, you should just hear the Northern Regional station in your district, but naturally, with only a detector valve and one stage of amplification you cannot expect to get really good loud-speaker reproduction from that station. The reaction control should build up gradually and distortion should be present before the plop. If this is not the case, and the set plops before distortion is audible, you have either too much H.T. on the detector valve or too large a condenser for reaction control. This should be adjusted accordingly. If you wish to get these other stations at entertainment value, you must certainly add a good H.F. stage and not rely upon reaction to bring the signals up to loud-speaker strength.

SCREENING A CHOKE

"I have just finished building a receiver to my own design and have come across a rather peculiar trouble. The set oscillated, no matter where I put the condensers. After being worried for some time I tried to find the cause, and after reading through some back numbers of 'Practical Wireless,' I decided to try the effect of moving about the coils and H.F. choke. The latter seems to be the cause of my trouble. It is home-made, on a one-inch former, and when I put my hand round it the oscillation stops. Does this mean that it wants screening? If so, what is the best material to use?"—(S. J. K., York).

The fault may be due to interaction between the choke and one of the other components in the set, and therefore before going to the trouble of screening remove the screws which hold the choke in position and try the effect of turning the choke about so that it rests in different positions. You may find a position in which stability is restored, and the choke should then be fixed in that position. If you are unable to stop the instability by turning the choke about, fit a small tube covered with tin-foil or aluminium foil over the choke, but allow a space of about half-an-inch between the screen and the windings of the choke. The screening material should, of course, be joined to earth.

DATA SHEET No. 28.

Cut this out Each Week and Paste it in a Notebook

METRIC CONVERSION TABLE

	Multiply by
Centimetres to ins.	.394
Metres to feet	3.281
Metres to yards	1.093
Sq. centimetres to sq. ins.	0.155
Sq. metres to sq. yds.	1.196
Cub. cm. to cub. in.	0.061
Cub. metres to cub. ft.	35.315
Grammes to grains	15.4
Grammes to ounces	0.035
Grammes to lbs.	0.002
Kilogrammes to tons	0.00098
Cub. cm. to fl. ozs.	0.0035
Litres to pints	1.76
Litres to cub. ft.	0.035

FREE ADVICE BUREAU COUPON

This coupon is available until April 8th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 1/4/33.

CATALOGUES RECEIVED

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

PILOT Q.P.-P. KIT

WE have just received from Peto-Scott Co., Ltd., 77, City Road, London, E.C.1, a constructional chart of their new Pilot Guardian Q.P.-P. 4-valve Kit. A full size wiring diagram is given, together with detailed instructions for building the set which is claimed to give all-electric volume and screened-grid selectivity with small capacity. The price of the kit of parts, including ready-drilled panel but less valves, is £3 19s. 6d. Readers can obtain a copy of the chart for 1s. from the above address.

"ATLAS Q.P." MAINS UNITS

THE latest folder issued by H. Clarke and Co., Ltd., Atlas Works, Patricroft, Manchester, gives particulars of their new mains units, which have specially designed smoothing and voltage regulation for all sets using quiescent pull-pull or "Class B" amplification. There are three models, the "Q.P. 24" suitable for A.C. mains; the "Q.P. 26," also for A.C. mains, but incorporating a trickle charger, and the "D.Q.P.," which is designed for D.C. mains.

BELLING-LEE CLIP-ON UNIT PICK-UP

ANY possessor of a radio receiver and a portable gramophone can enjoy radio-gram results by fitting the new Belling-Lee clip-on unit. This consists of a standard type pick-up, tone arm and volume control on a special mount which can be clipped instantly on and off the side of any portable gramophone. Full particulars, and price of the unit, are given in a booklet, a copy of which can be obtained from Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

SMITHCRAFT RADIO CABINETS

A WELL-DESIGNED and built receiver deserves a well-designed cabinet to house it, and the most discriminating constructor will find a suitable cabinet for his set in a folder issued by Smith's Cabinets, Ltd., 18-20, Hertford Road, London, N.1. The models available include speaker cabinets and table radiogram models. The cabinets, which are obtainable in either oak, mahogany or walnut, are hand polished to a piano finish, and grilles are backed with gold silk gauze. Loose base and baffleboards are supplied with each cabinet. All readers who are interested in high-class cabinets at moderate cost should make a point of getting one of these folders from the address given.

GRAHAM FARISH COMPONENTS

OVERSEAS readers will welcome the new Graham Farish catalogue, which is printed in either English, French, German or Spanish. Amongst the components listed are the Filt Percolative Earth, Lit-Los Condenser, Ohmite Resistances, Fixed Condensers, and a new twin-screen H.F. choke. A copy of either of these catalogues can be obtained from Graham Farish, Ltd., Masons Hill, Bromley, Kent.

FORMO PRODUCTS

THE new range of components shown in the latest Formo list should appeal to all discerning constructors. Amongst the components listed are dual-range aerial and band-pass coils, L.F. transformers, multicouplers, and dual and triple gang condensers. The ganged condensers can also be obtained mounted on a common base-plate with either two or three matched ganged coils with coupled switches. In the triple gang condenser each assembly is provided with an ordinary trimmer. The list also includes a range of Formo "Hymeg" fixed condensers of various capacities up to 14 mfd.

CLUBS AND SOCIETIES

(Continued from page 86.)

the fundamental principles underlying the transmission and reception of television, and described the construction of receivers using the scanning disc and neon tube and also the Kerr cell mirror drum. He showed his new receiver of the mirror drum type, which aroused considerable interest among the members present. The beginners' lecture on loud-speakers was given by Mr. Tyler.

Replies to Broadcast Queries

All inquiries should be addressed to *The Editor*, PRACTICAL WIRELESS, 8-11, *Southampton Street, Strand, London, W.C.2*, and the envelope marked *Broadcast Query Service*, in top left-hand corner. Stamped addressed envelope should *not* be enclosed, as replies cannot be sent by post, but will be published in due course in each issue of PRACTICAL WIRELESS.

F. W. CLARKE (Maidenhead): VWZ,-Kirkee (Poona), also on 17.24 m. (17,400 kc/s). PIP (St. Leonards-on-Sea): W9BHT, W. P. Ingersall, 251, E. Chestnut St., Canton, Ill.; W8OK, E. L. Murrill, 3rd Avenue, Huntington, W. (VA); W8GIY, Jim E. Correll, Camp Skeel, Oscoda, Mich.; W8GR, G. H. Norris, 8410, Brush St., Detroit, Mich.; KGA, regret, cannot trace. ONE VALVE (Faringdon): G5BJ, G. Brown, 62, The Ring, South Yardley, Birmingham; G20P, Captain G. C. Price, 2. St. Annes Villas, Hewlett Road, Cheltenham, Glos.; G2BS, Marconi Co., Ltd., Chelmsford; G2XS, H. W. Sadler, "St. Raphael," Anston Ave., Worksop, Notts.; G6ZS, C. Grundy, 234, Rishton Lane, Bolton, Lancs.; G6HK, J. H. Harker, "Dunelm," Church Lane, Lincoln; G2VR, H. B. Old, "The Shack," Spring Lane, Lambley, Notts.; G2GG, A. H. Kidd, Malborough House, Newbury, Berks; G2XV, G. A. Geaps, 2, Salisbury Villas, Station Road, Cambridge; G5CD, D. N. Corfield, 10, Holders Hill Gardens, Hendon, N.W.4, London; G6LM, R. A. Hiscocks, "Sylvandelle," Malmesbury Road, Chippenham, Wilts.; GBC, Rugby calling GLIZ, a ship and TFO, a station in Iceland; G6FY, R. A. Fereday, 37, Walwood Road, Leytonstone, London, E.11; G600, T. Woodcock, 8, George St., Bridlington, Yorks.; G6JJ, Dr. J. O. Pender Smith, 30, Wellesley Road, Colchester, Essex; G2LZ, F. A. Mayer, "Stilemane," Wickford, Essex; PAOKK, Louis de Groot, 38, Delistraat, The Hague, Holland; PAOASD, W. F. Jacot, 73, Euterper Straat, Amsterdam, Holland, PAORS, P. Van der Meer, 174 Lange Geer, Rotterdam; XID, Dr. James M. B. Hard, (130 Apartado, Mexico, D.F.; G6CB, G6ZM, G5ZI, PAPOE, Regret, cannot trace. T. E. L. (Cadishead): If call sign is correct, namely, with three letters, only amateur experimenter with artificial aerial; possibly in your immediate neighbourhood; write to Radio Society of Great Britain, 53, Victoria Street, S.W.1. BARTY (Leigh): Apparently amateur transmitter in your immediate neighbourhood; cannot trace it in published lists. T. DAVIES (Leigh): (1) PAONC is not given in published lists; if sure of call letters write to N.V.I.R. Post Box 400, Rotterdam (Holland); (2) G5TZ, W. G. Sherratt, 11, Both Road, Cowes (I. of W.). TWO VALVE (Jedburgh): W20E, E. A. Smith, 102, Montoe Street, Brooklyn, New York; W9BAC, Richard Laplander, Dollar Bay, Mich.; G5AW, A. E. Wood, 247, Leigham Court Road, Streatham, S.W.16; W2EUV, G2AB, G6AI, G6YJ, cannot trace; VWZ, Kirkee near Poona (India) on 17.24 m.).

HOW YOUR SET WORKS

(Continued from page 70.)

pass on to the following valves and so to the loud-speaker.

Connecting Up the Batteries

There is no need to go into the subject of the action of the two amplifying valves again, but I would draw your attention to the connections to the various batteries. The low-tension (L.T.) battery or accumulator is connected by wires to the filaments of each valve (separate batteries are not necessary), and is switched on or off by means of the push-pull switch marked "Filament switch."

The high-tension (H.T.) battery has its positive (+) end connected by a wire, which branches into three. (One goes to the anode resistance of the first valve, one to the primary of the transformer, and one to the speaker. The negative (—) end is joined to the negative side of the low-tension battery. No switch is necessary here as no current flows when the filaments of the valves are switched off, therefore, the one switch connected in the low-tension battery circuit is all that is required to start the set going or to stop it.

The grid bias battery has its positive end joined to the negative side of the L.T. battery, while the connections from the valves are plugged in to separate points on the battery. For this purpose several sockets are provided so that just the right voltage to suit the valve may be obtained. You will notice that all the batteries have one end or the other connected to the "earthed" end of the tuning coil. The wire from the batteries to this point thus forms a sort of common lead to which all circuits have their return.

I think I have now dealt with all the points I intended to in the working and construction of our three-valver. Needless to say I have not gone into the matter anything like deeply, but that was not possible, or, indeed necessary, in a short series of articles of this type. What I have endeavoured to do is to give you some idea of the kind of thing that goes on inside your set. It is for this reason I chose a simple type. Even a partial understanding of the working of this will, however, make the operation of your own set more interesting, and will provide a starting point for the study of more advanced circuits.

CORRECTION

In the article entitled "Improvements and Refinements" which appeared in our issue dated March 11th, a draughtsman's error occurred in Fig. 6, page 1,176. To correct this illustration delete the line running from the anode of the valve to the resistance which is joined to the G terminal of the L.F transformer.

ADVERTISEMENT INDEX

P. W. Gift Stamp No. 27

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3D

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ROUND *the* WORLD *of* WIRELESS

Royal Command Variety Broadcast

AS in previous years, the B.B.C. will be given an opportunity of relaying the Royal Command Variety Performance which has been fixed to take place on May 22nd. For this occasion the G.T.C. has lifted the ban on music-hall artists taking part in the show.

Vienna's Super Power Transmitter

THE giant Bisamberg station which is to take over the broadcasting of the Vienna programmes is rapidly nearing completion, and it is expected to come on the air for its initial tests early in April. In order to avoid interference with the Rosenhuegel transmitter now in operation, the experimental broadcasts will be carried out in the earlier hours of the day and at the end of the advertised programmes. So stand by for a much heftier Radio-Wien!

Summer Time

BOTH France and Belgium changed over to Summer Time on March 26th and consequently until we adopt B.S.T. on April 9th, these countries will be *one hour ahead* of us. Holland will alter her clocks on May 15th. From the April date our time in Great Britain will coincide not only with France and Belgium but with all those continental countries working to Central European Time, namely, Germany, Austria, Italy, Switzerland, Scandinavia, etc. As Spain, Portugal, Algeria, Morocco, remain on Greenwich Mean Time all the year round, during the B.S.T. period we shall be *one* hour in front of them, and *two* hours ahead of Iceland. The difference between British Summer Time and Eastern European Time will be cut down to one hour; Moscow's local time will only be two hours ahead of us.

Snowed Up!

DURING the recent blizzard, one of the most northerly of the Norwegian broadcasting stations, Bödö was snowed up for three days, and was compelled to send out an S O S to obtain food and outside assistance. During that period the announcer carried on by giving the local listeners a transmission of gramophone records interspersed with a "news" bulletin in which he described the living conditions of the imprisoned staff.

Radio Luxembourg on the Air

ON 1,191 metres the new 150 kilowatt transmitter now transmits a regular programme daily. A News Bulletin is broadcast every evening at 7 p.m. G.M.T. in German and French as well as in the Luxembourg dialect. The station would appear to work from 7 p.m. to about 10 p.m. G.M.T., during which period, on some days, gramophone records alternate with a concert given by a studio orchestra. At present the Monday and Thursday transmissions are dedicated to Germany, those on Tuesday and Saturday to France and Belgium, Wednesday to local listeners, Fridays to Holland and Sundays to the British Isles. The studio employs both men and women announcers.

In This Issue:

An Edgar Wallace Broadcast

ON April 19th the B.B.C. will produce a microphone version of the late Edgar Wallace's thriller, *The Ringer*, for which, in the leading part, they have succeeded in securing the services of Constance Cummings the American film star. There will be two performances of this play, namely, April 19th for Regional and April 21st for National listeners.

The first broadcast of Horace Annesley Vachell's comedy, *Quinneys*, arranged for these dates will be postponed until later in the year.

Extension of Jazz Veto on Germany

FOLLOWING a government decree to stop the playing of "Hot" music in the Berlin studio, the veto has been extended to the entire country and now includes not only broadcasts but all dance bands in public places and houses of entertainment. The Germans must now declare themselves satisfied with the waltz and the tango.

PTT Radio-Paris

THE French State has officially declared its intention of taking over the new Radio-Paris transmitter. According to a French report the station will no longer be permitted to broadcast foreign publicity concerts.

The New B.B.C. Long-wave Station

THE B.B.C. has concluded the purchase of the site at Wychbold, near Droitwich, for the new transmitter to replace Daventry 5XX, and preliminary work has already started. The new station, which will radiate the National programme, will work on a power of 100 kW. In addition to this transmitter, a high power medium-wave Regional station will also be erected on the same site, and when completed will replace Midland 5GB, which was experimentally built in 1927. Although no date can yet be fixed, it is anticipated that the Droitwich 100 kilowatter may be able to take over the Daventry service by the summer of 1934.

The Sincerest Form of Flattery

THE example set by Radio Luxembourg, namely, a transmitter for the purposes of widespread publicity, is arousing considerable interest on the continent. It is now reported that Romania is inclined to follow this lead and that negotiations are already proceeding with a foreign group of financiers to secure capital for the installation of a super-power transmitter at Temesvar near the Hungarian border. Will more imitators come along?

The Nice-Monaco - Corsica High-power Station

WORK on this new P.T.T. station is to be started this month. Although nominally of a power of 60 kilowatts, the transmitter is planned to permit of an

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

increased energy in the near future, as the French authorities are anxious that the programmes should be available to all inhabitants of the Riviera. It is probable that a 286-metre wavelength will be adopted, namely, the channel at present used by PTT Montpellier, which, on completion of the new transmitter, will be closed down. Studios are to be erected at Nice, Cannes and at Monte Carlo.

Listen to Milan-Vigentino

IN order to provide an alternative programme for Milan listeners, the EIAR has again brought into operation the Vigentino 7 kilowatt station, which acted as a standby when the 50 kilowatt transmitter at Siziano was formally opened. The second Milan station is now working experimentally on 453.8 metres; it relays wireless entertainments from Rome, Naples and other Italian studios.

New Valves

I SHOULD think that the research staffs of the various valve-manufacturing firms must be having a very hectic and busy time just now, for new types of valves seem to be emerging every day. The introduction of automatic volume control brought the double-diode and then the double-diode triode and single-diode tetrode—what names! Whilst these were still "hot from the oven" the new "Class B" amplifier came into being, and now we have the high-frequency pentode. One can be excused for asking "What next?" The peculiar thing is that although these valves seem to have come upon us all at once, there has been a job of useful work awaiting each one, and no sooner has a valve been "released" than it has been put to good use. Perhaps the only unfortunate part of the business from the average constructor's point of view is that most of the newcomers are only suitable for mains-operated receivers. At the same time, he can take comfort in the knowledge that the "Class B" valve, at any rate, is essentially a battery valve, and a most economical one at that.

H.F. Pentodes

THE H.F. pentode is not too well known as yet, but there is no doubt that it is going to be extremely popular. It is really a development of the S.G. and V.-M. valves, and not of the low-frequency pentode, as its name might suggest. This valve is already obtainable in both "ordinary" and variable-mu form and from my own experiments I can vouchsafe for its extraordinary abilities. It has all the advantages of the best V.-M. valves but is not so critical in regard to its screening grid voltage requirements and actually gives more amplification. The new valve has a very high impedance and thus can only give of its best when followed by an ultra-efficient, or high-dynamic, tuning circuit; this condition can readily be complied with by making use of Ferrocart coils. So far as I am aware, the H.F. pentode is not yet made as a battery valve, but I for one sincerely hope it will be before summer comes, because in that form it should be perfectly ideal for use in portables, where stability and high amplification are the principal requirements.

INTERESTING and TOPICAL PARAGRAPHS

Q.P.-P. Transformers

QUIESCENT push-pull amplification is still increasing in popularity and many readers will, no doubt, be trying it. I am often asked why a special input transformer is advised and if an ordinary push-pull transformer cannot be used instead. Actually the latter kind of transformer *can* be used, but as it is of lower ratio than the proper Q.P.-P component it will not provide as much amplification, and therefore one of the chief benefits of the new system will be lost. The new quiescent push-pull input transformers have a step-up ratio of 9 to 10 to 1, as compared with about 3 to 1 for ordinary P.-P. ones.

Q.P.-P. Eliminators

IT is interesting to notice how one radio development paves the way for another. For instance Q.P.-P. amplification led to the introduction of special H.T. batteries having tappings every 1.5 volts over the last 20 volts or so. And now it seems that different types of eliminators will be required for Q.P.-P. and "Class B." The difficulty with ordinary eliminators is that the voltage they give from any tapping is proportional to the current load; as the current is increased the voltage goes down, and vice versa. Of course, the whole idea of the new amplification systems is that the anode current consumption is proportional to the amplitude of the signal voltages being handled and thus the current is less on soft, than on loud, passages of music. But with an ordinary eliminator the voltage rises as the current falls and the higher voltage tends to increase the current, with a net result that there is a tendency for the current to remain more or less constant. This means that the amplifier will not do justice to "light" and "shade" and that reproduction will suffer in consequence. What is required, then, is an eliminator whose voltage will remain constant over a change in load of 10 milliamperes or so. I have not gone fully into the question, but it seems that the only way to make a suitable eliminator will be by using a smoothing choke of low resistance and a rectifier with an ample current reserve. Or perhaps the same result could be achieved by employing an eliminator of rather higher current rating than is actually required, and shunting a resistance of about 20,000 ohms across its positive and negative terminals; the resistance should hold the voltage reasonably steady. Anyhow, here is a little problem that is worth thinking about.

A new chapter in the history of wireless was opened recently when Cape Town addressed the British Commonwealth of Nations from the top of Table Mountain, Cape Town.

SOLVE THIS!

Problem No. 29.

Jefferies had a simple two-valve set employing a detector valve working on the normal grid-leak principle, transformer-coupled to a small power valve taking a current of 5 mA. at 150 volts. A relative gave him a small mains unit for a birthday present, but this delivered 60 mA. at 250 volts maximum, and was provided with no tappings. How could Jefferies use this unit with his small set without introducing any alterations to the unit and without damaging his valves? Three books will be awarded for the first three correct solutions opened. Address your solutions to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, marking your envelopes Problem No. 29, and post to reach us not later than April 10th.

SOLUTION TO PROBLEM No. 28.

When used as a radio-gram. the detector valve becomes an L.F. valve with appropriate negative grid bias. Therefore, to enable radio to be received this bias must be removed, and Jackson should have inserted a simple switch in the pick-up leads to disconnect the pick-up on radio.

The following three readers received books in connection with Problem No. 27:—

W. Sanders, 16, Pollard Street, S. Shields, Co. Durham; W. G. Walker, "Kinver," Etruria Road, Basford, Stoke-on-Trent; F. Brayne, 13, Wood Street, Tunbridge Wells.

Output or Input?

A GOOD deal of misunderstanding often arises in connection with the name applied to that transformer used between the set and loud-speaker. When it is built into the set we refer to it as an output transformer, and yet when it is attached to the loud-speaker it gets the very opposite name of input transformer. Which is right? As a matter of fact both are, but they are derived in different ways. The transformer certainly deals with the output from the set and the input to the speaker, so the name is purely a relative term. Nevertheless, I think it would be a good thing if we could decide to call this component by one name no matter what its position may be—and "input transformer" is certainly not a good one because that is what we call the transformer which feeds two valves in push-pull.

JACE.

ELECTRICAL INTERFERENCE

Causes and Remedies Discussed by FRANK PRESTON, F.R.A.

I SUPPOSE one of the greatest difficulties encountered by the writer of articles is that of choosing his subjects. No matter how enthusiastic and interested he is in regard to some particular topic it is no use writing about it unless his readers are also going to be interested. I must confess that I have met with this difficulty on numerous occasions, but it does not apply in the present case. A few weeks ago, under the heading of "Radio Ramblings" the subject of electrical interference was briefly introduced: and I can judge from the letters since received that the matter is generally considered to be of great importance. Two simple methods of reducing interference caused by electrical apparatus were described and concluded by asking readers to try them and to kindly advise us of the results obtained. Many have done so and their letters have been very much appreciated.

A Good Idea

One method suggested, and which I had found very useful, was to join together the aerial and earth leads and to connect both of them to the aerial terminal. It was pointed out that this method was only likely to be of value on the shorter wavelengths and if the earth lead was fairly long. It was also mentioned that the reason for the success of this scheme could not be explained satisfactorily by existing theories and that my results were perhaps in the nature of a "fluke."

However, I am delighted to learn that others have now found the suggestion of value. For instance, H.L.P. (Perth) writes "I am a mere novice in anything to do with wireless, but on reading an article in PRACTICAL WIRELESS I thought I would try the idea about joining the earth lead to the aerial terminal. My set is a S.G.3 and on joining the wires I found it was just as you said—hardly any interference. The only difference I noticed was that Scottish Regional seemed to be one point further up on the dial, but volume was almost as good as usual. My earth lead is rubber covered, but only 10 feet long."

Another reader, E.H., of Cashel, Tipperary, I.F.S. says: "In response to the request in PRACTICAL WIRELESS for March 11th, in reference to connecting the earth lead to the aerial terminal; I have tried this and strange to say it made absolutely no difference to normal reception on medium-waves, but on long-waves the set is unstable. May I point out that my earth lead is only six feet long?

It Does not Always Work

These two are typical of a number of letters received and although they prove that the idea is good they also show that I was wrong in assuming that the earth lead must be a long one for the method to be effective. But in support of my suggestion that the method would not always prove successful, there is a letter from H. S. (South Shields) in which the writer says—"—Regarding your method of connecting together the aerial and earth, I am afraid this experiment was not satisfactory. I think in my case the signals were going straight to earth. I could get stations (presumably free from interference) but much below usual strength."

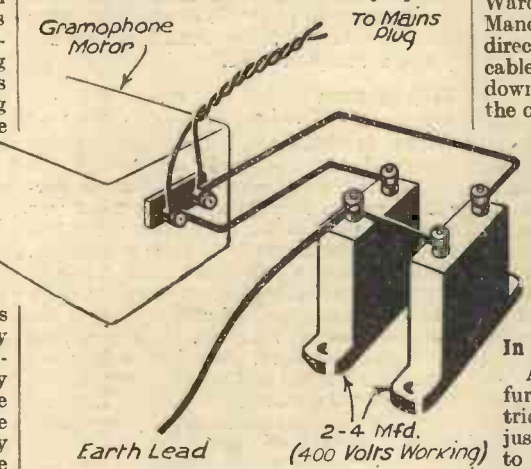


Fig. 1.—A simple method of curing interference caused by an electric motor or similar device.

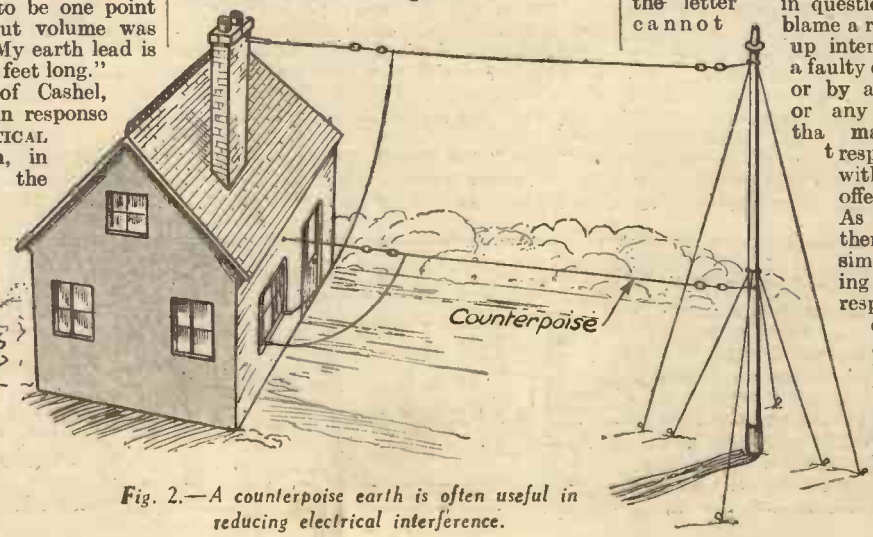


Fig. 2.—A counterpoise earth is often useful in reducing electrical interference.

Shielded Down-Lead

Another suggestion I made for reducing electrical interference, was to replace the aerial lead-in by a length of the special shielded cable which has just come on to the market. I am afraid that I was somewhat premature in recommending this method because a number of readers have written to say that they have as yet been unable to obtain the new material from their local dealers. It will thus be helpful to know that the cable is made by Messrs. Ward and Goldstone of Pendleton, Manchester, from whom it can be obtained direct, in 20 foot lengths. The screened cable simply replaces the normal aerial down-lead and connection is made from the outer metal braiding to earth. Although it is primarily intended for the aerial lead, I have found it helpful even for the earth lead when the latter is fairly long; the braiding is then connected along with the inner wire to the earthing plate or tube. I should be very pleased to hear from readers who try the screened lead-in, if they will write to me c/o The Editor.

In Reply to a Complaint

And now I would like to offer some further suggestions for eliminating electrical interference, but before doing so just allow me to make passing reference to a letter reproduced in PRACTICAL WIRELESS No. 26 under the title of "All-mains Receivers and Interference." The writer said he considered it "rather unfair on the part of manufacturers to expect a purchaser who has paid a high price for a set to go to outside sources for a cure of this household type of (electrical) interference." Of course one can see some justification for these remarks, but I am afraid the writer has not weighed up all the facts of the case, and I have no doubt that more than one manufacturer will already have replied to the letter in question. After all, one cannot blame a receiver for picking up interference caused by a faulty electric light switch or by an electric motor, or any other device for that matter; surely the responsibility rests with the owner of the offending apparatus. As a matter of fact there is not always a simple way of modifying a set to prevent its responding to local electrical disturbances. The methods referred to above might do the trick, but they cannot be guaranteed. Moreover, the particular interference likely to be experienced

(Continued overleaf.)

ELECTRICAL INTERFERENCE

(*Continued from page 93.*)

may take one of many forms, each of which demands its own special remedy. Obviously, then, it would be an utter impossibility to design any receiver which would be immune from all kinds of electrical interference. In addition to this, there is the question of cost. Even if some revolutionary device could be fitted to a set, it must necessarily add to the price of the outfit and consequently every purchaser would have to pay more for his set whether he required the "anti-interference" unit or not.

Tracing the Source of Interference

I have pointed out that different kinds of interference require different methods of prevention, so let us examine the question more closely. In case of difficulty, the first thing is to discover whether the stray noises are being picked up by the aerial or are coming into the set through the mains leads (when a mains receiver or eliminator is employed). This can be done by comparing results with and without the aerial and earth connected. If interference is just as bad in either case, it is obviously being transmitted through the supply leads or is being picked up by the receiver itself. On the other hand, if it is found that the aerial is responsible, one of the remedies already referred to can be tried. But if you know the cause of the interference, it is much better to tackle it at its source wherever possible. For instance, if it is noticed that interference is only experienced when a particular switch is "on" you can be pretty sure that either the switch or the apparatus it feeds is at fault. Bad contact in a lamp holder or a damaged switch can be a great nuisance, but the cost of repair or replacement is small. When the trouble is due to an electric motor (perhaps a gramophone motor, hair drier or other domestic appliance) you can generally effect a cure by joining two large capacity (2 to 4 mfds.) condensers in series across the motor terminals and connecting an earth lead to the centre point of the two condensers. The method is illustrated in Figure 1. It is important that the condensers should have a working voltage of at least 400 for otherwise the insulation might break down.

If the interference starts regularly at a certain time of day, you can generally trace it quite easily to some flashing electric sign or generator in the vicinity. There is only a narrow field to "search" because electrical disturbances rarely travel over distances greater than 100 yards or so. Having found the origin of the trouble you can do little more than request the owner of the apparatus to attend to the matter. In the case of a motor or generator you might suggest the condenser arrangement of Figure 1; it will almost invariably give some improvement even if it does not prove a complete cure.

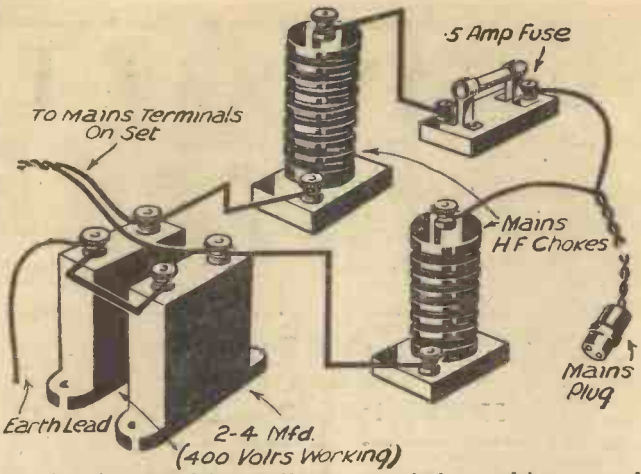


Fig. 3.—A rather elaborate filter circuit which is useful in cases of serious electrical interference of the kind introduced by the mains leads.

Difficult Cases

Probably the most annoying kind of trouble is that caused by tramways and electric buses. There is no difficulty in tracing the interference, but local authorities are not easy to approach when you want to suggest that they should spend money in the interests of their ratepayers. Rather than waste time and postage, you will probably find it better to try one of the suggestions referred to at the beginning of this article. When neither of them is effective, you might reduce the size of your aerial and employ the screened cable for the whole of its length. Another idea which is often useful, though frequently difficult to put into practice, is to dispense with the normal earth connection and use a counterpoise earth as shown in Figure 2. The counterpoise is in effect a second "aerial" consisting of a single wire running parallel to the aerial proper; it must be thoroughly insulated and is connected to the earth terminal of the receiver. In mild cases of interference, some relief can be obtained by connecting a 2 or 4 mfd. fixed condenser in series with the earth lead; this system is worth a trial.

Should you come to the conclusion that interference is coming to the set *via* the mains supply leads your mode of procedure will be rather different. Incidentally, mains leads do very often act as an effective aerial and pick up all kinds of H.T. impulses. (You know, of course, that they can be employed instead of an outside aerial). The object, then, must be to "filter" the mains supply by inserting an H.F. choke in one or both leads. Ordinary chokes are useless for this purpose since they will not carry the necessary current, but special components are made by Messrs. Bulgin and also by Messrs. Wearite. Start by connecting a choke in one lead first of all and if this proves insufficient put one in the other lead as well. As an alternative to the H.F. chokes a split-condenser filter of the type shown in Figure 1 might be connected across the mains leads at their point of contact with the set. Sometimes it is found that neither of these latter methods is sufficient completely to cure the trouble and in that case a more complicated filter circuit like that shown in Figure 3 must be resorted to. Here we have a special mains H.F. choke connected in each supply lead and also a pair of large-capacity (2 to 4 mfd.) condensers wired in series across the supply. The earth wire is removed from its normal terminal on the set and joined to the junction of the two condensers. It is also a wise precaution to include a .5 amp. fuse on the "mains" side of the filter to prevent damage in case of a short-circuit or the breakdown of a condenser. All the filter components should be placed in some kind of box so that there will be no danger of getting a shock by accidentally touching any of the terminals.

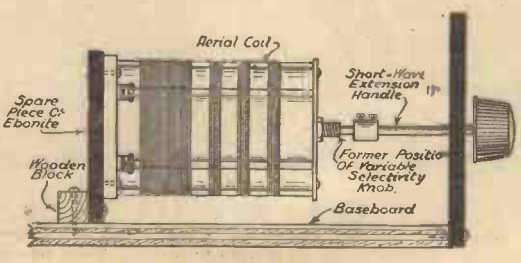
Voltage Fluctuations

There is yet one further prevalent source of trouble which we have not considered and which is due to fluctuations in the mains voltage. Although supply companies are legally supposed to maintain the mains voltage within 4 per cent. of its rated figure one often finds a variation of as much as 15 per cent. Such voltage surges naturally make themselves known by various forms of "noise" or by variations in volume level. There is no real cure in the hands of the listener, but often a certain amount of relief can be obtained by connecting a lamp across the mains terminals of the set. The lamp will absorb a good deal of the surge voltages and help to maintain a silent "background."

I have not mentioned all the possible causes and cures of electrical interference, but I think sufficient has been said to show what steps should be taken and to make it quite clear that every individual case must be treated on its own merits. I would just add that the Technical Staff of PRACTICAL WIRELESS will be pleased to render assistance, through its Advice Bureau, to all readers who are in difficulty. But remember that for them to be of real assistance you must supply the fullest possible details of your trouble, since it is not easy to suggest remedies when given such vague descriptions as "intermittent crackles," "buzzing sounds" and so on.

Extension Handle for Tuning Coil.

MANY readers no doubt have in use an aerial coil with a small variable condenser enclosed in the top, for selectivity purposes. When the set using this coil is enclosed in a cabinet, it often proves awkward to get at the condenser, but I eliminated this difficulty by making the following changes. First, I mounted the coil horizontally, as shown in the sketch,



and removed the bakelite knob from the top. Then by boring a hole in the front panel and attaching a short-wave extension handle to the condenser spindle, I was able to re-attach the knob on to the extension handle, so that the selectivity could be controlled from the panel. This arrangement also helps to eliminate hand-capacity, when tuning in some of the weaker foreigners.
—R. G. RENTON (Harlesden).

THE IMPORTANCE OF LAY-OUT

With Some Ideas Which Will Help You to Make a Clean and Efficient Job When Designing a New Set.

By ALBERT E. OAKLEY

I SUPPOSE the most thrilling moment about the construction of a set comes when it is finished. The wiring has been checked over, nuts finally tightened, batteries and power connected and the set is switched on. What will be the result? So many things may happen. Oscillation, growls, hum, reception of the local station all round the dial—silence. The constructor of, say, a PRACTICAL WIRELESS set has only to work carefully, methodically and unhurriedly, and, above all, to stick to the design, components, and the precise lay-out instructed and all will be well.

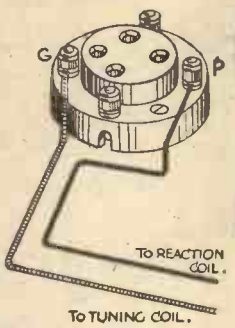


Fig. 1.—Do not run H.F. wires close together.

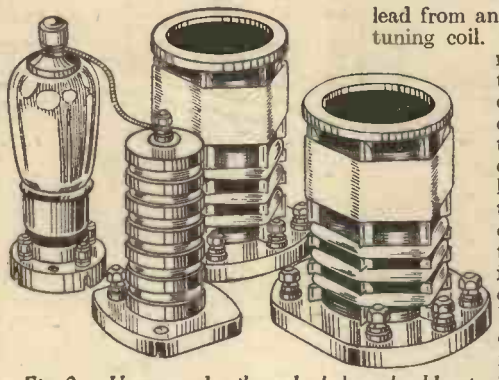


Fig. 2.—Unscreened coils and chokes should not be mounted near one another.

Building to Your Own Design

But the man who really gets the craze for construction—and most of us do—will want to build sets of his own design in addition to the published ones. Commencing with a standard circuit, he will add his own refinements, try out some pet idea and use up certain components he has on hand. Possibly the set is going into an existing piece of furniture, and must be designed to fit. The work of designing a set falls into three heads, viz., planning the circuit, selecting suitable components and designing the lay-out. It is the latter I propose now to discuss.

The first thing the amateur designer will do, very naturally, will be to set out all his components on the baseboard, if this already exists, or on the board from which it will be cut. Having compactness and neatness prominently in mind he will arrange and rearrange till he gets everything into the smallest space. He will then probably settle the size and cut out the baseboard, screw down the components and make ready to start wiring. Unless, however, the wiring detail was fully planned at the same time it is almost certain that this method will result in a bad tangle, with wires crossing and recrossing. Many will be of unnecessary length, grid and anode wires will exert undesired magnetic and capacitative effects, and the result will be at best a set which does not yield the maximum of efficiency, and at worst a real dud. Let me explain what to do, what to avoid and why.

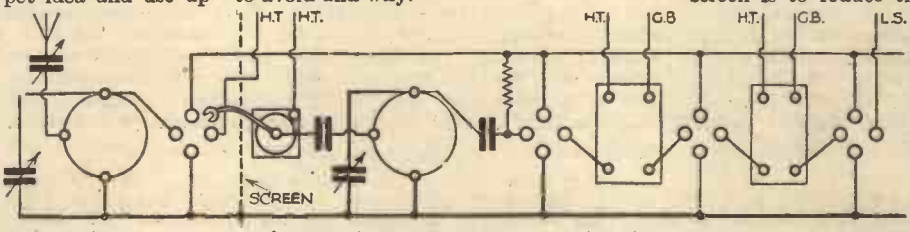


Fig. 3.—Shows the chain of essential components in a 4-valve S.G. receiver, arranged and connected in the simplest possible manner.

What to Avoid

Long leads are bad. Those carrying high-frequency currents, that is the grid and anode wires, and the coil connections to grid or anode, should be as short as it is possible to make them. Why? Because these wires are radiating energy, and every inch of length increases the radiation. Grid and plate wires in close proximity mean, therefore, a transfer of energy from plate to grid—virtually an increase in grid-anode capacity. This results in a tendency to instability or, perhaps, damping and weakening of signals according to the directional relation of the conductors. Fig. 1 shows how such a mistake might easily be made by running the reaction lead from anode alongside the grid lead to tuning coil. If any two such wires must run in the same direction they should be well separated; one, say, on the baseboard, the other in the air. The low-tension or filament leads are of minor importance as to length, but must not run close to H.F. leads. This would cause loss, and often affect the matching of coils, while in the case of ganged condensers the adjustment might be affected. Coils tuning successive stages must not be mounted close together unless they are of the canned type. Fig. 2 shows an arrangement which might appear neat and tidy, but as the coils and choke would react powerfully, the effect would be disastrous. If screening partitions are used to separate the H.F. stages the coils should be mounted as far away from them as is practicable, for the effect of a close up screen is to reduce the inductance of the coil, so altering its wavelength range, and probably introducing ganging difficulties. In addition, the screen absorbs power from any H.F. conductors which may be near to it. The loss from a wire passing through the screen at right angles, as, for example, the lead from the choke to anode of the screened grid valve will not be material, but wires parallel to screens should be avoided.

The L.F. Side

The conductors carrying L.F. currents are less important than the H.F. ones, but it is still best to stick to the rule of "short, direct and well apart." Care must be taken in the arrangement of transformers and chokes, as these are surrounded by an alternating magnetic field. Interaction between these L.F. components is one of the frequent causes of low-frequency oscillation, particularly in that irritating form called "motor boating." Mount these items, therefore, with their magnetic

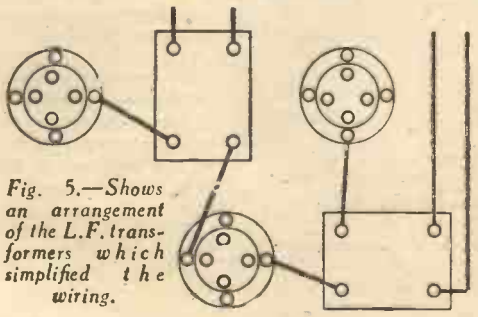


Fig. 5.—Shows an arrangement of the L.F. transformers which simplified the wiring.

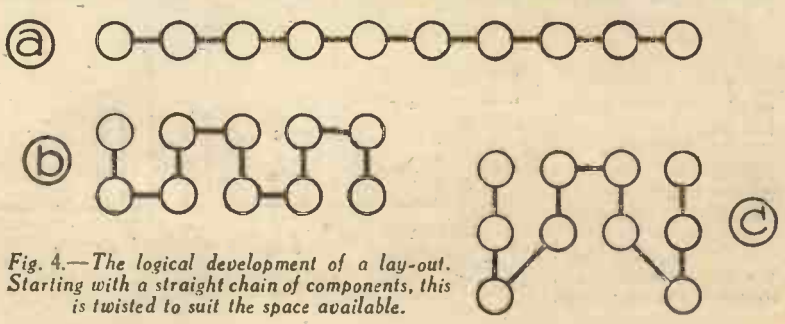


Fig. 4.—The logical development of a lay-out. Starting with a straight chain of components, this is twisted to suit the space available.

axes at right angles one to the other, and don't have them closer together than is necessary. This will generally obviate serious interaction. Fig. 5 shows a suitable arrangement.

Go as You Please Wiring

The reader has probably seen sets where the wires, generally flexes, are taken from point to point without any pretence at orderly arrangement. This system, or, more properly, lack of system, had a certain vogue for a while, but it is, in the writer's opinion, thoroughly bad, for its appearance is slovenly and amateurish, one is taking chances, and probably spoiling the job for the sake of a few minutes more time spent in wiring.

Arranging the Components

Let us consider how the components of a straight four are connected. If we lay them out in a sort of chain, single file as it were, it is easy to follow the connections, and a glance at Fig. 3 will show that the necessary wires can be made short and direct. Unfortunately this would involve a long and inconvenient cabinet, so we must find a more compact way of packing them in without violating the rules which have been enumerated. But in whatever positions on the board we place our components, they will still form a chain as shown in Fig. 4, where (a) represents ten main components in the ideal, but impracticable single line, (b) a double line, and (c), an arrangement which conforms to the usual shape of baseboard, and leaves a central space for the projection of the tuning condensers. It will be understood, of course, that these diagrams are merely symbolic of the broad idea of a chain. The components will rarely be so geometrically positioned because of their various shapes and sizes, the necessities of different circuits, etc.

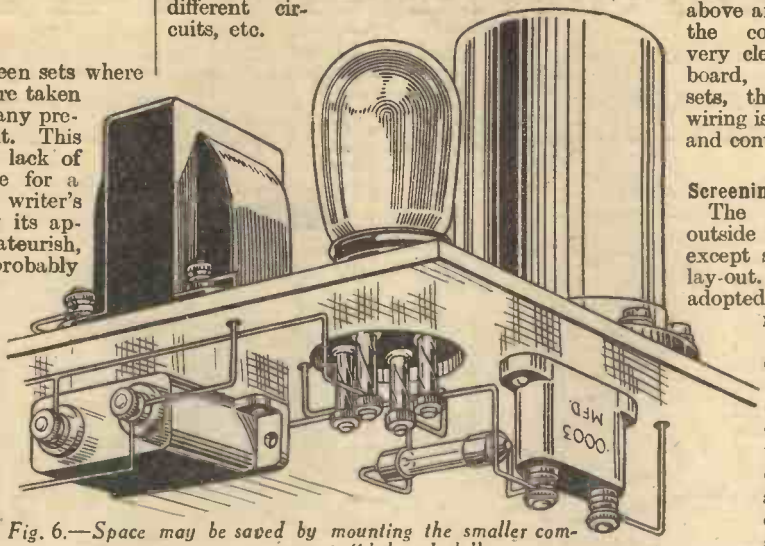


Fig. 6.—Space may be saved by mounting the smaller components "below deck."

Saving Space

The tendency of design is towards compactness and still greater compactness. Considering their great power the best sets to-day are strikingly small compared with the apparatus of but a few years ago. Adoption of the chassis method of construction will help materially towards space saving and tidy wiring. Many of the smaller items can be fixed beneath the chassis, reserving the "deck" for the main components. The decoupling condensers, resistors, grid condensers and leaks can with advantage be placed below. Switches for "on-off" and wave change are conveniently mounted on the panel below the chassis line. Valve holders of the disc or "wafer" type should be used, and the wiring may be all below deck, or partly above and partly below. Although the concealed method gives a very clean appearance to the baseboard, yet, for most home built sets, the mixed arrangement of wiring is generally the more efficient and convenient.

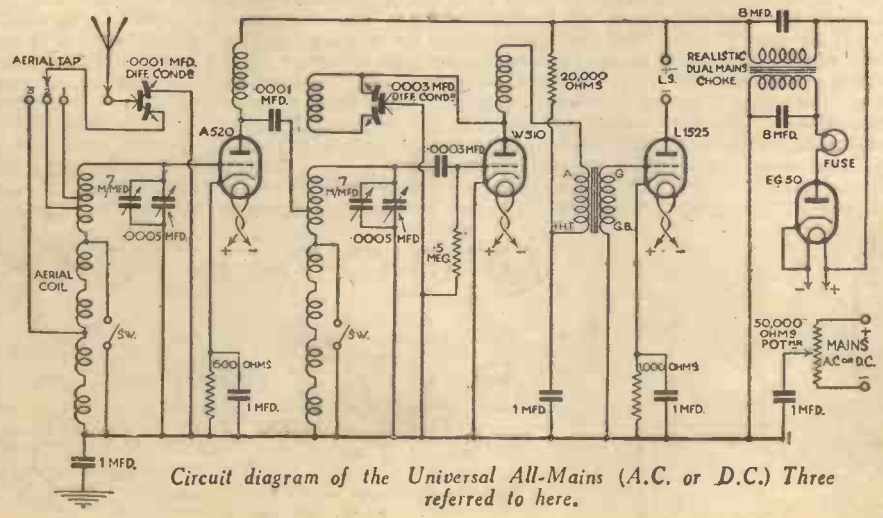
Screening

The problems of screening are outside the scope of this article except so far as they concern the lay-out. If band-pass tuning is adopted, or any circuit involving more than two tuning coils, then canned coils are necessary. If using a single S.G. valve with the usual tuned aerial and intervalve circuits, open coils may be used with due precautions. One coil is preferably mounted at right angles to the other, and as far apart as possible unless a screen is interposed between the stages, in which case the coil positions present less difficulty. If a partitioning screen is not used, then the H.F. choke in the anode feed should be of the screened variety, while in all cases the valve should be metallized. Certainly the full use of screened components makes the lay-out problem simpler, for the valves, coils, etc., can be packed closely together without fear of interaction, and one has little more than the wiring problem to consider. All screens, whether partitions, chassis, coil cans, condenser covers, etc., should be connected to L.T. negative and earth.

An Ingenious Universal Three-Valve Set

A Three-valve Receiver which may be Plugged Direct into either D.C. or A.C. Mains

WHEN you wish to make up a receiver for a relative or friend, and that friend lives in a house fitted with D.C. whilst you are on A.C., or when you build a set for use on A.C. mains and move to a district where D.C. is supplied, the difficulties appear almost insurmountable. The circuit shown on this page, however, is of a three-valve receiver, employing special valves, which may be used indiscriminately on any type of electric supply. As will be seen from the diagram, in place of the customary transformer used on A.C. mains sets, a potentiometer is joined across the mains input terminals. This feeds the receiver through a special type of valve, the EG.50, which acts as a rectifier if the supply should be alternative, but purely as a ballast resistance when the supply is D.C. The heater connections for the valves are omitted from the diagram to avoid complications. The remainder of the circuit is straightforward, and employs an S.G. valve in the first stage, and a power detector in the second stage. The output is delivered by a Power Valve of similar construction. These valves are all of the Ostar-Ganz type, handled in this country by Eugen Forbat, of 1, Rosebery Avenue, E.C.1.



Circuit diagram of the Universal All-Mains (A.C. or D.C.) Three referred to here.

In PRACTICAL WIRELESS dated October 15th last, a description was given of how a two valve battery receiver was converted to all mains working by means of these valves, and many readers asked for details of a three-valve set using the same types of valve. The circuit illustrates the arrangement which we recommend. It will be noticed that no heater transformer is required with these valves, which operate with the full mains voltage on the heaters, and may be used with mains voltages between 110 and 250 volts. The consumption is very low.

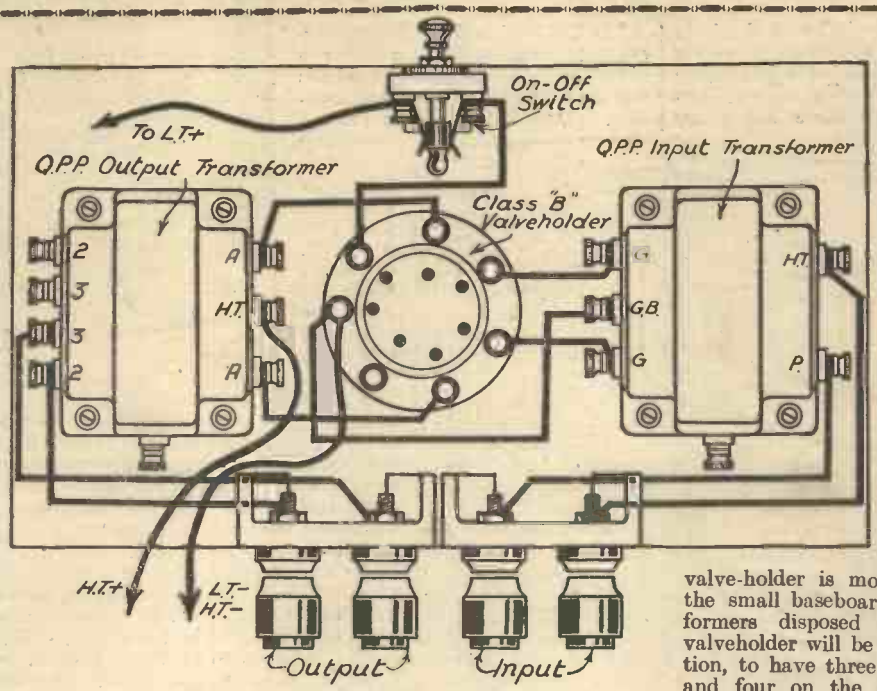
STILL LEADING!

OUR "CLASS B" UNIT

A Simple Easy-to-make Unit Employing a Class B Valve, and the Necessary Accessories for Addition to Any Existing Receiver. A Cheap Method of Testing Out Class B Amplification Without Building a New Receiver.

AT the time of writing this article, Saturday, March 25th, *the first 7-pin valves* to be released to the Press have just been received, and in accordance with the PRACTICAL WIRELESS policy of *being first*, we give in this issue details of a receiver and a unit employing this, the very latest development in wireless valves.

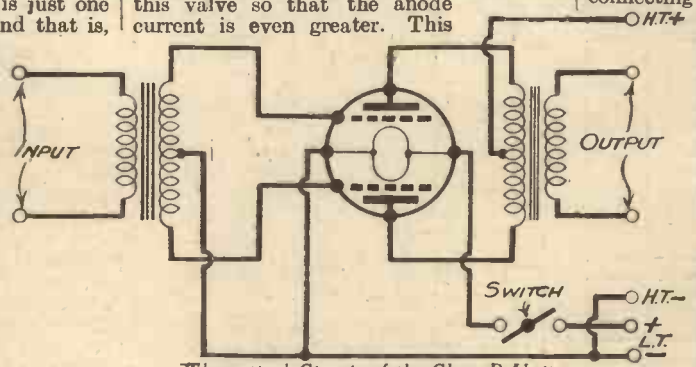
Undoubtedly, the majority of readers like to try out the various new developments which are introduced into the radio world, and this is sometimes a matter of difficulty, owing to the fact that there is not always a desire to dismantle a receiver which is giving good service. Sometimes, too, the present receiver employs very expensive parts, and these naturally are not of the kind which may be put in the junk-box whilst new parts are purchased to build up a new set. "Class B" is a new development, and as you will have read last week, it gives a phenomenally large output from a battery-operated receiver, and requires no grid-bias. In order, therefore, that readers may try out the scheme, the unit described in this article has been made up and may be adapted for use with practically any broadcast receiver. There is just one point which must be stressed, and that is, that the input transformer used in this unit will only give of the best when used direct in the anode circuit of a small power valve. This is not due to the particular make of transformer used, as this point applies to every driver transformer used with Class B valves, and the reason will be apparent if you refer back to last week's article on the Class B valve.



Wiring diagram of the Class B Unit

Power Necessary

As you will see, the flow of grid current in the transformer secondary necessitates the supply of power to that secondary, and the method of obtaining this is to use a step-down transformer, and to supply the primary with a really good current. Therefore, if the receiver with which you intend to use this unit employs a choke output circuit, the best results will be obtained if you cut out the choke which is included in the anode circuit of the valve you are using. Another point which must be emphasized is that the valve feeding the input of this unit should be a Cossor P. 215, or at least a valve of exactly similar characteristics. This valve takes an anode current of 10 mA. with 7.5 volts grid-bias, and an anode voltage of 150, although for best results with Class B it will be found preferable to slightly under-bias this valve so that the anode current is even greater. This need not cause any doubt regarding the life of the H.T. battery as the Class B valve takes such a small current that it compensates for the increased current of the driver valve whilst at the same time delivering such a large speech signal.



Theoretical Circuit of the Class B Unit

The Unit

A glance at the wiring diagram and theoretical circuit will show that there are only four components employed, two Class B transformers, an on-off switch, and a valve. The construction of the unit is, therefore, simplicity itself. The valve-holder is mounted in the centre of the small baseboard, with the two transformers disposed on either side. The valveholder will be found, on close inspection, to have three terminals on one side, and four on the other (that is with an imaginary line drawn across the diameter). If you examine the wiring diagram you will see how to stand this holder, unless, of course, you obtain a holder with the marking on the terminals. The two terminal blocks are screwed to the rear edge, with the input terminals connected to the input or driver transformer, and the output terminals joined to a pair of terminals on the output transformer. The on-off switch is centred on the panel, and wired in the filament lead as shown. When connecting the output terminals to the transformer use ordinary flex to begin with, and try the effect of using different combinations of the four terminals to see which best suits your particular loudspeaker. The remainder of the wiring is carried out with Glazite, and is extremely simple.

Obtaining Best Results

As already mentioned, to obtain the best results from the unit it must be joined direct in the anode circuit of a small power valve. Connect the two input terminals to the anode circuit of the output valve of your present receiver, and switch on the two units. The maximum H.T. voltage should be applied to the unit, and if instability is introduced through using the direct anode connection in your receiver output circuit, you will have to introduce a low value decoupling resistance and

(Continued on page 132.)

"PRACTICAL WIRELESS" "CLASS B" UNIT

1 SS/B Driver Transformer .. .. } 1 SS/BC Output Choke	Sound Sales
1 On-Off Switch S.38 ..	Bulgin
1 7-pin Valve Holder (baseboard type) ..	Whiteley
1 Cossor 240 B. Valve	
4 Terminals, Input—, Input+, Output, Output.	Belling Lee
2 Terminal Mounts ..	Belling Lee
1 Battery Cord—H.T.+, H.T.—, L.T.+ L.T.	Belling Lee
1 Baseboard 9in. by 5in.	
1 Panel 9in. by 5in.	

THE WIRELESS HOUSING PROBLEM

A Practical Article on the Construction of a Serviceable Radio Cabinet of Modern Design.

By "CABINET CRAFT"

THERE are many wireless enthusiasts who construct their own receiving sets and are sadly at a loss when it comes to making up a suitable cabinet to house them. Also, there are many who purchase their sets ready-made, usually in a somewhat plain case, and who would like to make for the set a cabinet really worthy of it. They can easily do this and house the speaker and set in one cabinet. This article should make an especial appeal to these workers, as it describes how a cabinet was actually made to contain a Cossor All-Mains set and a double-cone speaker. For a battery driven set, there is plenty of room behind the speaker for all batteries.

The illustration, Fig. 1, shows the cabinet as completed, while the diagrams give the necessary details and measurements for the construction. The set itself, over all, measured 18¼ in. long by 12½ in. wide and 8¼ in. deep, while the cone speaker was 18in. square. The depth of the speaker need not be taken into consideration. The aerial condenser control is on the left-side of the set, and the terminals on both sides must be allowed for in the width, and also suitable-size holes must be made in the sides of the cabinet to give access to these fittings. So the over-all width of the cabinet and projecting controls determines the width of the cabinet inside. The height of the cabinet is determined by the size of the speaker, which is in the upper compartment. From these general dimensions, an idea of the amount of wood required for the cabinet can be judged.

Fig. 1.—The completed cabinet.

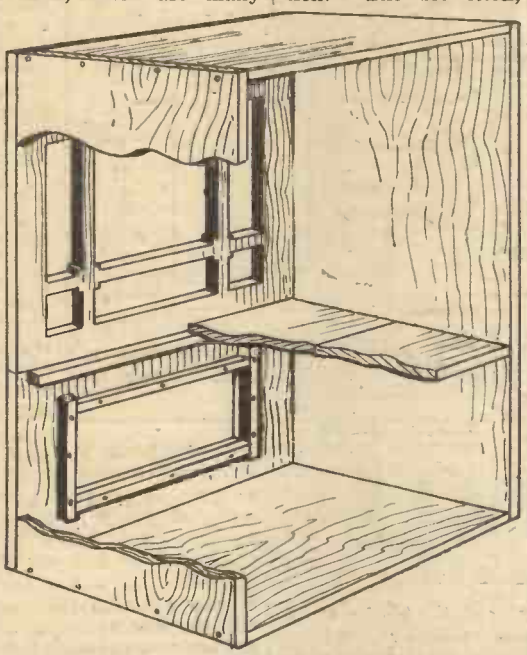


Fig. 3.—Showing the inside construction of the cabinet.

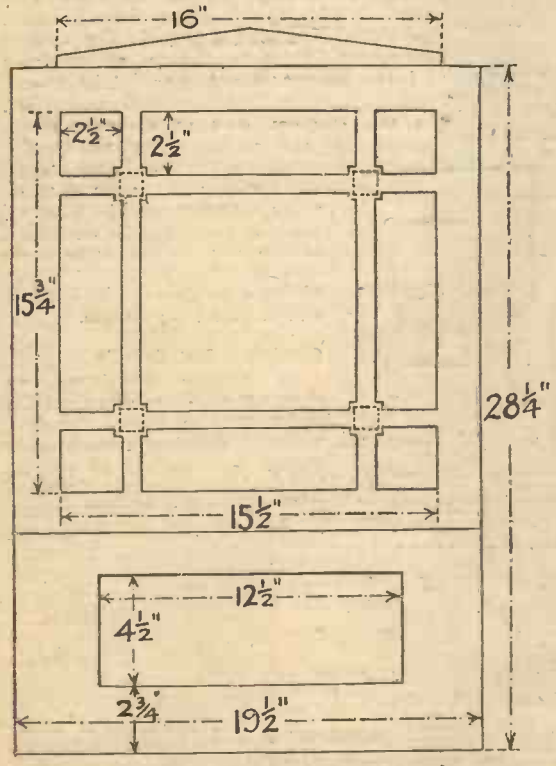


Fig. 2.—Front of cabinet with all necessary dimensions for making up.

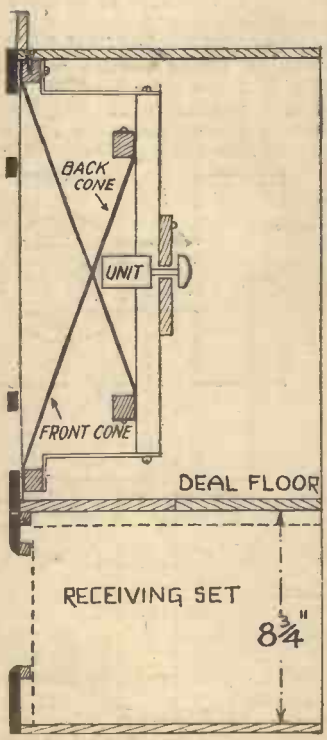


Fig. 4.—Section through set and speaker.

Constructional Details

The sides, top, and bottom consisted, in the actual cabinet, of ⅝in. thick birch plywood (7-ply), while the front was ¾in. thick solid Spanish chestnut made up in two pieces, as indicated in Fig. 2. The floor of the speaker compartment consists of ⅜in. deal in two widths, and cut 18⅜in. long. It was screwed through the sides, the holes for the screws being countersunk and afterwards covered with ½in. by ⅛in. strips. To accommodate the overhanging lip on the top of the set, and also to add to the appearance, the panel of the set was recessed an extra ½in., and this was done by gluing and screwing four ½in. square strips of oak round inside the lower half panel opening, as shown in Fig. 3. The method of building the cabinet was as follows. After the sections were cut and squared up, the positions of the screw holes were set out 3/16 in. from the ends of the sides and 9 5/16 in. up from the bottom edge for the floor screws. The bottom and top of the cabinet measured 18⅜in. long by 12½in. wide, and to these the sides were screwed and the floor added. The top fretted front, 1ft. 7¼in. long by 1ft. 7¼in. wide, was next added, and a ½in. square fillet glued to the underside of the deal floor and flush with its front edge, this fillet taking the top edge of the lower front, the join between the two pieces being later covered with strips, as also were the screws holding the fronts to the sides and top and bottom. There is no baffle-board to the type of speaker used, it consisting only of a frame 18in. square, of 1in. square wood, to which the linen is attached. Another frame, 12in. square behind and held away from the first at a distance of about 4in. The small frame is held by two square uprights having a 5in. board nailed across the middle to take the unit. The speaker was fixed in the cabinet by screws through the top and one side, and was held away from the floor entirely, as shown in Fig. 4.

THE ABC OF SELECTIVITY

PART III

A Practical Article Explaining Methods of Obtaining It

By W. B. RICHARDSON

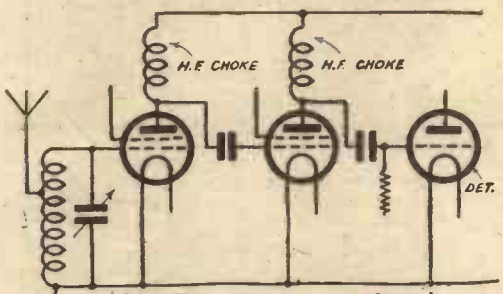


Fig. 1.—Test circuit to prove that selectivity is dependent on the number of tuned circuits.

WHEN we think of a really selective set we naturally imagine one with one or more stages of H.F. amplification. Indeed, we have become so used to associating H.F. amplification with long range and selectivity that we are inclined to take it for granted. I wonder how many of us if we were suddenly confronted with the question: "Why should a 3-valve set with two screen-grid stages be more selective than one with 2 L.F. stages?" would be able to find an answer. And yet it seems to me that unless we have some idea of the "reason why" we must of necessity be groping in the dark when it comes to designing or choosing the design for a selective receiver.

That H.F. amplification *does* give selectivity there is no doubt whatever, but the question is—How does it do it? The best way to arrive at the answer is to compare it with L.F. amplification. As you know, L.F. amplification does not increase selectivity. Wherein then lies the difference? Is there some fundamental dissimilarity between the two systems which would account for the difference in their behaviour? Of course there is. H.F. stages which are used before the detector are tuned whereas the L.F. stages which follow after are untuned. It is the tuned circuits which make the difference.

Selectivity Dependent on Number of Tuned Circuits.

I have already stated that, other things being equal, an increase in the number of tuned circuits gives an increase in selectivity. The action of a number of tuned circuits in cascade might be compared with a rack of sieves, the top sieve being of coarse mesh and the others of increasing fineness. The top sieve makes a very rough selection of the material being sifted, while each succeeding one narrows down the selection until with the last one only the wanted particles are passed. With several tuned circuits in a receiver each one increases the selectivity until the last one passes only a prescribed narrow band of frequencies.

The fact that the increase in selectivity is due solely to the tuned circuits can be demonstrated by fitting up a receiver with several stages of *untuned H.F. amplification*. By this I mean that instead of having a tuning coil and condenser between each H.F. stage the coupling is carried out by means of a resistance (as with R.C.C. coupling used in the L.F. stages) or by means of an H.F. choke as in Fig. 1. Apart from the fact that there is not quite so much amplification as with tuned stages the most noticeable difference is that selectivity is of a very low order. In fact the apparent selectivity owing to the amplification of wanted and unwanted stations alike is worse than if no H.F. valves were used at all.

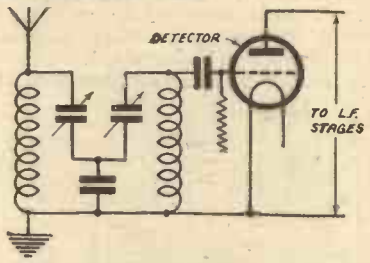


Fig. 2.—One way to employ two tuned circuits is to place them both before the detector.

The Object of H.F. Valves.

When two tuned circuits are coupled together there is always some loss in signal strength. This depends, of course, on the tightness of the coupling. It may be that only 70% of the available energy is transferred to the second circuit. However, the gain in selectivity is such as to make it worth while. In this respect two coupled circuits differ from a single circuit, for as we have already seen none of the expedients which are normally used will increase the selectivity of the single circuit without introducing a disproportionate loss in signal strength.

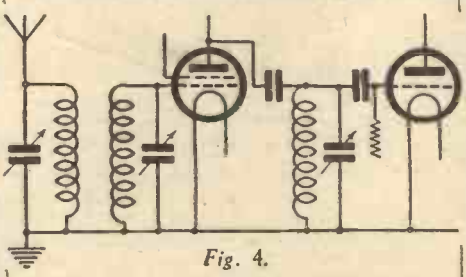
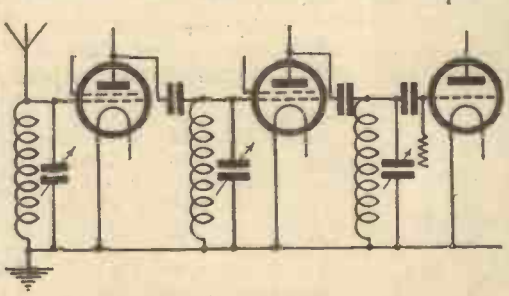


Fig. 4.



Figs. 4 and 5.—Optional arrangements for three tuned circuits.

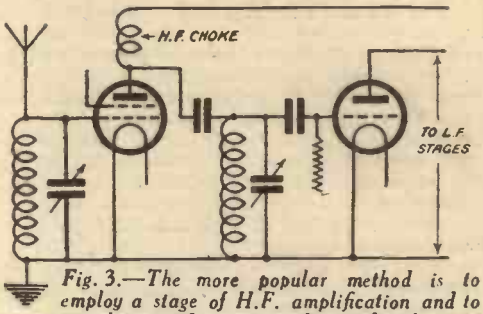


Fig. 3.—The more popular method is to employ a stage of H.F. amplification and to use the second circuit as the coupling between the S.G. valve and the detector.

However, although from the point of view of selectivity two tuned circuits are better than one we cannot go on increasing the number indefinitely without taking into account the loss in sensitivity which each additional circuit entails. This is where the H.F. valves come in. They make up for the loss between each circuit. Of course, modern valves do more than just make up the loss; they give a decided increase.

In this connection it may be easier to understand the function of the H.F. stages of a set if we consider the valves as the means of coupling the tuned circuits rather than the more usual way of looking upon the tuned circuits as the means of coupling the valves.

Alternative Arrangement of Tuned Circuits

Let us now have a look at the various methods of coupling several circuits when we have one or more H.F. valves available. Firstly, let us take the case of just two circuits. Here there are two alternatives. The first one, which we have already seen, is to place both circuits before the detector as in Fig. 2. The various methods of coupling we have already studied so that there is no need to go into that again here. The second method, which is the more popular, is to employ a screen-grid valve and use the second tuned circuit between the S.G. valve and the detector as in Fig. 3. What are the pros and cons of the two arrangements?

Range or Quality?

From the point of view of selectivity alone there is not much to choose between them, but when it comes to the questions of range and quality there is some difference. Circuit Fig. 3 gives greater range because the signal impulses are amplified by the S.G. valve before detection. As you know, the perfect detector has yet to be discovered, and with the popular leaky-grid arrangement the rectifying effect drops off rapidly below a certain input. This means that *very weak* signals are to all intents and purposes not rectified at all. Of course it's no use adding more L.F. stages to bring them in because *you cannot amplify what is not there!* If the detector has not rectified them then they are lost. This is where the H.F. valve comes in. It amplifies the H.F. impulses from weak stations so that they are strong enough to make the detector

(Continued on page 100.)

(*Continued from page 99.*)

function. From this you will see how the circuit of Fig. 3 has the advantage over that of Fig. 2. Fig. 3 employs pre-detector amplification but Fig. 2 does not.

The advantages of Fig. 2 circuit are chiefly those of quality and cheapness. If the coupling between the two coils is arranged to give a band-pass effect then the quality will be good and no tone compensation will be required in the L.F. stages; also the somewhat expensive screen-grid valve is not required. With Fig. 3 circuit, on the other hand, band-passing is not possible: therefore if the circuits are made very selective some loss of high notes is bound to result.

With three tuned circuits there are again two possible arrangements. The first is to use one H.F. stage with band-pass input and a single intervalve circuit as in Fig. 4, and the other is to use two H.F. stages with a tuned circuit between each. This is shown in Fig. 5. Here again the choice will depend on other considerations than that of selectivity alone, from which point there is not much to choose between them. The number of tuned circuits being the same so the selectivity will be about the same.

Low-loss Circuits Essential

A fact which is not always realised is that to obtain the full selectivity from a number of tuned circuits each must be designed on efficient lines—lines similar to those laid down in Part I of this series. It is not sufficient to have a low-loss aerial coil followed by indifferent intervalve coils and still less so to have *all* of them of small inefficient design with the idea that the enormous magnification of modern valves will make up for the losses. Certainly the valves will make up for the loss in *sensitivity* but they cannot restore lost *selectivity*. They can increase the *height* of the response curve of the detector grid circuit, but they cannot alter its *shape!* No, each circuit, if it is to pull its full weight, must be designed on low-loss lines. If you need practical proof of this statement you have only to take the example set by the new Ferrocart coils. These are essentially low-loss coils and give remarkable selectivity. The great feature about them is that they are not only highly efficient but also extremely compact. On the other hand, the ordinary type of coil is either efficient *or* compact—but not both!

Selective Tuners must be Carefully Matched

Another point is that the more selective the circuits are the more accurately must they be tuned. This fact will often explain why a receiver employing two circuits tuned with separate condensers will give better range than one using three circuits tuned with a three-gang condenser. Owing to inaccurate ganging the second set is not properly tuned and is therefore not giving of its best.

I have often read descriptions of receivers in which the designers have made a virtue of flat tuning in the intervalve circuits. They stated that ganging was "easier." Surely a most naive admission of the shortcomings of the ganging! Had the ganging been accurate there would have been no need for flat tuning. In this connection it will be noticed that indifferent ganging and flattish tuning go hand in hand. It is no use providing selective coils if they cannot be tuned. On the other hand, if the coils are unselective it does not matter so much about the condensers being dead accurate. Of course if full advantage is to be taken of really selective coils used with ganged condensers then both the coils and the condensers must be carefully matched and all the stray capacities and inductances due to the wiring balanced out. Regarding this last point endeavour should be made

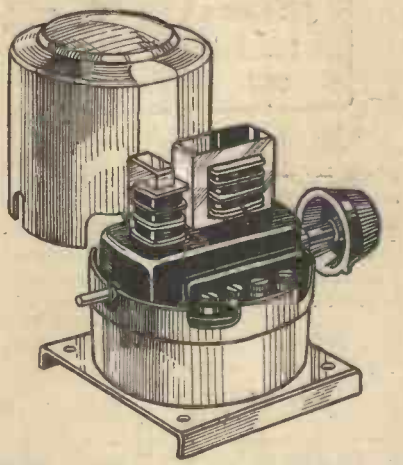


Fig. 8.—A Ferrocart coil which gives remarkable selectivity and has small dimensions.

to obtain some symmetry of lay-out, by which I mean that the connecting wires to each coil should be as near the same length and shape as the corresponding wires to the other coils. In this way the added inductances and capacities will be approximately the same for each circuit, and thus ganging will remain more accurate over the whole scale than would be the case if the trimmers were relied upon to make up the differences.

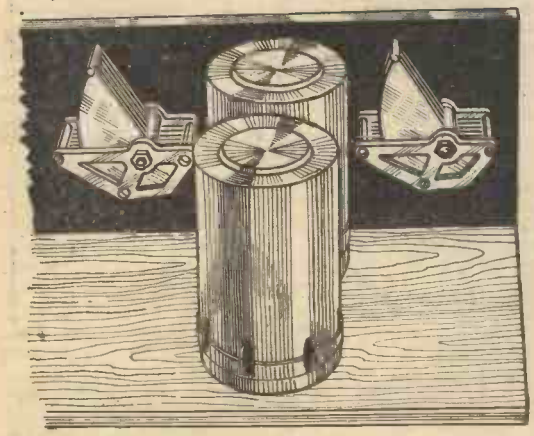


Fig. 7.—An arrangement which allows of a more compact lay-out but is not so efficient as that shown in Fig. 6.

Compactness *versus* Efficiency

With the increase of tuned circuits there are always two important questions to be considered. One is the means of tuning them and the other is the question of space. With one H.F. stage only (two tuned circuits) it is possible to get a high degree of efficiency by using fairly large coils spaced well away from a single metal dividing screen as in Fig. 6. This arrangement is very popular, but if still greater selectivity is wanted then another circuit must be added.

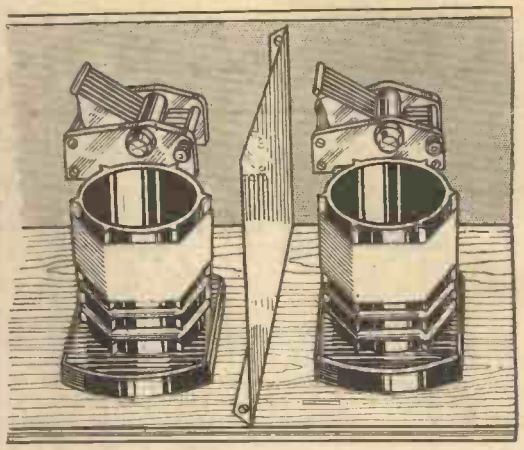


Fig. 6.—Good selectivity can be obtained from two tuned circuits arranged as above.

To repeat the same arrangement again by using a third similar coil, condenser and screen would make the whole thing unnecessarily bulky and the three condensers would be exceedingly difficult to tune. The usual thing to do, therefore, is to employ three comparatively inefficient screened coils and a three-gang condenser. The resulting arrangement is even more compact than with the single H.F. stage but it naturally does not give the same increase in selectivity that three low-loss coils and three separate condensers would. An alternative arrangement is to use a two-gang condenser and a single condenser instead of the three-gang one as a sort of compromise. Of course the Ferrocart coils already mentioned are a distinct step towards a solution. They provide in a small space coils of an efficiency equal to very large coils of the ordinary type.

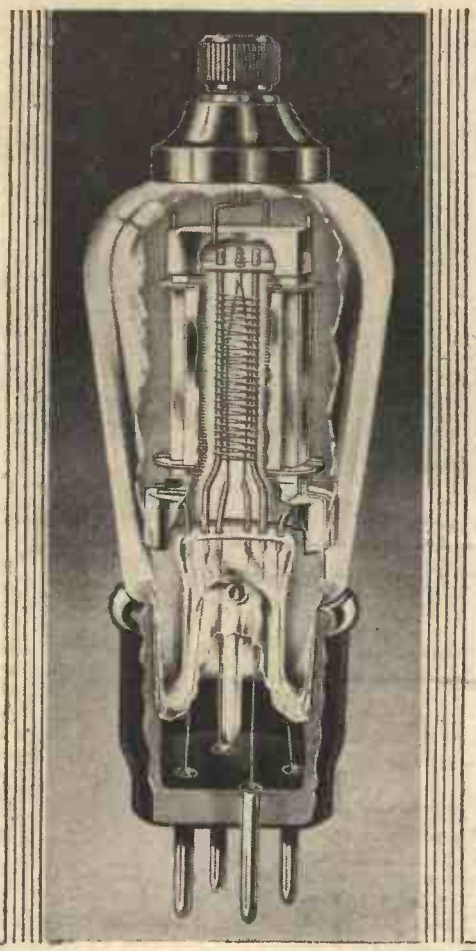
Effect of the Detector on Selectivity

There is one point in connection with selectivity which must not be overlooked. I refer to the damping effect of the detector valve on the circuit immediately preceding it. With leaky grid detection this is often considerable and results in reduction of selectivity and general alteration of the tuning. It is not so apparent with a single tuned circuit because there is no other similar circuit with which to compare it, but with two or more the last circuit is noticed to be flatter in tuning than the others and also to be difficult to gang with them. Anode-bend detection is often suggested as a solution, but it is usually found that under working conditions the "Miller effect" due to the inter-electrode capacity of the valve nullifies the advantage gained by the absence of the grid leak and condenser.

Screened-grid Valve as Detector

Probably the most practical solution of the problem is the use of a screen-grid valve as detector. Due to its internal screening it is free from the Miller effect and so throws less damping on the previous circuit even when used as a leaky grid detector.

Returning to the question of intervalve circuits I find I have not made any reference to the various systems of connection. As regards selectivity there is not much to choose between tuned-grid, tuned-anode or transformer coupling. Each employs its own individual method of sharpening the tuning, such as reducing the size of the coupling condenser, taking a tapping or reducing the number of turns on the primary.



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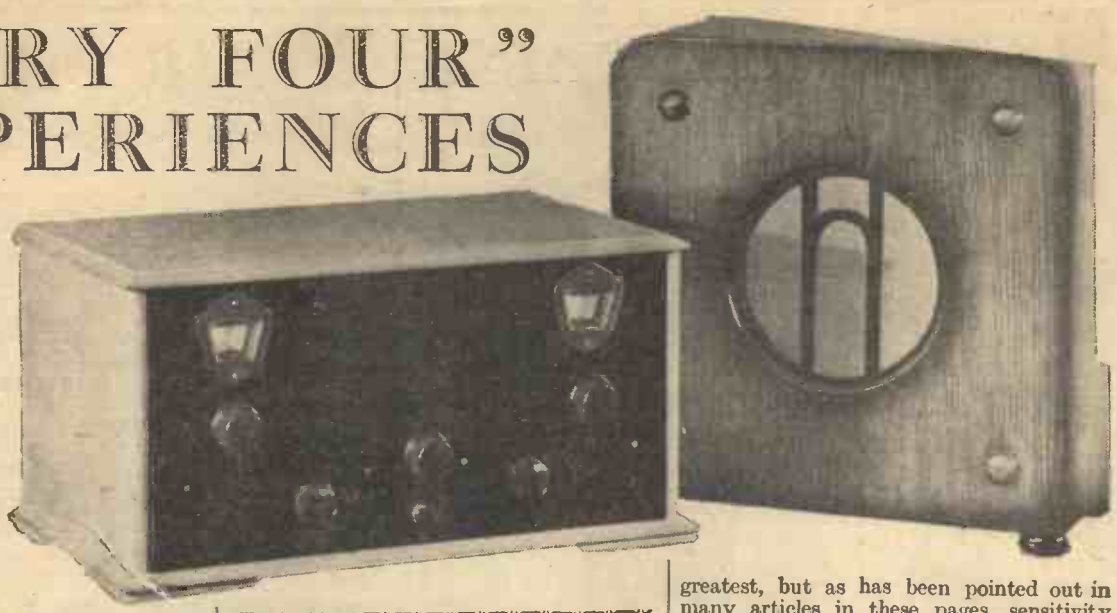


JUDGING from the vast correspondence which has been dealt with regarding my "Fury Four," there are very few real difficulties which have arisen. As was to be expected, this circuit was so carefully worked out that there was very little that could go wrong, and the majority of the queries which have been received were relating to quite simple points. In order, therefore, to anticipate any questions which may be asked by builders of this receiver in the future, I will give details of the points which have been raised. Just a friendly hint: Please do not ask your queries over the telephone.

Some General Queries Answered and Anticipated!

By F. J. CAMM

The Fixed Condensers

Quite a number of readers wrote to enquire about the two fixed condensers which are used in the H.F. decoupling circuits. In the specification these are referred to as Dubilier Type BE.31 with a value of .1+.1. On the case of the condenser appears the marking .2 CT. Some readers thought that the condenser which they had bought was of the wrong type. Actually the condenser consists of two .1 condensers joined in series inside one case. The junction of the two condensers is provided with one lead, whilst a lead is brought out from the remaining terminal on each condenser. Therefore the condenser has a total capacity of .2 and is centre-tapped. If, therefore, you buy the condenser specified you will understand the meaning of its marking.

The "Fury Four" ready for a test.

The Reaction

Another point which has cropped up in some cases is the reaction control. This does not seem to function in some receivers when the knob is rotated clockwise. If your receiver suffers from this peculiarity, try the following idea. On the coil furthest from the panel, terminal 2 is joined to the screw on the coil chassis. On the blueprint terminal 5 is also joined to terminal 2, whilst the reaction condenser is joined to terminal 6. Leave terminal 2 joined to the metal chassis, but change over the two wires which are joined to terminals 5 and 6. That is to say, terminals 2 and 6 are joined to earth, and terminal 5 to the reaction condenser. In some cases this will be found an improvement so far as the reaction is concerned.

Selectivity

Complaints of lack of selectivity are nearly always found to be due to lack of skill (if I may call it such) in handling the receiver. As I pointed out in the notes on tuning the receiver, if the potentiometer is left turned nearly fully on, the *sensitivity* is greatest, but as has been pointed out in many articles in these pages, sensitivity and selectivity work together. That is to say, if the set is made sensitive, it becomes unselective, and conversely when made selective the sensitivity falls off. Therefore remember that when you are in need of selectivity you must reduce sensitivity by turning down the potentiometer. In order to get back the strength of the station you desire to receive, recourse must be had to the reaction control, and there is a certain amount of "skill" in being able to balance these two controls so that the weak station which is transmitting on a wavelength close to that of a high-powered one may be received clear of interference.

Balanced Circuits

The three tuning coils are matched, and the single and the double-gang condenser are also matched. Therefore, the tuning points on the two dials should be practically identical. If one dial is more than 10 degrees out, then the circuits are not wired up correctly, or undue stray capacities have crept in due to bad wiring or bad spacing of wiring. This will give you something to work on, therefore, if your circuits are well out of tune. The small pre-set condenser must be correctly adjusted for your local conditions, and there is no need to touch this once the preliminary adjustment has been carried out. The small slotted nut on the side of the ganged condensers should be adjusted with a long thin strip of wood to avoid hand-capacity effects, and there will be found to be a critical spot on this, although it is not very easy to find. The best thing is to tune in a very weak station on the bottom of the medium wave-band (preferably when London is not working) and to set it by that. This setting should hold right up to the top of the long-wave band.

Quality

Not one single complaint has been received concerning the quality of the reproduction, and this appears to have fulfilled my wish to please everybody, so far as tone is concerned.

This completes the points which have been raised concerning the actual receiver, but I should like to point out the following things. Two London readers 'phoned me up (although it is stated on the Queries and Enquiries page that queries cannot be

(*Continued on page 121.*)

UNDERSTANDING YOUR AERIAL

By GILBERT E. TWINING

This Article Describes in a Simple Way the Functioning of the Aerial together with the Comparative Merits of the Different Types.

AN efficient aerial can be said to be an elevated wire placed at the necessary height, insulated and isolated as far as possible from all earthed objects, such as walls, high buildings, iron guttering, etc. It is the means whereby electrical vibrations originating from the transmitting stations are received and conducted to the receiving set. It must be understood that the aerial is constantly having set up in it a large number of minute pulsating electric currents of different frequencies, for each broadcasting station has been allotted its own frequency or wavelength. In other words, the violent electrical vibrations in a transmitting station's aerial will produce electric waves in space and these waves coming into contact with the receiving aerial will set up in it electrical vibrations of exactly the same frequency as those of the transmitter. An aerial, however, has its own natural wavelength; this is the wavelength to which the inductance of the wire is tuned by its own capacity, therefore the nearer the natural wavelength of the aerial is to the station being received the stronger will be the signals from that station. It must follow, then, that the inductance of the aerial tuning coil and the capacity of the variable condenser in the set to which the aerial is connected, will have little effect in overcoming or cutting out the signals from the station which the aerial naturally tunes in to. But, however, if the aerial is shortened, then its natural wavelength will be reduced and so remove it farther away from the station received. The aerial will then have less control over the tuning of the set, and so allow the aerial, when the correct length or rather the best length for the district in which it is situated is arrived at, to be entirely controlled by the set's own tuning circuit.

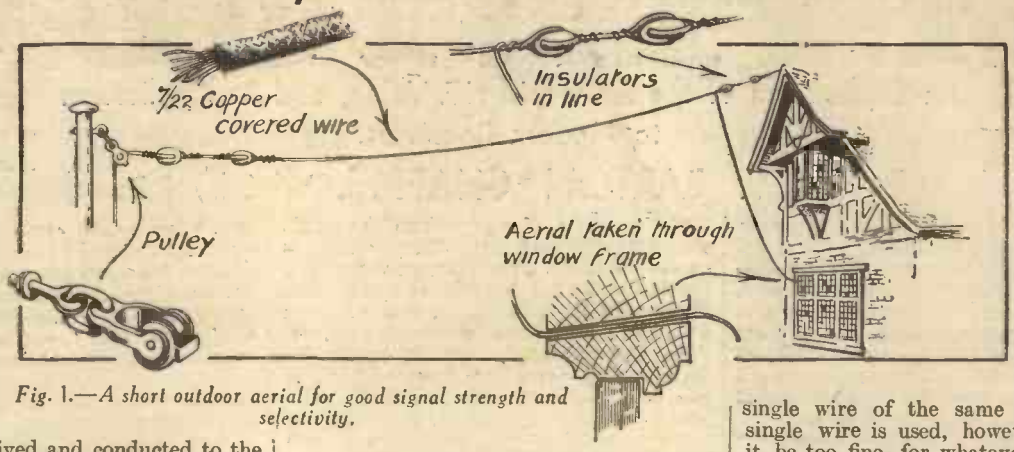


Fig. 1.—A short outdoor aerial for good signal strength and selectivity.

Frequency of Vibration

The minute currents which the aerial collects surge up and down the wire; the coil to which it is connected adds a certain amount of length to the aerial, the bigger the coil, (that is to say, the greater its length or number of turns it has upon it), then the greater the time taken for the surges. Frequency means the time that the currents take to flow in the aerial, backwards and forwards, causing it to vibrate at a definite frequency. Therefore if the length of the aerial is altered, so also must the frequency of the vibrations be affected and the set will then be said to be tuned to another station, either of a shorter or a longer frequency, depending upon whether more wire was wound around the coil or some taken away. This is said to be altering the inductance of the coil, but it is easier in actual practice to alter the capacity of a variable condenser which is connected across the coil. It is only when wavelengths of widely different frequencies are needed that complete new coils, or at least separate windings, are necessary, such as medium and long wave coils of the dual-range type and, of course, short wave coils.

The coil and condenser are so adjusted, enabling the aerial to be in "tune" with a certain transmitter of a given frequency. This really means the resonance or building-up effect of one frequency only, so that the strength of the current received from one station to which the set is tuned will be very much greater than that of the adjacent stations to which it is not in tune. The high-frequency currents mentioned above mostly travel on the outside of an aerial and it is for this reason that stranded wire is preferred, as the area of a number of strands must be greater than that of one single wire of the same diameter. If a single wire is used, however, do not let it be too fine, for whatever the thickness used it must offer some resistance to the H.F. currents picked up, therefore the larger the gauge of wire the easier will be the passage for the flow of current.

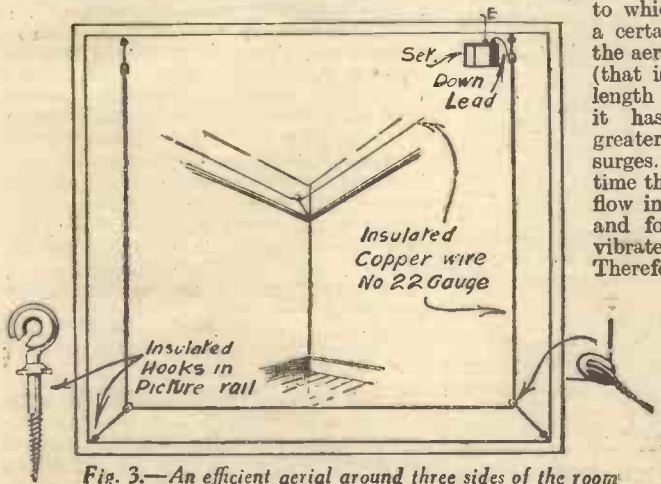


Fig. 3.—An efficient aerial around three sides of the room hung from its picture rail at a distance of 1 foot.

The Outdoor Aerial

An aerial which is erected out of doors still remains one of the most efficient types that can be obtained, for if care is taken in choosing the spot where it is to be placed, special note being taken, as before mentioned, from the point of view of isolation, it should be selective and very efficient for long distance reception. Many people already having an aerial outside in the garden have discarded it for one placed round the picture rail or elsewhere in the house. If the garden aerial had been shortened and a little more attention paid to it the trouble of

(Continued on page 121.)

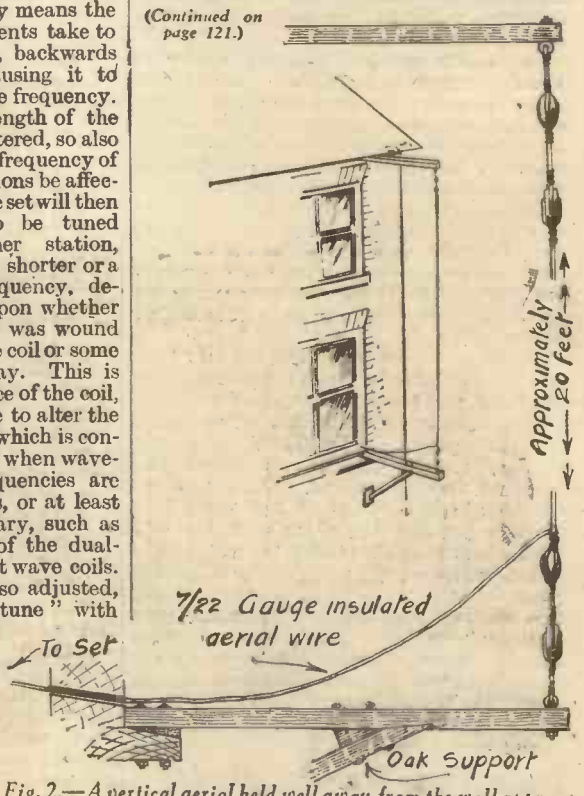


Fig. 2.—A vertical aerial held well away from the wall approximately 20 ft. high, will give very good results.

H.F. PENTODES

An Explanation of the Multi-grid H.F. Valve, and its Application to Modern Receivers.

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc.

IT is an open secret that the coming season will almost certainly see the general use of high-frequency pentodes as radio-frequency amplifiers. Although, at first, they may only make their appearance in sets of the most advanced design, there is no doubt that in due course valves of this type will, to a very large extent, replace the familiar four electrode or screened-grid valve in the high-frequency stages.

For this reason, it is not too early for listeners to learn something of the new method of amplification, and the reasons for its adoption. In the first place, it must be stated right away, that actually high-frequency pentodes have been available for some little time, although so far they have not been used very widely. Now, however, their appearance in commercial form, for the use of the average listener, is imminent.

Where is the Difference ?

In external appearance, and in general design, high-frequency pentodes do not differ greatly from screened-grid valves, the only addition being the third grid which, like the low-frequency pentode third grid, is connected to the cathode of the valve. In application, also, the high-frequency pentode and the screened-grid valve are identical, so that the user will have no difficulty whatever in accustoming himself to the new valves.

What, then, will be the difference between the two types of amplifier ? Briefly, the main difference will lie in the much greater sensitivity of the pentode, giving a much larger overall gain per valve stage, but in addition, the pentode allows a considerably wider degree of latitude as regards operating conditions, as will be explained. First of all, however, because the high-frequency pentode must be considered as a development of the screened-grid valve, it is necessary to consider briefly the facts which led up to the introduction of the screened-grid valve itself.

Up till about five years ago, the only type of valve available for use as a high-frequency amplifier was the ordinary three electrode valve. Theoretically, such a valve should be quite a good amplifier of radio-frequency signals, but in practice its possibilities could not be fully realized. You see, owing to the physical design of the valve (the position and closeness of the electrodes and the leads coming from them) the metal parts of the valve acted as the plates of a very small condenser. For low-frequency work, this condenser effect, or "inter-electrode capacity" as it is called, was not very serious, but on radio frequencies this small condenser allowed a considerable part of the amplified high-frequency energy in the anode circuit to pass back to the grid circuit *within the valve.*

Feed Back Difficulties

You will scarcely need to be reminded that the return of energy from the anode circuit to the grid circuit in any valve is equivalent to the process known as reaction, the energy so fed back being re-amplified in the valve. At first sight, this may seem a very efficient and useful arrangement, but the difficulty was that owing to this re-amplification, more high-frequency energy was built up than could be utilized, or, to put the matter in technical language, the valve generated free oscillations. This excess energy produced an unstable condition of the circuit, and was manifest by howling and other distressing symptoms.

The screened-grid valve was the final and best solution to the difficulty. In addition to the usual control grid, this valve has a second grid which is kept at a positive potential of approximately half the high tension voltage applied to the anode. Two effects follow. In the first place, the second grid, being arranged between the true grid and the anode, and being connected to earth *via* the high-tension battery, acts as an electrostatic screen between the grid and anode, and thus prevents high-frequency energy from passing back from the anode to the grid. The circuit thus remains stable, especially if care is taken to screen effectively all other components in the high-frequency circuits. The second point is that the amplification factor of the screened-grid valve is very much greater than that of the triodes it replaced, and because of the stable condition of the circuit, this high amplification factor can be utilized to good advantage.

S.G. Valve not Perfect

Why, then, is it now found necessary to introduce a further type of high-frequency valve ? Well, in spite of the high efficiency of the screened-grid valve, it is not perfect in certain respects. I do not want to go too deeply into technicalities, so it must suffice to say that in order to obtain stable working with a screened-grid valve, a certain rough proportion between the screen voltage and anode voltage must be maintained. The respective values are not very critical, as anyone who has used a screened-grid valve will know, but the fact remains that the value of the anode current is not absolutely and at all times governed by the voltage applied to the grid of the valve. In certain circumstances, an interaction takes place between the screen and the anode, and the anode current variations do not follow the variations of grid voltage. Not only does this mean distortion, but also an unstable condition of the circuit.

In the high-frequency pentode, a third grid is situated between the screen grid and the anode, and is connected to the cathode or filament, as the case may be. It thus acts as an electrostatic screen and shields the anode from the screen grid, preventing the flow of electrons from the anode to the screen grid—the cause of the unstable condition referred to above.

Thus, we have the screen grid used to prevent high-frequency energy passing from the anode to the control grid, and the third or "earth grid" employed to prevent secondary emission from the anode to the screen grid. As a result, the high-frequency pentode can be relied upon to give efficient and stable amplification because the anode current is governed almost entirely by the signal applied to the control grid, and is not effected by the relation between the screen voltage and anode voltage to the same extent as in the screened grid-valve.

High Impedance Necessary

In addition to this, the characteristics of the high-frequency pentode are much higher than those of a screened-grid valve. That is to say, we may expect higher values of amplification factor and of mutual conductance. Other things being equal, therefore, a high-frequency pentode should give a greater degree of amplification than a screened-grid valve. There is, however, one little snag. On account of its special construction, the high-frequency pentode has a considerably higher impedance than a screened-grid valve. Now the overall amplification obtained from a valve, while it depends to a large extent upon the amplification factor of the valve, is also governed by the impedance of the valve and of the apparatus connected in its anode circuit. Actually, the overall amplification, or "stage gain" as it is termed, is given by the formula :—

$$\text{Stage gain} = \frac{\text{Amplification factor} \times \text{load impedance}}{\text{Valve impedance} + \text{load impedance.}}$$

It will be seen, therefore, that the stage gain can never be as great as the amplification factor of the valve, but that, subject to certain practical limitations, the higher the impedance of the load in the anode circuit, the larger the proportion of the amplification factor which can be utilized.

In order to make full use of the high amplification factor of the high-frequency pentode therefore, it will be necessary to use tuned high-frequency couplings of the highest possible efficiency as a high-efficiency tuned circuit forms a load of high impedance. The introduction of the high-frequency pentode, therefore, will stimulate manufacturers to produce coils of higher and higher efficiency, for without these the advantages of the new valves cannot be exploited to the fullest possible extent. At the same time, even when using what are now termed high-efficiency coils, such as are employed in the best home constructed and commercial sets of to-day, the high-frequency pentode will give better amplification than the screened grid-valve.

(Continued on page 126.)

FIRST AGAIN!

THE BETA UNIVERSAL FOUR

A "luxury" receiver, employing variable-mu valve, tone-controlled L.F. stage, and a Class B output stage.

By the *Practical Wireless* Technical Staff.

IT is, as every reader knows, impossible to please everyone the whole of the time. Nowhere is this more obvious than in wireless journalism. A receiver is described in one journal which appeals perhaps to the listener who craves for the reception of stations in the very remote parts of the globe; this has no appeal to the older folk who require only the quieter forms of music broadcast from our home stations. Another article describes a receiver which is guaranteed to "lift the roof" so far as volume is concerned; again, the older or more sedate listener abhors loud volume. Or it may be that a receiver is described which is guaranteed to reproduce the very lowest note that the B.B.C. transmits, and complaints will be received that the piccolo is not reproduced with the screech that a piccolo player likes to hear. So it goes on, and it is thought perhaps, that there is not the slightest possibility of building a receiver which can appeal to all. After carrying out a few experiments in the PRACTICAL WIRELESS laboratories, and in view of the latest arrival in the wireless world (the Class B valve), we hit upon the circuit which is given on this page. A study of this will show that it is almost possible to arrive at a circuit which will go a long way to pleasing everyone. Before passing on to a description of the circuit, let us examine it and see wherein the novelty lies.

The new Cossor 240 B 7-pin base valve.

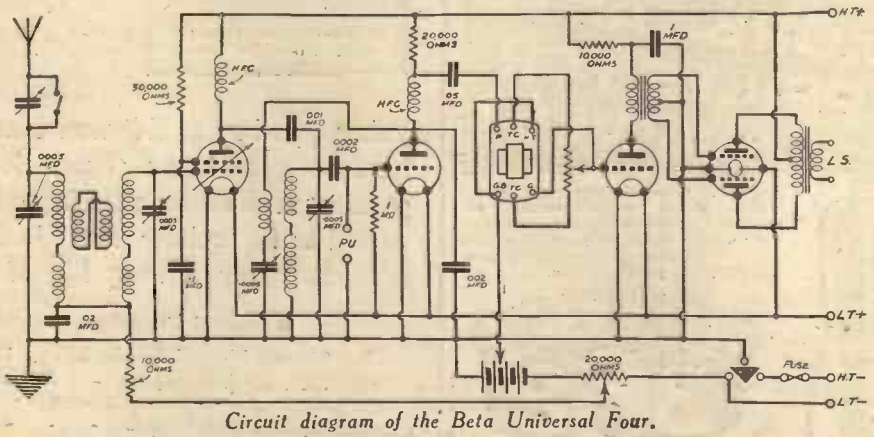
The Circuit

Commencing at the input end of the circuit, we find that a band-pass tuner is employed. Obviously, therefore, the listener under the shade of one of the B.B.C. main station aerials is catered for here. This form of aerial input circuit is the most selective which can be employed to-day, and it provides a separation which is employed by the actual transmitting stations, so that there can be no jamming; and, furthermore, the method of obtaining this selectivity results in the reproduction of all the high notes so that the range of frequencies passed on is the total which is used by the transmitter. No one can find anything to complain of in this part of the circuit, therefore. The first valve is of the variable-mu type, giving range, and a really simple method of reducing volume. The seeker after long-distance stations can therefore reach out, by employing this valve at its most sensitive position, whilst when the home stations are required, the volume may be reduced to a whisper without introducing distortion. The manner in which the variable-mu does this has already been explained on numerous occasions in these pages. The output from this valve is fed into the tuned-grid circuit of the detector valve, working on the usual leaky-grid principle. Sensitivity is thus good, whilst the provision of a reaction winding on the coil enables the strength of weaker stations to be boosted. Furthermore, owing to the fact that the coil used is matched with the two band-pass coils, a three-gang condenser may be employed, and by choosing components here which are all of the same make it has been found possible to introduce a dial on the condenser which is calibrated direct in wavelengths. The position of any station is therefore easily found and no "searching" is necessary.

The coupling from the detector valve to the first L.F. valve is carried out by means of a special tone-control transformer. This is a component made by the Multitone Electric Company, and is used in conjunction with a special graded potentiometer. By adjustment of this potentiometer it is possible to vary the reproduction from normal to "all bass" or "all treble." In other words, the high notes or the low notes may be eliminated. The value of this is felt most in the removal of heterodyne whistles, or in adding depth to organ music, etc. The tone of the reproduction may therefore be adjusted by each individual listener to suit personal likes. The output from this transformer feeds a small power valve, which is next coupled to the latest Class B valve. The result, therefore, is that the loud-speaker receives a signal which is free from interference, is controlled as to tone, and is of a volume which will suit either the listener who wishes to join the family circle in a dance, or who desires to hear really high-class music in an atmosphere of "refined" tone.

The actual receiver is very simple to build, and although there may appear to be rather a formidable array of knobs on the panel, the handling of the receiver is not difficult. There is the main tuning control, the volume control, the reaction control, and the tone control. The on-off switch cannot, of course, be classed as a control. Reaction will only be needed at infrequent intervals when it is desired to bring up the strength of the very weak stations.

Next week we shall give the preliminary constructional notes regarding this receiver.



Circuit diagram of the Beta Universal Four.

LIST OF COMPONENTS FOR THE BETA UNIVERSAL FOUR

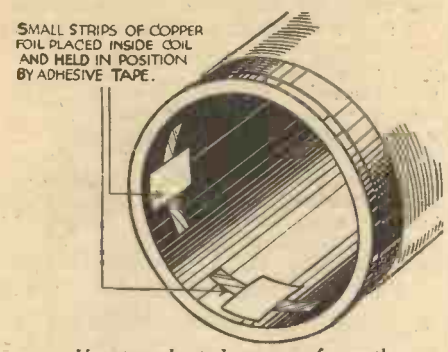
One Pair Telsen Band Pass Coils (Type W. 290).
One Telsen single Matched Coil (Type W. 216).
One Telsen Three-gang Condenser with Disc Drive.
One Telsen Aerial Condenser with shorting switch.
Three 4-pin chassis-type valveholders. Clix.
One 7-pin chassis-type valveholder. Clix.
One .02 Dubilier fixed condenser, type 9200
One .001 ditto ,, 670
One .05 ditto ,, 9200
One 1 mfd. ditto ,, BB
One .0005 mfd. ditto ,, 670
One .1 mfd. ditto ,, 9200
One 10,000 ohm spaghetti resistance. Lissen.
One 20,000 ohm ditto Lissen.
One 30,000 ohm ditto Lissen.
One Bulgin H.F. Choke, Type H.F.9.
One Lissen standard H.F. Choke.
One .0005 mfd. reaction condenser. Lissen.
One Multitone Toco 1-4 L.F. Transformer.
One Multitone Graded Potentiometer.
One Benjamin Class B Driver Transformer.
One Busco three-point switch with fuse-holder.
One Lewcos 20,000 ohm Potentiometer.
One Becol Ebonite Panel, 15in. by 7in.
One 2 megohm Lissen Grid Leak with wire ends.
One Lissen 16-volt Grid Bias Battery.
One Lissen 120-volt H.T. Battery.
One Lissen 2-volt Accumulator.
One Rola Loud-Speaker, Type F.6/PM/O1/Class B.
One 5-ply Baseboard, 15in. by 10in.
One Cabinet. Peto-Scott.
One Cossor 220 VSG valve (metallized).
One Cossor 210 Det. valve (metallized).
One Cossor 215 P. valve.
One Cossor 240 B. valve.
Three Belling-Lee Terminal Mounts.
Six Belling-Lee Type B Terminals (Aerial, Earth, Pick-up, Pick-up, Loud-Speaker, Loud-Speaker).
One Belling-Lee Four-Way Battery Cord.
Three Wander Plugs, G.B.+, G.B.1 and G.B.2.
Sundry Screws, Fuse Bulb, Coil of Glazite, Flex, etc.

THE HALF-GUINEA PAGE

Radio Wrinkles FROM READERS

A Ganging Device

THE presence of metal in the field of any coil will have the effect of lowering the inductance of that coil if the metal in question is non-magnetic. This effect is often responsible for making it impossible

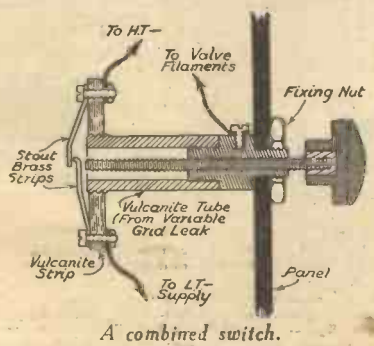


Varying the inductance of a coil.

to tune two circuits with a ganged condenser throughout the wave range covered by the coils, since this system requires the inductance of the coils to be practically identical, and if unscreened coils are employed and not mounted similarly on a metal chassis, the varying proximity of the metal may result in a difference of inductance which cannot be allowed for by use of the condenser trimmers. Such a case was cured easily by the use of a very simple dodge, and perfect ganging obtained over the whole scale. By noticing which condenser was set at the smaller value I located the coil of higher inductance. Small strips of copper foil were then inserted in this coil, thus reducing its inductance, until perfect ganging was obtained. The foil was then retained in position by a few strips of adhesive tape. A very wide range of adjustment is possible by this method, and an astonishing reduction in inductance may be obtained by inserting one complete turn of wire, though this is seldom necessary.—M. L. HASELGROVE (North Harrow).

Handy Switch

THE accompanying sketch shows a switch made from one of the "one hole fixing" variable grid leaks or anode resistances, which were popular a few years ago, with the addition of a few odds and ends from the junk box. It has the advantage of switching on the valve filaments before the H.T. supply, and switching off the latter before the L.T. to valve filaments.



A combined switch.

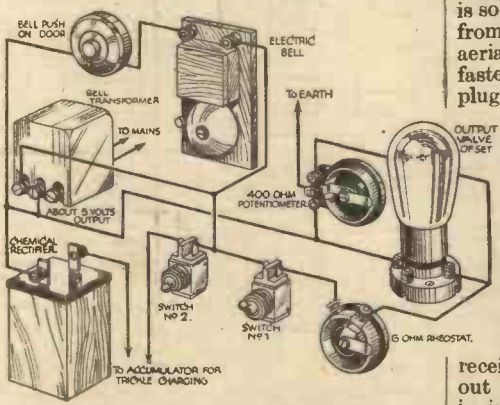
THAT DODGE OF YOURS!

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

It may also be used to prevent unauthorized interference with the set, as it is easy to entirely remove the switch spindle by simply unscrewing same right out. I have used this gadget on a four-valve set for several years with entire success.—E. C. MIDWINTER (Southfields).

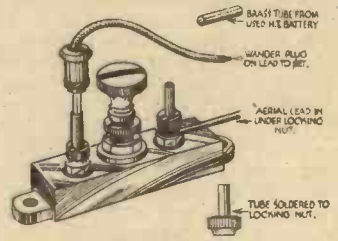
Making Good Use of a Bell Transformer

I HAVE recently purchased a bell transformer costing about 4s., and have put it to three very good uses. Firstly, to work a front door bell. Secondly, to heat the filament of the power valve in my wireless set. Thirdly (in conjunction with



A novel way of using a bell transformer.

the excellent chemical rectifier described in PRACTICAL WIRELESS of January 21st), to charge the accumulators which feed the remaining valves in my set. As I am deriving H.T. from an eliminator my set is now virtually "all-electric." The appended illustration will indicate all the connections. The bell transformer I mounted in the hall next to the door bell, as it gives a slight hum in circuit. The wires from the 5-volt output of the transformer to the bell were tapped, and a length of flex run under the carpet to the set, which is in an adjoining room. The wires were then taken to a switch and then to a rheostat. An ordinary 4-volt power valve is used and the rheostat arm was slowly moved round until the set gave forth its normal output. Care must be taken not to pass more voltage than the valve is rated for. A 2-volt valve can be used with the rheostat arm adjusted accordingly. A potentiometer is necessary, and the slider is kept in the half-way position. With switch No. 1 closed, and No. 2 open, the bell transformer supplies the filament of the power valve. With switch No. 1 open and No. 2 closed, the accumulator is on charge. The wiring was done throughout with twin flex, and the whole arrangement works admirably. It should be quite possible to run extra low frequency valves from the transformer output, but not, of course, H.F. or detector valves, because of mains ripple. During any of the foregoing operations the front door bell rings merrily whenever called upon.—K. W. FRASER (Bexley).



Using a plug and socket to cut out a condenser.

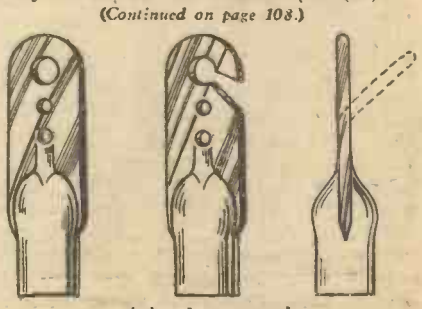
Cutting-out a Condenser

I HAVE adopted the following idea for cutting out or tuning in, on a pre-set condenser. To each screw terminal nut is soldered a short piece of brass tube taken from an old H.T. battery. The end of the aerial lead-in is fixed under one nut and fastened down. On the lead to set, a wander plug is fixed. All that is then necessary is to "plug in" to whichever terminal you wish to use. This method dispenses with all switching and wiring, as will easily be seen by reference to sketch.—R. B. POYNDER (Caversham).

A Handy Terminal

THIS terminal can be attached quickly by one hand, and is useful for the aerial and earth leads to a receiver which is often placed close to a wall. This means that the receiver terminals are usually nearly out of sight, and to use both hands is inconvenient. The terminal is of the type used for a car ignition lead, and is readily obtained from a garage for a penny. A few seconds with a file or chisel will alter the terminal to the required shape, as suggested by the diagram. The wire may be soldered in or slipped through the hole and hammered tight. The blade of the terminal may also be easily bent to an angle, which is a further convenience in many instances.—H. COMBES (Bolton).

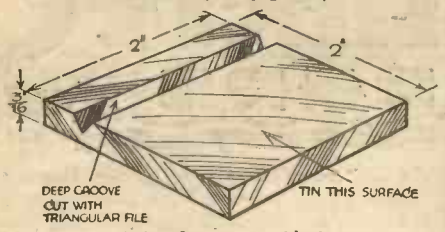
(*Continued on page 108.*)



A handy terminal.

RADIO WRINKLES

(Continued from page 107)



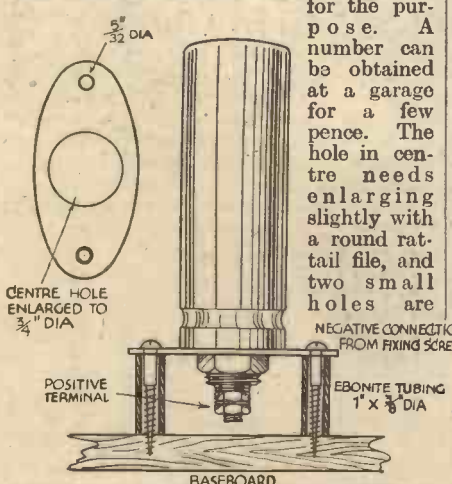
A handy tinning block.

A Tinning Block

A TINNING block for tinning connecting wires, soldering tags, etc., is a most valuable accessory for a wireless workshop, and one which can save a lot of time and trouble. You will need a thick piece of copper or brass for the block. Suitable dimensions are 2ins. square, and $\frac{3}{16}$in. thick. Clean up one surface, and make a deep V-shaped groove across it with a triangular file. Now put the block on a gas ring, heat it up, apply flux to the groove and the flat surface and coat them well with solder. You will find that you can nearly fill the groove with solder, without any running away at the ends. To tin the ends of your connecting wires, whether solid wire or stranded flex, put a trace of flux on each wire, rest it for a moment in the groove of the block, and the job is done cleanly and well. You can tin tags and other small flat articles by applying them to the flat surface of the block.—A. V. HORT (Wembley).

Mounting an Electrolytic Condenser

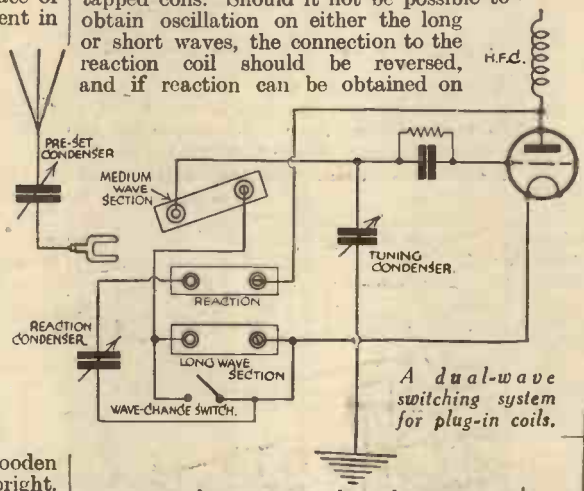
SEVERAL manufacturing firms have recently placed on the market a new type of cylindrical electrolytic condenser which is primarily designed for mounting on a metal chassis with $\frac{1}{4}$in. hole. When the condenser is screwed home the outer case comes into contact with the metal chassis, automatically earthing same and forming the negative pole of the condenser. The question arises as to how these condensers are to be mounted on a wooden baseboard, for they must be kept upright. I mounted mine as shown in the accompanying sketch. On hunting through my scrap box I came across an old motor-car inner tube valve plate. This is elliptical in shape and made of stout brass, with a fairly large hole in the centre. Just the very thing for the purpose. A number can be obtained at a garage for a few pence. The hole in centre needs enlarging slightly with a round rat-tail file, and two small holes are drilled through at each end. For supporting the plate, two pieces of ebonite tubing 1in. long and about $\frac{3}{8}$in. diameter are used, the fixing screws passing through them, as indicated in the accompanying sketch.—A. A. LAMBERT (West Hartlepool).



A neat mounting device for electrolytic condensers.

A Practical Dual-wave Switching System

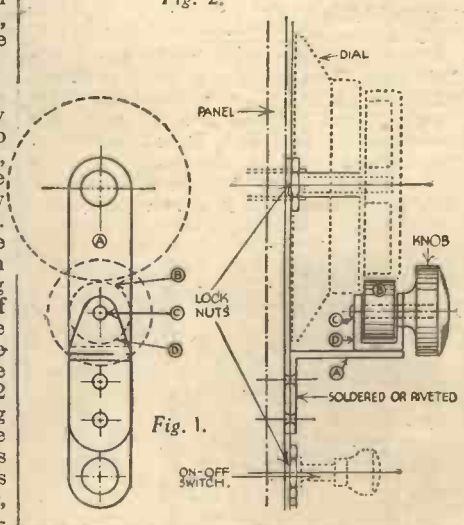
THE arrangement described here enables experimenters to have the advantages of dual-range switching with the use of plug-in coils. As will be seen from the diagram, three coil bases are mounted on the baseboard, two close together, in order to obtain a tight coupling, whilst the third is arranged to swivel to obtain a variable coupling. The centre coil base is for the reaction coil and is wired in the usual manner; the coil base which is in close proximity to the reaction coil is for the long-wave section, and this is wired in series with the other coil (for the short-wave section) and can be shorted by a push-pull switch. In operation a coil of 200 turns is placed in the long-wave socket, a 75-turn in the reaction, and a 60-turn—preferably of the X-coil or centre-tapped type—in the short-wave socket. The aerial is connected through a pre-set condenser of low minimum capacity to the end of the short-wave coil which goes to the grid condenser, or to the tapping in the case of the X or centre-tapped coils. Should it not be possible to obtain oscillation on either the long or short waves, the connection to the reaction coil should be reversed, and if reaction can be obtained on one wave but not on the other, reverse the connections to the coil which fails to oscillate. It might be noted that a very efficient arrangement can be set up as described, as the better makes of plug-in coils are good by modern standards, being wound with thick wire and have little solid dielectric.—P. TAYLOR (Penzance).



A dual-wave switching system for plug-in coils.

A Useful Slow-motion Device

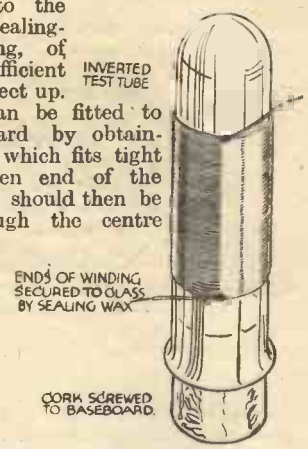
THE accompanying sketches show how an existing slow-motion of a ratio of 4 to 1 can be converted to about 20 to 1, for keener tuning. A is a bracket made from $\frac{5}{8}$in. by $\frac{1}{16}$in. brass strip in any of the forms shown in Figs. 1, 2 and 3. As the on-off switch is usually beneath the tuning condenser the arrangement shown in Fig. 1 may be used, the bracket tail being clamped under the existing bush nuts of each, as shown. No holes need therefore be drilled in panel. If it is desired to have the dial closer than $\frac{1}{16}$in. to the panel, then the arrangement in Fig. 2 or 3 may be used, where the clamping nut of the on-off switch and one countersunk screw through panel is required to hold the bracket. B is a rubber washer (Fig. 1), $\frac{5}{8}$in. diameter, with a $\frac{1}{4}$in. hole (as used for a gramophone motor seat). C is a spindle pushed into B and revolving in two bearings D. If there is any tendency to slip (and there will not be if correctly fitted), a piece of adhesive tape wound round B will make an effective adjustment. A coat of black enamel or thin pitch makes it hardly noticeable.—J. MOORE (Glasgow).



Fitting an additional slow-motion device.

A Simple Short-wave Choke

WHILE experimenting with short-wave receivers and adaptors I have found that a very efficient short-wave choke can be made by obtaining an ordinary test-tube, such as can be bought at any chemist's, and winding same to within an inch of each end with a thin gauge cotton-covered wire. The ends can then be finished off by sticking them to the glass with sealing-wax, leaving, of course, sufficient wire to connect up. The tube can be fitted to the baseboard by obtaining a cork which fits tight into the open end of the tube, a hole should then be bored through the centre of the cork and a screw inserted long enough to reach the baseboard. The cork can then be firmly screwed down and the open end of the tube fitted over it.—D. B. COOKE (Hereford).



Method of mounting a simple short-wave choke.

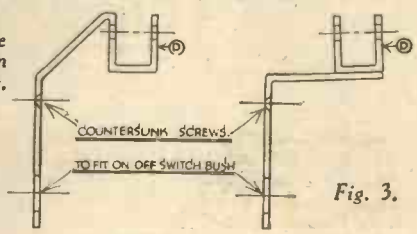
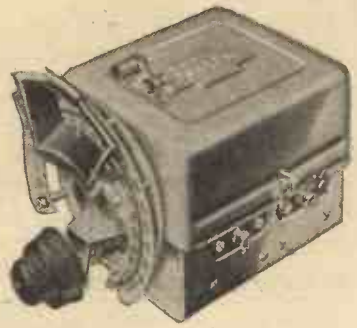


Fig. 3.

Fig. 2.

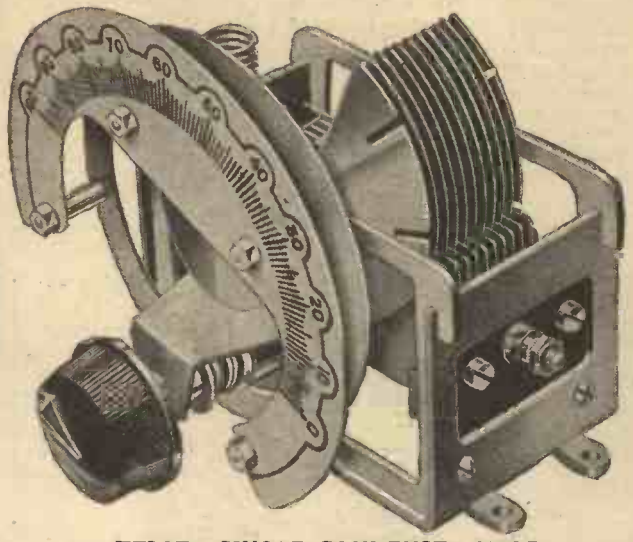
Fig. 1.

TELSEN
PRECISION COMPONENTS



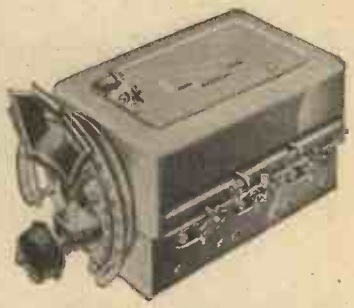
TELSEN TWIN GANGED CONDENSER

Comprises two perfectly matched units, giving accurate and simultaneous tuning of two circuits by rotating a single dial. A knob concentric with the main tuning control operates a variable trimmer. Complete with disc drive, dust cover, escutcheon plate, pilot light holder, degree and wavelength scales, Price 16/6



TELSEN SINGLE CONDENSER UNIT

Designed for use in modern receiver circuits where accuracy of tuning is essential. A pressed steel frame of great rigidity completely obviates distortion, the rotor and stator vanes being let into high pressure die-castings to ensure permanent accuracy of spacing and eliminate the possibility of the vanes working loose. In attractive stove aluminium finish, complete with disc drive, escutcheon plate, pilot light holder, knob, degree and wavelength scales. Price 9/6

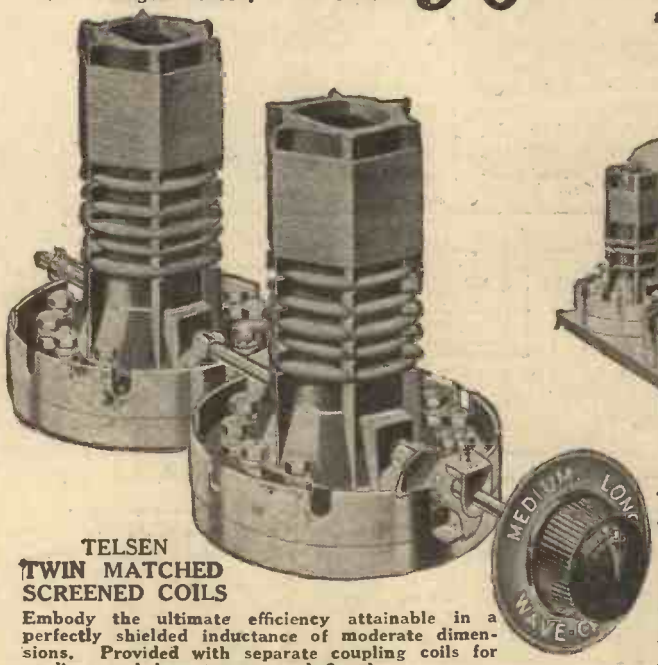


TELSEN TRIPLE GANGED CONDENSER

Comprises three perfectly matched units, giving accurate and simultaneous tuning of three circuits by rotating a single dial. Trimmers are provided across each section. Complete with disc drive, dust cover, escutcheon plate, pilot light holder, degree and wavelength scales, Price 22/6

TELSEN Intermediate Frequency TRANSFORMER COILS

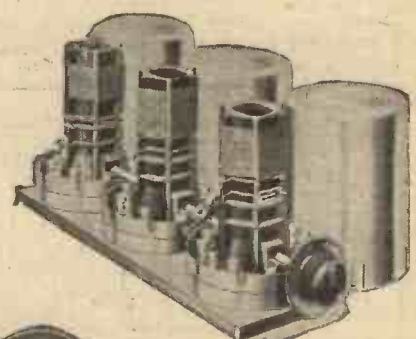
Consists of two tuned circuits adjustable for different values of stray capacities, with variable filter coupling so that optimum conditions for both quality and selectivity may be obtained. Totally screened. Price 12/6



TELSEN TWIN MATCHED SCREENED COILS

Embody the ultimate efficiency attainable in a perfectly shielded inductance of moderate dimensions. Provided with separate coupling coils for medium and long waves, and fitted with cam-operated rotary switches. Complete with aluminium screening cans. Price 17/-

Also Triple Matched Screened Coils ... 25/6
Single Screened Coil 8/6



TELSEN BAND-PASS AND OSCILLATOR COIL UNIT

The ideal coils for any superheterodyne circuit.

Comprises the Telsen Band-Pass Coils and Oscillator Coils mounted as a single compact unit on a rigid metal plinth base. All wave-change switches ganged with single knob control. Price 25/6

Also Superhet Coils, Type No. S.330 ... ... 25/6

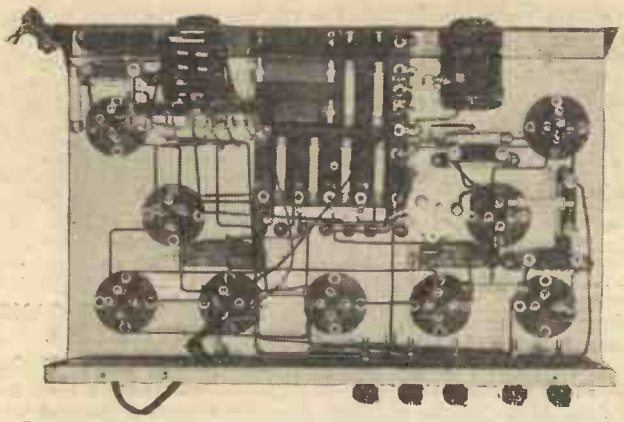
TELSEN RADIO COMPONENTS FOR LASTING EFFICIENCY

ANNOUNCEMENT OF THE TELSEN ELECTRIC COMPANY LIMITED, ASTON, BIRMINGHAM

OUR REPLY TO THE—

LAST week I gave preliminary details and explanations of the circuit of our latest receiver, the "Supersonic Six." It is the first superheterodyne of which we have given constructional details, and, as is the case with all our sets, the design has not been rushed through. We had in mind first of all the production of a superheterodyne which would be cheap to build and yet provide the quality of reproduction the super-sclective capabilities and the station-getting properties which are the cardinal features of the superhet. circuit. Superheterodyne receivers in the past have been costly, and for that reason I have hesitated to devote much space to them, but I have received many letters from readers living in swamp areas, and even from those who live in districts where interference should be non-existent, asking PRACTICAL WIRELESS to produce a set which would satisfy their special needs. The Supersonic Six is that set, and, as with the Fury Four, **I give my personal guarantee of free advice to every reader who builds it.** It will easily receive a century of stations, and what is more important, it will separate them.

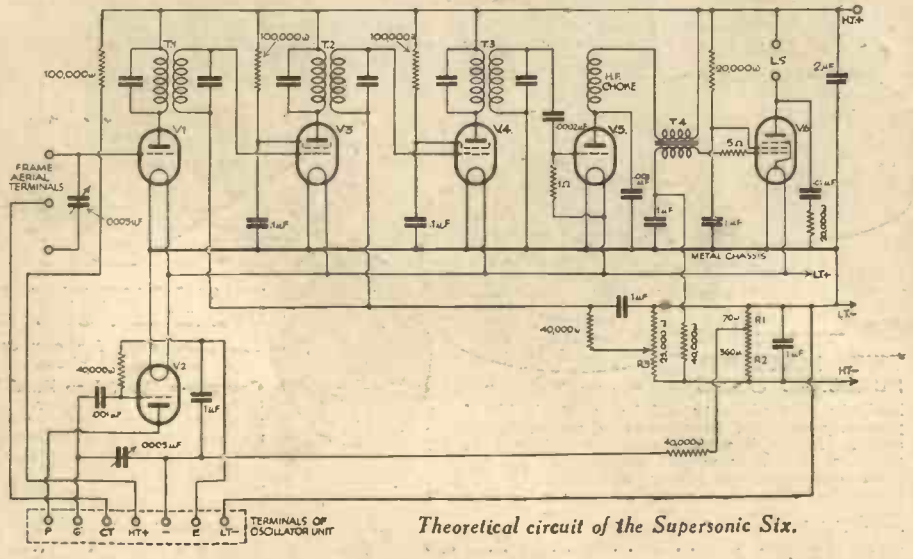
I will briefly go over the circuit again. An examination of it will show that the detector functions on the anode-bend principle of rectification. The signal input is derived from a frame aerial and local oscillation from the oscillator valve is introduced into the frame-aerial circuit *via* the centre tapping. The beat frequency of 120 kilocycles obtained by heterodyning incoming signals with the oscillator is transferred to the grid circuit of the first intermediate frequency amplifier by means of the special band-pass transformer. A further stage of intermediate frequency amplification is given by the fourth valve and the second transformer. The signal is next passed to the second detector through another transformer and finally passed to the pentode-output valve by the low-frequency transformer.



Sub-baseboard view of the Supersonic Six. Note the clean lay-out.

Voltage-dropping resistances are used to obtain automatic bias for the oscillator valve and the pentode. Potentiometer volume control is used to vary the bias applied to the variable-mu intermediate frequency valve. A glance at the photographs will show the clean and symmetrical lay-out of the panel and the components. The right-hand dial is for tuning the frame-aerial circuit, and the left-hand dial is for tuning the oscillator circuit to the correct frequency difference. The remaining controls are for volume and wave changing. This latter switch performs the triple function of switching the set off (centre position) to the medium waves (anti-clockwise), and the long waves (clockwise). The aluminium chassis, complete with Clix valve-holders, can be obtained already drilled from Messrs. Wright and Weaire. The special intermediate frequency transformers are designed on the band-pass principle, and they are responsible in no small degree for the extreme sclectivity of the receiver. Automatic grid-bias is adopted and possesses the great advantage that there is no

Pictorial view of the Supersonic S



Theoretical circuit of the Supersonic Six.

A "Practical Wireless" Gua
BACKED BY REAL READE

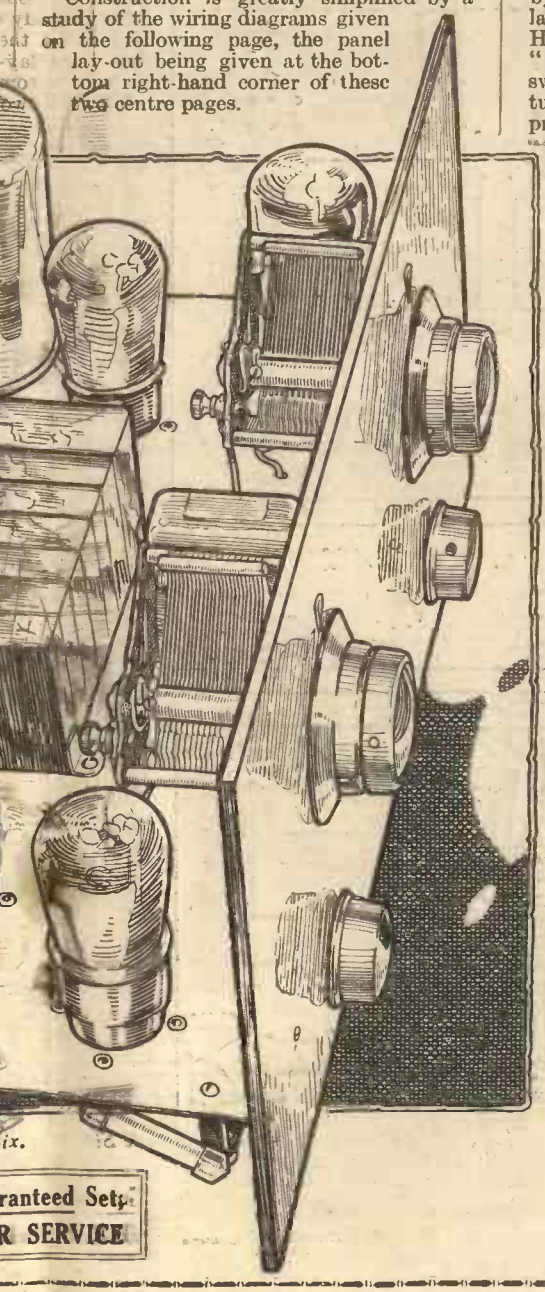
ersonic Six —SELECTIVITY PROBLEM

A highly efficient Super-Heterodyne Receiver which Carries My Personal Guarantee of Free Advice and that it Performs in the manner claimed. Operating instructions will be given next week

By F. J. CAMM

grid-bias battery to worry about, for as the H.T. battery runs down the grid-bias to the oscillator and output valve falls in sympathy.

Construction is greatly simplified by a study of the wiring diagrams given on the following page, the panel lay-out being given at the bottom right-hand corner of these two centre pages.



ix.

ranteed Set
R SERVICE

It will be seen that the wiring is straightforward and, in conjunction with the photographs, should present no difficulty. Take care before connecting the batteries to note that the transformers and valves are in their correct sockets.

The constructor who has had no previous experience with superhet. receivers of this type may like to have these advance details of operation.

After switching on, locate the local station by swinging the oscillator condenser only. Having tuned in the "local" on this dial swinging the aerial-tuning condenser will produce what will appear to be a startling result—the local will be heard all over the dial! This is quite in order, however, and it will be found that shifting the oscillator-dial reading by one degree and bringing the aerial-tuning condenser to approximately the same dial reading (its exact position will be indicated by a marked increase in "noise") results in the *complete* removal of the local station.

Having found the dial readings corresponding to the two circuits being in step, the dials should be carefully moved together when stations should be found at almost every degree on the dial.

It should be noted, by anyone not familiar with the high degree of selectivity obtainable with this type of circuit, that stations that can be obtained at full loud-speaker volume are in and out of tune in about one degree, and are quite easily missed unless great care is exercised in tuning.

It will soon be discovered that the most sharply tuned circuit is the oscillator, and, after becoming familiar with the "feel" of the controls, the oscillator-tuning dial should be calibrated in terms of stations or wavelengths. This assists in removing a certain amount of troublesome "sorting out" when it is desired to receive a particular station at a later date.

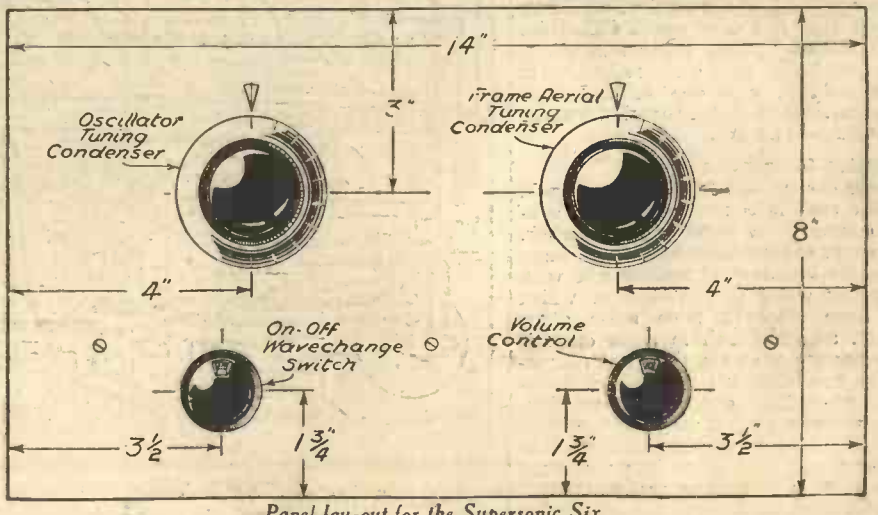
It will be found that drastic use of the volume control will be necessary on a large number of stations in addition to the locals.

To obtain best results, it is necessary to use a loud-speaker suitably matched to the pentode used in the output stage.

Next week I will deal with the operation of the Supersonic Six in greater detail. Meantime, I cordially invite any reader to write to me on any point not made clear in this or the preceding article. I can thoroughly recommend this superhet., and would add that it lends itself admirably to the use of the Westector Cold Valve. As has been already pointed out in the articles on this new development, it forms an admirable detector unit and, consequently, may be used in place of the second detector (V5). The circuit showing this modification, together with the necessary alterations which have to be made, will be given next

(Continued on page 112.)

Rear view of our first superhet—The Supersonic Six.



Panel lay-out for the Supersonic Six.

LIST OF COMPONENTS FOR THE SUPERSONIC SIX

1 Paxolin Panel drilled 14 in. by 8 in.: (Peto-Scott)
1 Aluminium Chassis; drilled 14 in. by 8 in. (Peto-Scott)
1 Oscillator Coil and Switch unit with window, dial and knob. (Wearite)
1 I.F. Transformer. (Wearite type O.T.1)
2 I.F. Transformers. (Wearite type O.T.2)
1 H.F. 10 Choke. (Bulgin)
1 Special 8 mfd. condenser block. (T.C.C.)
2 0.1 mfd. condensers, type 65. (T.C.C.)
1 0.0002 mfd. condenser, type 34 (T.C.C)
2 0.001 mfd. condensers, type 34. (T.C.C.)
1 0.01 mfd. condenser, type 34. (T.C.C.)
1 Special Resistance Unit. (Dubilier)
1 1 meg. Grid Leak. (Dubilier)
1 500,000 ohms Grid Leak. (Dubilier)
1 20,000 ohms 1 watt Resistance. (Dubilier)
2 40,000 ohms 1 watt Resistance. (Dubilier)
1 1 amp fuse. (Microfuse)
1 25,000 ohms volume control. (Watmel)
1 Hypernik L.F, 3-1, Transformer. (Lissen)
2 0.0005 variable condensers with slow motion dial, type No. 2 S.M. (Polar)

5 Terminals (2 L.S. and Aerial 1, 2 and 3) (Belling Lee)
1 Centre-tapped frame aerial. (Eelex)
8 4-Pin sub-baseboard valve-holders. (Clix)
1 5-Pin sub-baseboard valve-holder. (Clix)
1 4-way Battery Cord (H.T.+, H.T.—, L.T.+, L.T.—. (Belling Lee)
1 P.M. 4 Mansfield Moving-coil Speaker. (W.B.)
6 Cossor Valves, 210H.F., 210 L.F., 220 V.S.G. (2) 210 DET., 220 P.T.
1 Lion 120-volt H.T. Battery.
1 Ediswan 2-volt 40-ampere hour Accumulator.

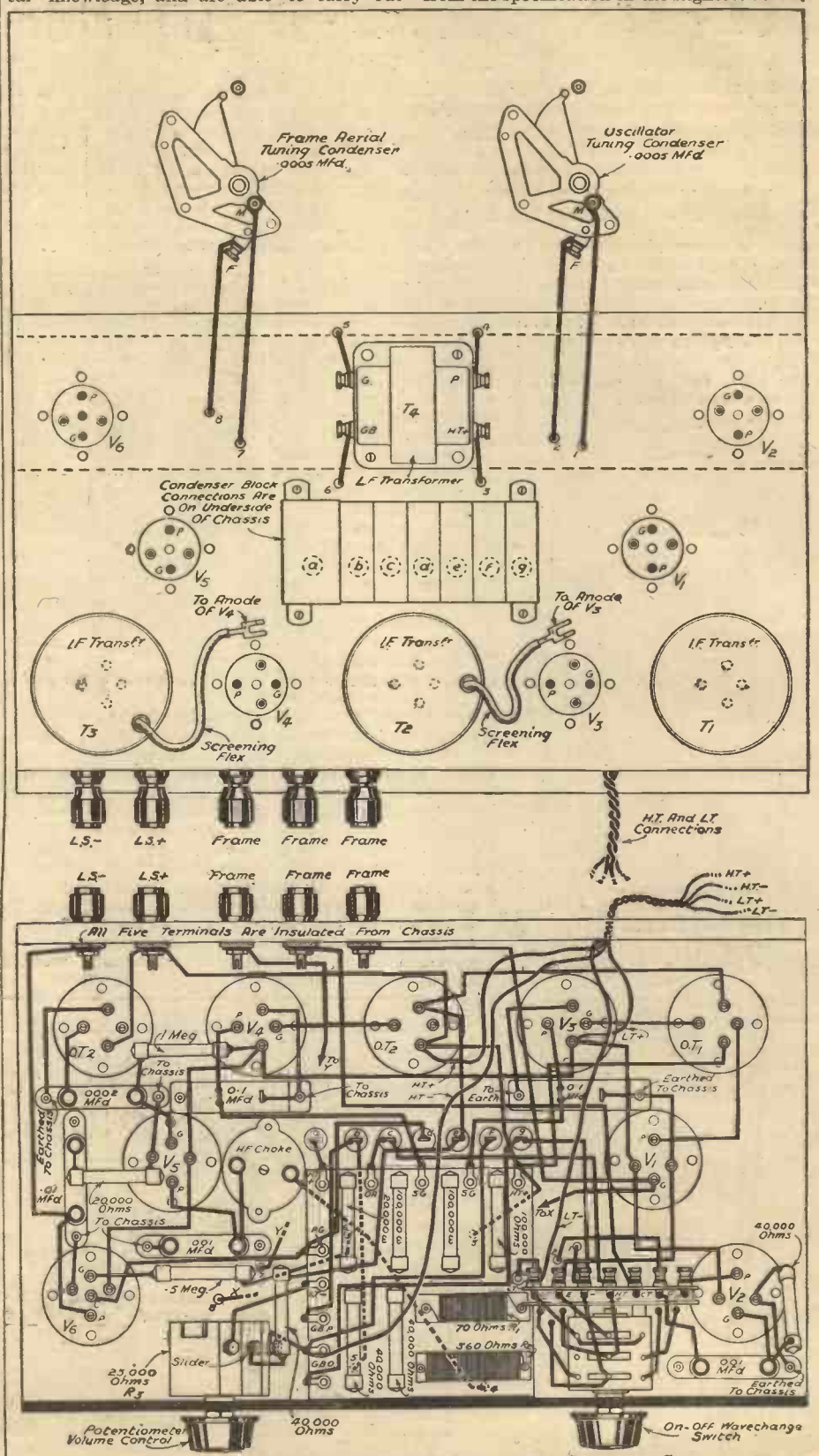
(*Continued from page 111.*)

week. Of course, no amplification is provided by the detector when this particular arrangement is used, but in view of the high amplification given by the receiver as a whole the volume of even the most distant stations will be sufficient for normal requirements. Instructions regarding the modifications will be given next week.

I have just received a query from a reader who asks whether it is possible to employ this receiver without a frame aerial, and he wishes to use it with an ordinary outdoor aerial. There are two very good reasons why this is not possible. Firstly, the input circuit must be provided with a centre-tap, and this cannot be arranged on a normal outdoor aerial and earth system. Secondly, and perhaps this is the more important reason, the over-all amplification provided by a receiver of this type is so great that the energy which is picked up by a small frame aerial in the normal house is ample for the production of loud-speaker signals from all the worth-while stations of Europe. If an arrangement such as an outdoor aerial is joined to the receiver, the energy fed into the receiver would be so great that not only would difficulties be experienced from overloading, but there would also be a great reduction in the selectivity, and one of the most important features of the superheterodyne receiver would be lost.

Alternative Components

Before closing this article I must again mention that it is not possible to substitute component parts of the receiver. After every set is published in these pages we receive letters from readers who wish to employ some particular item which they have removed from some other receiver, and although in some cases it might happen that the electrical characteristics are identical, the risk of introducing some fault owing to interaction, wrong voltage, etc., is so great that it is preferable to inform you that no substitutions can be made. For the same reasons, it is definitely inadvisable to endeavour to make up the intermediate frequency transformers, even though you are able to obtain from a catalogue or similar source details of the windings. It might seem to many to be a waste of time to mention these two points, but it is surprising how many readers write in each week with queries on these lines. Undoubtedly some of these readers possess sound mechanical and electrical knowledge, and are able to carry out the work in a workmanlike manner, but the question of matching, and other details, are generally so critical that the time spent on the work would be wasted. Please, therefore, do not write to me with questions on the lines I have just mentioned, and if you wish to build the receiver, do not depart from the specification in the slightest detail.

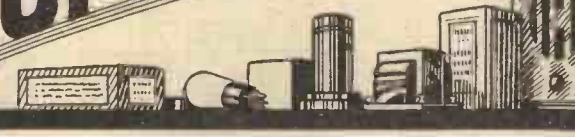


Above- and sub-baseboard wiring diagrams of the Supersonic Six.

The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

Conducted by F.J. CAMM



Condenser

A CONDENSER consists essentially of two or more metal plates separated by a non-conducting substance such as air, mica, ebonite, bakelite, oil, etc. Although one of the simplest components used in wireless, its action is not easy to explain. Sometimes a condenser is said to be a piece of apparatus designed to store electricity. This is quite correct, but to the man who does not know very much about electricity such a statement seems to need amplifying. When he discovers, for instance, that his own wireless set is bristling with condensers of various sorts and sizes he naturally wonders why they are all necessary. If they store electricity, he argues, then his set must be a veritable electrical storehouse! Anyway, the idea of storing anything rather suggests that the thing stored is doing no useful work.

Well, actually the storing action is not used in quite that way. It is not like putting so much furniture in a depository and leaving it idle for a number of years. No, a condenser is used to receive and re-deliver the electricity at a very high speed. A condenser is always associated with pulsating or alternating currents. As the pressure or voltage of the current rises so electricity will flow into the condenser, and as it falls again so the condenser gives up the stored electricity. In fact condensers in high-frequency circuits have often to deal with currents which fluctuate at the rate of a million or more times per second! This means that they fill up with and discharge electricity at the same enormous rate. They could hardly be compared to sleepy storehouses!

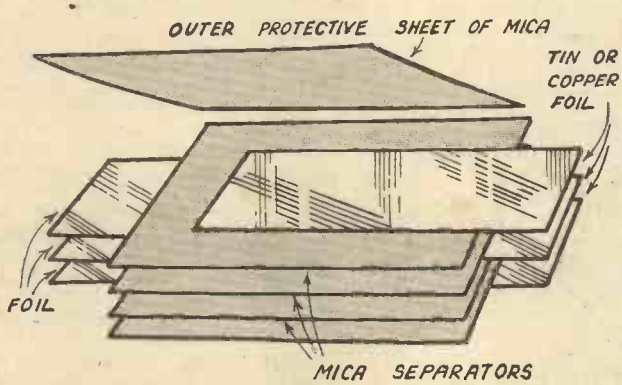


Fig. 1.—How a fixed condenser is built up.

The Action of a Condenser

One way to explain the action of a condenser is to compare it with that of one of the road springs on a motor-car. Applying a force to the spring, such as when the car goes over a bump, will bend it. In other words, it stores up the energy which might otherwise bounce the car in the air. As soon as the bump is passed, however, the road spring unbends and so sends the wheel downward to fill up the drop on the other side. The car body remains steady the whole time it is going along, while the spring moves up and down, first storing and then releasing energy as the wheel mounts the bumps and drops into the pot-holes. The same sort of thing happens when a condenser is in use. When a voltage is applied to the terminals of the condenser current flows into it, but as soon as the voltage is lowered then the "springiness" of the condenser causes the current to flow out again.

Although condensers are used for many different purposes, full details of which we cannot give in the space available, it is interesting to note that one of them is that of "smoothing" a current in much the same way as the springs of a car "smooth out" the road. If a direct current fluctuates slightly in value and it is desired to get rid of this, a condenser is connected between the wires carrying the current. The action is as follows: If the current rises slightly above normal, then the extra current flows into the condenser. Should it decrease slightly, then the deficiency is made up from the current stored in the condenser. This, you will see, is exactly analogous to the action of the springs of a car racing along a bumpy road. The condenser smooths out the irregularities in the flow of current in the same way as the springs of the car smooth out the irregularities in the road surface.

Different Types

Condensers are of two main types—fixed and moving. Fixed condensers are used where the size of the condenser has to be the same all the time. They are usually made of thin sheets of copper or tin foil separated by sheets of mica, waxed paper, or bakelite. Details of the construction of a typical fixed condenser are given in Figs. 1 and 2. Fig. 1 shows how the alternate layers of foil and mica are arranged. You will notice that the sheets of foil protrude alternately from one end and then the other end of the "sandwich," but that the ones sticking

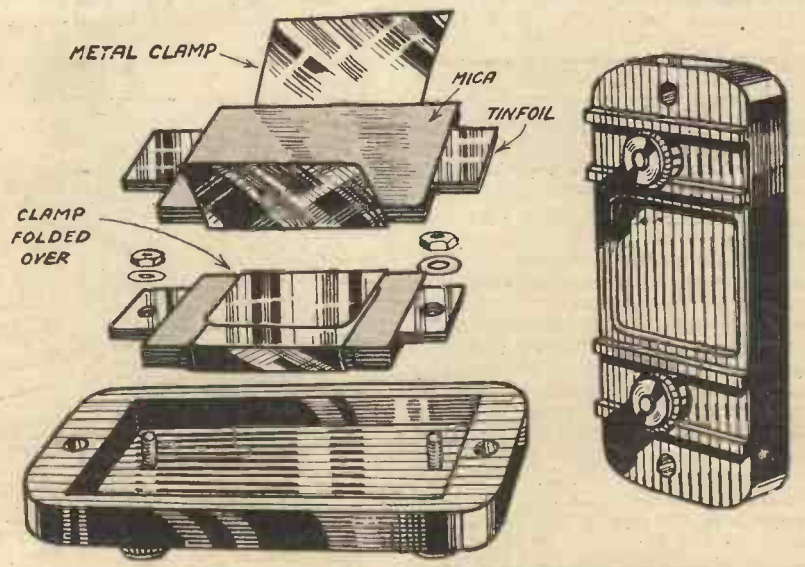


Fig. 2.—Three stages in the construction of a mica condenser.

THE BEGINNER'S A B C OF WIRELESS TERMS
(Continued from March 25th issue, page 26.)

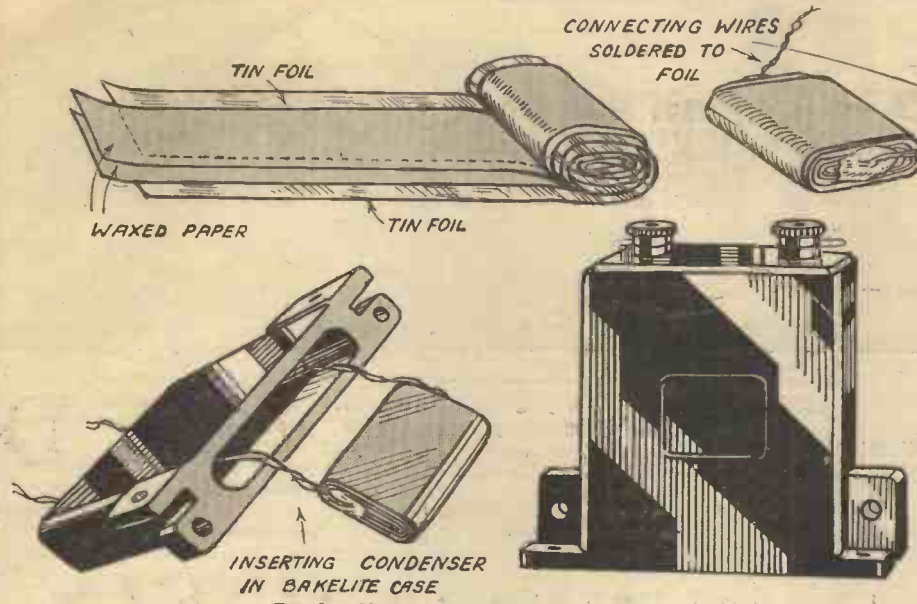


Fig. 3.—How a paper condenser is made.

out at one end do not in any way connect with those which protrude from the other end. They are insulated by the sheets of mica. Fig. 2 shows the various stages in the making of the complete component. The pile of mica and foil is clamped together with a metal band, then it is placed in a small shallow bakelite case, and connection made by means of soldering or with nuts and washers to the two terminals. The whole is then sealed up by pouring in a wax-like composition which, on cooling, sets hard. This is done from the back of the case. The front, showing the finished appearance, is illustrated on the right.

The reason for using a pile of plates instead of just two separated by one sheet of insulating material is because in the larger sizes the sheets would have to be so big as to be cumbersome, therefore a large number of small ones is used instead. The alternate plates are joined together so that it comes to the same thing as using two large plates.

Another way of producing a compact condenser is to use two long plates and to roll them up into a small bundle. For this type of condenser the plates are made of two strips of tinfoil separated by lengths of waxed paper. The sheets of tinfoil are offset so that on rolling up the "bundle" the edge of one sheet protrudes beyond the edge of the paper on one side, while the edge of the other sheet likewise shows all along the other side of the paper. This is shown in the top illustration in Fig. 3. When the whole thing is rolled up, connection can be made to the two sheets of tinfoil by flattening down the foil sticking from each end of the roll and soldering a wire to each. You will notice that after the condenser is rolled up it is pressed flat before going into the case.

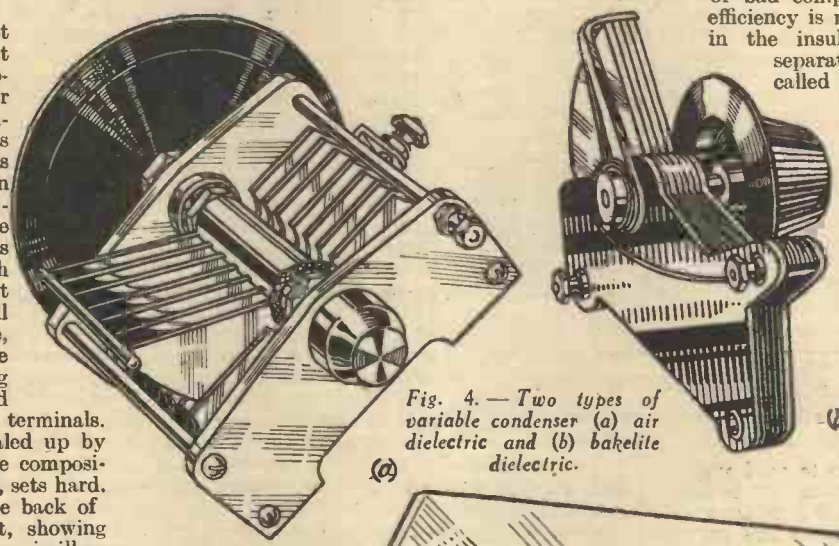


Fig. 4.—Two types of variable condenser (a) air dielectric and (b) bakelite dielectric.

When the size, or the *capacity*, as it is called, of a condenser has to be varied while it is in use, as in tuning a wireless set, then a *variable condenser* is used. This again may take various forms, but it usually consists of a number of stiff metal plates or vanes mounted on a spindle. By rotating the spindle these plates are made to interleave with another set of plates whose position is fixed. In this way the amount of overlap of the two sets of plates can be varied, thus varying their effective area. Three typical examples are shown in Figs. 4 and 5. The one in Fig. 5 is really three condensers mounted on one spindle. It has the advantage that the three condensers can be varied by the same amount at the same time by turning *one* knob only. This is very useful in some circuits and saves having three knobs to "twiddle" on the front of the set, when one will do the job.

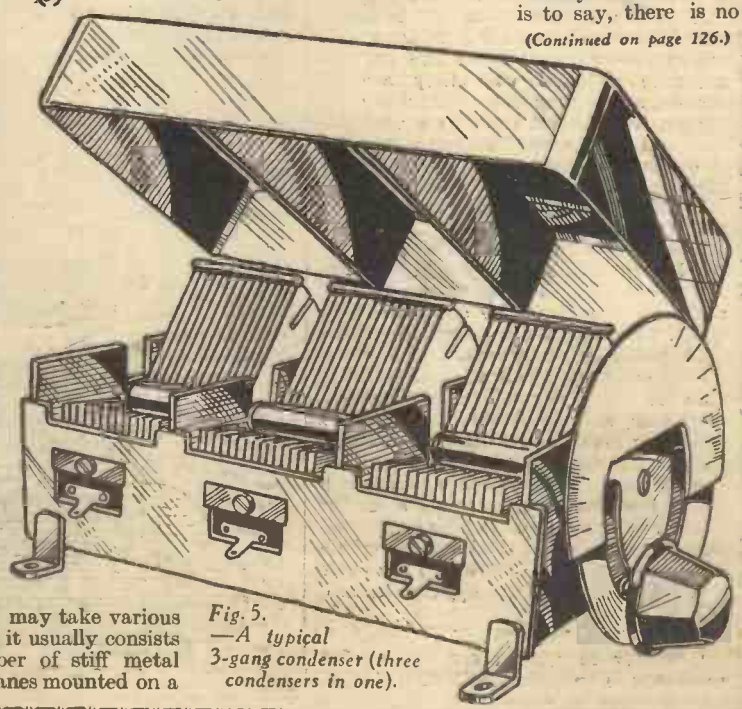


Fig. 5.—A typical 3-gang condenser (three condensers in one).

Efficiency of Condensers

The efficiency of a condenser depends on its ability to return all the electricity which it stores. That is to say, it must be able to give back as much energy as goes into it. The extent to which it is able to do this determines whether it is a good or bad component. Where loss of efficiency is most likely to occur is in the insulating medium which separates the plates. This is called the *dielectric*, and if it allows some of the charge on the plates to leak from one to the other, then that much will be wasted and will not be returned by the condenser. In such a case the condenser would not be 100 per cent. efficient.

Great care has to be taken to see that the dielectric is as near a perfect insulator as possible. In variable condensers air is usually used; that is to say, there is no

(Continued on page 126.)

MAKING A PUBLIC ADDRESS OUTFIT

An Efficient and Cheap Arrangement which will be Found Extremely Useful to Clubs, Sports Associations, etc. By J. H. REED.

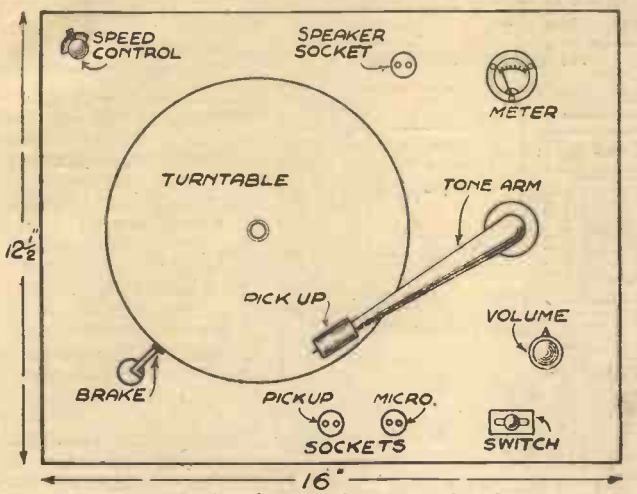


Fig. 1.—The lay-out of the motor-board.

IT would be rather interesting if, at the meetings of any club to which you may belong, all announcements and speeches were to be made through the medium of one or more loud-speakers and interspersed from time to time with musical selections. As may be inferred from the title of this article, the actual equipment necessary is not only economical as regards running costs, but also as regards cost of construction. It should be noted that although gramophone equipment is included it may be omitted if speech only is required. It was, however, thought best to include it in the description.

As described, the outfit is equipped with two-volt valves and a self-contained direct current high-tension supply unit, with automatic grid bias. Where alternating current is available a transformer and rectifier may be added. Alternatively, dry batteries or H.T. accumulators may be employed, and these are particularly useful for work out of doors, and, provided that they are of reasonably large capacity, will not be found expensive to run.

In this case the mains unit may be omitted. A dotted line is marked round the unit on both the theoretical and practical wiring diagrams (see Figs. 2 and 6). Where, however, the mains are handy the anode current may be increased from the 10 milliamps used with batteries, to as much as 20 milliamps, by increasing the anode voltage and thus increasing the volume. The current for the microphone is obtained from the low-tension or filament accumulator and is automatically switched on and off with the set itself.

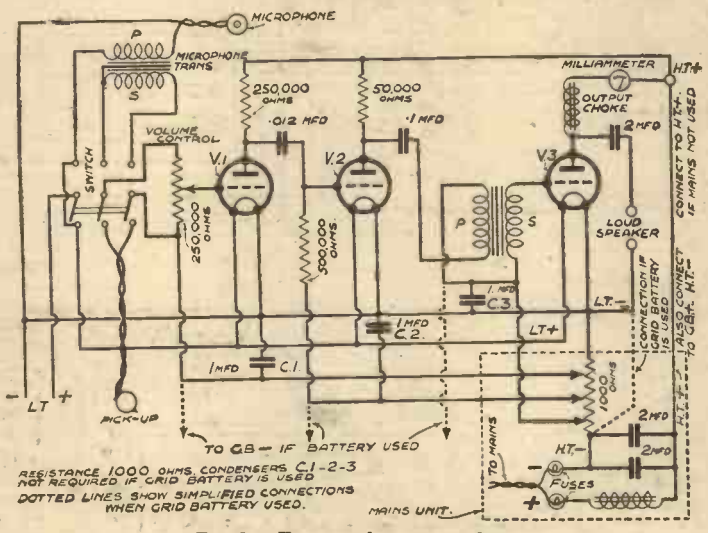


Fig. 2.—The complete circuit diagram.

Now to deal with the capabilities of the equipment. Using H.T. from the mains and at a pressure of about 200 volts, the volume obtainable is ample for a small hall and will be found to suffice for such occasions as Scout and Club meetings, private dances, whist drives, etc., and also out-of-door functions, such as garden parties; whilst by using six-volt valves and better loud-speakers, really serious work may be undertaken.

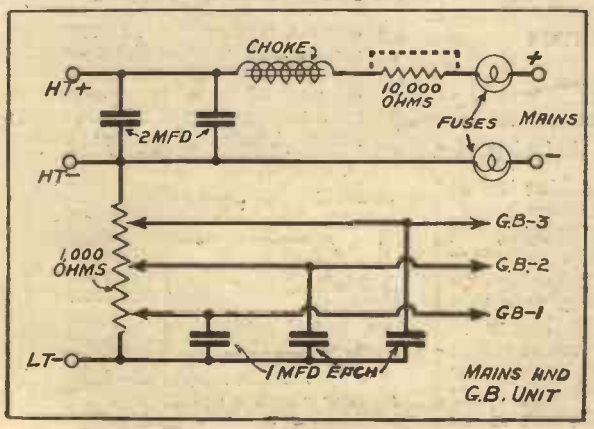


Fig. 3.—The mains and grid bias arrangement.

Arrangement of Components

With the exception of the low-tension accumulator, the whole of the amplifying and mains gear is mounted beneath a baseboard measuring about 12½in. by 16in. It should be noted that the dimensions given may be varied to suit particular components that the constructor may have to hand. This baseboard, which carries the controls on top, may be built into a suitable box or suitcase. The valve panel consists of a strip of ¼in. ebonite 10½in. long by 1¾in. wide (Fig. 7), and is fitted with three sets of valve sockets. Ordinary valve holders may, of course, be used if desired. The valve strip is supported beneath the base by means of two vertical wooden strips. The top view of the baseboard shows, in Fig. 1, on the right front the three position switch which controls the microphone, pick-up, and valve filaments. Immediately behind this is a 250,000 ohms volume control which operates on both microphone and pick-up circuits. At the back of the volume control is the tone arm for the pick-up and again behind this is a milliammeter. The object of the meter is to enable the quality to be checked, and, by the aid of the volume control, to avoid overloading. To the left of the milliammeter is the loud-speaker socket and plug, and at the far left corner is the gramophone motor speed control. At the near left corner is the gramophone brake, whilst along the front are the sockets and plugs for pick-up and microphone.

The Amplifier

The amplifier uses three valves, which are coupled in the following manner. The first, with the volume control permanently wired between its grid and grid-bias leads, is connected by means of the switch to either the microphone or pick-up (see Figs. 2 and 6). Its anode circuit contains a 250,000 ohms resistance, which is in turn connected to the high-tension lead. The value of the anode resistance may be varied to

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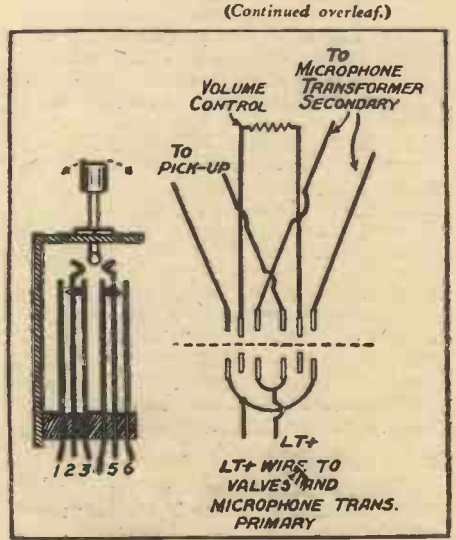

Fig. 4.—The connection to the change-over switch.

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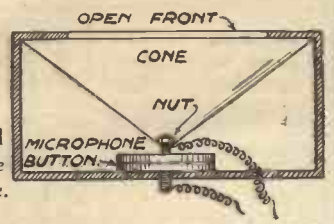

Fig. 5.—A simple cone microphone.

suit the particular valve used, but should not be less than 100,000 ohms. The grid of the second valve is coupled to the first anode by a 0.012 mfd. condenser, which may be made up from a number of smaller condensers in parallel. The grid leak of the second valve is of 500,000 ohms resistance. The second valve anode circuit contains a 50,000 ohms resistance, which also goes to H.T. This resistance is also connected at the anode end to one side of a 0.1 mfd. condenser, the other side of which is taken to one of the primary terminals of a L.F. transformer, thus giving the popular parallel feed which enables a cheap transformer to be used without fear of undue distortion. The secondary of the transformer is connected to the grid and grid-bias leads to the third valve, and the grid-bias terminal of the transformer is also connected to the remaining primary terminal on the transformer. It may be necessary to reverse the primary connections of the transformer to obtain the best results and to avoid "motor-boating." The output valve is fed through an anode (L.F.) choke which in the case of the original is a scrapped transformer, the secondary winding of which, however, is in perfect condition. This is of rather large dimensions and acts quite satisfactorily. A lead is taken from the anode of this valve to one side of a 2 mfd. condenser, the other terminal of this condenser being connected to one of the loud-speaker sockets. The remaining socket is connected to L.T. negative.

Automatic grid-bias is obtained by connecting, in the case of the mains unit, a 1,000 ohms resistance between H.T. negative and L.T. negative, a 1 mfd. condenser being shunted across each lead (Fig. 3). The resistance must be of a type that can be easily tapped as the various G.B. leads must be connected to different points on it. A Graham Farish "Ohmite" is quite suitable. If desired this resistance may be omitted—with the condensers—and grid-bias batteries used, but about 20 volts will be necessary.

Different Types of Microphones

Three different types of microphones are used, although only one is actually necessary. The most satisfactory "mike" is made in the following manner. A solid block of hard wood, about 4in. cube, has a recess cut on one face to a depth of ¼in. and 3in. wide and long (Fig. 10). A length of ¼in. square brass rod is fitted at each side of the recess and these rods are of sufficient length to reach from the bottom of the hollowed part through the top of the block. Connecting wires are soldered to the projecting portions. The space between the rods is nearly filled with carbon granules and a layer of thin sheet rubber stretched right across the front. The rubber is held in position by a small wooden frame, having inside measurements of 2½in. by 2½in., and which is screwed to the block. Another type of "mike" employs a microphone button to which is attached a very thin aluminium diaphragm. The button is secured to the underside of a round switch block (Fig. 11), and the diaphragm, which is secured to the button by the central screw on the latter, is screwed to the base of the switch block.

A microphone button is also used for the third type of microphone, and in this case is fitted inside a small wooden box. To the front of the box is attached a 3-in. diameter cone, which is made in exactly the same manner as a loud-speaker cone (Fig. 5.) and is attached to the button by the central screw thereon. This particular model has been found very good indeed.

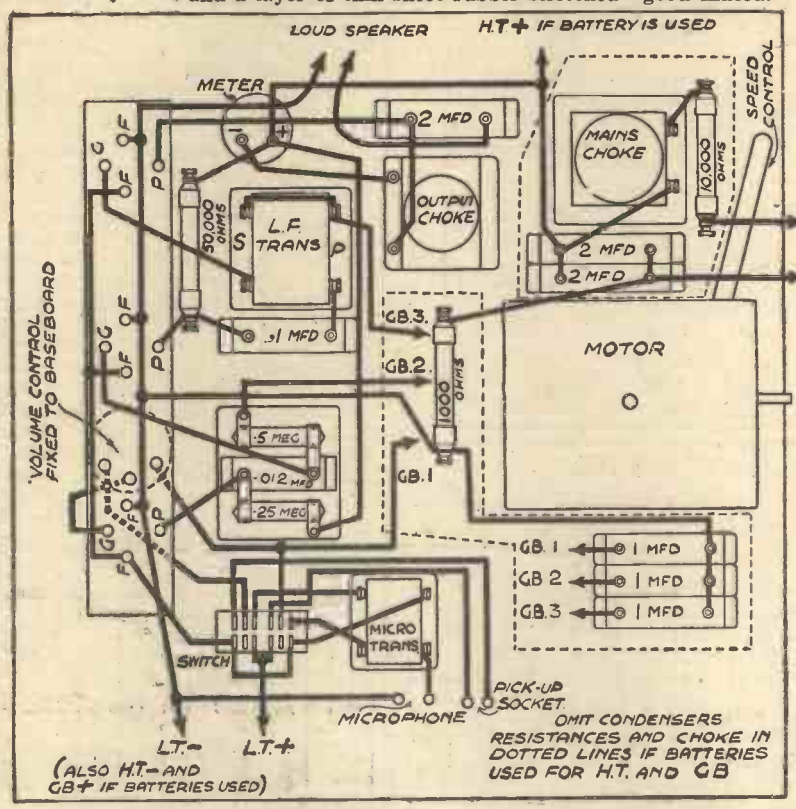

Fig. 6.—Wiring diagram of the outfit.

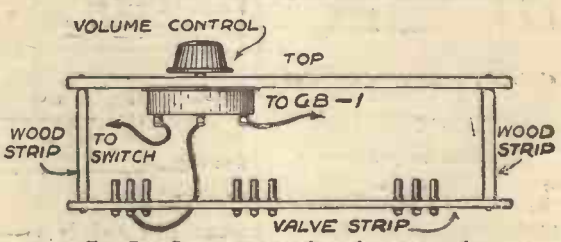

Fig. 7.—Connection to the volume control.

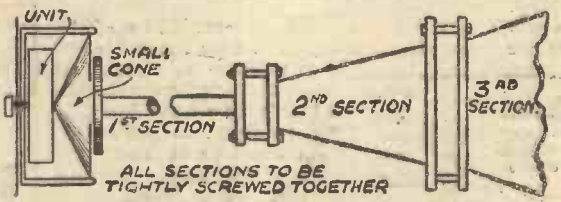

Fig. 8.—Method of building up the loud-speaker.

Loud-speakers

The speaker used by the writer employs a balanced armature unit which drives a 5in. diameter cone. The cone and unit are assembled in a small box, and the front of the cone is covered, except for a central hole of 1½in. diameter. Into this hole is fitted a 6ft. long horn of more or less exponential type. Actually, this consists of three sections, the first having a parallel bore of 1½in. with a length of 2ft. (Fig. 8), and is constructed from cardboard tubing. It carries at its free end, that is, the end away from the unit and cone box, a round switch block which may be screwed to a similar block on the next section. This section is also 2ft. in length, and its diameter increases from that of the first section up to 3in. at the far end.

The wide end of this tube also carries a wooden block which, in turn, is screwed to a similar block on the next portion. Here the construction varies and the end part is of square cross section. Its width at the narrow end is 4in. increasing to 18in. at the mouth. It may be constructed from thin wood.

If you happen to have a good cabinet type loud-speaker (cone), its directional qualities may be improved in the following simple manner. Obtain two wooden hoops of diameter a little more than the cone, and also one of twice the diameter of the cone (Fig. 9). One small hoop and the large one are fastened together with 2-ft. lengths of strip wood, and the inside of this "cone skeleton" lined with thin three-ply or stout cardboard. The remaining small hoop is fixed to the small hoop on the part already constructed with a length of three-ply, so that there is a distance of about 2ft. between the hoops. The three-ply should be fixed

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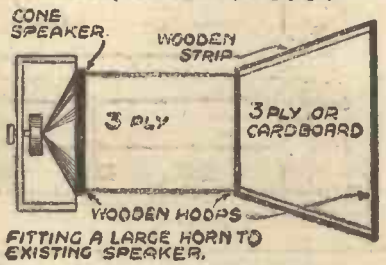


Fig. 9.—An alternative loud-speaker design.

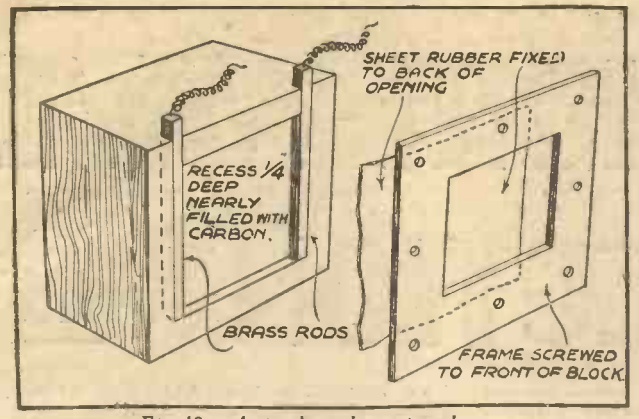


Fig. 10.—A simple carbon microphone.

(*Continued from page 118.*)

inside the small hoops so as to make a large diameter cylinder. The last hoop to be fitted is now screwed to the front of the loud-speaker, as seen in the sketch.

The following two-volt valves are recommended:

1st stage: R.C. or H.F., impedance about 30,000 to 60,000 ohms.

2nd stage: L.F. or small power, impedance not more than 10,000 ohms and less for preference.

3rd Stage: Super-power valve of less than 5,000 ohms impedance. Preferably 2,000 to 3,000 ohms.

Most of our readers will know practically all that is necessary regarding the operation of this equipment, but for the benefit of those who do not the following hints are given. Perhaps the most important point to note, when using a microphone, is to arrange it some feet behind the mouth of the loud-speaker. This is really essential, as otherwise the "mike" will pick up the sound from the loud-speaker and a most violent howl will result. Using the milliammeter as a guide, adjust the grid bias voltages until the needle of the meter is steady, even on loud speech or music. A slight trembling of the meter may be overlooked, but violent movement must be prevented. The volume control should be used with discretion, and it may, at times, be necessary to vary the volume whilst the set is actually in operation, particularly to check overloading due to sudden loud sounds.

The control switch, which was obtained for the sum of one shilling during a "wireless sale," is a twelve-point "Dewar," and really consists of two small double-pole double-throw switches combined, and operated by one knob (Fig. 4). If desired, however, an ordinary small double-pole double-throw switch and an ordinary filament switch may be used. One of the sections of the "Dewar" switch controls the accumulator, whilst the other, in one position, connects the secondary of the microphone transformer across the volume control. The other position switches in the pick-up across the volume control in place of the "mike." The upright or central position of the switch is "off."

The high-tension unit consists of a smoothing choke—an old transformer of generous proportions will do quite well—and two 2 mfd. condensers (Fig. 3). Connected between the mains lead and the choke is a 10,000 ohms resistance which, for 220 volt mains may be used to cut down the voltage to about 120, with a corresponding anode current of 10 milliamps.

Alternatively, the resistance may be short circuited in order to get the full mains voltage, and an increased anode current.

This consists of a motor with turntable and controls. It may be mounted on the set,

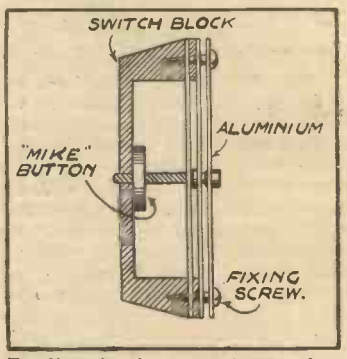
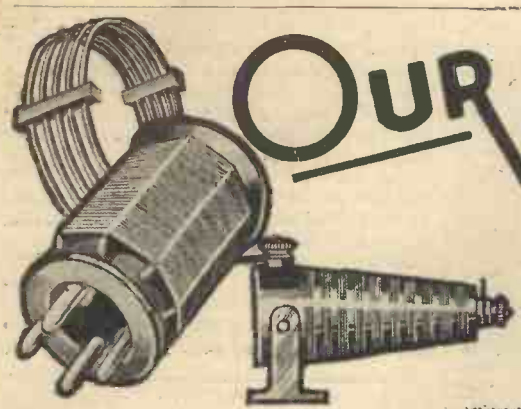


Fig. 11.—Another type of microphone.

as shown, or used as a separate unit. The pick-up (Fig. 6) may be of any good make, although that used by the writer was described by him in *Hobbies*, No. 1,844, dated February 21st, 1931. This also applies to the loud-speaker unit.



OUR SHORT-WAVE SECTION

A DUAL-PURPOSE UNIT

A Simple Choke Device for Curing Instability in Short-wave Receivers.

By ALF. W. MANN

FAULTS in home-constructed short-wave receivers are due to a variety of causes, consequently, various methods must be used to overcome them. The home constructor invariably keeps an eye open for those radio gadgets which can be made throughout at home, with a minimum of expense. One of the most common troubles encountered by the inexperienced short-wave constructor when his first receiver is tried out is instability, due to the straying of H.F. currents into the L.F. stages. The result is that the headphones and cords are alive when touched by the hands. The receiver is difficult to tune, and even a movement of the head or body will cause the transmission being received to vanish entirely, accompanied by violent oscillation.

Experienced short-wave constructors know that decoupling and the incorporation of output devices are a sure cure and safeguard against straying high-frequency currents, but the beginner is not, as a rule, in the happy position of being able to purchase the necessary components in order to derive full benefit from such necessary refinements.

Under these circumstances readers will doubtless be interested in the little unit about to be described, which will greatly assist them to stabilize their receivers and prevent the H.F. effect in cords. An additional advantage of the unit is that provision is made for coupling two pairs of headphones in series in order that a friend may listen as the operator tunes around the wavebands.

Before entering into details concerning the construction of the unit, the writer wishes it to be understood that it has been tested over a period of years, during which efficient and inexpensive output devices were rare, and decoupling unknown. The pitch of efficiency which has been reached in short-wave receiver performances was, during the above period, undreamt of. Later, owing to the series headphones idea, much use has been made of the unit in order to allow fellow enthusiasts to hear the latest creation in operation. It is, therefore, a practical proposition, and the majority of the material required, if not already in the reader's box of radio "odds and ends," can be obtained for a few pence.

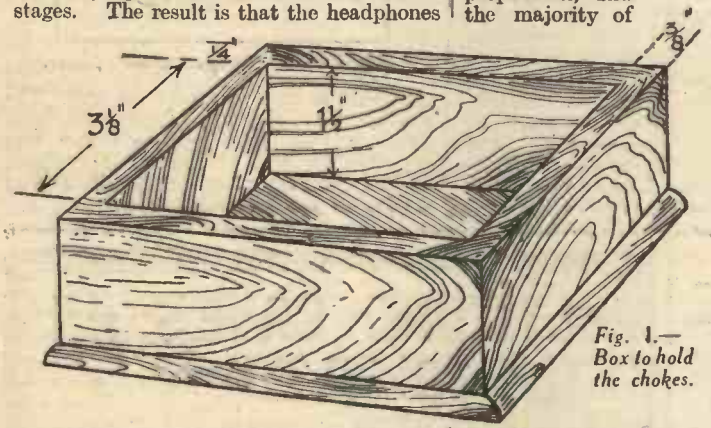


Fig. 1.—Box to hold the chokes.

MATERIAL REQUIRED

- 2 Plain Ebonite, Fibre or Wood Formers, 1" diameter by 3½" long.
- 1 Piece of ebonite (panel), 4½" by 3¾" by ¼".
- 3 Banana plugs (red).
- 3 Banana plugs (black).
- 3 Sockets for above (red).
- 3 Sockets for above (black).
- 2 Pieces of wood (pine, oak, etc.), 4⅜" by 1½" by ¼"
- 2 Pieces of wood, 3⅛" by 1½" by ⅜".
- 1 Piece of wood, 4¾" by 4⅛" by ¼".
- 3" length of connecting wire for coupling sockets C-D.
- 28' 30 D.C.C. wire (copper) for each choke; total length required, 56'.

Constructional Details

The first part of the constructional work which should be taken in hand is the cabinet—or box. This form of procedure may, at first sight, appear strange to my readers; nevertheless, it is the correct procedure, the reason being that although it is the simplest of wood-working jobs, everyone has not the same skill in the handling of edged-tools, and it is, under the circumstances, far easier to fit the choke-formers and panel to suit the box than *vice versa*. Reference to Fig. 1 will make the construction of the box clear; note, however, that inside dimensions only are given.

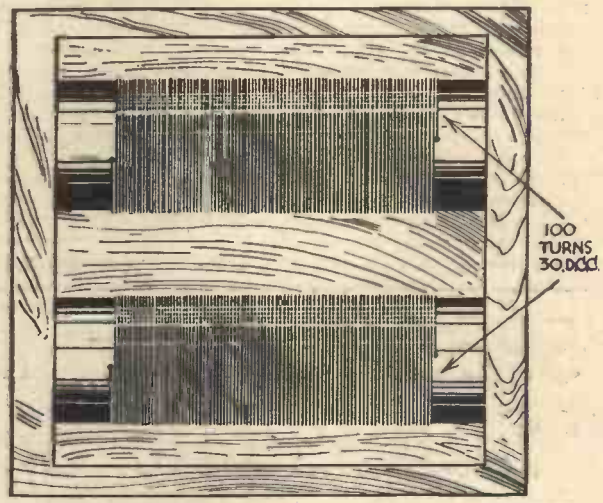


Fig. 3.—How the chokes are made up and mounted.

After the four sides of the box have been sprigged together, the panel should be

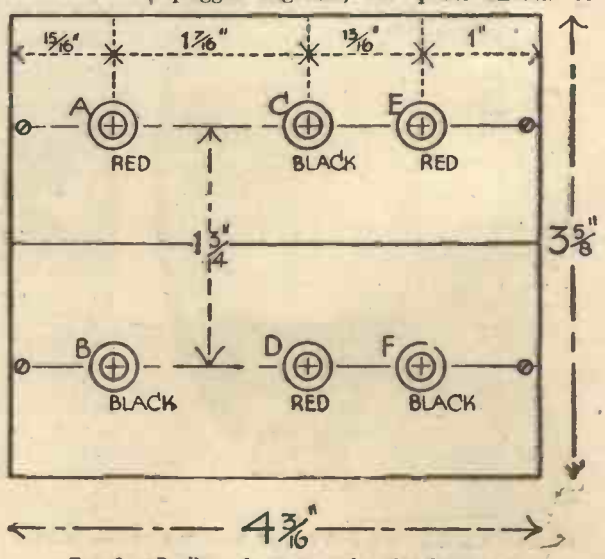


Fig. 2.—Drilling dimensions for the ebonite top.

marked out and drilled, and sockets fitted; next, fasten the panel to box-frame by means of four brass screws—⅜in. will be quite suitable.

The chokes should now be taken in hand. If 30 D.C.C. wire is used, it will be found that one inch of former will consist of 44.7 turns (see Data Sheet No. 5). Winding should be commenced at approximately ⅜in. from end of former. The termination of same will be ⅜in. from the other end of former also. The number of turns required is 100 on each former.

When the choke windings are completed, thread the ends through the usual double holes, and leave at least 3in. of wire at each end. Fig. 2 gives a plan of panel; the sockets to the undersides of choke-leads should be connected, as follows:—

One end of choke to socket A, remaining end to socket E, the second choke being coupled to sockets B and F. Sockets C and D should now be coupled together with a short piece of Glazite wire.

The base of cabinet is 4⅜in. by 4⅛in. by ¼in., so that all sides overlap ⅛in.

The complete unit should be coupled to your receiver, as follows (see Fig. 2):

Socket A (red) to + output of receiver.
Socket B (black) to — output of receiver.
Red Socket E=phones or speaker +.
Black Socket F=phones or speaker —.

To use two pairs of phones in series, the connections are Socket C — Socket E + of one pair of phones; Socket D + Socket F — of second pair of phones; the connection between C and D being, as previously stated, by a short length of Glazite inside the cabinet.

FURY-FOUR EXPERIENCES

(*Continued from page* 102)

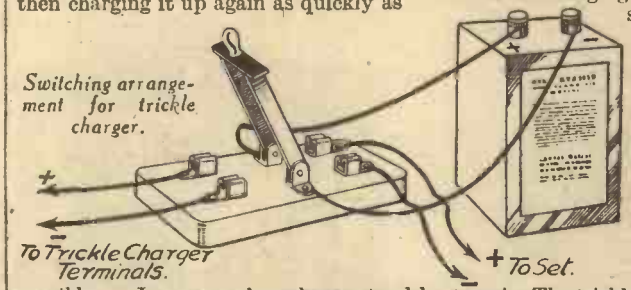
dealt with over the 'phone) and complained that the receiver was not functioning as I claimed. After being assured that everything had been done to endeavour to get it in working order I offered to examine the receiver at the workshop and see what the trouble was. In one case the builder appeared to have built the set out of all the parts which I had decided *not* to use. It was as much unlike the "Fury Four" as a motor-car. Ordinary baseboard-mounting valveholders were used; odd types of fixed condensers; odd spaghetti resistances, etc.; and the reader wondered why the set would not work! In the other case several components were not as specified, and when the wiring was checked it was wrong in several places. As soon as the wiring was corrected, the set worked, but not as the original "Fury Four," owing to some of the parts used being of the wrong electrical value. One reader inquired if a metal chassis could be used, and the reply to this is: Yes, if you like. Actually it is not essential, and the only thing which will be gained by using metal is simpler earth connections may be made to the holding down bolts, but the metal will be more difficult to cut and drill. For the same reason, metal foil may be used to cover the baseboard, but it is not essential.

I think that clears all the points which have so far been raised, and I shall be very pleased to hear from readers who have built the receiver and are obtaining the results I claimed, or who, for any reason not explained above, are unable to obtain satisfactory results.

I express my thanks to the hundreds of readers who have so eulogistically written to me regarding the "Fury Four." F. J. C.

ABOUT ACCUMULATORS

AN eminent electrical technician has this week made some apt remarks regarding the care of accumulators, and, although his advice was chiefly directed to those engineers who have large stand-by batteries in their charge such as those used for emergency lighting and the like, in hospitals, cinemas, liners and hotels, there is no reason at all why they should not be applied to the smaller users in the realm of wireless. The most important point was that it has been proved over and over again that the use of a trickle charger is much preferable to the practice of letting an accumulator run completely down and then charging it up again as quickly as possible. In cases where large stand-by batteries are used as I have enumerated above, it often happens that they are not connected into circuit for many years, although they have to be ready at any moment to deliver their full output if necessary. This is a tribute to the efficiency of our modern power stations, which so rarely break down, but should the odd chance happen, and the power supply fail for even a short time, the engineer in charge of the accumulators would have no excuse accepted if his batteries failed to deliver the current when required. As you all know, an accumulator has a certain leakage of charge even on open circuit if left for long intervals, and this slow discharge is more harmful to the plates than any definite load would be, and it is advised that a small trickle charger be connected in the circuit to counteract this small loss. If, therefore, you have mains in your house of any voltage (either A.C. or D.C.) a trickle charger would be a good investment. The rate of charging of the trickle charger is to some extent regulated by the state of the battery, but if you use good judgment you can avoid excessive charging if your accumulators are in daily use for wireless purposes by switching on the charger as soon as listening is finished for the day. The charger is left on all night and the next day until listening is commenced again. The trickle charger should be switched off from the mains and from the accumulator when the set is working and a double throw double pole switch could be used as illustrated for accumulator switching. J. P.



UNDERSTANDING YOUR AERIAL

(*Continued from page* 103.)

unselectivity could have been rectified without the introduction of the unnecessary damping effect of the picture rail aerial. The tendency to-day is to think that it is no use having an efficient outdoor aerial because the great need is sharp tuning. While sets do tune sharply on a short indoor aerial, when they are coupled to an outside aerial the selectivity is seriously cut down. This is true in some cases, but the point is that with the short outside aerial it is far easier to isolate it and insulate it from the surrounding earthed objects than can possibly be done with the indoor variety, and thus secure a much better signal strength. By isolation is meant the ability to keep the conductor free from losses due to any stray capacities which may be formed with earthed objects. If the aerial runs for any length close to a wall, etc., some of the collected energy will leak to earth through the condenser action formed by firstly, the conductor, secondly, the air, which in this case is the dielectric, and thirdly, the wall. The only way to overcome these losses is to keep the aerial well away from other conductors. This is one of the chief difficulties with indoor aerials, for naturally they have to depend upon the wall for suspension. In Fig. 1 is shown a very good layout for the modern aerial; in the first place 7/22 ordinary stranded copper wire is advised, insulated for preference, that is to say, either enamelled or covered wire can be used, this will safeguard it against corrosion, which rapidly takes place in a smoky city. The length should be between approximately 30ft. to 45 ft., but this is governed, of course, by the distance the set will be used from a large powered station. The main consideration is the height clear of any screening, for if this is kept in the region of 30ft. to 40ft. it will not make the set any the less selective, but it will generally increase the signal strength on distant stations. Even a vertical wire, see Fig. 2, carried on supports well away from the outside wall by about a foot or more and run from the top to the bottom of the house, will give wonderful results and be very selective. The signal strength will be good on most average sets and better all round results should be obtained than with an indoor aerial.

The next best thing to the efficient outdoor aerial is the aerial which is erected in the roof. It should be well insulated, but it is not possible to isolate it entirely, for even in a roof it may be only a short distance of 6in. to 8in. from a conductor to earth and this will seriously affect results. The length of wire used must be fairly short, not more than 50ft. and sometimes less, otherwise capacity losses will be set up, this will counteract any gain in signal strength. Good results are often obtained by merely running a length of 22 gauge cotton covered wire around three sides of the room, slung from the picture rail about a foot away on insulators as shown in Fig. 3. The whole point is that with an indoor aerial there are many different kinds of metallic bodies in the building which are liable to effect the signal strength and mar reception.

This type is the least efficient of all aerials, the chief fault being its very low signal pick-up. It is very handy where space is a governing factor or if the owner is constantly moving about. Of course, the very handy portable sets are compelled to utilise a frame aerial, although this necessitates extra valves for amplification purposes. Therefore, it can be seen that in order of merit the outside aerial is first, then the vertical outside wire, followed by the indoors roof aerial, and then the picture rail conductor, followed by the frame aerial.

TELE-TALKIE TOPICS

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

Gas Discharge Lamps for Television

IN television apparatus in which the lamp is directly controlled by the incoming signals, and not where the light from a projection lamp is altered through a modulating device as in a grid cell, glow lamps have been very largely used as they require a comparatively low current for normal operation. Higher current intensity is not advantageous inasmuch as the output valve has to furnish the current for the lamp and with higher currents the price and size of the apparatus, and the difficulty of handling, increase. Lower currents may, of course, be used when the positive column of a gas discharge lamp is chosen, but in this case very high voltages are employed as the older gas discharge lamps require this condition for proper functioning. Through the new development of a special light valve with glowing electrodes, however, it has been made possible to construct lamps which burn on ordinary lighting mains voltages.

Compared with glow lamps the use of gas discharge valves with positive columns and glowing electrodes presents a great improvement as the light intensity of the positive columns is much greater than that of the glow lamp. Lamps with neon filling and mercury filling have been constructed on these lines and although the resultant images were considerably brighter than with the normal neon lamp, the experiments using the ordinary scanning disc were not quite satisfactory. When using a mirror drum good pictures resulted when the lamp was used in the form of a "light sprayer." Here a glow cathode is in a metal tube, while the anode is outside the metal tube, the discharge being compelled to pass through the narrow cylinder and consequently produce a brightly illuminated spot at the tube end.

Fig. 2.—Showing very clearly how the mirror screw is built up like a spiral staircase.

Lamp Details

The development of the sodium lamp has, however, shown great promise of producing a light source for use with scanning discs. According to experiments which have been carried out on the Continent it is possible to obtain from the sodium lamp about 80 per cent. of the energy contained in it in the form of visible light, that is a degree of efficiency can be secured which is twenty to thirty times higher than the normal glow lamp and gas discharge lamp. If after this consideration a sodium lamp is used in a container which may be heated, then comparatively low energy will suffice to maintain a high light intensity of the lamp, several experiments confirming this statement.

The Fernseh A.G., who have used these lamps, have obtained with them television images of a brightness that had previously

Fig. 1.—One form of helicoidal receiver used for television.

been considered impossible when employed in conjunction with a scanning disc. The current required for such a lamp is of the order of one-tenth of an ampere, the voltage at the lamp being about 100 volts and measured photometrically this produces a light intensity of 126 candles. The lamp is bent to a U shape so that the separating line between the 2ft. shanks does not cause interference and a matt glass disc is chosen as the front sealing arrangement through which the whole matt glass disc appears equally bright. Experiment has shown that the sodium light follows perfectly current oscillations up to over 100,000 cycles, so that the reproduction of images with great detail is possible.

Scanning Without Drum or Disc

Many ingenious schemes have been propounded for carrying out the operation of scanning, an essential function common to both the transmitting and receiving ends in television. Most workers, apart from those who stake their claim with cathode ray tubes, pin their faith in discs with holes punched direct or used in conjunction with lenses in one form or another, or else they prefer to use a mirror drum usually in the form of a narrow cylinder with mirrors round the edge. Each mirror is fixed at a slightly different angle to its immediate neighbour, so that when revolved this combination builds up the required light field.

Recently, however, a certain amount of attention has been given on the Continent to the "mirror screw" or "helicoidal" method of scanning. In effect this is somewhat similar to mirror drum working, but it enables the exploring device to be built up in a more compact form. Two examples of this mechanical form of scanning are shown in the accompanying illustrations, and they will be seen to resemble a screw with a large pitch or a "spiral stairway." At the end of each "arm" is a reflected device which projects this spot on to a screen, but by twisting the arms in the fashion shown the arrangement becomes quite novel in character. Up to the present, however, the images shown with this device have not equalled those portrayed with a disc or drum, but it is interesting to record the efforts made by various inventors in different directions in order to find that which is best for ultimate public use.

WIRELESS TERMS TRAVESTIED—4

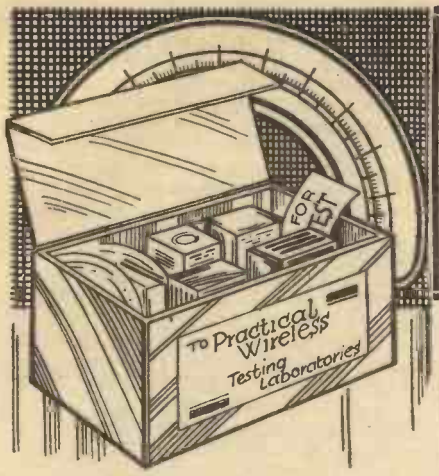
Leaky Cell.

MY OPINION! By the Editor

EVERY time I receive a query relating to selectivity I cannot help feeling that we are falling into the same mistake, and showing the same lack of foresight as our forefathers did regarding the making of roads. The congested state of our roads to-day is a "tribute" to the lack of vision of those who lived in the period of which we nowadays speak with veneration as "the good old days." They were really bad old days, and motor-car designers to-day have a pretty tough problem in producing cars—not as one would imagine to create a given performance—but to stand up to our abominably bad roads. Obviously, the solution to better motoring is better roads, and if the roads were perfect we could abolish the pneumatic tyre altogether. The roads of the ether bid fair to provide an analogy with the roads of to-day. The ether roads, it would seem, have been built by those who had no eye to the future. Hence its present congested state, and its bad condition. Radio designers have to design their sets to suit those roads which are badly in need of widening and ironing out. You will perceive that the gravamen of this note is that attempts to solve the selectivity problem can only be made by tackling the effect, instead of the cause. Selectivity is a question of waveband, not of receiver design, and the best receiver to-day is merely a compromise between what is ideally possible and what is practicably permissible. If you want selectivity you can only have it at a price, and whilst broadcasting stations must compulsorily operate on the 9-kilocycle separation basis, no satisfactory solution can be found. It is just as well that we face that fact. PRACTICAL WIRELESS can give you selective circuits. It can give you circuits which will rope in all the stations, but you cannot have it in one receiver. If you want selectivity you must be content with fewer stations, and if you want the largest possible number of stations you must be prepared to sacrifice a certain amount of selectivity. If, therefore, your complaint is that your receiver (whether home-made or purchased) is non-selective do not always blame its designer; for whilst all receivers are not equally selective or equally sensitive, and whilst, too, the question of location plays an important part in the problem, under the present conditions of the ether the cause is external to the effect. On the present basis it is a drawback to the system of allocating wave-lengths. In a nutshell, radio designers and component manufacturers are operating under difficulties quite outside their control, and the fact that, in spite of the draw-backs to which I have drawn attention, such a marked degree of selectivity is possible bears tribute to their assiduity, enterprise, and service to their public.

My "Fury Four," of the selective properties of which so many readers have written in such glowing terms, is an example of the very best possible compromise between the diversity of factors alluded to above. It is thought that short of a superheterodyne, no more selective a receiver can be produced. Moreover, it gives selectivity with extreme purity, and there is plenty of volume on tap. The irreducible minimum only has been sacrificed.

F. J. C.



Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

LION H.T. BATTERIES

THE usual type of H.T. battery has the sockets spaced at various intervals all over the top of the battery, and this method of tapping has not been varied until the arrival of the battery shown on this page. Here the various sockets are brought to the side and arranged in a neat line, and this greatly facilitates the insertion of the plugs when the battery is used in a receiver where there is not too much space allowed for it. The particular battery which is illustrated has a total voltage of 150 volts, tapped at 40, 50, 60, 120, 130, and 140 volts, with the addition of grid bias tappings at the side. Other models are obtainable with 60 volts, 100 volts, and 120 volts, at 4s. 6d., 7s. and 9s. each, and a 9-volt grid bias battery is obtainable at 10d. The internal resistance of the battery is very low, and the discharge rate of the battery is 11 mA. in the case of the 120 volt battery above mentioned. These batteries will stand up to hard wear, and may be recommended.

The Lion H.T. battery.

MAINS POWER RADIO UNIT

THE eliminator which is illustrated below is the model A.C.2 manufactured by the Mains Power Radio Company, and is a very attractive unit for the user of a receiver employing from one to five valves. The unit, as will be seen, is totally enclosed in a metal case and this is finished in a pleasing blue crackle enamel effect which is an effective insulator. There is thus little risk of a shock should the case for some reason be touched whilst the operator is also touching a high-tension positive point. This is a small but important point. The unit is provided with five sockets, three positive, one negative and one earth. To the latter the case is electrically connected. These sockets may be seen on the front of the unit, and they are not only very clearly identified, but the metal part of the socket is well sunk, so that it is impossible to touch them with the fingers. The sockets take the standard split or solid pin. The output at the various positive tappings is designed for a screen-grid valve, a detector valve, and a maximum-voltage tapping, and according to the amount of current taken the first gives 75 to 90 volts, the second a similar voltage, whilst the maximum tapping delivers 120 to 150 volts. The current rating of the unit is 18 to 22 mA., and this is ample for normal requirements. Tested on a four-valve set the unit worked perfectly silently and gave the required voltages with no trouble at all, and owing to the adequate ventilation holes provided there was very little trace of heating. The price of the unit is £2 10s.

One of the M.P.R. Company's mains units.

EMICOL

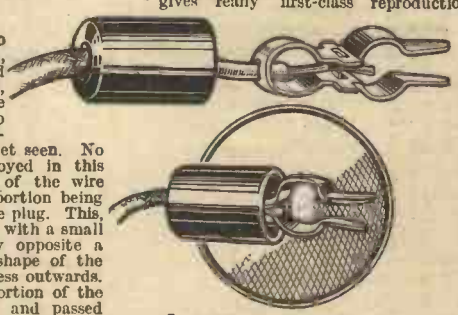
THE Electrical Measuring Instrument Co., Ltd., whose trade mark is Emicol, announce that they are now established at 55, Cardington Street, London, N.W.1, where they are continuing to manufacture measuring instruments of every description. The products of the firm are 100 per cent. British, and include voltmeters, ammeters, ohmmeters, pocket voltmeters, portable testing apparatus, etc.

LISSEN Q.P.-P. COMPONENTS

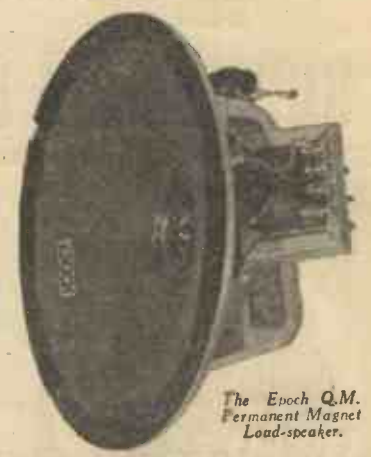
MESSRS. LISSEN have produced two new components for the quiescent push-pull circuits, one a Hypernik inter-valve transformer with a ratio of 1 to 8, and the other an output feed choke. The former is designed especially for feeding two power valves (or pentode valves) in order to fully load them and enable an output of 2 watts or so to be obtained. The primary inductance is 35 henries with no D.C., dropping to 20 henries at 4 mA. The resistance of the primary is only 370 ohms. The secondary has a resistance of 15,000 ohms. The output feed choke has an inductance of 12 henries at 40 mA. rising to 18 henries with 7 mA. The D.C. resistance is 400 ohms. In addition to these two components Messrs. Lissen have also produced two pentode valves, type P.T. 2A, and an interesting pamphlet describing the construction of a powerful two-valve circuit employing a screen grid valve as detector followed by the two pentodes in quiescent push-pull. The Lissen one-knob control unit is employed, and this enables a really powerful little set to be constructed from all Lissen parts. The pamphlet gives on one side a full-size blue print with all wiring and constructional notes. It may be obtained free on application to Messrs. Lissen.

METEOR WANDER PLUG

THE latest type of wander plug to be produced is shown on the right, and is a product of Messrs. Ward and Goldstone. There have, of course, been many different types of this little component produced from time to time, and this particular plug is certainly the simplest which we have yet seen. No screws or screw threads are employed in this arrangement, both the attachment of the wire and the holding on of the insulated portion being accomplished by the springiness of the plug. This, it will be seen, is made in one piece, with a small projection on one side immediately opposite a cut-out on the opposite side. The shape of the plug tends to cause the points to press outwards. To attach the wire the insulated portion of the plug is simply pulled off the metal and passed down over the lead, and a space of about a quarter of an inch of wire bared. This is then threaded through the hole in the end of the plug and passed across the small central projecting piece. If now the insulated sleeve is pushed down over the plug, the two sides are pressed together, and the wire is nipped between the projection and the small cut-out. The pressure against the sides of the sleeve retains this in position, and the kink caused in the wire prevents it from being withdrawn. The outward pressure also ensures a good electrical contact against the sides of the battery sockets when it is inserted in a grid bias or H.T. battery. The plug costs 1½d. with red or black sleeve.



Something new in wander plugs—The Meteor.



The Epoch Q.M. Permanent Magnet Loud-speaker.

EPOCH Q.M. LOUD-SPEAKER

THE loud-speaker illustrated is a new model produced by the Epoch Radio Mfg. Co., Ltd., especially for use in the output circuit of two valves working on the quiescent push-pull principle. This has a cobalt steel magnet of liberal dimensions, and is fitted with a 8½in. moulded diaphragm. To enable satisfactory matching to be carried out a special six-ratio transformer is fitted, and this provides ratios of 15 to 1, 22 to 1, 27 to 1, 34 to 1, 47 to 1, and 63 to 1, the speech coil being wound to 5½ ohms. This is a splendid little speaker handling up to 4 watts, and gives really first-class reproduction. Tested on the Q.P.-P. amplifier, the speech was brilliant, with a good high-note response, and bass was natural without being boomy. The volume from two pentodes was more than sufficient for the average room, and the sensitivity, when tested on a weak signal, was of a high order. The price is 32s. 6d., and it should be noticed that this is not one of the standard Epoch speakers just fitted with a Q.P.-P. transformer, but has been produced and balanced especially for that particular method of L.F. amplification. It may be obtained in a handsome oak cabinet for 45s.

H.F. PENTODES

(*Continued from page 104.*)

Why are radio engineers so anxious to increase the sensitivity of receivers by introducing these high-amplification valves? One reason is undoubtedly the rapidly increasing condition of ether congestion, due to more and more high-powered broadcasting stations coming on the air. In order to cope with this situation it is necessary to adopt various devices to improve selectivity, all of which have the effect of reducing signal strength so that increased amplifying power in the set is necessary. Again, more and more listeners are demanding sets which will work quite satisfactorily and give a full choice of programmes without the use of an outdoor aerial, and it is only by using the most efficient types of radio-frequency amplifier that mains aerials and plate aerials within the cabinet can be suitably employed.

It may be asked what are the signal handling capabilities of the screened-grid pentode. The answer is approximately the same as an ordinary screened-grid valve. In other words, apart from such minor alterations as the adjustment of voltage dropping resistances, screen potentiometers and grid bias, a high-frequency pentode can be substituted simply for an existing screened-grid valve, and will work well, although better results will be obtained if more efficient coils are also fitted. When the set is tuned-in to a very strong signal, however, such as that from the local station, there will be the same risk of distortion due to overloading as with a screened-grid valve, unless some form of input control is fitted.

For this reason it is expected that valve-makers will offer a choice of high-frequency pentodes, some of which will have characteristics similar to the variable-mu screened-grid valve, namely that by increasing the grid bias the valve is able to handle greater signals without distortion, but, of course, giving a smaller degree of amplification.

THE BEGINNER'S A B C OF WIRELESS TERMS

(*Continued from page 114.*)

solid matter between the plate except at the one or two points where the plates are joined to the frame. This is the most effective type of condenser. However, it is not always possible to use air. The next best dielectric to air is *mica*. This is used extensively in small fixed condensers.

It should be noticed that the closer the plates are together, the greater is the capacity of a condenser, therefore the dielectric is always made as thin as possible, so as to reduce the number of plates necessary for a given capacity. For example, a condenser consisting of one or two sheets of tinfoil separated by the very thinnest strips of mica will have the same capacity, that is it will hold as much electricity as one with much larger plates but separated perhaps $\frac{1}{16}$in. apart in air. Although air is the most efficient dielectric, it stands to reason that an air-spaced condenser cannot be made as compact as one using thin sheets of mica, paper, or bakelite, since if the plates of an air condenser are placed very close they may accidentally touch, and so discharge the condenser. That is why if you buy a variable condenser with bakelite dielectric, such as the one shown at (b) Fig. 4, you will receive a much more compact instrument than one of the same capacity but with the vanes separated by air, as in the one shown at (a) Fig. 4.

See also *CAPACITY, DIELECTRIC, DIFFERENTIAL CONDENSER ELECTROLYTIC CONDENSER*, etc.

WAVEBAND SWITCHING WITH PLUG-IN COILS

A READER who uses plug-in coils asks for a method of waveband switching without coil changing.

Here is a simple method of using plug-in coils for wavechange switching which I use with success. First, for use with "swinging-coil" reaction and using a 3-way coil holder, the coils are plugged in in the following order: Long-wave, reaction, short-wave (Fig. 1). The reaction-coil must be of a suitable size to provide reaction on both wavebands. One end of both the long and short-wave coils is connected to earth, and the other ends are connected to the two studs of a S.P.D.T. switch. The arm of the switch is connected to aerial, grid condenser and aerial side of aerial tuning condenser. Of course, the aerial coils in this case must be made movable, and the reaction coil fixed. The reaction coil is connected in the usual way. For circuits employing capacity control of reaction it is simpler, as three single coil holders may be used, and all coils remain fixed. (See Fig. 2.)

—P. TREVOR (Salisbury).

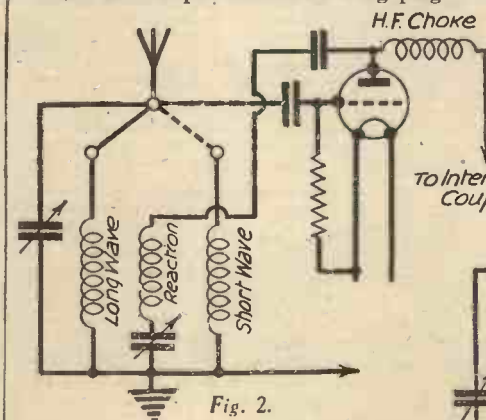


Fig. 2.

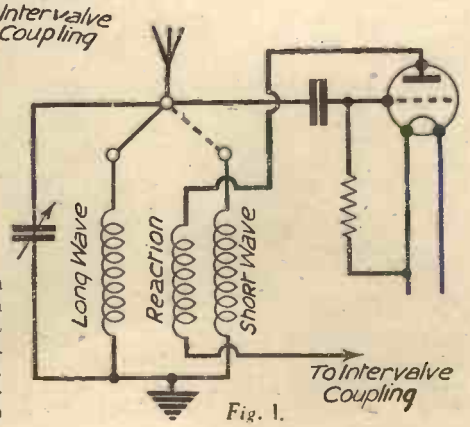


Fig. 1.

IMPRESSIONS ON THE WAX

A REVIEW OF THE LATEST DISCS

Some "Stars" Amongst Funny Records

By E. REID WARR

THERE are few things in ordinary existence which cause more differences of opinion than what is, or is not, humorous. It is, perhaps, as well that we do not "all think alike," for it might well be that nothing (or everything) would appear funny—a very distressing state of affairs!

What is the test of humour? Since everybody has his own idea of humour, and everybody differs from his neighbour, it is impossible to reduce humour to a formula. There is one *attribute* of humour, however, which hall-marks it for the listener, and that is the number of times it will stand repetition and still "raise a laugh." Humour must awaken its response at once: if it does not, one of two things is true. It is not humour at all, or it is not the type of humour which appeals to the listener. We often hear a "turn" in a wireless vaudeville programme which delights us at first, leaves us unmoved the second time we hear it, and on its third repetition impels us to switch off. Conversely, there are occasions when our favourite comedian is broadcasting and we hope he will do such and such a number, which we always enjoy. Evidently our particular brand of humour!

Now I want to recommend some recent records, some of which will suit everybody. They will be so described as to allow readers to choose at least one which will give many laughs for months—even years—to come.

First, one by that wonderful little comedienne, Cicely Courtneidge. This is entitled "*Double Damask.*" It recounts her efforts to buy "*Two Dozen Double Damask Dinner Napkins.*" The ensuing tongue-twisting conversation between the shopper, assistant and shop-walker as they try to repeat the order is the most comical scene imaginable. It is impossible not to laugh even if one hears it every night for weeks. This is on *H.M.V.* B4314, and costs 2s. 6d., a price which works out at a very small fraction of a farthing a laugh.

Of a different school, but an equally brilliant artist—Stanley Holloway. His dialectical skill in the "Sam Small" monologues are models of perfection. The dry, imperturbable Lancashire characters he portrays cause one to chuckle continuously rather than to roar with laughter, leaving a feeling of real enjoyment at the end, and the chuckles go on and on. Test this out on his *Columbia* record No. *DX*353 (4s.), a "12-incher" with "*The Lion and Albert*" on one side and "*Three Ha'pence a Foot*" on the other. There is nothing to choose between them; each is a gem of real comedy. The first has been heard on the wireless, by the way. If you belong to the North Country you'll have this record already, if the South, you *should* have it.

Now for a "pair." The stock-in-trade of Billy Caryll and Hilda Mundy is incompatibility—increased to the *nth* degree. They quarrel, venomously. This dynamic pair go all out on a *Broadcast* record, "*Soaked*" and "*At it Again*" (No. 3253, 1s. 6d.). The lines are well written, and are so well put over that they never seem to get stale.

That very superior person, Gillie Potter, is capable of some very good performances, and some not nearly so good. His humour has a biting flavour and I have never yet met anyone who is undecided about him. You either enjoy his nonsensical arrogance immensely, or his satire exasperates you. Appropriately enough, I think his "*Truth About the B.B.C.*," his masterpiece (*Decca*, *K*650, 3s.). He scourges the lofty disdain of the officials for the smaller fry and their adulation of the great with such audacity that his hearers must wonder if "there isn't something in it." Gillie Potter's technique is quite apart, and his art can be best studied on this record.

A different type of monologuist is John Tilley, who quickly jumped to the top in non-stop vaudeville. He meanders gently and disconnectedly from one episode to another in a strange, detached way. His extravagances have, nevertheless, such an air of comic possibility that he wears extraordinarily well. For example, his "*Army Estimates*" (which has nothing whatever to do with the title, by the way), on *Imperial* 2741 (1s. 3d.), is a record which seems always fresh, a test of the real artist in the most difficult medium, the humorous monologue.

It would be unfair to omit what is definitely the best character sketch ever put on a record, "*Flat Footed Jean*" (*Columbia DB*1009, 2s. 6d.). This is the story of a Scottish Wooing and the three parts are played by the Authoress, Valentine Dunn, John Laurie and a vocal prologue and epilogue are sung by Tom Kinniburgh. This is a perfect gem of quiet, subtle Scottish humour. The theme is the traditional caution of the Scot—even in his love affairs—and the delightful intimacy of the whole scene, so wonderfully acted, gives the hearer a feeling that he is overhearing by a piece of accidental good luck an entirely charming comedy of real life.

Here, then, are half a dozen records which are endowed with humour of such a quality as to justify their inclusion in the variety section of any record library, however small. Each can be heard again and again; each time it will evoke fresh laughter. Hear some of them and see if you agree with me.

Our Most Versatile British Band

If you set out to collect examples from every class of music between Dance and Oratorio, Opera and Military March, it would involve a lengthy and trouble-

(*Continued on page 128.*)

IMPRESSIONS ON THE WAX

(Continued from page 127.)

some search before a really comprehensive and satisfactory selection was made.

This thought struck me on looking through a list of the records which Debroy Somers and his Band have made. These performances form what is probably the most representative musical anthology in existence. Now I am fully aware of immediate conflict with certain musical principles in recognizing the ability and fitness—even the *right*—of any one band to play with propriety, say extracts from the "Messiah" if they then proceed to play Dance Music. I would meet the charge of vandalism by the opinion that it is better to hear good music well played—no matter by what medium—than not to hear it at all. Chopin did not write his Funeral March for a Military Band, yet how has this immortal piece found a place in everybody's life? Certainly not as a pianoforte solo. Scores of parallels are to be found in the history of musical composition. This, it seems to me, is the unanswerable case for Debroy Somers' Band.

Now Mr. Somers first of all has a fine musicianly sense—an asset which takes him all the way. The correct atmosphere of the piece is never lost for a moment. Consider his "Stealing Through The Classics" series, performances which brought more than one protest from the purists. I have only one criticism; that they pay tribute to the craze for medleys, but it must in fairness be said that the idea behind the "Stealing Through" series *was* to give a bit of everything. All the same, Debroy Somers' Band is good enough to play right through many of the excerpts, without abridgement. This is proved by the competent opening amongst the "Masters"; Beethoven and Liszt are finely handled. Then with equal ease the "Opera" (Balfe or Wagner!) selections are played. Follow the "Oratorios"—grandly done, and finally the "Ballets" record which includes extracts from the Coppelia and Casse Noisette. I am unable to see anything offensive in his "Oratorio" record, indeed if Mr. Somers is so well able to popularize Handel and Mendelssohn, Beethoven and Delius, good luck to him. Better to hear composers this way than not at all, as I said before.

This band has a great flair for music of the "stirring" kind. Hear, for instance, his Overture 1914 on *Columbia DX*292. Reduced to simple formula here is a number of War-time marches. But Overture 1914, is much more than this. Tschaikovsky's "1812" gave birth to the idea perhaps, and "1914" emerges as an overture where the components are skilfully welded into a harmonious whole. Call it what you will—overture, fantasia, scena, Overture 1914 is a not unimportant bit of history.

Then to his Dance Music. Many are apt to forget that he conducted one of the earliest broadcasting dance bands. When Debroy Somers sets out to play a fox-trot, he wisely keeps company with the best Continental bands—he is not afraid to use his fiddles. And so *his* versions become music *per se*—not a series of saxophone ululations. Hear his latest record "Her Name is Mary" and "Roll Along, Kentucky Moon," *Columbia CB*563, 2s. 6d., as an example of dance music. By which I mean *music* in *dance* rhythm.

Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by his correspondents

A Magnificent Bargain

SIR,—I have duly received the "Encyclopædia," and desire to express my sincere thanks for such a magnificent bargain. Although I have not yet had time to more than glance through it, it is certainly beyond my expectations. I can thoroughly recommend all readers of PRACTICAL WIRELESS to apply for it without delay. One need have no fear now of not being able to trace faults, etc., in sets which cause trouble. Wishing your journal the success it fully deserves and again thanking you.—M. WOODLAND (London, S.W.).

"Interesting and Instructive"

SIR,—I have received your Wireless Encyclopædia, and being a novice at wireless, I am looking forward to spending many pleasant hours with it. I also think PRACTICAL WIRELESS equally interesting and instructive, and wish it every success. —F. G. ASKEW (Hinderwell).

Keeping Earths Moist

SIR,—I am quite in agreement with the remarks of D. F. C. (Gloucester). I would point out that if any reader employing an earth tube device will take the trouble to water it twice a week with two pints of water—to which two tablespoonfuls of salt have been added—he will get all the percolative earth he desires, and reception will be much improved.—REGULAR READER (Greenwich).

"A Wonderful Book"

SIR,—Just a few lines to say how delighted I am with my presentation copy of Wireless Constructor's Encyclopædia. It is a mine of information and is written so clearly and concisely that any amateur can follow it, with little or no knowledge of wireless. It is just the thing I have been waiting for and is a book to be cherished by every wireless fan. Those who have not yet received their copy have certainly a treat in store. Thanking both Mr. F. J. Camm and the Technical Staff of PRACTICAL WIRELESS for compiling and producing such a wonderful book at a price to suit the most humble of pockets.—R. J. FALOON (Wexford).

Congratulations from South America

SIR,—You may be surprised to receive a letter from an enthusiast of your popular radio paper from Buenos Aires. I have been a constant reader of your grand wireless journal since No. 1, and I heartily agree with other readers that this is the best paper on wireless matters yet published. —WALTER H. SMITH (Buenos Aires).

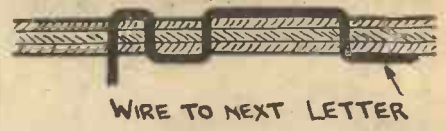
Congratulations from a Reader in India

SIR,—After receiving so many letters of appreciation from your readers in England, my letter will seem rather superfluous. You might almost characterize it as a voice from the wilderness. All the same, allow me to join the host of your admirers and congratulate you for publishing a really useful and helpful radio journal, which fulfils every want of the amateur. It is undoubtedly the finest of its kind offered to the radio enthusiast. The paper contains a lucid exposition of wireless theory and practice, and is copiously illustrated with neat diagrams. Every page is full of interesting and instructive reading matter. What is more, the articles are totally free from "technical" mysticism, which is the bugbear of every beginner. In short, your paper caters for the novice as well as for the experienced amateur. If its present standard is maintained its success is assured.

In conclusion, I must tender my best wishes and thanks for an excellent achievement.—M. B. ICHAPORIA (Bombay).

Learning the Morse Code

SIR,—With reference to the "Wrinkle" on learning the morse code, published in the February 25th issue, I should like to state that I constructed an apparatus very similar some time ago but it differed in the following respect which I think would make its construction very much more easy. A small sheet of plywood was obtained and the morse code including numerals marked out on it, allowing the correct spacing, equivalent to one dot, between the dots and dashes. My next step was to drill a small hole at the end of each dash and dot, and then to thread



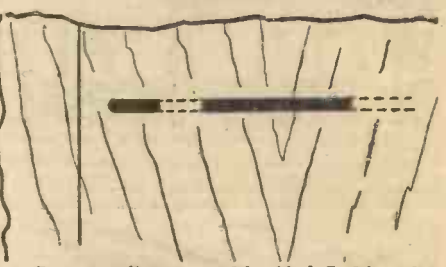


Diagram illustrating Mr. Neil C. Munro's letter.

bare copper wire of about 18 s.w.g. through these holes so that wherever there was a dot or dash the wire was uppermost, while in the spaces the wire was underneath the board. By this method a lot of connections were avoided, but the results obtained were very satisfactory. The accompanying sketch shows the idea.—NEIL C. MUNRO (Welling).

Short-Wave Station—C.T.I.A.A.

SIR,—In the S.W. section of PRACTICAL WIRELESS for March 11th, it is stated that Lisbon (C.T.I.A.A.) works on a wavelength of 31.19 m. on Wednesdays and Fridays, with cuckoo call ad lib. Allow me to correct these statements. Wavelength as announced is 31.25 m. Broadcasts on Tuesdays and Fridays 21.00–23.00 G.M.T. Cuckoo call is given three times only.—J. RIDDLE (Dumbarton).

[*C.T.I.A.A., Lisbon, since leaving the 41 metre band has always announced its wavelength as 31.25 m. As, however, its broadcasts were marred by H.B.L. Prangins on 31.27 m.—a separation of 5 kc/s—the wavelength was reduced for some time to 31.19 m. It is now back again on about 31.25 m. The broadcasts are made on Tuesdays and Fridays, but have also from time to time been given on Wednesdays. As regards interval signal, the cuckoo call is transmitted, ad lib., in groups of 3.*—ED.]

Takes the Place of Four

SIR,—I feel that I cannot let another week pass without expressing my appreciation of PRACTICAL WIRELESS. I have large numbers of wireless periodicals and magazines, dating back to 1921, and have been having four a week, but after reading the first few numbers of PRACTICAL WIRELESS, I cancelled all the others, finding that PRACTICAL WIRELESS gives me all the information and instructive articles I require. They are full of new interest, and written in such clear and simple language. I think that is why large numbers of keen amateurs are turning to PRACTICAL WIRELESS. I have lived in the Dominions for many years and only recently returned home, but I can assure you that many readers will be waiting for mail days to bring them their copy of PRACTICAL WIRELESS. Wishing PRACTICAL WIRELESS all the success it deserves.—"AMATEUR," (Streatham, S.W.).

(Continued on page 130.)

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT the B.B.C. are proposing to erect a new long-wave station having four times the power of the present Daventry 5XX.

—THAT Russia proposes to build a station working on approximately the wavelength of London Regional, with a power of 500 kW.

—THAT the highest power at present employed is 120 kW.

—THAT an ordinary Push-pull transformer may be used for the output circuit of Class B valves provided it is of the correct impedance.

—THAT there are some further new types of valves at present being developed.

—THAT one of these is known as the "diode-triode" valve.

—THAT two receivers may be joined in series on the same aerial for the purpose of receiving two stations at once.

—THAT this is the method employed for receiving both sound and vision for television receivers.

—THAT a special meter is necessary to detect distortion in a Q.P.-P. stage.

NOTICE

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

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

PRACTICAL LETTERS

(Continued from page 129.)

The Goods

SIR,—I am writing to you to acknowledge receipt of Wireless Constructor's Encyclopædia. I must say I am more than delighted with it.

As regards PRACTICAL WIRELESS, it's the goods and the only wireless paper I am taking in now. Maybe I am a bit old fashioned, but I should like to see a plug-in coil set printed in your paper. I have tried several dual-range coils, but have gone back to plug-in every time.

Could your experts give us a way of switching with three plug-in coils, so that medium and long-wave could be received without changing coils? Again thanking you for the volume.—C. BLANDFORD (Smethwick).

Superb Production

SIR,—I have just finished looking through your splendid "Wireless Encyclopædia." It is a superb production all through, and I thank you very much indeed for it.—J. S. Shelly (Manchester).

Handsome Gift

SIR,—I wish to express my thanks for the handsome gift which I received under your generous scheme. It is, as stated, a splendid work, fit to grace any library. Wishing you every success.—J. D. MENZIES (Merton Abbey).

Extremely Pleased

SIR,—Thank you very much for your Wireless Encyclopædia to hand last week. It is indeed a book for which constructors have been waiting and wanting, and I for one am extremely pleased with it.—ARTHUR M. HINDES (Great Yarmouth).

Useful Gift Volume

SIR,—May I express my appreciation of your extemely useful and practical gift volume, and also of your excellent weekly, PRACTICAL WIRELESS?—JOHN SLATER (Edinburgh).

The Best Weekly

SIR,—Many thanks for the souvenir Encyclopædia. It is really good, and contains a great deal of practical information, written in a concise manner. It is invaluable to the constructor. PRACTICAL WIRELESS is easily the best weekly for the keen amateur. Radio Ramblings is an excellent feature.—R. W. WINSTONE (Hampstead).

A Proud Possessor

SIR,—Please let me take this early opportunity of thanking you for your pleasant gift of the Wireless Constructor's Encyclopædia, of which I am now the proud possessor. Wishing your wonderful paper PRACTICAL WIRELESS every success for the future.—JAMES GRIERSON (Thornton Heath).

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.

GLASGOW RADIO CLUB

A lantern lecture entitled "The Radio Valve; What it is and Does," was given at the last meeting of the Glasgow Corporation Transport Department Radio Club on March 10th, by Mr. J. McKenzie Wilkie. The lecturer dealt with the manufacturing and the various functions of the valve. All communications should be addressed to the Hon. Sec., Mr. C. Smith, Glasgow Corporation Transport Department, Possilpark Depot, Glasgow.

THE SOUTHALL RADIO SOCIETY

The easy method by which distant stations transmitting on short waves could be received, surprised a large audience at a recent meeting of the Southall Radio Society on the occasion of the visit of Mr. Hall, who gave a lecture and demonstration on Short-wave Adaptors. In a very interesting lecture on the design of short-wave adaptors Mr. Hall described the necessary features which should be incorporated for a successful circuit and showed various methods by which inherent difficulties in the circuits could be overcome. He also explained the autodyne circuit. Amongst the stations received during the demonstration were Moscow, Drummondville (Canada), Rocky Point, America, and a station in Java, but as the meeting was held in the "White Hart Hotel" on the main Uxbridge Road, considerable interference was experienced from passing buses. The demonstration proved most convincingly the scope for short-wave experimentation.

ILFORD AND DISTRICT RADIO SOCIETY

On February 23rd Messrs. Eugen Forbat and W. K. Alford lectured on the latest types of Ostar Ganz High Voltage Valves. After the practical uses had been described, illustrated by a circuit drawn on the blackboard, which showed how the "universal" operation was obtained, a demonstration was given of a 3-valve receiver incorporating these valves. Surprise and great interest was observed among members when a quick change was made from D.C. to A.C. supply, and the receiver went on working just the same, without adjustments being made at all.

On Saturday, March 4th, a large party visited the Brentwood Receiving Station, by courtesy of the Imperial and International Communications Ltd., and a really excellent instructive time was enjoyed among the short-wave receivers. After the beam aerials had been examined at first hand, the visitors were conducted over the station by Mr. Keen, who had rigged a special amplifier to enable everyone to hear signals from EAM Madrid, which were being received, on one of the 14-valve superhets. The latter was explained by stages, including the transformation of the incoming jammed signals to a clear tone at high speed. Lastly, the party were privileged to examine the Standard Frequency Measurer, the working of which was explained in detail, and whose accuracy was to 1 part in 200,000. The Hon. Sec., Mr. C. E. Largen, 16, Clements Road, Ilford, will be pleased to give details of the society on application.

THE CROYDON RADIO SOCIETY

On a recent Saturday morning members of the Society visited the factory of Celestion, Ltd., Kingston-on-Thames, and saw the various stages of a loud-speaker's construction. What was even more interesting, however, was the laboratory, and here the Chief Engineer, Mr. Tyrrell, explained how a speaker's frequency curve was obtained.

Actually, such curves are of more value in judging performance than would be the ear alone, and it was seen how an oscillator gave notes from 30 to 20,000 cycles. The loud-speaker under test was placed in a heavily-damped room and fed by these oscillations, while a microphone picked up the results, and the frequencies could then be measured. Thus was the overall speaker response in the form of a varying curve obtained. Hon. Sec., E. L. Cumbers, Maycourt, Campden Road, South Croydon.

HACKNEY RADIO AND PHYSICAL SOCIETY

At our last meeting, held at the Hackney Electricity Showrooms, we had the pleasure of listening to an exceptionally interesting lecture when Mr. C. Gwinn, B.Sc., gave a talk on "Electric Condensers." Commencing his talk by a discussion on paper dielectric condensers, Mr. Gwinn dealt at length with their composition, method of manufacture, capacity induction and leakage. The lecturer's remarks on the causes of breakdown was most enlightening. After completing his remarks on paper condensers Mr. Gwinn next dealt with wet electrolytic condensers and after explaining the reason for development and their principle of working, went on to suggest many useful methods of utilising this type of condenser in preference to the paper type. Local readers of PRACTICAL WIRELESS are invited to write for particulars of membership of this Society and programme of future talks. A. F. ROGERSON, Hon. Secretary, 19, Sewdley Street, Clapton, E.5.

ANGLO-AMERICAN RADIO SOCIETY (HUDDERSFIELD BRANCH)

A very enjoyable evening was spent at a meeting held on March 21st in the society's club room. An

(Continued on page 132.)

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE

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

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

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

D.C. MAINS VOLTAGE

"I have a commercial receiver, bought last summer from a firm which has now gone out of business. It had an input adjustment of 200 to 250 volts. I am moving to another district in April, and the supply there is 150 volts D.C. How can I adjust the set so as to use it on the new supply? I do not want to meddle with the inside of the set as it has automatic bias and other refinements which I might upset as I am not technical."—(S. D., Muswell Hill, N.).

There is no need to be worried about the change-over, S.D., as you have a very simple way out of the difficulty. As the mains and receiver are D.C., all that has to be done is to include a good battery of 50 volts in series with the mains input to your receiver. To save trouble we would suggest a good wet H.T. battery of the accumulator type, and when you have found the correct polarity of the mains, join the battery in series in the negative lead to the set. This will augment the mains voltage and bring it to 200 volts.

METALLIZED VALVE

"I have a small portable set which I made some years ago, and in an endeavour to modernize it I fitted a metallized detector valve. I find now that I cannot get the London station on the set, and before this used to come in at 20 degrees. The Midland, which used to be at 50 degrees, now comes in in place of London. What have I altered in fitting the new valve? No wires have been touched, and no other component has been interfered with."—(W. H., Harrow).

You have probably got a tuning coil in the portable, or some other inductance, which is situated close to the valve. Previously this gave the tuning range which you required, but the new valve has the metallized coating connected to L.T. negative, and the presence of this earth potential body close to the coil has altered its value with the result which you have found. If you cannot move the coil away from the valve, we are afraid you must either make a new coil, or use an unmetallized valve as before.

FAULTY GRID CIRCUIT

"My set is a Detector and 2 L.F. with R.C. Unit and Eliminator. Up to now this has worked admirably, but lately has developed a very strange attitude. Having shut off L.T. and H.T. when retiring, next day on switching on again, nothing happens until I take out grid-bias negative plug, and immediately replace in same position, when everything appears to be O.K. until shutting off again, when the same performance has to be repeated. New valves have been tried—new L.T. and G.B. Also rewired, but without success. Aerial and earth appear quite satisfactory."—(D. U. D., Old Trafford.)

The fault points most definitely to a defective grid circuit in the L.F. stage, and therefore you must carefully check the wiring, and test each of the grid components. These will be the resistance in the R.C. stage, and the secondary of the L.F. transformer. If these prove definitely O.K., the valve-holders should be examined for a faulty connection between the terminals and the spring which grips the valve leg.

ALTERNATIVE COMPONENTS

"I notice that you do not give any alternatives to the parts which you specify for the 'Fury Four.' I have a whole lot of parts at home as the result of my experimenting in the past, and I should like to know whether it is absolutely essential that I should adhere to those you name. It does not seem to me that there would be any difference in using some of those parts which I have got, and I do not want to buy new ones just to try out the set. Can you advise me on this point?"—(R. J., Peckham.)

There is a reason for not giving alternatives. To the average listener there does not appear to be any difference in, for instance, an H.F. choke made by one firm, and a choke made by another firm. When designing a circuit, however, it is necessary to take the circuit as a whole, and then to decide on the values of various parts, in addition to other characteristics. For instance, two different makes of H.F. choke are employed in the two H.F. stages. The reason for this is as follows. The decoupling circuits consist of identical values of resistances and condensers, and if the two chokes were also identical in characteristics the result would be two similar oscillatory circuits, which would no doubt give rise to instability. The choice was made therefore so that the characteristics are totally dissimilar. Other parts of the circuit require similar consideration, and unless you are thoroughly well-informed on technical matters it will not be advisable to change the parts indiscriminately.

DATA SHEET No. 29

Cut this out each week and paste it in a Notebook.

WEIGHTS OF MATERIALS

MATERIAL	lbs. per cub. ft.	Specific Gravity
Aluminium	160	2.56
Bismuth	615	9.85
Brass	505	8.10
Bronze	544	8.73
Copper	558	8.94
Cork	10.15	.16
Ebonite	71.7	1.15
Glass	168	2.7
Gold	1206	19.32
Lead	708.65	11.35
Mercury	846.51	13.56
Oak	50	.80
Paper	43	.7
Platinum	1342	21.5
Silver	655	10.5
Steel	480.6	7.8
Tin	454.6	7.3
Tungsten	1193	19.4
Zinc	449	7.2

EFFECT OF REACTION

"I have a simple little set employing a detector and L.F. stages. I am only poor, and therefore buy cheap batteries, etc., and while I was talking to a friend the other day he upset me rather by saying that when I used reaction I was using up the juice, and that the H.T. would run out quicker. Is this so? I like to hear it loud, but he says that the louder it is the more the battery goes. Can you please tell me if this is right?"—(R. S. D., Bethnal Green.)

Your friend was misleading you, or he did not know much about wireless matters. It is, of course, a fairly common fallacy that distant stations take more current. Your receiver employs only a normal detector and L.F. stages, and therefore the total current is probably about 8 milliamps. When you receive the London stations you will find, if you were to put a meter in the anode circuit of the detector valve, that there would be a slight drop in the total anode current when the station was tuned in without reaction. As an instance, a normal leaky grid detector might show, in your district, a decrease of 1 to 2 milliamps when tuned to London. If reaction is then employed the drop will be even greater, as the stronger the signal, the lower the current with this form of detector. The current from the L.F. stages, provided they are properly biased, will remain the same, no matter how loud (up to the overloading point, of course). Therefore, if you use reaction, you will *reduce* the current taken by your set. With Q.P.-P., of course, this is not true, but you are not using that method of L.F. amplification, and therefore your friend was misinforming you.

ULTRA-EFFICIENCY

"I am making up a set to get really perfect results, and the following point occurs to me. The losses introduced by the valve holder and the base of the valve must be fairly large, if measured. Would I gain anything, therefore, by removing the base and soldering my connections direct to the wires of the inside of the valve? I am anxious to make everything absolutely tip-top in my set, and this point stumps me."—(W. G., Edgware.)

For short-wave work this method of connecting the detector can sometimes be advantageously employed. For normal broadcast-band reception, however, there is nothing to be gained. The losses in the other parts of the circuit will offset any gain introduced by decapping the valve, and provided the valveholder is of a good make, the losses will not worry you on the normal wavelengths. For short waves, of course, every little bit of stray capacity will be important, and a decapped valve will probably enable you to obtain better results.

TELEVISION LAMP

"I have made up the Televisor described in Twenty-five Tested Wireless Circuits, and have used an ordinary Beehive Neon lamp for the output arrangement. When I first connected it up, nothing happened. I then tried different methods of connection, and find that with a certain voltage the spiral arrangement glows, whilst with another connection the little disc glows. I can't, however, make them both glow together. Is there anything wrong with the lamp, and how should it work, please?"—(T. P. L., Tonbridge.)

With a D.C. current, only one element of the Neon lamp will glow. With an A.C. supply, however, the elements glow alternately. For television purposes, the lamp should be joined in the anode circuit so that the largest element glows, and in the beehive type of lamp the spiral should be the one to work on. In the correct type of Neon lamp, the two elements are divided up so that the correct one is a large, flat plate, whilst the other is a small rod. In the advertisement type of letter lamp, the letter should glow. You must have sufficient anode current, or other method of obtaining a current, to cause the element to glow at a fairly brilliant value, before signals are applied to it. If the anode current is unsufficient to obtain the glow, then a separate source of supply must be used for the purpose, and the signal currents fed to it via a condenser.

SUPERHETERODYNE

"I have tried the 'Fury Four,' and all other sets, but have found that owing to my unfortunate position, I cannot get the stations such as Toulouse which work right on top of the London station. After hearing a friend's superheterodyne receiver I have decided that this is the only type of set which will do for me. Are you in agreement? If so, can you publish, at any early date, a constructional article on such a receiver? I guess it will be a bit hard for the average inexperienced amateur to make up a real super, but there must be thousands who would be satisfied with no other circuit. I should be glad to have your views."—(F. H., Potters Bar.)

In response to many requests for such a set we are giving our readers the Supersonic Six, preliminary details of which were announced in our pages last week.

FREE ADVICE BUREAU COUPON

This coupon is available until April 15th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 8/4/33.

CATALOGUES RECEIVED

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

"CLIX" PLUGS AND SOCKETS

A LARGE percentage of reception troubles are traceable to faulty connections in a set, often through the use of inferior plugs and sockets or similar fittings. By the use of "Clix" fittings this sort of trouble is avoided, and the latest list issued by Lectro Linx, Ltd., gives particulars of several "Clix" terminals, plugs, sockets, and connectors which are well known for ensuring good contact. A recent addition to the "Clix" range is a neat chassis-mounting valveholder fitted with resilient helically-slotted sockets with terminal ends. Another efficient "Clix" fitment is the "Master" plug with specially made prongs which are adaptable to different sizes of sockets.

EDISWAN BATTERIES

A COMPREHENSIVE range of H.T. batteries, accumulators, torches and refill batteries is given in the latest booklet issued by Edison Swan Electric Company, Ltd. Included in the range are standard and double capacity H.T. blocks and grid-bias batteries. Batteries for hand lamps, bell and electric clock batteries, and 2-volt accumulators of various capacities (in glass cells) are included in this useful list, a copy of which can be obtained on application to the above firm at 123, Queen Victoria Street, London, E.C.4.

"TONIC" TRICKLE-CHARGER KIT

A PRACTICAL solution to the charging problem is to be found in "The Tonic" Self-generating Trickle-charger kit which is marketed by the patentee, T. R. P. Williams, Netherend, Cradley, Birmingham. The outfit consists of the necessary copper and zinc plates for forming a battery of improved Daniell cells suitable for charging a 2-volt accumulator at home, without any trouble. This simple trickle-charger should be a boon to anyone using a small capacity accumulator and especially to those living in remote country districts. The price of the outfit, with cardboard covers, is 7s., or, with Bakelite covers, 8s. 6d. Postage on either type is 9d. Leaflets giving full particulars can be obtained post free from the above address.

"GRIPSO" PLUGS AND SOCKETS

WE have received from The Gripso Company, a booklet giving a useful range of "Gripso" accessories, including shrouded plugs and sockets with coloured sleeves and indicating names; insulating bushes; tag ends; lead-coated spade-ends; indoor aerial hook insulators; earthing clips; and various types of push-pull indicating switches. The address is 32, Victoria Street, London, S.W.1.

THE SIX-SIXTY "SUPER FIVE"

ONE of the latest A. C. Mains Receivers to be placed on the market is the Six-Sixty "Super Five," a high-class model embodying many outstanding features. Although listed at the moderate price of 14 guineas, the receiver has two screened-grid stages and power pentode output giving maximum selectivity and ample volume without distortion. It has single tuning control, the dial being calibrated in wavelengths. The set and speaker, the Six-Sixty Ferrodynamic type, are housed in an attractive walnut cabinet. Further particulars are given in a new folder, a copy of which can be obtained on application to the Six-Sixty Radio Coy., Ltd., 17-18, Rathbone Place, Oxford Street, London, W.1.

PIX VALVES

A NEW folder we have just received gives particulars of Pix valves, together with their characteristics and curves. These valves, which are remarkably low in price, have a triple-coated Neodymium filament which produces a strong controllable emission. Printed on the folder is a useful comparison table of Pix valves, with various other makes. A copy of the folder can be obtained from British Pix Co., Ltd., 118, Southwark Street, London, S.E.1, enclosing a stamp for postage.

BELLING-LEE RADIO CONNECTIONS

A SMALL booklet is to hand from Belling-Lee, Ltd., giving particulars of their well-known terminals and connectors, including indicating terminals with non-rotating name; spade terminals with spring prongs; terminal mounts; wander plugs; shrouded plugs and sockets; mains input connectors; and fuses and battery cords. The terminal mount, listed at 8d., is now reduced to 6d. The address is Cambridge Arterial Road, Enfield, Middlesex.

ERIE RESISTORS

ERIE resistors and grid leaks are made of solid carbon and a rare earth composition having the property of carrying a high load without any tendency towards open circuiting. The wire leads are soldered to copper which is forced into the ends of the resistor under intense heat. It is claimed for these resistors that they are absolutely silent and stable in use. A simple colour code is used to designate resistance values, and in addition, the resistance value is indicated on a small label. Particulars of the full range of these components are given in a folder issued by The Radio Resistor Coy., 1, Golden Square, London, W.1.

ALL ABOUT CLASS B

A BOOKLET dealing with both the Q.P.-P. and Class B forms of Push-push Amplification has been prepared by the Multitone Electric Company. Both systems are fully explained, and every point likely to crop up in fitting and using Push-push is dealt with in a thoroughly practical manner. In addition, the best methods of converting existing sets are described and illustrated by means of clear and simple diagrams. The booklet is obtainable free of charge from the Multitone Electric Company, 95-8, White Lion Street, London, N.1.

CLUBS AND SOCIETIES

(Continued from page 130.)

excellent programme was given, including a film of the recent visit of members of the society to Moorside Edge Station. We wish to appeal to all amateur transmitters in Huddersfield and district to join our society, as we are arranging some special experiments this summer which should be of great interest to them. Will interested readers please write to the District-Organiser, Mr. L. Goucher, 10, West Grove Avenue, Dalton, Huddersfield, for full particulars.

LEICESTER EXPERIMENTAL SHORT-WAVE SOCIETY

The second meeting of this Society was held recently, and a competition was announced for the listener members on the 20 metre amateur band. Leicester stations G5VH, G6WV and G6JQ have kindly consented to radiate slow morse at certain times for the benefit of members who will shortly be applying for transmitting licences. This society was founded to bring together the short-wave enthusiasts, and to help generally with difficulties that most amateurs encounter. Particulars would be willingly forwarded on request. Hon. Sec., S. H. Whitley, 69, Wilberforce Road, Leicester.

Broadcast Query Corner

UNDER the above title, with the assistance of a recognized authority on foreign broadcasting matters and a regular contributor to wireless publications both at home and abroad, we have inaugurated a special Identification Service, which has proved of great assistance to our readers. When tuning in well-known stations it happens frequently that listeners pick up wireless transmissions of which they fail to recognize the origin. It is to solve these little problems that the *Broadcast Query Service* has been organized.

Replies to Broadcast Queries

ADIOR (Glasgow): PAONC, cannot trace; advise you to write to N.V.I.R. Post Box 400 Rotterdam (Holland); PAOZK, W. Keeman, Cnan Van Necklaan 227, Rijswijk (Holland); G6IA, T. H. Colebourn ("Ardchalligan" Selbourne Drive, Douglas (I. of Man). F. G. DAVIES (Rhondda): Cairo (Egypt) working with Paris; on either 29.84 m. (SUV) or 31.17 m. (SUY)—via Abu Zabal. I. W. LOVELOCK (Acton): Cannot trace either call; would advise you to write to Radio Society of Great Britain, 53, Victoria St., S.W.1. HAM (East Finchley): (1) China—XGA to XUZ inclusive; (2) (a) F8 followed by 2 letters—France and Colonies (Amateurs) (b) F8M—Morocco (Amateurs); (c) RYA-RYZ, Lithuania; (d) YL not LY (Latvia). BRS 1038 (Herne Bay): W2XAF, Schenectady (N.Y.) relays WGY on 31.48 m. Go BETTER (Kensington): Harmonic of Moscow T.U. on 25 metres.

(Continued from page 97.)

condenser between the input terminal which is joined to H.T.+. You will find that the strength of signal which can be handled by the Class B valve is very great, and the result is that a really tremendous output is obtained. There is no grid bias to be juggled with, as in the case of Quiescent Push-pull, and no adjustments whatsoever have to be made in the output stage. The 215P. valve handles a really powerful signal, so that with the majority of receivers the bugbear of over-loading is completely removed. Naturally this is not an invitation to force reaction to its very limits as the result will be distortion, and in view of the high quality of the Class B valve it is obviously undesirable to spoil this by trying to get Johannesburg or Juan-les-Pins or some similar weak or long-distance station at full room strength with the very minimum of H.T. Provided you bear this point in mind, you will find that this unit, in conjunction with the average receiver, will give you results which have hitherto only been obtained with mains receivers employing super power valves in the output stage, and, you should, therefore, use the very best loud-speaker you can obtain.

ADVERTISEMENT INDEX

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FREE INSIDE! DATA SHEET No. 17. "HANDY TABLES"

Practical Wireless

3D.

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Announcing The Self-Contained A.C. TWIN

ROUND *the* WORLD *of* WIRELESS

Ventriloquial Announcements

WHEN listening to Radio Barcelona (EAJI), you may have heard, at intervals, what appeared to be a dialogue between two men. This cross-talk is mimicked by the announcer, José Trorés, a skilled ventriloquist, who in these announcements incorporates a number of publicity "puffs." They are a regular and popular feature of the Barcelona studio.

Three Interval Signals

BEROMÜNSTER (Switzerland) on 459.4m. is a station heard by most radio fans. It takes its programmes from Berne, Zurich and Basle. In each instance the city which provides the entertainment is mentioned by the announcer, and each individual studio possesses its own interval signal—a musical-box melody. Try to memorize these tunes, as if you miss the announcements they will assist you in identifying the origin of the broadcast.

B.B.C. Statistics

OF the ten shillings paid by listeners to the Postmaster-General, during 1932, the B.B.C. as its share received 4s. 7d. In all the net annual revenue, totalling £1,628,738 showed an increase of £203,388, of which extra licences represented £127,421. In 1932–33, the B.B.C. made a return grant of £150,000 to the Exchequer. During 1932, £663,424 was spent on wireless entertainments, or £5,489 more than during the previous year. Considerable credit is due to the engineering side of the concern in view of the fact that of 59,547 broadcasting hours from the B.B.C. transmitters the total time lost through technical hitches was only 17 hours and 46 minutes. Taking the share of the licence money allotted to the B.B.C. into consideration, a rough calculation shows that the cost of the home entertainments, to the average broadcast listener, is about one penny per week! Proving without doubt that wireless is the cheapest form of entertainment.

A Sequel to the Madrid Conference

THE delegates of the posta and telegraphic administrations of all States interested in broadcasting will meet at Lucerne (Switzerland) on Monday, May 15th, to formulate a new plan of European wavelengths. Their decisions will be based on the proposals discussed and passed at the last Madrid Conference.

America's Sponsored Broadcasts

THE National Broadcasting Company and the Columbia System have come to an agreement in respect to certain characteristics of the publicity entertainments transmitted over their individual networks. The prices of commodities advertised in these programmes are permissible so long as they are only mentioned once in a fifteen-minute broadcast. It has also been agreed that in such transmissions the representatives of the sponsoring firms will not make any comparison of their prices with competitive concerns when boosting their wares over the microphone. Every effort is to be made to make these entertainments of a lesser commercialized character in order to render them more acceptable to the listening public.

The Call of the Turk

ON some evenings, providing conditions are favourable, a few degrees above your condenser readings for Radio Luxembourg, but when this station is resting, you may hear strains of Oriental music. They emanate from Istanbul (Constantinople) on 1,200 metres. The announcer (Tanburi Djemie Bey) gives out the call in both Turkish and French, namely, *Allo, Allo, boucari Istanbul telsiz telefonou* (*Ici Radio Istambul*). You may sometimes identify the transmission by its repeated strokes on a gong, at intervals between items. Oriental music is broadcast in the early evening hours, a Western European concert and news bulletin following later.

Russian Press News Broadcasters

FOR the supply of official news bulletins to the provincial newspapers, the Soviet authorities, until the short-wave wireless stations are completed, are making nightly use of the high-power broadcasters at Moscow and Leningrad. At the conclusion of the day's programmes, you may hear these stations calling distant cities such as Samara, Sverdlovsk, Kiev, Samarkand, Vladikav Kaz and so on. There then follows a slow dictation of official news paragraphs, the word *Stotcka* (comma) appearing at frequent intervals. Russian newspapers are not allowed to print any news other than that supplied through Government sources!

German Political Broadcasts

UP to the present, considerable use has been made in Germany of gramophone records for the rebroadcast during more convenient hours of topical events, and political speeches were re-transmitted to listeners in the same manner. With the advent of the Hitler administration, however, programmes are now interrupted for the inclusion, at any moment, of Government pronouncements. As all transmitters can be linked up with Berlin, a simultaneous broadcast is carried out at a moment's notice. The compiling of local programmes has thus been made increasingly difficult for the organisers as the day's entertainments have to be re-arranged at the "eleventh hour" to fit in with State requirements.

IN THIS ISSUE:

BUILDING THE BETA UNIVERSAL FOUR

THE A.C. TWIN

THE SUPERSONIC SIX

FRAME AERIALS

A HANDYMAN'S TESTER

A TWO-POINT AERIAL SYSTEM

A SIMPLE REMOTE CONTROL

NEXT WEEK!

SOLVING THE PORTABLE PROBLEM.

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

Testing Valves

WHEN testing a receiver in which the valves are suspected, few constructors are sufficiently fortunate in having a complete set of spare valves to try, but this disadvantage can often be overcome, as some types of valves will work temporarily in any position. An S.G. valve will make a perfectly good detector when plugged into the valve-holder in the ordinary way, the top terminal being ignored. In the same way an S.G. valve will make a reasonably good power-valve, its impedance being round about 5,000 ohms when used in this manner.

Mains Interference

INTERFERENCE with the volume of a receiver by the electric wiring in a house is becoming increasingly common. When it is found that the volume of a receiver is changed because somebody has switched on or off a light, the trouble may usually be obviated by earthing the lead covering or iron piping system in a number of places. This phenomenon is usually accounted for by a house wiring circuit having a natural wavelength roughly equal to the station being received.

Volume Controls

THE majority of volume controls are extremely noisy in operation, which is inclined to be irritating when searching for any length of time. This fault can be minimized, or completely stopped, by connecting a condenser of 2 mfd. or more between the slider and one side of the resistance. This method can be used equally well with 3 terminal volume control or 2 terminal control, such as the variable resistance controlling a variable-mu valve. This method should never be used with volume control on the L.F. side.

Modulation Hum

MODULATION hum can usually be cured by connecting two condensers in series across a mains, and earthing the centre point. This is so well known that it would seem that we should apologize for mentioning it again, but it is not generally known that it is possible to waste the electric current night and day if the on-off switch is in the earthed side of the mains. It is, of course, best to use a double-pull switch to shut off both mains when using this arrangement.

Class B Amplification

THERE is an enormous amount of attention fixed on Class B amplification at the present time, and readers will doubtless be aware that the whole principle of this output technique relies on the output current increasing with the incoming signal. This current may rise from two to forty-five milliamps, and secondly, it is almost impossible to use an eliminator, as the variation in current would cause the voltage from the eliminator to vary within wide limits on all the valves, which would result in distortion, in addition to the extraordinary effect it would have on the reaction control.

Metal Chassis

WITH the advent of the metal chassis, many constructors and, we fear to say, designers, completely lost their heads

INTERESTING and TOPICAL PARAGRAPHS

in their desire to connect every possible terminal to the nearest point of the chassis. On a four-valve set, there may be as many as twenty wires going to the chassis, and secondly, twenty separate currents would flow from one part of the chassis to the other. This method of omnibus returns can cause the most untraceable happenings, and instances have been known when a receiver that has been made completely unstable has had stability restored by connecting a slot in the chassis, and sending a troublesome current in another direction.

A FINE PORTABLE.

Listening to the "His Master's Voice" "Superhet Portable Six," a self-contained battery instrument which receives all worth-while stations with amazing selectivity.

An Evil of Metal Chassis

ANOTHER evil which is common to metal chassis is the practice of connecting one side of the S.G. condenser in a mains set to the chassis. This means that the bias resistance of the valve is between the earth end of the condenser and the cathode of the valve, which can, in certain instances, cause violent instability. The low potential end of an S.G. condenser should always be connected to cathode and not to earth.

Blue Glow

FIVE years ago, a bluish glow in a valve would indicate that the valve was soft, *i.e.*, the vacuum had become low, with the result that electrons were heating the particles of gas, and breaking them up. Until fairly recently, softness was unknown in the modern valve, and fortunately, still is, but all the same, some of the latest valves show a blue glow that would lead the average constructor to believe that it was soft. Curiously enough, this new blue glow is caused by the valve being exceptionally hard and denotes a particularly good specimen. This glow is fluorescence, and is a ray shot off the anode by the terrific impact of the electrons, which is not surprising when it is realized that an electron in a modern high-slope valve may exceed a speed of 10,000 miles per second.

"Free" Grid Bias!

THE very word "wireless" is a misnomer, and so are a good many of the associated terms. A particularly glaring example is "free" grid-bias, as, far from being free, the bias voltage supplied by it is subtracted from the H.T. voltage applied to the valve. Free bias is sometimes called automatic bias, which is equally ridiculous, as it rather implies that a grid-bias battery requires winding up, or some form of manual starting.

Keeping Your Radio Up-to-Date

EVERY year thousands of perfectly good radio sets are scrapped by their owners as worn out. Actually, the only parts of a receiver, apart from batteries, which can deteriorate, are the valves. New valves can work wonders with an out-of-date set. One important factor must be borne in mind, however. Modern valves are much more sensitive than those of two or three years ago, and care must be exercised in choosing suitable types. The Mazda range includes valves for every type of set, and radio dealers are always ready to assist purchasers in choosing them correctly. These valves are used by most of the leading set manufacturers and specified by the foremost designers. The Mazda valve research laboratories have been responsible for many of the most outstanding radio developments of recent years.

SOLVE THIS!

Problem No. 30.

After two or three days' work Blackman had practically finished his new receiver. This was a self-contained three-valve set, employing S.G. Detector and Power valve with Band Pass Tuning and a Three-gang condenser. A particular item was to be transmitted in the evening to which he was very keen to listen, and in his hurry to get the set into its cabinet he unfortunately broke the detector valve. He had no spares, and the shops were closed. What was the simplest way of using the receiver to provide the item to which he was so keen to listen? Three books will be awarded for the first three correct solutions opened. Address your solutions to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark your envelopes Problem No. 30. No other correspondence should be enclosed in the envelope, which should reach here not later than April 17th.

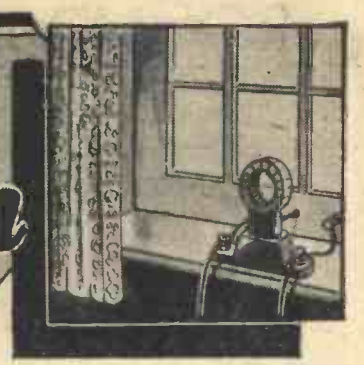
SOLUTION TO PROBLEM No. 29.

Jefferies only needed a resistance of approximately 15,000 ohms to insert in series with the H.T. positive output from his Mains Unit. This would be the nearest commercial value of resistance obtainable to provide the necessary voltage drop.

The following three readers received books in connection with Problem No. 28:—

A. W. Preedy, 59, Kyree Road, Clapham Common, S.W.11; A. C. Peck, 15, Pelham Road, Wood Green, N.22; W. J. Butterfield, 104, Cambridge Road, Seven Kings, Essex.

A two point Aerial System



An Ingenious Arrangement with Many Advantages

By A. C. BURNS, M.Sc., F.I.C.

IT is not always realized that the average aerial is often unnecessarily long and, furthermore, that the usual "outdoor" system can, in many cases, adequately be replaced by what might be termed a semi-outdoor type. This applies particularly in the case of the now commonly employed H.F. Det., L.F., set.

The alternative to the normal outdoor system, *i.e.*, the strictly indoor arrangements, generally affords more "selective" reception or better elimination of unwanted stations, but only at the expense of volume. The writer has for the last three years successfully employed an aerial system, arranged as shown in Fig. 1.

This system offers at least four advantages, viz :—

(1) The upright external portion is a distinct advance on the normal strictly indoor system and, if the house has unused attics or loft, the portion inside the roof (shown by dotted lines) can be extended round and well clear of three walls of the attic and just clear of the roof. Foot-lengths of silk thread will afford ideal insulation, particularly since in many attics and certainly in lofts or lumber-rooms there is no need to sacrifice efficient insulation by fixing the aerial close to the ceiling or room walls, just for the sake of tidiness.

It is usually easy to find a point in the roof eaves, more or less directly above the windows, W1 and W2—a point where a hole is readily drilled through the wood-work, just under the roof gutter. Indeed, in most lofts there are ventilation gaps in many places where the roof meets the walls. In any case, the lead from window to roof need not be vertical and certainly can be less unsightly and less dangerous than the average outdoor aerial. As in the case of the strictly indoor type, there is no need to "earth" the aerial in thundery weather nor are atmospherics so dominant as those associated with the outdoor system.

(2) The effective pick-up of this system can be almost doubled by continuing the aerial back from the roof (see dotted lines) and down the outside of *another* wall of the house, thence leading it in once more, but to a *different* room *via* another window.

(3) Herein lies the main advantage of the two-point system. By providing a separate "earth" at this second window, the set can conveniently be used in either room at will—an advantage particularly to owners of radiograms. and sets with contained speakers and with no speaker extensions to other rooms. To operate the set in the other room, all that is necessary is to connect up to the alternative "A" and "E," leaving the aerial and earth terminals in the first room unconnected. The total length of the aerial system will be unaltered by the change-over, so that tuning will remain unaffected and stations will come in at the same points on the dial in whichever room the set is used.

Fig. 1.—How the aerial system is arranged.

Variation of Aerial Capacity

An ordinary 6d. tuning-coil holder fixed in both rooms at the lead-in points, as shown in Fig. 2, makes a very neat anchorage for the aerial and earth leads, and has the advantage that it can easily be used as an earthing-switch by simply inserting the usual shorting-plug, "B" (see also Fig 3). Now for a little experiment!

Try the effect of inserting some of your obsolete tuning coils; if you no longer possess these in your junk box, they can be obtained very cheaply secondhand nowadays. The effect of inserting tuning coils in series with the aerial lead has been discussed from time to time, but equally interesting results are obtained by introducing these coils in parallel, *i.e.* across the aerial-earth leads. Not only is volume altered—both increased and decreased, according to the size of coil used—but the range of the tuning scale (condenser) of the set can be usefully extended.

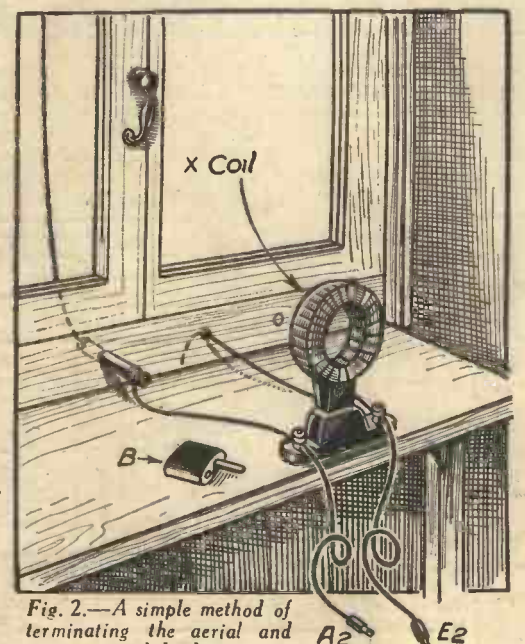


Fig. 2.—A simple method of terminating the aerial and earth leads.

For example, a number of well-known receivers, particularly when operated with small external aerials, cannot tune in the 1,875 metre Huizen (or Hilversum), which regularly offers such interesting programmes, particularly between 7.40 a.m. and 8.40 a.m. daily. In such sets, this station, in effect, is "off the scale." By inserting a 200 coil (or other long-wave coil) in the holder, the aerial-circuit capacity is so altered that the station now comes in at the upper end of the scale, and with a little margin to spare. Naturally the other station settings have become temporarily, but only slightly altered—being, in fact, displaced to slightly lower dial reading.

The introduction of these coils in the aerial circuit, both in parallel and in series, naturally alters the capacity of the aerial-tuning circuit, and its variable condenser, just as does the addition of a small variable condenser of the compression type. The fact that you are virtually shunting the aerial to

(*Continued on page 140.*)

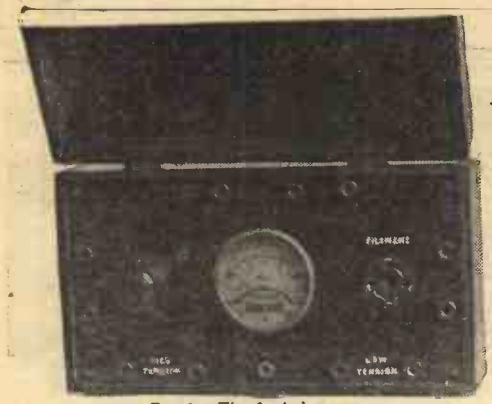


Fig. 1.—The finished tester.

A HANDYMAN'S WIRELESS TESTER

With this Easily-made Instrument Various Tests can be Quickly Carried Out.

By S. BRASIER

Fig. 4.—How the parts are mounted.

WHEN you are tracing that elusive fault in your set, how often have you wished that you had something to simplify and speed up the job? Quite a number of times, I expect! So with this thought in mind, the handy tester here illustrated was designed, but not without limitations. In the first place it had to be cheap to construct. Secondly, it was required to do everything that one wants to do when testing a receiver. Lastly, it had to be neat and compact.

Now as you see from the list of components, the most expensive item is the triple reading meter. In fact this more or less determines the cost of the whole outfit. The instrument used proved to be very accurate when tested against precision meters, and is quite satisfactory for all ordinary purposes. The other parts are quite usual items, and you will probably have most of them on hand. Regarding the second point, here are a few tests that can be made:—

Voltages of L.T., H.T., and G.B.; anode current of any valve; continuity tests; short circuits; valve filaments (including mains valves); tracing distortion, etc.

All this can be done without the usual confusion of pieces of wire, odd batteries, meters and the like. Just a neat box in a convenient place, and a testing lead.

Details of Construction

The construction should present no difficulties as the illustrations show everything quite clearly. The whole outfit is housed in a cigar box measuring 8½in. by 4½in. In the original model the lid of the box was taken off and used as the panel, and another lid, recessed to about ½in. was made. This gives clearance for the leads when the tester is closed. If, however, you obtain a box about 3½in. deep, you can use a separate piece of wood or ebonite for the panel, in which case it should be sunk about ½in. into the box.

The position of the components can be seen from the panel layout (Fig. 3). A fretsaw should be used for cutting the holes for the valve-holder and meter, the latter being a good push fit to obviate other fixing. With regard to the valve-holder, the terminals on this must be reversed so that connection can be made from underneath. The holder is then pushed through the hole and screwed or bolted to the panel. A strip of thin metal, bent to shape and screwed at each end to the panel holds the 4½-volt battery in position under the meter. This can be easily seen from Fig. 2. The .01 condenser which is connected across the milliammeter is held in position by its own wiring. Care should be taken when wiring up.

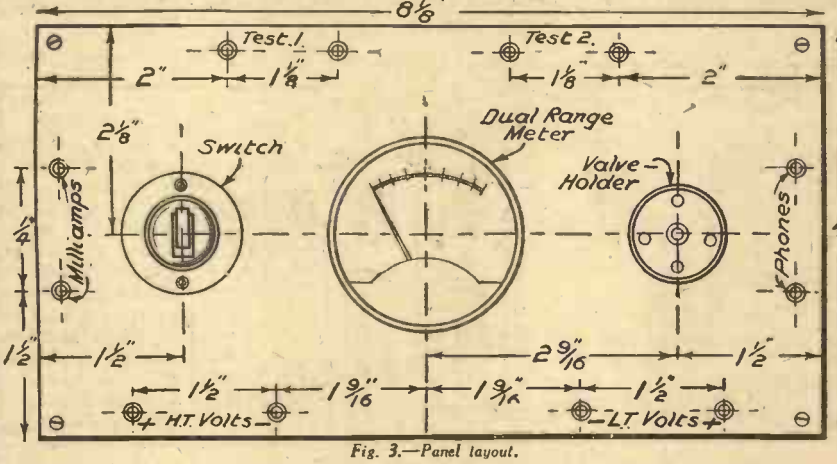


Fig. 3.—Panel layout.

Here it should be noted that if you do not use the specified meter, the points of connection will probably be different. Also, when soldering to the spikes of the meter, do this as quickly as possible, otherwise you may disturb the inside wiring. Be most careful to put the 1½ and 4½-volt plugs in their correct sockets. This completes the important points regarding the construction, so now a few words about using the unit.

Using the Tester

Obtain a yard of twin flex and furnish each of the two ends with plugs. This completes the testing lead, and all you have to do is to plug one end into voltmeter, milliammeter, or whatever you like, and test with the other end. The testing points for high and low voltages and milliamp readings will be obvious. Sockets marked test 1 are for low resistance continuity tests such as point to point wiring, tuning coils, etc. Connect one end of testing leads to sockets marked test 1, the other end going to component under test. Short-circuits will also become obvious using this test, as on completion of a circuit a reading of 1½ volts will be obtained.

Test 2 is used in conjunction with telephones plugged into the sockets so marked, and should be used for testing continuity of transformer primaries, H.F. chokes, loud-speaker units, etc. Proceed as for test 1, but plug leads into test 2 sockets. A click in the 'phones on completion of a circuit gives you peace of mind here. By the way, don't forget to switch on before performing any tests. If a valve is plugged into the holder on the unit, a reading of 1½ volts will remove all suspicion from the heater or filament. Regarding the milliammeter test, it is a great advantage if you have a spare lead with one end permanently connected to a Bulgin 5-pin split anode adaptor. With this in use the milliammeter is automatically put into the plate circuit of any valve. All manner of other tests will suggest themselves to the constructor. It should, however, be realised that high tension eliminator voltages cannot be measured with the meter used. A good approximation of the voltage on the plate of a valve

(Continued on page 172.)

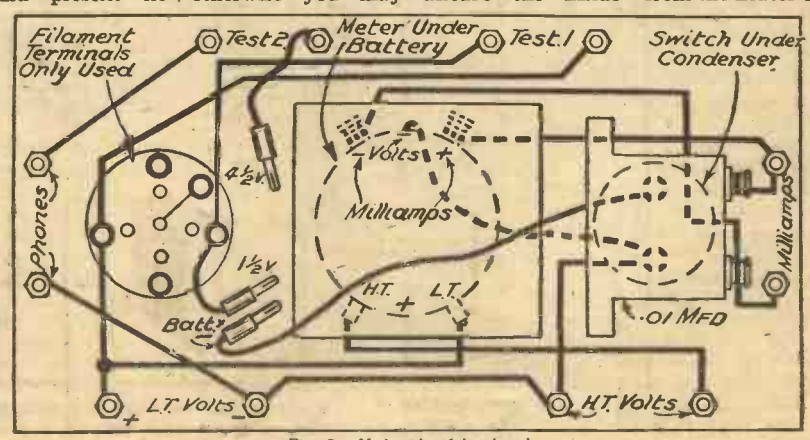


Fig. 2.—Underside of baseboard.

The Supersonic Six

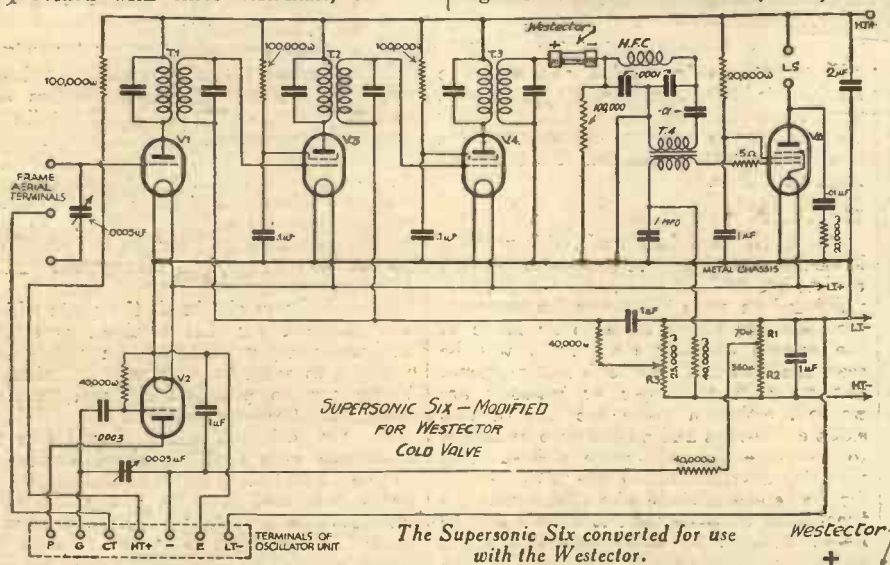
How to obtain the best from this most modern of Broadcast Receivers, which is covered by MY PERSONAL GUARANTEE

By F. J. CAMM

LAST week I gave you very brief instructions for handling this efficient six-valve set, and for the benefit of those who are not familiar with the super-heterodyne circuit I will give more complete instructions.

The Frame Aerial

First of all the frame aerial. This is provided with three terminals, the two outside ones being joined to the ends of the frame and the centre one being connected to the centre tapping of the complete frame. These three terminals should be joined to the three terminals on the rear of the receiver in the same order, that is, the centre terminal on the receiver is joined to the centre terminal on the frame, and the two outside terminals are joined to the other two terminals on the frame. There is no other method of using this receiver, and therefore you must have the frame aerial, which must also be of the centre-tapped variety. Join the L.T. leads to the positive and negative terminals of the 2-volt accumulator, and plug the two H.T. leads into the respective ends of the 120 volt H.T. battery. Now on the left-hand side of the panel the lower knob has a small window through which will be seen the word "Off," when the knob is in one position, and rotation of the knob to left or right will show the letters "L" and "S" through the window. To commence with, turn the knob so that the letter "S" is visible, and then set the frame aerial switch so that that also is adjusted for the medium waves. On the particular aerial specified this will be when the small lever on the switch is pushed home into the upper contact. The receiver is now in working condition, and is tuned to the medium waves. Turn the right-hand knob until you hear a rushing noise from the loud-speaker, and then set both tuning dials to read '0.' To operate the receiver, at least for the first time, two hands are necessary, and therefore the left-hand tuning dial should be held in the left hand, whilst the right-hand dial should be taken with the right hand.



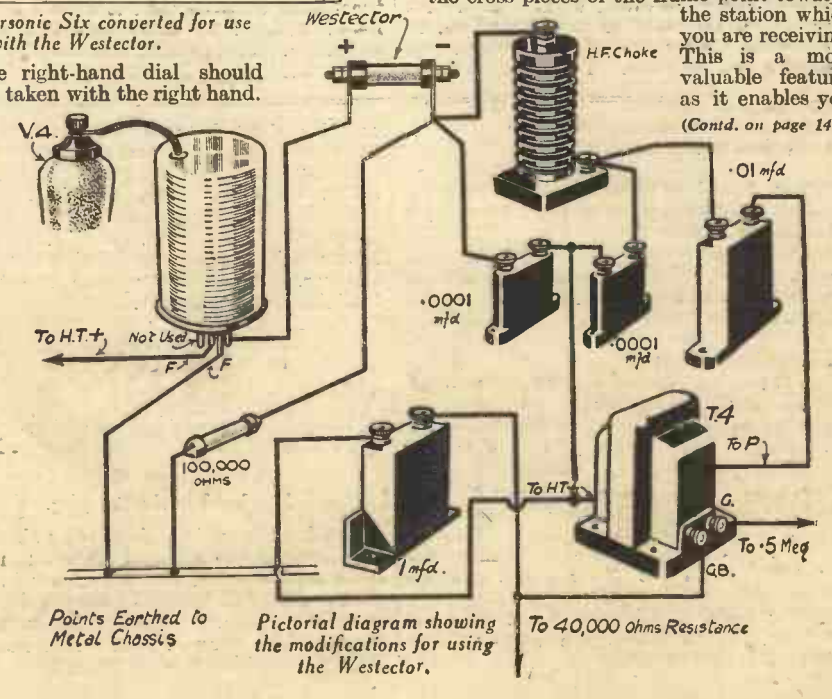
The Supersonic Six converted for use with the Westector.

Now advance the left-hand dial very slowly a degree at a time, and at the same time swing the right-hand dial over a distance of about five degrees above and below the point shown by the left-hand condenser. Proceed through the whole scale of the condenser in this way, and the moment you hear the slightest sign of a signal, stop turning the left-hand dial and carefully adjust the right-hand. It may sound that the operation is complicated and tedious, but actually it is exceedingly simple, and is much easier when once you have appreciated the operation of the dials. You have to bear in mind that one degree on the dial in this receiver will tune in and tune out a station. For instance, in London it is possible to rotate both dials, in step, and at one degree to hear nothing, and to tune in the London station to full strength and out again before coming to the next degree. However, carry out this tuning operation right through the scale and see if you can hear a station. When something is heard the frame aerial will require orienting, and this operation should also be carried out if you find that for some reason you can tune through the whole scale without hearing a station.

Adjusting the Frame

The operation of adjusting the frame in this way is called the "orientation of the frame" and it has to be turned so that the cross pieces of the frame point towards the station which you are receiving. This is a most valuable feature, as it enables you

(Contd. on page 140.)



Points Earthed to Metal Chassis

Pictorial diagram showing the modifications for using the Westector.

To 40,000 ohms Resistance

The Supersonic Six.

LIST OF COMPONENTS FOR THE WESTECTOR SUPERSONIC SIX

1 Paxolin Panel drilled 14 in. by 8 in. : (Peto-Scott)
1 Aluminium Chassis : drilled 14 in. by 8 in. (Peto-Scott)
1 Oscillator Coil and Switch unit with window, dial and knob. (Wearite)
1 I.F. Transformer. (Wearite type O.T.1)
2 I.F. Transformers. (Wearite type O.T.2)
1 H.F. 10 Choke. (Bulgin)
1 Special 8 mfd. condenser block. (T.C.C.)
0.1 mfd. condensers, type 65. (T.C.C.)
1 0.001 mfd. condenser, type 34. (T.C.C.)
2 0.01 mfd. condensers, type 34. (T.C.C.)
2 .0001 mfd., type 34 (T.C.C.)
1 Special Resistance Unit. (Dubilier)
1 500,000 ohms Grid Leak. (Dubilier)
1 20,000 ohms. 1 watt Resistance. (Dubilier)
2 40,000 ohms. 1 watt Resistance. (Dubilier)
1 100,000 ohms. 1 watt Resistance (Dubilier)
1 1 amp fuse. (Microfuse)
1 25,000 ohms volume control. (Watmel)
1 Hypernik L.F., 3-1, Transformer. (Lissen)
2 0.0005 variable condensers with slow motion dial, type No. 2 S.M. (Polar)

5 Terminals (2 L.S. and Aerial 1, 2 and 3) (Belling Lee)
1 Centre-tapped frame aerial. (Eelex)
8 4-Pin sub-baseboard valve-holders. (Clix)
1 5-Pin sub-baseboard valve-holders. (Clix)
1 4-way Battery Cord (H.T.+., H.T.—., L.T.+., L.T.—. (Belling Lee)
1 P.M. 4 Mansfield Moving-coil Speaker. (W.B.)
5 Cossor Valves, 210 H.F., 210 L.F., 220 V.S.G., 220 P.T.
1 Westector, type W4 (Westinghouse Brake & Saxby Signal Co.)
1 Lion 120 volt H.T. Battery.
1 Ediswan 2-volt 40-ampere hour Accumulator.

(Continued from page 139.)

to cut-out the interference caused by a station working on a wavelength very close to that of the station you want, but which is situated much closer to you than the required station. With the ordinary type of receiver, or outside aerial, it is impossible to eliminate this form of interference, but with the frame aerial you simply turn it so that it forms an angle with the interfering station. Naturally, if the two stations are in the same direction you are still at a loss, but it is even then possible to make use of the directional feature and to practically get rid of the station. On the majority of European stations it will be found unnecessary to turn the lower right-hand control full on. If turned too far, the set bursts into oscillation, and naturally you cannot receive speech or music when it is in that condition. It must be used, therefore, to bring the station to just the strength you require and no more. There are no other adjustments to be carried out, and the receiver is, therefore, simpler to operate than many sets employing half as many valves, but the number of stations which can be received is sufficient even for the most ambitious.

The Westector

As pointed out last week, this receiver lends itself admirably to the use of the new cold valve, or Westector, and the diagram published on page 139 shows the necessary modifications which have to be made to the second detector circuit. It will be seen that the H.F. choke is still required, but no grid condenser or gridleak are wanted, although there are one or two extra condensers and a resistance necessary to complete the cold-valve circuit. The pictorial diagram shows the arrangement for the benefit of those who cannot read the theoretical diagram, and it should not be found difficult to carry out this slight alteration. Fortunately, the second detector has no bearing on any other parts of the receiver, and all the various voltage dropping resistances and decouplers are still of the same value as when the ordinary valve is employed in this stage. The cold valve does, however, result in a saving of low-tension and high-tension current, and this is no doubt of great value to those readers who find it difficult to get accumulators charged or who cannot afford to be continually renewing the H.T. battery.

Provided you obtain all the parts which are specified for this receiver, you will find no difficulty whatsoever in getting the receiver to work as soon as it is finished. There are no pitfalls which will prevent you getting the same results as were obtained with the original, and I should like to emphasize here that the circuit employed is one of the most selective known to the radio art, and if it is not possible to separate two stations on this superheterodyne receiver, then it is not possible to separate them on any other set, no matter of what make.

(Continued from page 137.)

earth does not necessarily mean reduced signal-strength. The writer finds that, with the set tuned to Radio-Paris, for example (using a tight coupling and minimum reaction), the simple insertion of the 200 coil boosts up the volume considerably. It is all a question of aerial capacity, a subject which does not call for further discussion here.

Interesting Effects

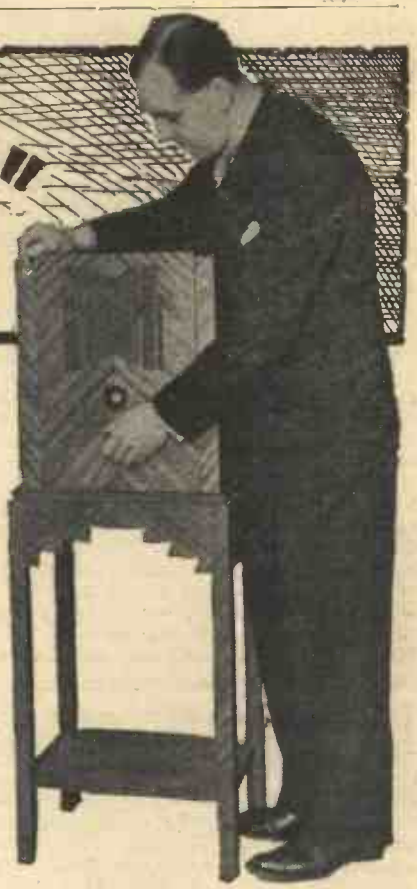
The effects are still more pronounced when the coil-plugging is conducted at the end of the aerial remote from the set, *i.e.*, where the aerial returns in the *other room*, particularly if this room contains an extension-speaker, further interesting results can be noted by plugging in different coils. For example, tune in to Daventry National in one room and plug in a 200 or 150 coil in the other room. There is no particular change, except when using smaller coils, which give some drop in volume. Now insert the shorting-plug and note that, though the aerial is now actually shorted to earth, there is still sufficient capacity in the aerial system to afford "nice quiet volume." With the set in the other room, here is a handy method of cutting down volume. Under these conditions, too, one can enjoy reasonably good reception during thundery weather, for the atmospheric noises are diminished considerably.

Fig. 3.—The shorting plug.

Another interesting effect can be obtained by tuning in the Midland Regional in one room and shorting the coil-holder in the other. Many of you will expect a distinct drop in volume, whereas, actually, there is no audible change. Tune into London Regional, with the shorting-plug still in circuit, and you will note a distinct *increase* in volume. Individual experimenters must try for themselves the effect of introducing various sizes of tuning-coil across the aerial-earth leads at the point most remote from the set end of the aerial. It is all a matter of capacity, and it doubtless so happens that the natural capacity of the writer's aerial-system gives the above effects with the 200-coil and the shorting-plug.

Finally, the presence of aerial-earth leads in two rooms allows of convenient control of volume in those cases where the speaker in use is in a room away from the set. Volume can be readily controlled by shunting a suitably high-volume high-value variable resistance across the leads, which, incidentally, allows also of some degree of selectivity control. A low-capacity variable condenser can likewise be shunted across for purposes of controlling selectivity, though in this case better results are obtained by inserting the condenser in series with the aerial, and in the manner usually recommended.

Building the "A.C. TWIN"



A New Type of Receiver for All-mains Operation. Two Pentode Valves in a Circuit Designed for Quality Reception on an Energized Moving-coil Loud-speaker.

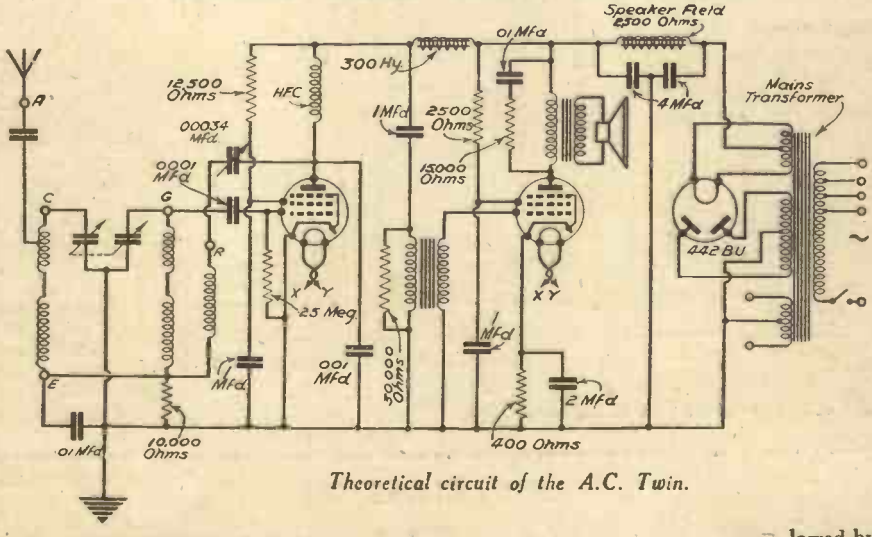
By W. J. DELANEY

FROM inquiries which I have made amongst radio retailers, and also from a number of friends, I have decided quite definitely that there is need for a mains receiver which is designed to give a really high-quality output from the local station. It is quite true that many listeners wish to receive fifty or more stations on the loud-speaker, but there are many more whose main aim is to hear the local station, with the choice of an alternative, at full room strength, with irreproachable quality of reproduction. So far, the majority of receivers which are available, either from the manufacturers, or from designs published in periodicals, and which are designed to give a really large output, are of the multi-valve type with one or more H.F. stages. The result of this is that there is more than one control to be handled, and the expense of the receiver is naturally rather high. There has not so far been available a receiver of the simpler type which will give that volume that many listeners require, without trouble and without a large outlay for a powerful receiver. Ten pounds seems about the limit to which those with whom I have discussed the question seem prepared to go, and they have asked for a receiver which will be simple to operate, **capable of the volume which has come to be associated with high-class mains receivers, but which is not of the type designed to get every station in Europe.**

My Experiments

I therefore set to work to try to design a small, compact receiver for as low a figure as possible, yet which would be capable of the performance which seemed to be required. I kept in mind the non-technical listener and especially the older generation to whom "knob-twiddling" would be right out of the question, and to whom a high-class musical performance from even one station would be sufficient. At the same time, I bore in mind that with both classes of listener just mentioned, there might be occasions when a little distant reception would not come amiss. At first I thought it would be quite easy to put together a receiver of this type, but one or two experiments showed me that there was quite an interesting field for study in this direction. The familiar detector followed by one L.F. stage was the basis, and after putting together such an arrangement (with the necessary mains equipment, of course) I decided that the power output was insufficient. Accordingly a pentode was used in the output stage, with the result that it was found impossible to fully load it and therefore it was not being efficiently employed. I next tried a good screened grid stage followed by a power detector operating straight into the speaker. This gave a slightly greater reach, but naturally the signal output was low. The next scheme to receive attention was a screen grid H.F. stage followed by a pentode valve acting as a detector and feeding the loud-speaker direct. This showed a little more promise but was still failing.

A "PRACTICAL WIRELESS" GUARANTEED CIRCUIT!



Theoretical circuit of the A.C. Twin.

The Final Circuit

Several more experiments were carried out, and finally I hit upon the most efficient arrangement. This consisted of a special **high-frequency pentode valve, employed as a power grid detector, followed by an ordinary mains pentode.** This gave great results, and all that remained was to decide upon the intervalve

(Continued overleaf)

COMPONENTS FOR THE A.C. TWIN

One Lewcos Band-Pass Filter, Type 51, B.P.F./R.
One Polar Uniknob 2-Gang Condenser, .0005.
One Igranic Transformer, Type T/24/B.
One Lotus .0003 Reaction Condenser.
One Bulgin Standard H.F. Choke (H.F.9).
One Varley 300 Henry L.F. Choke (D.P.16).
One .0001 fixed Condenser (Type S), T.C.C.
One .001 fixed Condenser (Type S), T.C.C.
Two .01 fixed Condensers (Type 34), T.C.C.
Three 1 mfd. fixed Condensers (Type 50), T.C.C.
One 2 mfd. fixed Condenser (Type 50), T.C.C.
Two 4 mfd. fixed Condensers (Type 84), T.C.C.
Two 5-pin valve-holders (Clix Chassis type).
One 4-pin valve-holder (Clix Chassis type).
One ½ megohm Erie Resistor.
One 12,500 ohm Erie Resistor.
One 400 ohm Erie Resistor.
One 2,500 ohm Erie Resistor.
One 30,000 ohm Erie Resistor.
One 10,000 ohm Erie Resistor.
One 15,000 ohm Erie Resistor.
One Heayberd Mains Transformer (Model A.C. Twin).
One Grampian Energized Speaker, Type E.1.
One Bulgin Mains Toggle Switch, Type S.80.
One Bulgin Small Mains Connector, Type P.21.
One Clix Terminal Strip.
Two Clix Wander Plugs (One black and one red).
One Cossor 442 B.U. Rectifying Valve.
One Cossor MS-PEN-A (H.F. Pentode Valve).
One Cossor MP-PEN (Pentode Output Valve).
One Smith Lyric Cabinet.
One coil Glazite, 3 yards red and black flex, screws, bulb for panel light, etc.

INTRODUCING THE A.C. TWIN

(Continued from page 143.)

components, so as to get the very best from the circuit design. A power detector requires a very accurate matching of the load in the anode circuit, and when a pentode is employed in this way, the difficulty arose of obtaining the correct load so that the maximum signal was passed to the L.F. stage. A suitable resistance would have required an H.T. supply of over 500 volts, so that this was ruled out. No transformer was available which could be included in the anode circuit, but obviously a really high inductance L.F. choke would be suitable. Messrs. Varley step into the breach here with a choke having an inductance of 300 henries and a D.C. resistance of 3,000 ohms. This will carry a maximum current of 10 milliamps, which is just about what the pentode will give when operating on full power. The L.F. transformer may therefore be parallel fed, and the design of this need not be so critical, provided it will give a good step-up, with a good overall response. In view of the cost of the anode component, it was felt desirable to keep the cost of the transformer low, and the Igranic component which was chosen costs only 5s. 6d., but gives splendid results when used in the manner I have adopted in this circuit.

The Speaker

The pentode output valve requires a load of between 6,000 and 7,000 ohms, and the next thing was to find a loud-speaker capable of giving this load without the expense of output chokes, etc., and I also thought it desirable to remove the necessity for a separate mains smoothing choke, by employing one of the energized type of speaker. These are cheaper than the permanent magnet type, and at the same time, no smoothing choke is needed, if the mains output is correctly chosen. The Grampian loud-speaker which I selected provides a load in its primary winding of 7,500 ohms when a certain pair of its terminals are employed, and this will obviously be admirable for our pentode. The field has a D.C. resistance of 2,500 ohms and requires a dissipation between 3.5 and 7 watts. The two pentodes which I selected consume just over 40 mA., and this current passing through 2,500 ohms would result in a voltage drop of just over 100 volts. This gives a dissipation of 4 watts, which is just above the minimum required and should prove adequate for our purposes. As 250 volts are required for the anodes of the valves, and there is a loss of 100 volts through the speaker, it is necessary to design the mains portion of the speaker to provide 350 volts.

The Cabinet

The final point was to find a suitable cabinet to house the various parts so as to provide a good-looking receiver which was capable of taking its place in the home, and which would not give "boxy" or "tinny" results. The Smith Lyric cabinet which is used may be obtained by itself, or in conjunction with a very neat stool, and this is shown in the photographs in this issue. **The performance of the final receiver is really excellent.** Although primarily designed, as I stated above, to give the local, with one alternative, at really high-class volume and quality, with no intricate adjustments, it is capable of receiving several stations at splendid volume. It is simple to build, and there is nothing difficult about the construction or operation.

This receiver will appeal to thousands, and will undoubtedly prove to be one of the most useful receivers which has yet been described to our readers. Further details will be published next week.

HOME-MADE COIL SCREENS

By W. G. MARSHALL

MOST constructors are, perhaps, anxious to take advantage of the improvements to be obtained from screened coils. The following is a description of simple and cheap home-made screens that any handy constructor can make for himself. Firstly, it must be remembered that it is important that the screens are sufficiently large in diameter to allow at least 1in. clearance all round the coils. This, of course, can be exceeded a little with advantage. No attempt will be made to describe the construction of a suitable dual-range coil, as this has been dealt with in recent issues of PRACTICAL WIRELESS.

Constructional Details

Procure a suitable size tin and lid; an ordinary cocoa tin will serve the purpose admirably. Strip the tin of its labels and well clean it inside and out. Then cut out the required number of slots in lid and the open end of tin, as depicted at A, Fig. 1. These should be just sufficiently wide to admit the wire used for wiring the coil in the set. Covered wire such as "Glazite" should be used. The lid is used as the base of the screen.

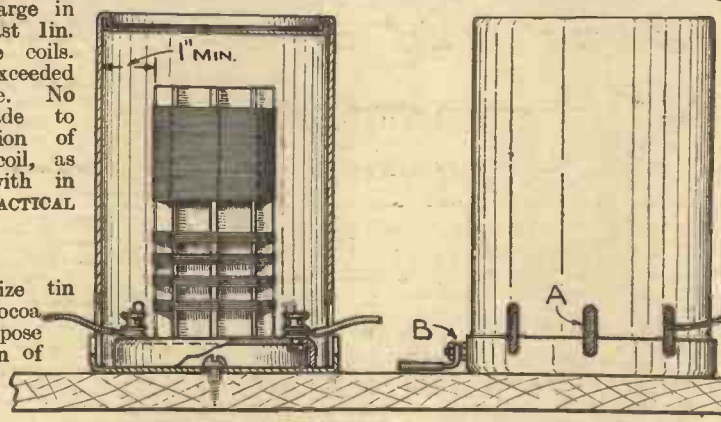


Fig. 1.—Section and elevation of the home-made coil screens.

A hole is punched in the centre for screwing down to the base board, or, alternatively, this may be omitted, as other holes will be needed to admit the screws for screwing down the coil base. An earthing terminal may be fitted if desired, as shown at B, Fig. 1.

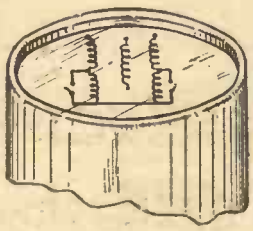
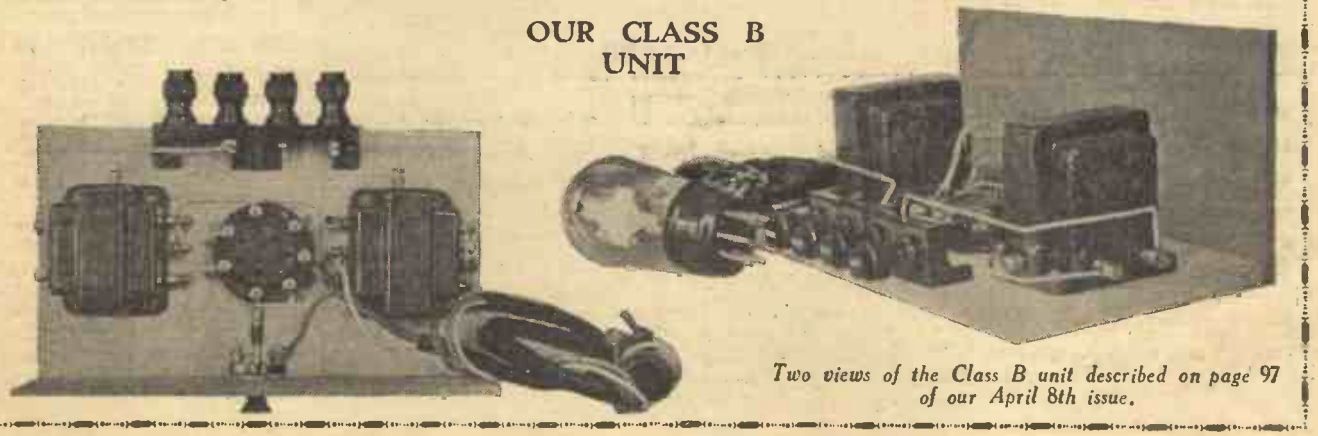


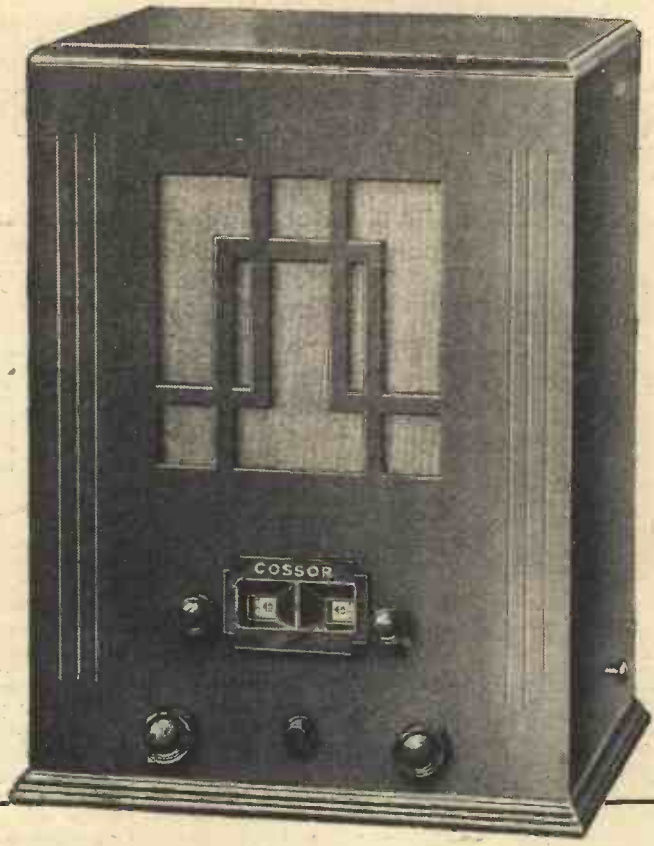
Fig. 2. — Identification circuit drawn on bottom of screen.

In the base of these tins it will be noticed that the bottom is recessed a little and this can be used for holding a disc of cardboard on which the circuit diagram of the coil has been drawn. This will provide a handy form of reference, as indicated in Fig. 2. Finally, the screens may be given externally a coat of aluminium paint, when they will assume quite a commercial appearance.

OUR CLASS B UNIT



Two views of the Class B unit described on page 97 of our April 8th issue.



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"SELECTIVITY all one could desire . . . TONE and QUALITY are wonderful . . ."

writes Yorkshire user

This satisfied Cossor owner continues: "I have had all kinds of home constructed Sets since 1923 but your Melody Maker *is the best yet.*"

For less than ever before you, too, can enjoy the remarkable performance of the Cossor Melody Maker. Equipped with Cossor Variable-Mu Valve—individually shielded coils—graded volume control—every up-to-date feature of design—the Cossor Melody Maker, at to-day's prices, undoubtedly represents the greatest possible value for money in Screened Grid Radio. Send at once for full details—use the coupon.

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To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5.

Please send me free of charge a full size Constructional Chart, which tells me how to build the Cossor *Battery / *All-Electric Melody Maker.

(*Strike out type not required.*)

Name .....

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NEW PRICES

BATTERY MODEL 335

with Self-Contained Loud Speaker

Kit of Parts includes 3 Cossor Valves (220 V.S.G. Variable-Mu Metallised Screened Grid, 210 H.L. Metallised Detector and 220 P. Output); Individually Shielded Coils. All-metal Chassis and all parts for assembling the Receiver as illustrated; handsome cabinet 18½ in. x 13½ in. x 10½ in. and 10 in. Balanced-Armature Loud Speaker. Provision is made for fitting Gramophone Pick-up Socket and Plug. Price **£6.17.6**

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Kit of Parts, complete with Valves for building Cossor Melody Maker Chassis for fitting to your own cabinet. Specification as Model 335 but without loud speaker or cabinet. Price **£4.19.6**

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ALL-ELECTRIC MODEL 337

With Self-Contained Loud Speaker

Kit of Parts for All-Electric Melody Maker Model 337 similar to Model 335 (as illustrated) but for all-electric operation, including Cossor Valves, handsomely finished Cabinet, 18½ in. x 17½ in. x 10½ in., Loud Speaker and all parts. For A.C. Mains only 100-125 or 200-250 volts (adjustable). 40-100 cycles. Price **£8.10.0**

Hire Purchase Terms: 20/- deposit and 9 monthly payments of 18/6

ALL-ELECTRIC MODEL 336

Kit of Parts, similar to All-Electric Model 337 except that no loud speaker is supplied. Handsome cabinet 10½ in. x 17½ in. x 10½ in. Price **£7.10.0**

Hire Purchase Terms: 21/- deposit and 9 monthly payments of 16/-

ALL-ELECTRIC MODEL 338

Kit of Parts for All-Electric Melody Maker Model 338 Chassis. Identical with Model 336 except that no cabinet is supplied. Escutcheon and template for drilling your own cabinet is included. Price **£6.15.0**

Hire Purchase Terms: 28/6 deposit and 6 monthly payments of 20/-

Models 336 and 338 are available for use on A.C. Mains only, 200 to 250 volts (adjustable), 40-100 cycles.

Prices do not apply in I.F.S.

A. C. Cossor Ltd., Highbury Grove, London, N.5. Depots at Birmingham, Bristol, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield, Belfast, Cardiff and Dublin. ♡ 2683

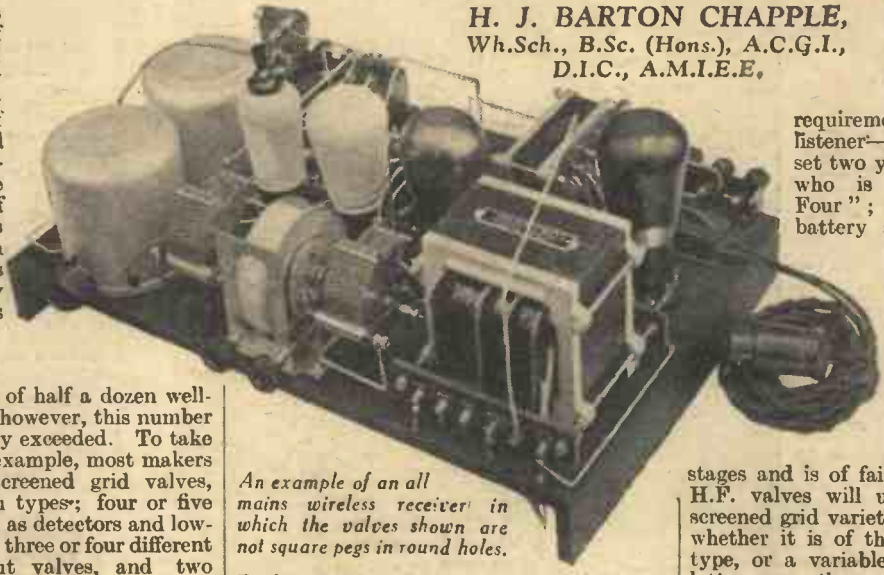
SQUARE PEGS IN ROUND HOLES

Notes on The Correct Choice and Use of Valves

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

THERE is an old adage which describes a misfit as a "square peg in a round hole." How easy it is for a radio valve to be a square peg; how frequently are unsuitable valves plugged into valve holders.

The choice of valves for a given receiver is not merely a matter of taking any screened grid valve, and any detector and any output valve, and of knowing that they will all work together satisfactorily. If that were so, the catalogues of valve manufacturers would each contain but half a dozen types in each range—battery operated and mains operated.



An example of an all mains wireless receiver in which the valves shown are not square pegs in round holes.

Number of Types

In the current lists of half a dozen well-known valve makers, however, this number of types is very greatly exceeded. To take the 2-volt range, for example, most makers list at least three screened grid valves, including variable mu types; four or five valves suitable for use as detectors and low-frequency amplifiers; three or four different three electrode output valves, and two or three pentodes.

Even supposing that each valve of one particular make had its practical counterpart in the list of each of the other manufacturers—which, by the way, is not always the case, the owner of a three-valve set of the screened grid, detector and L.F. class has the choice of at least four grades of screened grid high-frequency valves, five different types of detectors and seven different output valves. A similar state of affairs exists in the case of A.C. mains valves.

The questions which immediately suggest themselves are: How is it that such a large number of different valve types have been developed? Are they all necessary? Could not each maker's range be greatly simplified by some process of standardization?

A Logical Process

A development of a large number of valve types is the logical outcome of the great progress which has been made in valve technique during recent years. In the early days of broadcasting, a single type of valve was used indifferently for high-frequency amplification, detection and low-frequency amplification.

The natural process of competition tended still further to increase the number of valve types, while another factor was the invention of screened grid and pentode valves, both of which have characteristics which fit them for certain functions almost to the exclusion of all other types. Another reason for the multiplication of valve types was the demand for valves of ever-growing sensitivity and efficiency for use in battery-operated portable sets. Here the size and weight of both the low-tension and high-tension batteries are subject to severe limitations, and any development which resulted in even slightly improved output or in the saving of even half a milli-ampere of high tension current was welcome.

Replacements

It will naturally be asked why, when more efficient valves are produced, are not the older types discontinued. The answer here is that to a very great extent they are. The published valve lists of to-day contain a very small proportion of the valve types developed even during the last three years.

As a matter of fact, all sets of really modern design can be equipped with suitable valves from a very restricted selection—say, two screened grid types (one variable mu and one of the normal type), a single detector, and a choice of two triode and two pentode valves. But such a range would be far too limited for the many different forms of receiver which are still in existence but, having been built two or three years, do not represent the latest practice.

An Example

To take a simple example, so greatly has the modern low-frequency transformer been improved that a very high percentage of the detector valves of to-day are coupled to the following stage by a transformer, and results from the quality point of view are as good as and if not better than the earlier resistance capacity couplings, while, of course, the stage gain is much higher. The modern detector valve has been developed to work in conjunction with the modern transformer, and its characteristics are such that it will function equally well with direct or resistance fed transformer coupling. In sets of two or three seasons ago, however, many different forms of intervalve coupling were employed. There had to be, therefore, high amplification, high impedance valves for use in conjunction with resistance capacity couplings, others suitable for choke coupled amplifiers and general purpose valves for use as detectors and low-frequency valves for use as detectors and low-frequency amplifiers with transformer couplings.

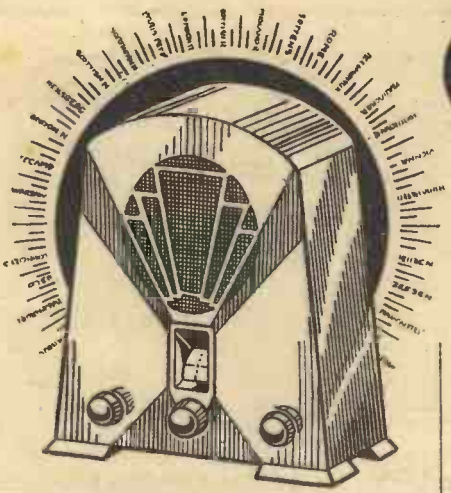
It is but right that listeners who are not able for the moment to procure a modern-to-the-minute receiver should be able to obtain still the valves which operate best with their old and possibly obsolescent receivers. A careful analysis of current catalogues reveals that the ranges of valves listed represent the minimum assortment to meet the reasonable requirements of every class of listener—the man who owns a set two years old, and the man who is building the "Fury Four"; the owner of an all battery set, he who uses low tension batteries and mains unit for high tension and the fortunate possessor of an all mains set.

A Few Hints

To begin with, if your receiver incorporates one or more high frequency amplifying stages and is of fairly modern design, the H.F. valves will undoubtedly be of the screened grid variety. You will also know whether it is of the normal screened-grid type, or a variable mu valve, for in the latter case there will be on the panel provision for volume control by varying the grid bias. You can hardly go wrong in the selection of valves for these stages, as most makers list only one variable mu valve and two normal screened grid valves, and you would do well to adhere to the types specified for the set you have bought or built, or at any rate to valves having very similar published characteristics. If, on the other hand, your high frequency valves are of the three electrode type, there are several alternatives. Should the stage be a neutralised one, a valve of the medium impedance type (20,000 to 25,000 ohms or thereabouts) should be chosen. For an untuned high frequency stage such as is often found in portables, a high impedance (R.C.C. type) valve, rated at 40,000 to 50,000 ohms is necessary for a resistance capacity coupled stage, or a medium impedance valve sometimes called "H" or "HF" for a choke capacity coupled stage.

For the detector in a modern set, valves of the type almost universally known as HL should be chosen, these being very sensitive and efficient valves with an impedance of the order of 20,000 ohms, and an amplification factor between the figures of 25 and 30. In an older set you will probably obtain best results from a valve designated as type L or LF if transformer coupled, or type H or HF if resistance or choke capacity coupled. In some receivers employing resistance capacity coupling with resistances as high as ½ to 1 megohm, valves of the RCC type must be employed as detectors. Where there is an additional low frequency stage between the detector and the output valve, the valve employed should certainly be of the L or LF type which can accept a stronger input signal without over-loading than the HL general purpose type.

(*Continued on page 148.*)



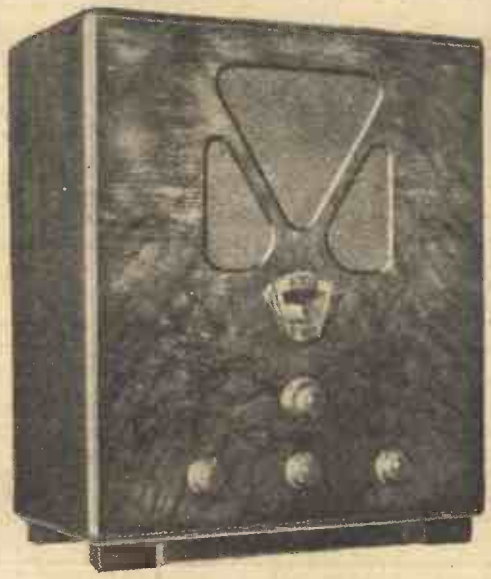
OUR VIEWS ON RECEIVERS

THE SUNBEAM UNIVERSAL MAINS RECEIVER MODEL U.35

A RECEIVER which is available for either A.C. or D.C. mains, without alteration, is a valuable arrangement for many listeners. The first one to be received by us for test is the Sunbeam, which is, incidentally, the first all-electric model to be produced by the Sunbeam Electric, Ltd. This is, as may be seen from the illustration, a very attractive looking receiver, from both the front and the back view. The cabinet is of neat walnut, with a simple but pleasing loud-speaker fret, and contains only four controls. These are, top centre, main tuning knob with concentric trimming control, and beneath it the mains on-off switch. On the right is a combined reaction and volume control, and on the left a combined wave-change and radio-gram switch.

The Circuit

The circuit, whilst of the orthodox S.G., detector and Pentode arrangement is very novel in many ways. First of all, the H.F. valve is of the ordinary S.G. type (specially designed, as are all the valves in this receiver for D.C. mains) and the cathode is returned to earth *via* a fixed and variable resistance. This introduces a variable factor across the aerial circuit and so acts as a pre-H.F. volume control, the actual component being ganged with the Reaction condenser so that the selectivity is also improved with the use of this particular knob. As the sensitivity of the H.F. stage is *reduced*, the reaction applied to the detector stage results in the sensitivity of this stage being *increased*. When these two controls are suitably chosen, as in this receiver, the result is a very nice adjustment of volume and selectivity combined. A special tuned-anode arrangement is employed for coupling the H.F. and detector stages and a change-over switch is inserted between the grid of the detector valve and the anode coupling condenser. This changes over from radio to gramophone reproduction. The reaction is capacity-controlled. An L.F. transformer is included direct in the anode-circuit of the detector valve and feeds the output pentode, which, as in the case of the remaining valves is of the Osram D.C. mains type. The output circuit of the Pentode is provided with a transformer to match the moving-coil correctly, and two additional terminals are provided for the use of an external loud-speaker when required. The mains equipment is, of course, the most interesting, in a receiver of this nature. No mains transformer is employed, as when the receiver is employed on D.C. mains there must, of course, be direct connection with the heaters, etc., of the valves. Accordingly a metal rectifier is included in one mains lead, whilst a smoothing circuit and special resistances are joined in series with this circuit for the purpose of voltage adjustment. The remaining mains lead is joined direct to the chassis, *via* the on-off switch. This necessitates the mains plug being inserted in the mains socket in the correct relation, and when using the receiver on D.C. mains no signals will result when the plug is in one position, whilst with A.C. mains, hum will be excessive unless the plug is in a certain position. This is pointed out by the makers in the instruction chart so that the listener need have no fear on this score.



The Sunbeam Universal Mains Receiver Model U.35.

Test Results

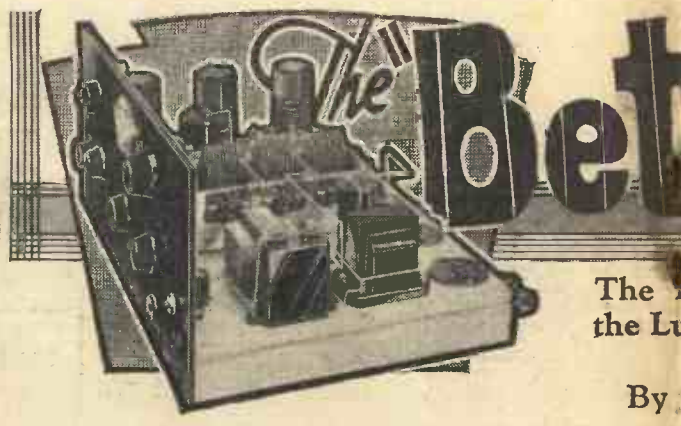
Unfortunately we had very little time to give this receiver a really thorough trial, but the short test which was given showed that it was a really sound job, and was capable of really great things. On D.C. the smoothing appeared adequate and no trace of hum or ripple was observed. The volume was ample, and the tone was very pleasing indeed. It was characterised by forwardness and brilliance, whilst there was no lack of bass. A special internal aerial is fitted inside the cabinet, and with this the volume obtained from London, in our laboratory, was more than would be needed in the average home. There was no trace of cabinet resonance, or "boxiness," and there was no difficulty in handling the receiver. The disposition of the controls enabled the best results to be easily obtained, and the receiver should appeal to many, especially those who are not in permanent residence and change from time to time from one type of mains to the other. There are one or two points which we should like to mention in the design of this type of receiver, principally with regard to the obtaining of the various potentials. First of all, the heaters of the valves are fed in series and the arrangement of feeding these valves is such that the risk of induced hum is practically removed. From the voltage dropping resistance the positive H.T. lead is fed to one side of the pentode heater from whence it passes to the S.G. heater. From this it goes to the Detector, and thence direct to the chassis. This is a splendid method of obtaining heater supplies for valves of the type employed and the advantage is reflected in the reproduction which bears no trace of commutator ripple (in the case of D.C.) or hum in the case of A.C. mains. To ensure adequate smoothing the condensers which are used in conjunction with the mains smoothing choke are of the aqueous electrolytic type, and, although the metal rectifier only provides half-wave rectification when using the receiver on A.C. mains this provides adequate smoothing. Finally, the price asked for this particular receiver, considering it is of the universal type, is very moderate, and we can thoroughly recommend it to our readers.

We congratulate the Sunbeam Electric, Ltd. on their enterprize in producing a receiver of such advanced design, and, at the same time, of such outstanding performance, at the extremely competitive price of 9 guineas. The specification which is given in brief below compares very favourably with many battery receivers.

SPECIFICATION

Receiver: Sunbeam Universal U.35.
Makers: Sunbeam Electric, Ltd.
Circuit: S.G., Detector and Pentode tuned-anode coupling, directly-heated D.C. mains-type valves. Circuit arranged for use indiscriminately on A.C. or D.C. mains with no alteration.
Speaker: Moving-coil, with transformer matched to the Pentode.
Consumption: 50 to 70 watts.
Controls: Three—tuning, wave-change and radiogram (combined) and volume and reaction (combined).
Cabinet: 18in. by 15in. by 9in., walnut.
Price: £9 9s. 0d.

FIRST AGAIN!



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LAST week we gave a description of this new receiver, and explained the reason for the development of a set of this type. It will be seen from this week's illustrations that the panel appears to bear a formidable array of controls, but, as was pointed out in the first notes, this is not actually the case. Although there are seven knobs on the panel front, it will be found that only two are normally required, namely, the main tuning control—which is, of course, used to select the station to which you wish to listen—and the volume control (which may be the variable-mu potentiometer used to reduce the strength of the station or the reaction condenser used to increase the strength). The remaining knobs control tone or selectivity, or change the wave-band or switch the set on or off, so that actually the receiver has two controls, with the others acting purely as refinements. However, the utility of these controls will be appreciated when you come to handle the receiver.

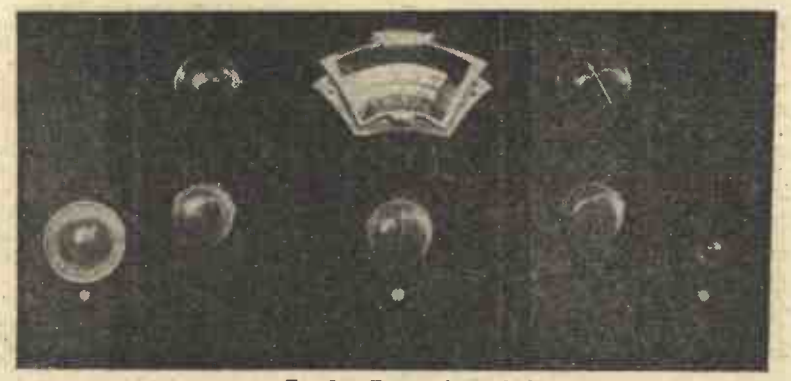


Fig. 3.—Front of panel.

The Panel

The first part of this receiver to build is the panel, and for this purpose the panel should be drilled from the dimensions shown in Fig. 2. In this illustration, by the way, the various controls are marked to show their purpose. The holes should be drilled to just take the individual components, and, unfortunately, these are not all of the same size. Therefore drill ¼in. holes at each point, and enlarge out to just take the various one-hole fixing bushes. The condenser escutcheon is marked out from the template supplied by the makers of the three-ganged condenser, and great care should be exercised to get this exact, as otherwise the dial markings will not be accurately registered in the window, and the pointer will not be of much use. To cut out the window for the escutcheon the best method is to scratch out the shape (from the template) and then to drill all round the edge with a ¼in. drill, each hole being separated by a space of about 1-16th. A sharp penknife should then be inserted in each hole and levered backwards and forwards, doing this on both sides. It will then be found very simple to give the piece of ebonite enclosed by the holes a sharp tap or two, when it will fall out. The hole need not be cleaned up, as the window will be found to fit comfortably. Drill and countersink the holes for the wood screws along the correct line, and then mount the panel components as shown in the illustration (Fig. 5). Now, before putting the panel on to one side, cut off a short length of Glazite and join one terminal on the potentiometer to the nearest terminal on the on-off switch, as shown in the wiring diagram, Fig. 6. Also attach the 10,000 ohm spaghetti to the slider terminal of the potentiometer. This part of the work may now be laid aside whilst the remaining constructional work is carried out.

The Chassis

The wooden chassis is made up from the 15in. by 10in. baseboard, with side runners 1¼in. deep. Before attaching these, drill the four holes for the valve-holders. For the valves V1, V2 and V3 these should be 1in. in diameter, but for V4, the 7-pin valve, a slightly larger hole is required. If a larger bit is not available, the hole may be drilled to 1in. and then filed out to just clear the seven valve legs. Now position all the different baseboard components, taking your guide from the wiring diagram (Fig. 6). For the three-gang condenser, again use the makers' template, marking for the purpose a line down the centre of the baseboard. When each component is in its correct position, mark with an awl or similar tool the position for each screw hole, and in addition pencil a dot where each of the numbered holes is shown. Note that there are two holes in the coil L.3 and one in the coil L.2. These should be marked through the holes in the bases of the Telsen coils. When all positions are accurately marked, remove the components and carry out assembly in the following manner. First of all attach the variable condenser, and then push the panel into position to make quite certain that the dial is accurately registered and that the spindle is on its correct centre. Next attach the three coils, but before driving in the fixing screws, remove the two band-pass coils from the small base on which they are supplied, and fit a three-gang rod through all three coils. This will ensure that the three coils are correctly centred. Again push the panel into position to make certain that the coil spindle will clear. If this is so, attach the small indicating plate on the panel for the wave-change switch. This will be found in the envelope in the coil box. Do not attach the coil L.1 too near the panel, or the bolts for the indicating disc will foul the coil screen. Attach the small limiting device

Fig. 4.—Components mounted on baseboard and partially wired.

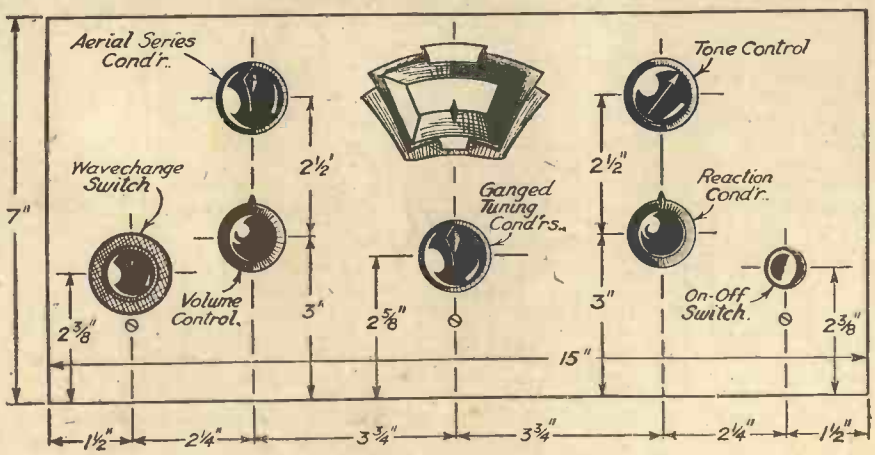


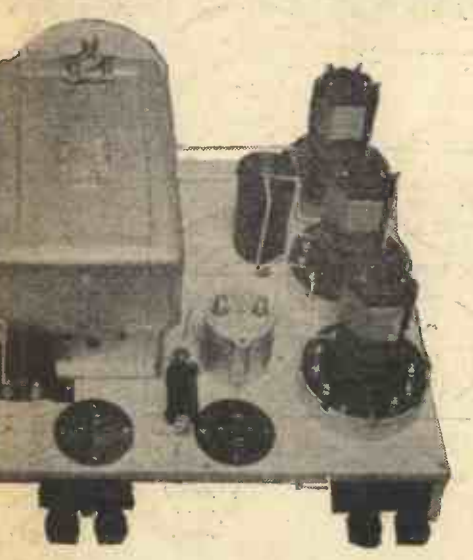
Fig. 2.—Panel-drilling dimensions.

a "Universal Four"

Preliminary Steps in the Construction of Luxury Receiver which was Briefly Described Last Week.

By the "Practical Wireless" Technical Staff.

to the switch rod between the coils L.3 and L.2 and attach the coils by means of ordinary wood screws. The remainder of the components may then be mounted, leaving the valve-holders till last. Note that the small



fixed condensers are not screwed into position but are held in situ by the connecting wires. The .1 mfd. condenser on the underside of the baseboard should not be fitted yet.

The Wiring

Now commence the wiring, taking those wires which are shown as passing underneath the .1 mfd. condenser to their respective points first of all. When these are completed, then attach the .1 condenser to the side runner, and put in the remainder of the wires. The filament leads should be put in first, then the leads to the variable condensers, and so on, omitting for the time being those wires which have subsequently to be connected to panel components. When all wires have been completed—a process which must be very carefully checked—attach the panel. Perhaps it would be as well to point out here that the best way of wiring a receiver is to take a blue pencil, and as a wire is put into its place to scratch through the same wire on the wiring plan. In this way it is impossible to leave out a wire unnoticed. A better plan is to make a large drawing of your receiver with the components, and also to make a large copy of the wiring plan. Then as you wire the receiver, draw in the wire on your copy of the set and scratch out the same wire on the wiring plan. When finished, you can check your large plans with the printed wiring plan, and there can thus be no mistake. Notice how the tone control is wired. A length of ordinary double (red and black) flex is cut off sufficiently long to reach from the potentiometer to the terminals marked TC on the Multitone transformer. Another length of single flex is then cut to the same proportions and the cotton covering removed from this. The three are then plaited together, and attached to the potentiometer with the plain rubber flex to the central terminal. The red and black flex leads may be attached to either of the outside terminals. On the transformer the plain rubber lead is joined to the terminal marked "G," and the red and black leads joined to either of the terminals marked TC. There are no other points about which any difficulty may arise, and all that remains is to attach the battery leads. Care should be taken in attaching these to the on-off switch, as the H.T. negative lead must feed through the fuse lamp, and the other two leads must be attached exactly as shown for the following reason. If you examine the theoretical circuit you will see that L.T. negative and one side of the potentiometer are joined together and to one side of the three-point switch. If this is not carried out exactly as shown, there is a risk that the connections will be made in such a manner that the potentiometer is in circuit with the grid battery the whole of the time, and it will naturally discharge the battery. Do not, therefore, make any alteration to this part of the wiring, or, for that matter, do not deviate in any particular unless you are an expert in wireless matters and appreciate what you are doing when carrying out the modification. It may be noticed that there is no H.T. lead to the output valve, and that there is no output transformer shown in the wiring diagram. The reason for this is that the particular loud-speaker employed, the Rola, is fitted with a special Class B output transformer and this is mounted in the cabinet. The wiring to this will be given next week, together with details for completing the wiring and operating notes.

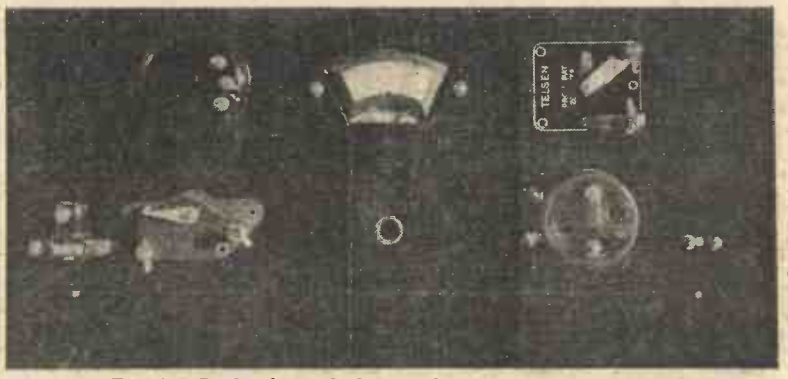


Fig. 5.—Back of panel showing how to mount components.

The speaker should therefore be attached to the rear of the baffle in the cabinet, and two leads soldered to the two outside terminals on the transformer fitted to the rear of this. These leads should be identified in some way, and then a third lead soldered to the centre terminal on the transformer. This latter lead should be carried down and the end attached to the wander plug on the H.T. positive-lead of the 4-way battery cord. The remaining two leads are simply connected to the L.S. terminals on the rear of the baseboard of the receiver. It may be thought necessary, to some listeners, to vary the tone a little, and this may conveniently be carried out by connecting a fixed condenser across the two L.S. terminals. Various values may, of course, be tried out to obtain the type of reproduction which suits your particular needs. The wiring is now complete, and the receiver is all ready for a test.

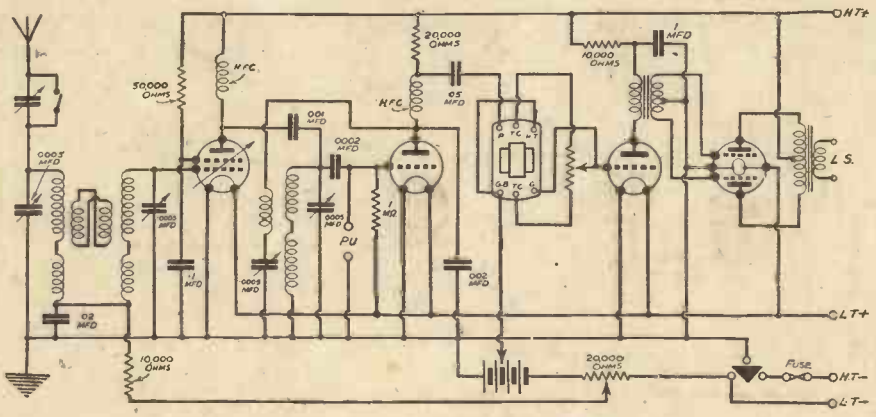


Fig. 1.—Circuit diagram of the Beta Universal Four.

Testing Out

To test out the receiver it is only necessary to connect the batteries and correctly adjust the controls, but there are one or two points here which require carefully watching,

(*Continued on page 154.*)

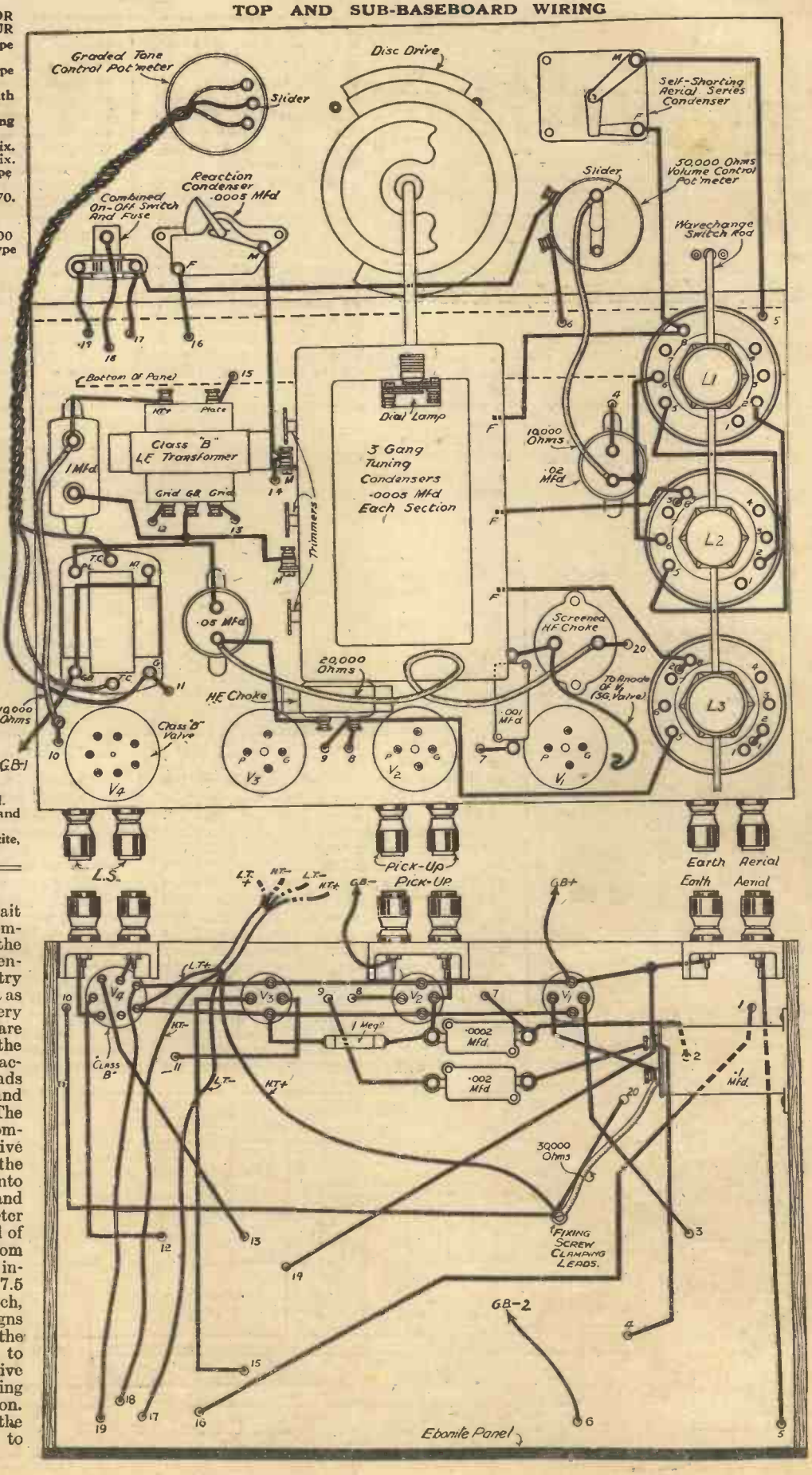
LIST OF COMPONENTS FOR THE BETA UNIVERSAL FOUR

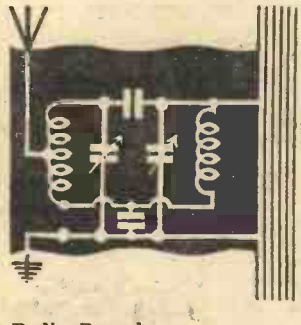
One Pair Telsen Band Pass Coils (Type W. 290).
One Telsen single Matched Coil (Type W. 216).
One Telsen Three-gang Condenser with Disc Drive.
One Telsen Aerial Condenser with shorting switch.
Three 4-pin chassis-type valveholders. Clix.
One 7-pin chassis-type valveholders. Clix.
One .02 Dubilier fixed condenser, type 9200.
One .001 Dubilier fixed condenser, type 670.
One .002 Dubilier fixed condenser, type 670.
One .05 Dubilier fixed condenser, type 9200
One 1 mfd. Dubilier fixed condenser, type BB.
One .0002 mfd. Dubilier fixed condenser, type 670.
One .1 mfd. Dubilier fixed condenser, type 9200.
One 10,000 ohm spaghetti resistance. Lissen.
One 20,000 ohm spaghetti resistance. Lissen.
One 30,000 ohm spaghetti resistance. Lissen.
One Bulgin H.F. Choke, Type H.F. 9.
One Lissen standard H.F. Choke.
One .0005 mfd. reaction condenser. Lissen.
One Multitone Toco 1-4 L.F. Transformer.
One Multitone Graded Potentiometer.
One Benjamin Class B Driver Transformer.
One Busco three-point switch with fuseholder.
One Lewcos 20,000 ohm Potentiometer.
One Becol Ebonite Panel, 15in. by 7in.
One 1 megohm Lissen Grid Leak with wire ends.
One Lissen 16-volt Grid Bias Battery.
One Lissen 120-volt H.T. Battery.
One Lissen 2-volt Accumulator.
One Rola Loud-Speaker, Type F.6/PM/O1/Class B.
One 5-Ply Baseboard, 15in. by 10in.
One Cabinet. Peto-Scott.
One Cossor 220 VSG valve (metallized).
One Cossor 210 Det. valve (metallized).
One Cossor 215 P. valve.
One Cossor 240 B. valve.
Three Belling-Lee Terminal Mounts.
Six Belling-Lee Type B Terminals (Aerial, Earth, Pick-up, Pick-up, Loud-Speaker, Loud-Speaker).
One Belling-Lee Four-Way Battery Cord.
Three Wander Plugs, G.B.+, G.B.1 and G.B.2.
Sundry Screws, Fuse Bulb, Coil of Glazite, Flex, etc.

(Continued from previous page.)

and although we propose to wait until next week before giving complete operating instructions, the following brief instructions will enable those who cannot wait to try out the receiver and get some idea as to its capabilities. The battery leads, having only four plugs, are extremely simple to connect, the L.T. leads being joined to the accumulator, and the H.T. leads being plugged into the negative and positive ends of the battery. The grid-bias is a little more complicated, the plug marked positive (that connected direct to the filament wiring) being plugged into the positive end of the battery, and the lead from the potentiometer being plugged into the other end of the 16-volt battery. The lead from the Multitone transformer is inserted, for the time being, in the 7.5 volt socket. Pull out the switch, and the receiver should show signs of liveliness. Adjustment of the potentiometer should be made to bring the set into its most sensitive condition, and then the main tuning knob rotated to tune-in a station. The series-aerial condenser and the reaction condenser may be used to adjust the degree of selectivity.

TOP AND SUB-BASEBOARD WIRING

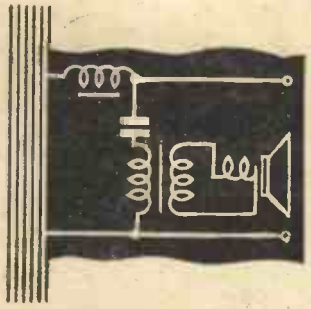




RADIO RAMBLINGS

By JACE

Jottings from my Notebook



Radio Bargains

WE see every day glowing advertisements in the Press of wonderful radio bargains. Sets which have been selling from £50 to £60 are offered at prices ranging from £10 to £20. To the uninitiated this is apparently a wonderful chance of obtaining a well-known set at a knock-out price. The first cost in most things is not the most important to consider, but the utility, the pleasure and the upkeep. When a manufacturer replaces an old model with a new one, which combines all the latest improvements and advancements in radio, the obselete models are gathered together and sold to dealers and stores. Some of the sets which brought in stations loud and clear are found to be unselective, others that were selective, so selective that they choked off the rich harmonies and produced distortion, some are "howlers." If you have had no past experience in radio, ask a "fan" who is a reader of a radio paper, and who has had actual experience with a radio set, for advice, or write to a journal for it. Hear his set, then, if you like it, buy or make just that set, and buy it from a regular radio dealer who will accept some form of responsibility for its good behaviour and give you service after sale. You cannot expect that when you buy a junk bargain. As a rule the store or dealer in regular radio products does not buy junk, for it does not pay to buy poor radio merchandise at any price.

Superhet or Band-pass

A COLLEAGUE said to me a few days ago: "You see, I was right when I told you the superhet would come into its own this season." I frankly admitted he was right. It has come into its own but, from a broadcast reception point of view, "it's own" does not approach the level which I think is necessary for the fidelity of perfect musical reproduction. It is willingly granted that the greatest need to-day, in wireless reception, is selectivity. There is an ever increasing number of high-power transmitters on the air, and it cannot be denied the problem is no longer how to receive them, but rather how to separate them. Exceptional selectivity is essential if programmes are to be heard free from interference or background. My contention is, the superhet gives all the selectivity needed, but, generally speaking, it is at the expense of quality, and it is for this reason my sympathies are more in the direction of the band-pass principle of tuning. The whole idea of the band-pass filter is that it should accept only a certain limited band of frequencies, consisting of the carrier waves of the wanted station and its side-bands. For good quality reproduction this band width should be preserved intact on all wavelengths. With well-chosen coils of this type, which give a 10-kilocycles separation, used in a circuit comprising two stages of screened-grid high-frequency amplification, a power detector, and push-pull output, sufficient selectivity can be obtained, with perfect reproduction, which is far and away superior to any superhet circuit for broadcast reception.

"Grid Leak," the popular writer on wireless

Eliminators and Mains Fuses

I SEE the old subject of two-tariff electric power supplies has again cropped up when a man was fined for using an electric lamp off a power plug. Non-technical users find it difficult to appreciate why current identical in character should be charged at two widely different rates merely because they come out of different plugs, and the temptation to use a lamp from the cheapest socket is very great. I do not know if an official ruling has ever been given regarding wireless sets, but I believe it is generally accepted that as our valves are really small editions of heaters it is quite in order to use them wired up to a cheap heating supply. In any case it does not matter much on the score of cost, for this is infinitesimal, but it is usually much more convenient to plug-in to a heater socket placed low in the room than to have a long lead reaching up to the electric light hanging from the ceiling. The latter is a nuisance to everybody, and for this reason alone the heating plug is the best one to use. When wiring up to the heating circuit, however, it pays to use some sort of fuse arrangement between the switch and the eliminator, or if you prefer it, the power supply unit. This is because the fuses fitted to the house heating circuits are very hefty in order to carry the large currents needed to warm up resistance heaters, and the average wireless set could be a smouldering heap of ashes, should anything untoward happen, before the main fuses would blow.

Electrical Unit as Basis of Monetary Transactions

DO you notice how one subject leads to another? Talking of mains reminds me of an account I saw the other day of how an American scientist and economist suggested that the best standard for basing monetary transactions is the electrical unit, and that an "Edison dollar" of 40 kilowatt-hours would have absolute stability, a property gold never seems to have had. The argument is that electricity costs much about the same to produce the world over and that something approaching the ideal standard would be obtained. This is as maybe, and funny things come and go in America, but I think the problem of transporting sufficient "juice" to pay off our war debts across the Atlantic would be quite a considerable one.

New Astronomer Royal

YOU will have read that our Astronomer Royal has recently retired and that Dr. Spencer Jones, F.R.S., has taken the place of Sir Frank Dyson, K.B.E., F.R.S., at Greenwich. The coming of broadcasting has given Greenwich some valuable publicity, and radio and electricity plays a large part in the time-keeping function of the Observatory. All the world looks to Greenwich for the time, and many other things besides, and great is the responsibility of those in charge there. The new Astronomer Royal has done good work in the interests of both astronomy and radio; he has been in charge of the astronomical station at Cape Town for many years and took over his new duties in March. When you think of it, the relationship between astronomy and radio is very close indeed. Both rely on ether vibrations for their being, and practically all we know of our solar neighbours is through the medium of the light rays they give off. These travel at practically the same speed as wireless waves and who can say that this is anything but a coincidence?

The Care of Condensers

TO avoid trouble with ganged condensers great care should be taken when fixing these components to the baseboard or chassis. The makers test the sections and adjust them to have practically equal values of capacity, but it stands to reason that if you afterwards twist the frame the capacities will be altered.

Twisting is usually caused by screwing down unevenly. The base plate or board to which the component is being fixed may not be flat. The result of tightening the fixing screws must therefore be to twist the condenser. In order to avoid the difficulty of not being able properly to gang the circuits, screw down very carefully.

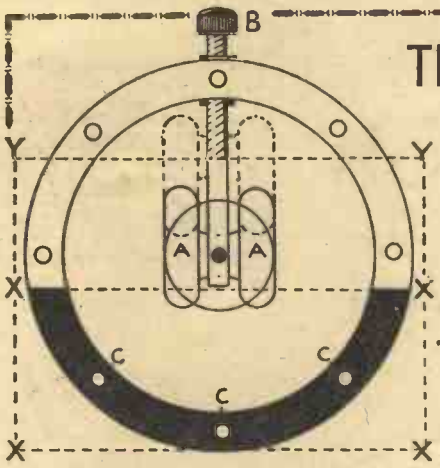


Fig. 1.—Plan view of base unit of speaker in diagram form.
- *A Pole pieces of magnet.*
- *B Knob for adjusting the horizontal movement of pole pieces.*
- *C Three screw holes for clamping the cap, diaphragm and base in position.*
- *X—X Dark portion of base rim supporting the diaphragm. The light portion has been filed down 1/64th of an inch.*
- *X—Y Shows amount of horizontal travel of pole pieces.*

THE MECHANICAL PROPERTIES OF METAL DIAPHRAGMS IN SOUND REPRODUCTION

The Possibility of Varying Sound Pitch and Tone by Diaphragm Control

By WM. CROMPTON

IT may seem rather bold to suggest that the pitch, or tone of the sound transmitted at the broadcasting station, can be altered or transposed into a different key, as it were, at the receiving end. If that was possible we should be treated to some rather startling and even fantastic reproductions. For instance, a tenor voice could be changed to baritone, or even bass, while music of a normally high frequency ratio could be transposed to frequencies of the lower octaves, and *vice versa*. Whilst musical trapeze after this fashion would no doubt only amuse the few, and irritate the great majority of serious listeners, yet it would appear that further research into the mechanical properties of metal diaphragms might lead to something extremely helpful in our quest for pure reproduction throughout the wide frequency range of modern broadcasting programmes.

The writer has achieved some rather interesting and novel results whilst experimenting with the ordinary circular metal diaphragm used with horn speaker models. Though the cone type of speaker is now almost universally used in the home, nevertheless the principle of sound reproduction is unchanged, and possibly the writer's experiences may open up new fields of investigation among those readers who delight in experimental work.

An Interesting Experiment

The first experiment is shown in Figs. 1 and 2, which give in diagram form a plan and sectional view of an old type loud-speaker base unit. In the original construction the diaphragm (D) was held rigid between the circular metal base (E) and the metal cap (F), the three components being clamped together with eight screws (C). The magnet coils (A) were fitted in the base concentric with the diaphragm and had a longitudinal adjustment (G). This arrangement follows closely that adopted in earphones. The alterations effected for experimental purposes aimed to ascertain whether the mechanical properties of the diaphragm affected reproduction in a large or small degree. The results certainly justified the work entailed.

The re-arranged unit (see Figs. 1 and 2) provided for a semi-rigid diaphragm and horizontal movement of the magnet coils, in addition to the up and down adjustment of the latter. The first part of the alterations was not difficult. About two-thirds of the upper rim of the base (shown blank in Fig. 1) was filed down, taking off approximately 1/64 of an inch, and a similar operation was performed on the corresponding portion of the inside face of the cap. Fig 2 shows the resultant fit. The diaphragm (D) is held in position by a section of the cap and base (X-X, Fig. 2), the latter being clamped with three screws instead of eight. Thus, approximately, five-eighths of the diaphragm is left free. The second alteration was more complicated. In order to allow a lateral movement of the coils and magnet, the metal base had to be cut away and mounted on a specially-constructed baseboard.

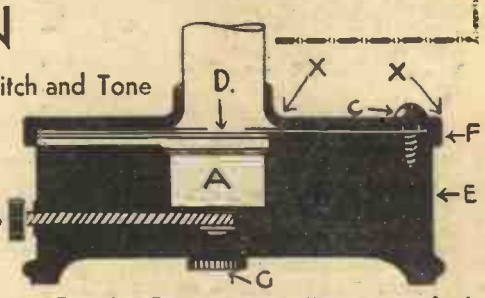


Fig. 2.—Diagrammatic illustration of the partially held diaphragm, and pole piece adjustments.
- *A Pole piece of magnet.*
- *B Knob for adjusting the horizontal movement of pole pieces.*
- *C Retaining screw gripping cap, diaphragm and base piece.*
- *D Free portion of diaphragm.*
- *E Base piece casing.*
- *F Turned-down rim of cap.*
- *G Knob for controlling the longitudinal or upward movement of pole pieces.*

Comparative Results

In order to test out fully the qualities of the unit, two scales were incorporated and calibrated in sixty-fourths of an inch. The original setting was accepted as zero for both the longitudinal and lateral adjustments, and comparisons were made with a similar horn speaker (unaltered) and a moving-coil cone speaker. These tests proved beyond all doubt that the semi-rigid diaphragm was exceedingly sensitive at certain settings, and further that zero setting was by no means the best setting. There appeared to be an effective lateral variation equal to about one-third of the diameter of the diaphragm. Within these limits there was a pronounced variation in the sound reproduction with hardly a trace of distortion, and very pleasing effects were obtained with pianoforte transmissions. The results were superior to those of the other speakers, particularly in recording the notes in the lower octaves. The higher efficiency of the semi-rigid diaphragm was noticeable in the case of speech, singing, orchestral suites, and pianoforte

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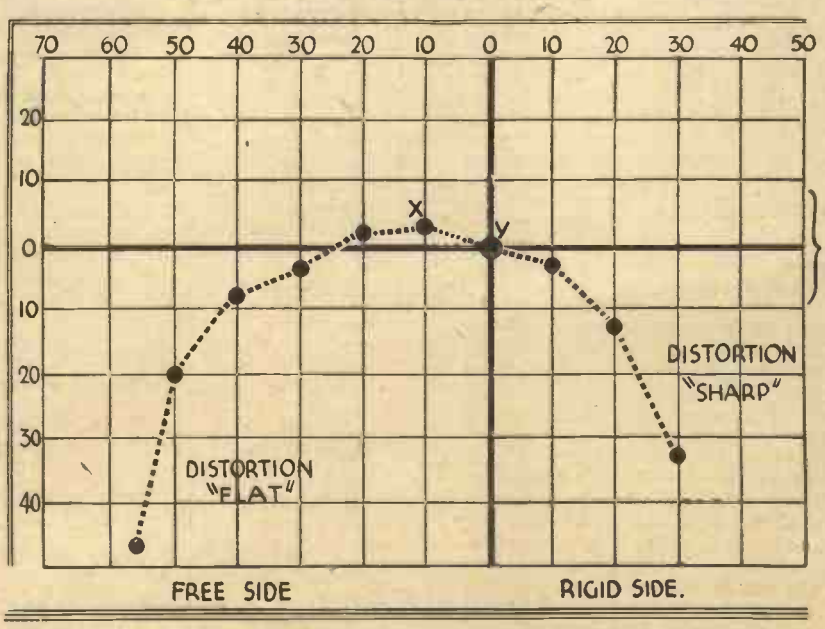


Fig. 3.—Chart showing results of tests with the semi-rigid type of diaphragm.
- *X Denotes the peak of efficiency in pure sound reproduction being considerably higher than the normal good setting of the ordinary type loud-speaker unit.*
- *Y Ordinary setting of orthodox loud-speaker unit for good reproduction.*

Returning the Compliment

The Receiver Responds to Care and Attention, and also to Inattention and Carelessness!

By CYNIC

A WIRELESS set, like any other apparatus, will always respond to care and considerate treatment. When you come to think about it, a radio receiver operates solely on account of and by virtue of certain electrical impulses and electric currents fed into it from various sources. What it does with these impulses and currents is settled once and for all by the technical design and physical condition of the apparatus, so that within the limits of these factors the performance of the set depends entirely upon the character of the various inputs of electrical energy. If these inputs are of correct quality and quantity, the set cannot fail to give reproduction as perfect as its technical design will permit.

Electrical Inputs

Now what are the electrical inputs to a receiver? Well, first of all there is the radio signal, introduced through the aerial circuit. Then there is the heating current for the valves, supplied by the low-tension accumulator in the case of a battery-operated set, or from the filament winding of the power transformer in an A.C. mains set. Thirdly, there is the anode feed which is provided by the high-tension battery or supply unit; and last, but by no means least, there are the grid biasing voltages applied to the grids of the amplifying valves either from a small dry battery, or by making use of the voltage drop across a resistance in the negative end of the high-tension supply.

It is a definite fact that if any of these is incorrect in quantity, or variable in quality, the receiver will not be able to reproduce faithfully the programme radiated from the broadcasting station to which the set is tuned. The technical name for any departure from accurate reproduction is "distortion." It will be of the very greatest service, therefore, to see in what ways distortion can be introduced, and the ways in which it can be prevented by the exercise of that little extra consideration which will enable the receiver to respond and to return the compliment.

Fig. 2—It is a good plan to have a voltmeter and milliammeter as part of the mains eliminator equipment.

The First Rule

Undoubtedly the first point to consider is the radio signal itself. It may be thought that, as this emanates from the broadcasting station, it is entirely out of the listener's control, and that, provided no distortion is introduced at the transmitting end, the signal will be applied to the first valve of the receiver in a perfect and undistorted condition. But this is far from being the case. It is fatally easy to introduce the element of distortion into the radio signal before it reaches the first valve.

In the first place, if your set is unselective—that is to say, unless the tuning is sufficiently sharp to eliminate all but the actual station to which you wish to listen for the moment—any interference from stations operating on adjacent wavelengths will be amplified throughout the various stages of the set, and will mar the final reproduction. On the other hand, if you make your receiver too selective, too sharply tuned, then, by cutting off what are known as the "sidebands," the higher notes and tones in both music and speech will be lost, and the quality of reproduction will be most unpleasant. Golden rule number one, therefore, for the listener who wishes to be kind to his set is to make the tuning neither too flat nor too sharp—just sharp enough to give the normal 9 kilocycles separation, and no more and no less.

Next, even if no actual distortion is introduced either by interference or by sideband cutting, a poor aerial or earth, or an inefficient tuning system may so reduce the signal strength that the detector valve, whose job it is to convert the radio signal into an audio frequency signal, is unable to operate efficiently and will, in consequence, distort. Distortion at this point is most likely to occur if the detector is of the "anode bend" variety, for this type of detector is only at its best when called upon to handle a fairly strong signal. Note rule number two—have the most efficient aerial and earth you can provide, and give your set reasonably robust signals to work upon.

Signals too Strong

But, as if to contradict the foregoing, it is possible to ask too much of your valves by applying a signal which is too strong for them to handle without distortion. This applies particularly to the screened grid high-frequency valve if one is fitted to your set. This valve is intended to amplify the incoming radio signal before it is passed to the detector, and is therefore a most sensitive type of valve. It will accept the weak signals arriving from distant stations

Fig. 1.—A good multi-purpose test set for carrying out measurements on a set to ensure absence of distortion.

and magnify them until they are powerful enough for the detector to handle them efficiently. You are not always listening to distant stations, however, and it is more than likely that, when you tune in to your local station, the full amplification of the high-frequency valve or valves is not required. Not only may the amplified signal be too powerful for the detector to handle, but the original incoming signal itself may be too strong for the high frequency valve to handle without distortion. Rule three for the proper treatment of your set, therefore, is to provide means for relieving the high-frequency valve from overloading. There are two main methods of doing this: first, the fitting of an input volume control, and, second, by employing in the high-frequency stage a variable-mu valve, which is a special type of screened grid valve whose sensitivity can be reduced, when it is required to handle strong signals, by increasing the grid bias. Details of these devices have all been described from time to time in PRACTICAL WIRELESS, so the matter need not be amplified further in this article.

L.T. and H.T.

Having assured ourselves that no cause of distortion is being introduced by way of the incoming signal, let us consider the effect of improper low-tension supply. The low-tension current heats the filaments or cathodes of the various valves, and causes them to emit the stream of electrons by virtue of which alone the valves can function. If your accumulator has run down, the filament temperature will be too low to give full emission; the value of the anode current will therefore drop, and, although everything else in connection with the set is in order, both volume and quality will suffer. Rule four, therefore, is to have your accumulator regularly charged so that the full voltage is always available for the valve filament circuit. Our French friends have a term for the low-battery which can be interpreted as "feeding battery." It is an expressive and very apt term, for to use a run-down accumulator is analogous to starving your valves—and an ill-nourished servant cannot do good work.

(Continued on page 163).

RETURNING THE COMPLIMENT

(*Continued from page 160.*)

But what of the high-tension supply? Well, here again it must be remembered that the high-tension power, or at least a part of it, is the actual power required to operate the loud-speaker, and if only a restricted ration is available, both quality and volume will deteriorate. Moreover, unless each valve is fed at the correct anode voltage, it cannot work efficiently—the degree of amplification will be reduced, and probably distortion will also ensue. A third effect of a run-down high-tension battery is that a high resistance may be introduced by one or more faulty cells, and, this resistance being common to the anode circuits of several valves, will cause electric coupling between the various circuits, leading to several forms of instability ranging from howling to that curious popping noise known as "motor-boating."

The next golden rule, therefore, is to maintain the high-tension supply in good order by renewing the high-tension battery when it is showing signs of running down; to assure yourself that each anode is connected to the correct high-tension tapping; and to test the H.T. supply occasionally by means of a milliammeter in the anode circuit of each valve. One form of multi-purpose home-constructed instrument I always keep by me for this and other tests is shown in Fig. 1. The approximately correct value of the anode current to each valve is always quoted by the valve maker on his instruction sheets and catalogues, and this should be checked up in the meter. Another good scheme, especially when using an eliminator, is to have a voltmeter and milliammeter as permanent parts of the equipment as shown in Fig. 2. This will enable the user to test immediately and see that all the "feeds" are satisfactory.

Grid Bias

Now comes the great question of grid bias. The object of applying grid bias voltage to amplifying valves is to maintain the average value of the grid voltage at such a figure that the alternate positive and negative swings of the incoming signal fall within the range which the valve can amplify without distortion. Either too high or too low grid bias results in partial rectification; that is to say, unequal amplification of positive and negative swings, and this means distortion. Check up, therefore, the value of grid bias, as indicated by the tapping used on the grid bias battery, with the anode voltage applied to the valve. The two should be in accordance with the figures given in the valve-maker's catalogue. An additional check can be made by testing the value of anode current, which should also correspond to the figure given in the catalogue.

At the same time, the nominal value of grid bias cannot be depended upon as being accurate if the bias battery has been in service for a considerable period, and it is a wise precaution to renew this small and inexpensive battery when the high-tension battery is replaced.

There is just one other cause of distortion which we have not dealt with—namely, the possibility of the amplified signal applied to a late stage of the set—say the output valve—being too great to be handled without distortion. The inclusion of a volume control after the detector stage will obviate this risk, and should you find distortion occurring and you are certain that you have eliminated all other causes, the use of a post detector volume control will no doubt remove the trouble.

THE MECHANICAL PROPERTIES OF METAL DIAPHRAGMS IN SOUND REPRODUCTION

(*Continued from page 159.*)

solos. It was possible to get a finer adjustment for each of these items than was possible with the all-rigid type and only a longitudinal regulator. These tests also showed that thickness and quality of the metal used affected the efficiency of the diaphragm; in fact, the writer came to the conclusion that pure reproduction depended very largely on the purity of the metal—all other things being equal, of course. For example, one test with a diaphragm having a highly-polished surface produced much better results than the use of a diaphragm of the same metal but coated with varnish.

Peculiar Distortion Effects

The graph shown in Fig. 3 sums up the results of these tests. The audible range of the lateral adjustment extends to approximately one inch beyond zero on the free side and about half that distance on the rigid side. The range for good reproduction is decidedly less, extending to 20 degrees ($\frac{5}{16}$in.) on the free side and about 12 in the other direction. At either end of the scale distortion is encountered, but with slightly different effects. The tendency on the free side is to impart a change of key or pitch—from "open" to "flat"; whereas on the rigid side the distortion is definitely "sharp." Hence the writer's opening remarks.

These latter characteristics, admittedly, may be more novel than useful, but they certainly show that the mechanical properties of the metal diaphragm are worthy of more serious consideration than has hitherto been given them. The last word in metal diaphragms has not yet been spoken, and anyone who has the facility for trying out diaphragms made from the different alloyed-ferrous metals will quickly realize the vast possibilities in that sphere of research once they have made a few tests.

The writer makes bold to state that the standard of reproduction obtained with this combination of semi-rigid diaphragm—lateral and longitudinal adjustment—is easily 20 per cent. purer over the optimum frequency band of broadcasting than obtainable with either the all-rigid diaphragm or moving-coil cone speaker. Another important point to watch in making tests of this kind is that particular attention to the longitudinal adjustment is of supreme importance. The slightest variation of the air gap between the pole piece of the magnet and the free side of the diaphragm has tremendous effect on the quality of reproduction, particularly when experimenting at the extreme end of the lateral scale. The tendency for the metal to set up violent mechanical oscillations predominates at certain points, and is productive of some very weird sound effects. Whenever the true coincidence of the two adjustments is arrived at, the range of pure reproduction does, however, more than compensate for the time and patience exerted in finding it.

ALL ABOUT ALTERNATING CURRENT RECTIFIERS

By C. H. WRAY, F.C.S.

AN alternating current is one which alternately reverses its direction in a circuit in a periodic manner. That is to say, it flows first in one direction and then in another, at regular equal intervals of time. To rectify an alternating current is to convert it into a unidirectional or direct current, that is, a current which flows continuously in one direction by means of a device known as a rectifier. This conversion is accomplished either by the suppression or the inversion of one half wave. Rectifying by suppression of one half wave is termed half-wave rectification, and by the inversion of one half wave full-wave rectification. The typical wave form of an alternating current, also that of half- and full-wave rectified currents are shown in Fig. 1.

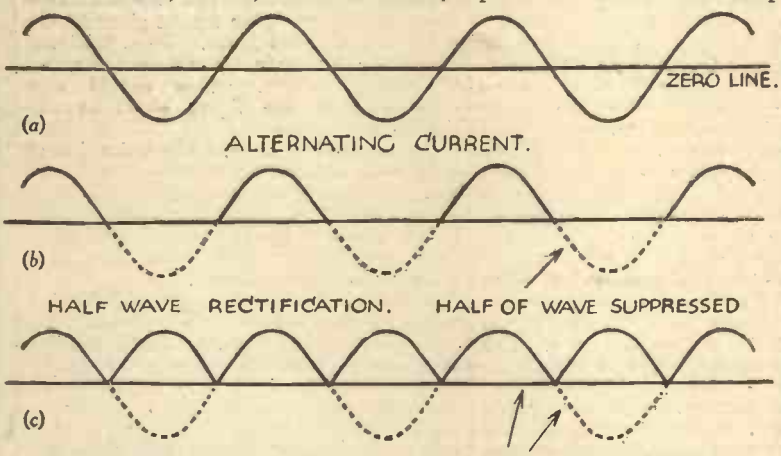


Fig. 1.—(a) The method of showing alternating current. (b) Half of the wave rectified. (c) Full-wave rectification.

A rectifier simply connected in series with an A.C. supply provides an easy path of low resistance for the current in one direction only, and offers a high resistance to the passage of current in the opposite direction. In other words, the rectifier allows the passage of the positive half of the A.C. wave, and rejects or suppresses the negative half, thus providing half-wave rectification.

Full wave, which is the more efficient method of rectifying, is obtained by the use of rectifiers connected in a suitable manner in order to utilize both the positive and the negative half of the wave, thereby converting both alternations into a movement of current in one direction. Both in half- and in full-wave, rectifying the rectified current is a unidirectional one of a pulsating character. Fig. 2 shows the rectifier circuits for half- and full-wave rectifying respectively.

There are several kinds of rectifiers in use at present, from the simple "wet" electrolytic, to the more complex mercury-arc type in which an arc is maintained between two electrodes, the cathode being kept at an incandescent temperature by the passage of the rectified current. It depends for its action upon the thermionic discharge from the cathode allowing the passage of current in one direction only. The mercury-arc type is unsuitable for dealing with small currents such as those required for wireless receiving sets, and is usually employed in large undertakings where heavy currents are dealt with.

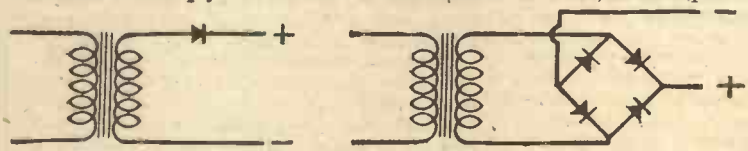


Fig. 2.—Circuit diagram of a half-wave rectifier, and a full-wave rectifier.

Chemical Rectifiers

Chemical rectifiers may be either the liquid or the dry type. The liquid type consists of two metals such as lead and aluminium, immersed in a suitable solution such as ammonium phosphate, or lead and tantalum, in a 20 per cent. solution of sulphuric acid. The disadvantages in the use of the "wet" electrolytic rectifier, are, its low efficiency, sedimentation necessitating frequent cleaning and renewing, temperature rise, creeping of the electrolyte, and evaporation.

The dry electrolytic type consists of plates of such substances as copper sulphide and magnesium in contact with each other, or silver sulphide and copper oxide, and their functioning as rectifiers depends upon chemical action between these materials. This chemical action results in chemical change in the composition of these substances, which in turn results in a lowering of the efficiency and steady deterioration of the rectifier. All substances that conduct electricity, both electronically and electrolytically, can act as rectifiers. Both the wet and the dry types of electrolytic rectifier depend for

(*Continued on facing page.*)

(*Continued from facing page.*)

their action on the property possessed by certain metals and materials when immersed in a suitable electrolyte in the case of the wet type, and in contact with each other in the case of the dry type, of allowing the passage of current in one direction.

The two types usually employed and incorporated in modern wireless receiving sets, are the thermionic-valve rectifier, and the metal-oxide rectifier. The thermionic-valve rectifier consists of a discharge tube, the cathode of which is maintained at an incandescent temperature by an external source of energy. Like the mercury-arc rectifier, it depends for its action upon the thermionic discharge from the cathode allowing the passage of current in only one direction.

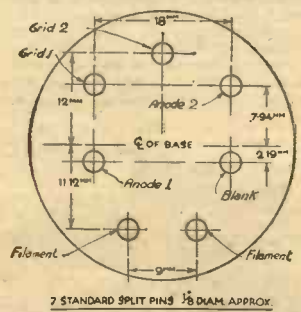
Full-wave Rectifier Valve

The full-wave rectifier valve differs in general construction from the wireless valve in that it has no grid. It consists of a glass bulb filled with an inert gas, usually Argon, and contains three electrodes, one of which is the filament or cathode. Argon gas for filling lamp bulbs and valves is produced from liquid air, which is purified, and the oxygen which contains 5 per cent. of Argon, is withdrawn and submitted to further purification. When the cathode of the valve is heated, the gas becomes ionized, thereby providing a low conductivity path for the free electrons flowing from the filament. The cathode is usually oxide coated, which provides for a copious electron flow at a lower filament temperature than would otherwise be possible. The filament is heated from a separate source of supply, and it is advisable that the voltage specified for this purpose should be adhered to.

The life of a valve rectifier is generally accepted as about one thousand hours, during which time the valve suffers a gradual decrease in efficiency, but with ordinary use its life is usually prolonged much beyond this period. Although the valve is a satisfactory rectifier, and is manufactured in various sizes suitable for small wireless purposes or for dealing with one kilowatt or so, it has the definite disadvantage that its life is limited. Its efficiency also is low compared to that of the metal-oxide type of rectifier.

The copper oxide, or metal rectifier, consists of a number of copper discs with a film of oxide formed on the surface. Its action as a rectifier is due to the electrolytic and electronic effect at the junction between the copper metal and the film of oxide. The metal rectifier possesses one great advantage over the valve type, that of permanence. Metal rectifiers may be connected in series or in parallel to provide required outputs of any magnitude.

CLASS B VALVE HOLDERS



This diagram gives dimensions of the new valve-holders for 7-pin (Class B) valves. The diagram is a top view.

Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

SOUND SALES CLASS B UNIT

THE arrival of the Class B valve, and its valuable use with a battery-operated receiver, has led Sound Sales, Ltd., to produce the unit shown herewith. It is on similar lines to the unit which was described in our pages the week before last, and does, in fact, employ the same transformers. In addition, however, Messrs. Sound Sales have introduced one or two refinements, which enable the unit to be employed with practically any type of receiver. A tone compensating device is included in the unit, which is finished in brown mottled bakelite. The 7-pin valve-holder is sunk below the top of the unit and as will be seen from the illustration, the valve-base comes just level with the top of the unit. The switch on the right of the valve breaks the filament lead, and so prevents the unit being left in operation whilst the receiver is switched off. The results given by the unit are really splendid, and it will be found a most valuable addition to the usual broadcast receiver. Where two L.F. stages are used in the latter, it is preferable to join the input terminals of the unit to the anode circuit of the first L.F. valve, and to use a power-valve of the Cossor 215.P type in that socket. This prevents the risk of overloading the driver valve, and so introducing distortion in the Class B valve. The price of the unit is 35s.

The Sound Sales Class B unit.

HIVAC VALVES

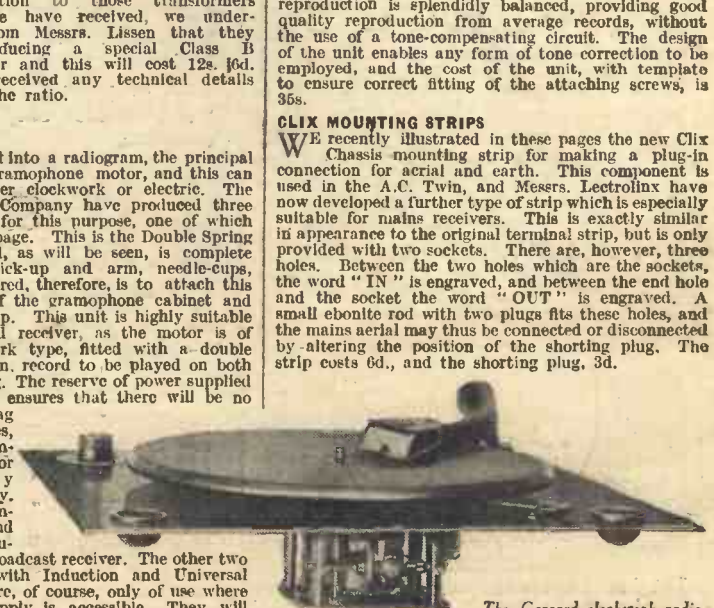
WE recently had the opportunity of visiting the factory of the High Vacuum Valve Co., Ltd., in London, and were able to inspect the elaborate machinery which is used by that firm in the production of the Hivac Valves. No pains are spared to produce a really high-class valve at a cheap figure, and great care is taken to ensure that individual valves are up to characteristic, and all the usual machinery for life test, vacuum test, etc., is installed. In addition, there are several novelties, such as the employment of a special electrode assembly for the screen-grid valves. The particular method of making this valve enables the metal coating which is usually associated with the valve to be dispensed with, and the process of making up the complete assembly is very interesting. The valves are sold at remarkably low figures, the general types of valve, such as the H210 and the L210, costing only 4s. 6d., whilst the screen-grid valve is 10s. 6d. A variable-mu valve is obtainable at 10s. 6d. also. The L.210 valve is of the 2 volt .1 amp. type, with an impedance of 8,600 ohms and an amplification factor of 10. The P.220 has a filament rating of .2 amps. at 2 volts, and an impedance of 3,000 ohms with an amplification of 6. The characteristics were checked over and were found remarkably consistent, very little error being traced. In actual use in standard receivers, the valves were all very good and noticeably free from microphony. Although these valves are cheap they may be highly recommended, and will be found to offer efficient service at a very reasonable figure.

DRIVER TRANSFORMERS

WITH the arrival of Class B amplification a completely new type of intervalve coupling transformer is required, and the reasons for this, and the considerations governing its design, have already been described in our pages (see the issue dated April 1st, page 51). We have so far received four of these special driver transformers, and they have all apparently been designed round the Cossor 240.B valve. The Lotus component is housed in a neat aluminium-finished case, and is very clearly marked with the particular type. Unfortunately, the majority of makers do not give this special marking, and it is, therefore, difficult to distinguish one type of transformer from another. The Lotus has a ratio of 1 : 2, and a primary winding of approximately 350 ohms. This gives an inductance of approximately 30 henries under working conditions, and is intended for use with the Cossor P.215 or similar valve as the driver. The cost of this component is 11s. 6d. The Benjamin Driver transformer is made to sell at 10s. 6d., and has a primary resistance of 300 ohms, with an inductance of 8 or 9 henries at 5 mA. The ratio is 1 : 1. The Multitone Class B Driver has a ratio of 1 : 2, and the primary resistance is only 200 ohms. This component costs 9s. 6d. The Sound Sales Driver is a cheaper product, costing 9s., and the ratio is 1 : 1. The primary resistance is approximately 300 ohms, and it will be seen that this figure is practically standard with this type of transformer. In addition to those transformers which we have received, we understand from Messrs. Lissen that they are producing a special Class B Hypernik transformer and this will cost 12s. 6d. We have not yet received any technical details of the windings or the ratio.

GARRARD MOTORS

TO convert a radio set into a radiogram, the principal addition is the gramophone motor, and this can take two forms, either clockwork or electric. The Garrard Engineering Company have produced three very suitable models for this purpose, one of which is reproduced on this page. This is the Double Spring Radiogram Unit, and, as will be seen, is complete with motor-board, pick-up and arm, needle-cups, etc. All that is required, therefore, is to attach this to the upper board of the gramophone cabinet and connect up the pick-up. This unit is highly suitable for a battery-operated receiver, as the motor is of the ordinary clockwork type, fitted with a double spring, enabling a 12in. record to be played on both sides with one winding. The reserve of power supplied by the double spring ensures that there will be no slowing down due to drag on very loud passages, and the mechanism employed in the motor works delightfully smoothly and silently. The cost of this complete unit is 63s., and this will be found a valuable addition to the broadcast receiver. The other two types are built up with Induction and Universal electric motors, and are, of course, only of use where the electric mains supply is accessible. They will be dealt with in a future issue.



The Garrard clockwork radiogram unit.

BELLING-LEE CLIP-ON PICK-UP

SOMETHING entirely new in pick-ups has just been received by us, and has evoked considerable praise. This is an ordinary pick-up with tone arm, but is intended for a definite purpose, namely, the conversion of a *portable* gramophone into a radiogram. As all our readers are aware, the only addition to the normal radio set is a gramophone motor and turntable, and doubtless, many listeners already have a small portable gramophone. With this type of instrument it is very difficult to find accommodation for the ordinary type of pick-up and tone-arm, as the space is so restricted. The motors usually fitted to these gramophones are quite suitable, however, for reproduction by the wireless receiver, and the problem is therefore to fit the pick-up in some convenient position *which will permit of correct tracking*. This Belling Lee Pick-up is mounted on a small rectangular box, covered with leatherette on three sides. The remaining side is provided with two "key-holes," and to attach it to your portable gramophone, all that is necessary is to fit two small screws on the side of the gramophone case, and then, when the unit is required for use, it is simply slipped over the screw-heads and a downward pressure locks it in position. Two terminals are provided for connecting the output of the pick-up to the receiver, and in addition, a volume control is fitted on the side of the base. Strips of felt on the side which fixes to the gramophone prevent damage to the cabinet work, and the unit may be called in every respect a "de luxe" production. The actual pick-up is of very small dimensions, but the electrical characteristics are of a high order. The reproduction is splendidly balanced, providing good quality reproduction from average records, without the use of a tone-compensating circuit. The design of the unit enables any form of tone correction to be employed, and the cost of the unit, with template to ensure correct fitting of the attaching screws, is 35s.

An ingenious gramophone connecting unit made by Messrs. Belling-Lee.

CLIX MOUNTING STRIPS

WE recently illustrated in these pages the new Clix Chassis mounting strip for making a plug-in connection for aerial and earth. This component is used in the A.C. Twin, and Messrs. Lectrolinx have now developed a further type of strip which is especially suitable for mains receivers. This is exactly similar in appearance to the original terminal strip, but is only provided with two sockets. There are, however, three holes. Between the two holes which are the sockets, the word "IN" is engraved, and between the end hole and the socket the word "OUT" is engraved. A small ebonite rod with two plugs fits these holes, and the mains aerial may thus be connected or disconnected by altering the position of the shorting plug. The strip costs 6d., and the shorting plug, 3d.

MY OPINION! By the Editor

8-11, Southampton Street, Strand, W.C.2.

The Bogies of Radio

ONE by one are the old bogies of radio, which were regularly dangled before awed readers by the radio parrots in the early days of wireless, being, to use a *cliché*, relegated to the limbo. The bogy-in-chief, the *bête noir*, in fact, was ebonite. Constructors were solemnly and regularly adjured to use ebonite for panels *and* baseboards if they wished to hear the sibilant whispers and dulcet declamations which sneaked away into the eager ether from the crude equipment which constituted Writtle —2MT. Nothing else would do, for the pundits had edicted that high-frequency currents had aversion to wood or aluminium, and would indicate the fact by stealing across the surface. Readers were even told that shiny ebonite should be dulled with emery powder to prevent surface leakage, and that the ebonite should be scoured lest any trace of the tinfoil used in its manufacture remained. It had not occurred to anyone in those days of chronic hand-capacity effects that a screened-surface ebonite would have been a boon.

Nowadays wood and metal panels and baseboards are used with impunity, and none of the dire effects forecast has been experienced.

Someone in the early days of motoring wrote that a visiting card should be used to gauge the tappet clearances, and that monstrously incorrect statement has been copied and handed down ever since, which shows that every industry has its parrots.

Have Your Copies Bound

REGULAR readers of PRACTICAL WIRELESS should carefully peruse the announcement on page 82 of issue dated April 1st. Next week we shall give details of a special offer to bind the twenty-six issues which make up Volume 1 of this paper. It is a tedious task to have to wade through twenty-six issues of a paper to find a particular article to which you wish to refer. Quite often the issue is missing or has been mislaid. I advise every reader of the paper to collect his issues together and to have them bound in the very attractive binding case, together with the title page, and very full cross-referenced index, which we have had prepared as a service to the reader. You will find that this can be done at a special bargain price of 5s. 6d., and the completed volume will provide you with a remarkable work of reference. If you require back issues to complete your file, these may be obtained for 4d. each, post free, from the Back Number Dept., Exeter Street, Strand, W.C.2. See next week's issue for details of this special bargain offer.

Readers' Queries

WE make no charge for answering readers' questions, but we stipulate that where a postal reply is desired a stamped and addressed envelope must be enclosed as well as the Query Coupon appearing on the Queries and Enquiries page. This coupon must be enclosed even when a postal reply is not required. Please note also that we cannot answer queries over the telephone, nor for obvious reasons can we modify commercial receivers. F. J. C.

By E. REID WARR

ALTHOUGH the present time of the year is usually regarded as the "close" season for recording, there is a surprising number of good issues just now, especially in the "popular" class. First of all, some of the best of the light orchestral tunes, in which Columbia excel this month. You will like *A Wedding in Java* and *The Chinese Story Teller* on *Columbia DB*1018. These are two very brightly played numbers by *The Bohemians*, a clever orchestra.

Soothing, very soothing, is a record by *Albert Sandler's Orchestra* on *Columbia DB*1061. They play Eric Coates's *By The Sleepy Lagoon* and *Under Heaven's Blue* with a most attractive delicacy. And then, very similar is *DB*1056, with that very graceful little thing *Loin du Bal* and *Sans Souci* (*A Waltz Intermezzo*). *J. H. Squire's Celeste Octet* are the players here, and either of these last two may be kept as a permanent cure for frayed nerves! *The Song of the Nightingale* with *Butterflies in the Rain* by *Fred Hartley's Quintet* on *Regal Zono MR*853 is quite pleasant, too, with a vocal thrown in.

It is not a frequent occurrence to find modern dance music good enough to buy as music, but here are two records which have much to commend them as companions for some time—*He was Only a Poor Musician* and *In Santa Lucia* on *Columbia CB*567. This is by a *very* good band, *Eddie Saxon's*. The other has a pair by the *Dajos Bela Orchestra*, *In a Little Café in Hernals* and *Play Me a Song of my Homeland*. These are on *Parlophone R*1430. *Leslie Bridgwater's Quintet* are very popular wireless artistes. They have done Strauss's *Voices of Spring* and *Wine, Women and Song* on *H.M.V. B*4257, and it is a very pleasant performance indeed. Then (German again) there is one of those performances which fairly shouts enjoyment with both titles and tunes. This is Marek Weber's performance of *Jollity on the Mountains* and *Viennese Singing Birds* (*H.M.V. B*4008). The first is especially good, with a yodelling background here and there. And, writing of Vienna, here is a record to have. Try Waldteufel's *Skaters' Waltz* and *The Schoenbrunner Waltz* on *Columbia DB*1064. These are by the *Vienna Symphony Orchestra*, who put up a sparkling performance. The orchestration is different from anything I have heard before in the *Skaters*, It is uncommonly good all through.

Before leaving the "band" records, I must confess to a quite unashamed liking for an occasional brass band. Another of the massed brass band records (*Regal Zono MR*844) can justly be called a "stunner." If you let your radiogram have full throttle, you may have a broken window, but you'll enjoy every bit of *The Gladiator* and *The Crusader Marches*.

Singers of All Sorts

One of the most popular of the new songs is *Once in a Blue Moon*. It has more than the usual appeal of its class and I recommend the singing of the *Hon. W. Brounlow* on *Columbia DB*1072. Its backing, *Sylvia*, is a pretty little song, too. Then, in a different sphere, that superb artiste *Supervia* has a great record in *Parlophone RO*20202. She sings (in Italian) *Santa Lucia* and *Mendelssohn's Spring Song* (in Spanish). Apart from the popularity of each, this record should be bought as an example of beautiful soprano singing. There is a vogue for what I believe are called "swamp" songs. I have come across a pair of negro laments which are very well sung. They are by *George Dosher* (bass) and the songs are *Take Me Away from the River* and *I Want to Go Home* (*Sterno* 1142). Here is a voice of tremendous depth and extreme richness.

A New Musical Play

Columbia presents some of the big numbers from *He Wanted Adventure*, which has just come to London from its Manchester trial run. The songs have been recorded on the stage and there is also a little dialogue here and there. There are several attractive songs, notably *The Monarch of the Seas*, by *Raymond Newell and Chorus*, and *You Come to Me*, a duet by *Raymond Newell and Marie Burke*. There are also some neat lines in *Smile and Be Bright* by *Bobby Howes and Wylie Watson*. A short appearance of *Judy Gunn* gives evidence of a very sweet voice. Those who have seen the play will like to have these records, for they are all admirably done, although recorded on the stage. The numbers are *DX*459–462.

A Great Symphony

As you know, the Brahms Centenary is being celebrated this year, and there will be many performances of his works. There is probably no other of his compositions which will be more liked than his *No.* 3 *Symphony in F Major*. Not the least of its charms is the versatility which is so apparent throughout. Brahms had an uncanny knack of passing from one passage to another, each entirely diverse in character. There are movements of crashing majesty immediately succeeded by a theme which is almost pastoral in its simple melody, and yet there is no incongruity. Space is needed to analyse each movement, but I do earnestly ask those who would be really stirred to hear the fourth movement. The early part is one of the most impressive episodes in music. This Symphony is done by the *Amsterdam Concertgebouw Orchestra* under Mengelberg, on four records—*Columbia LX*220–*LX*223. The recording is superb, and, as always, one can *feel* Mengelberg's conducting. A very important contribution to musical history is here in this performance.

Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by his correspondents

An Excellent Book

SIR,—I write to thank you for my "Wireless Encyclopædia," which I received in good condition. I think it is an excellent book, and it will be very much used by me in my wireless experimenting. It is in every way up to the standard of PRACTICAL WIRELESS, a paper I look forward to each week. The part dealing with television is most interesting and concise. Of course, I have not yet read it through from end to end, but the portion I have read contains information that gets right to the point. Thanking you again for a wonderful book and a sensible weekly paper.—E. ANYON (Huddersfield).

Getting the Foreigners in Daylight

SIR,—This morning I fully exploded the idea that a medium-sized set cannot bring in the "foreigners" *in daylight*. Reading in PRACTICAL WIRELESS that "Poste Parisien" was starting early morning transmissions, I got up a little earlier one morning last week to give myself time to find him. I have a big aerial, 120ft. long and a D-2 L.F. Trans. set. I cut out all selectivity and gave him the benefit of the full aerial. However, he did not take any finding—as soon as my dial was within 3 degrees of where he should be the volume was tremendous, so good-bye to the idea that medium-wave foreign stations cannot be received in daylight with ordinary battery sets.—"PRACTICAL READER" (London, W.).

An Appreciation : Television Reception

SIR,—Having read PRACTICAL WIRELESS since its introduction I must say that I am agreeably disappointed. Having been connected professionally with radio for twelve years, I have seen the rise of several so-called practical radio journals, all of which have degenerated into semi-fictional magazines within a short period. Naturally,

The Fury Four : "Wonderful Undistorted Volume"

SIR,—I have finished the "Fury Four," and am well satisfied with results. I have not heard a set that comes anywhere near it, as regards the wonderful undistorted volume. It's a real treat to listen to the pure reproduction.—E. T. SPARKE (Newport, I. of W.).

The Fury Four : A Wonderful Set

SIR,—I have made up the Fury Four and it is a wonderful set. I have fitted it into its cabinet, and I must say it is an A1 job. I get hand capacity effects when near the knob of single Lotus condenser. How can I cure this?—W. WIGHTMAN (Londonderry).

The "Wonderful Encyclopædia"

SIR,—Please accept my thanks for your wonderful De Luxe Encyclopædia, which is a most interesting book. I have also your binder for the Data Sheets which I look forward to every week. I find your paper, PRACTICAL WIRELESS, is the most interesting and practical weekly wireless journal at the low price of threepence. Wishing your paper and your staff every success.—F. MARGE (Merton).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT screening a complete receiver will not cut-out interference from electrical apparatus, as such interference usually arises through the Mains.
—THAT the remedy in such cases is to fit special Mains H.F. chokes in the input leads to the receiver.
—THAT a special combination 5-amp. fused plug should be used to couple a Mains receiver to a power point, as the latter is usually fused at a much higher value.
—THAT omission to attend to the above point may result in serious damage to the receiver and the house.
—THAT a larger condenser than that specified by the valve makers should not be used in the input side of a Mains unit employing a valve rectifier.
—THAT an ordinary valve may be used as a Diode and will provide practically distortionless signals.
—THAT either the grid, or the anode, or both, may be used for the purpose of using a normal valve as a Diode.

NOTICE.

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

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

One-Valver Wanted

SIR,—I wish to acknowledge receipt of the Wireless Constructor's Encyclopædia, Standard Edition. One can see by a casual glance through that the diagrams of components are right up to date, and the tables, etc., are of real value. I am a one-valve fan, and should like to see published in PRACTICAL WIRELESS a one-valve set using home-made coils. Wishing PRACTICAL WIRELESS success.—H. H. ASH (Lincoln).

Splendid Book

SIR,—I received the Encyclopædia all right, and I am highly delighted with it. I think it is a splendid book.—W. DENDERSON (Batley).

Old Wireless Set Wanted

SIR,—Will you be kind enough to find space in your journal for an appeal to your readers on behalf of an unemployed Club.

We would ask if any reader has a wireless set which is not required by him or her, and which could be given to the above Club for educational and recreational purposes.

The Club is situated in a distressed area and cannot afford to purchase a new set. The suggestion was made of appealing to PRACTICAL WIRELESS for help, and this is what I am now doing. Can you or any of your readers come to our aid?

WM. EVANS (Rhondda).

[*Letters containing offers will be forwarded.*—Ed.]

"Practical Wireless" in the Navy

SIR,—We are pleased to see that you are giving us more of the ultra S.W. stuff. I am going to build that "Below 10 metres" circuit that you gave us recently and I will send my results on to you.

The data sheets are most useful. I think that many of your readers would appreciate a really good two or three valve ultra S.W. receiver. Furthermore, I shall never be without PRACTICAL WIRELESS.—E. H. SLOMAN (H.M.S. *Erebus*).

3 Valve Short-wave Set

SIR,—The short-wave notes in PRACTICAL WIRELESS have proved very useful. May I suggest that you publish the information contained therein in tabular form so that the particulars can be seen at a glance?

I should like to see published full constructional details for a 3-valve short-wave receiver, *e.g.*, S.G. with tuned circuit, detector, and 1 L.F. valve.—W. W. WOODMAN (Willesden).

Quality Reproduction

SIR,—I would like to endorse H. S. Bassett's appeal for quality in PRACTICAL WIRELESS of March 25th. True, designers have to cater for the majority, but people who demand range and selectivity do not usually realize that they are sacrificing quality to obtain these things.

I appeal to PRACTICAL WIRELESS to give us a receiver, with a level frequency response between 50 and 8,000 cycles, with an output not too great, for the home, preferably with triodes in push-pull for the power stage (A.C. mains). I, for one, have a speaker capable of doing justice to such a receiver, and intend buying another, to use two speakers at half volume, rather than one at full volume, merely to improve quality.—JAMES T. BRINKWORTH (Bellingham).

(*Continued overleaf.*)

PRACTICAL LETTERS

(Continued from page 169.)

An Interesting and Instructive Book

SIR,—I should like to acknowledge the receipt of my copy of the "Encyclopædia," and thank you sincerely for a most interesting and instructive book.—REX. TAYLOR (West Norwood).

A Remarkable Free Gift

SIR,—I have received my copy of "Wireless Constructor's Encyclopædia" safely, for which please accept my thanks, and congratulations for such a remarkable free gift.—R. H. WAIN (Sheffield).

Fills a Long-felt Want

SIR,—Just a few words of appreciation concerning your wonderful Encyclopædia, which I received safely. I think it is a great work and fills a long-felt want of every wireless enthusiast, amateur or professional.—F. W. SALT (Long Eaton).

More than Satisfied

SIR,—Having received my "Wireless Encyclopædia" yesterday and by this time well examined it, I feel I should write and congratulate you on being able to offer such a fine volume at such cheap rates. I am more than satisfied—I am delighted. —G. J. (Liverpool).

Exceeds Expectations

SIR,—I can assure you that it is a great book, and, though I do not understand wireless technique, I will soon be able to pick it up from this book. It exceeded my expectations in all respects, and, those that did not go in for one have missed a real good thing.—A. C. V. (Shepherd's Bush).

A Fine Book

SIR,—I received my copy of your presentation volume, "Wireless Constructor's Encyclopædia," and wish to express my admiration for such a fine book. So well put together, and the illustrations are a fine example of much thought. The "completeness" of the volume leaves nothing to be desired.—E. S. (Sheffield).

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.

KETTERING RADIO AND PHYSICAL SOCIETY

"Gramophone pick-ups and automatic record changers" was the title of an excellent lecture delivered to the society on Monday, March 27th, by Mr. A. Freeman. A "Heath Robinson" pick-up, weighing several pounds and having a reed nearly a foot long, was shown by the lecturer, who described the construction and action of pick-ups in a delightful non-technical manner. The whole meeting had the novel experience of "feeling" music by joining hands across the output of a 50-watt amplifier connected to the pick-up. Explaining automatic record changers, Mr. Freeman exhibited an ingenious type of machine invented by himself, which played and automatically changed twelve 10in. or 12in. records.

Hon. secs.: Mr. R. J. Pankhurst (G5YF), 9, Shakespeare Road, Kettering, and Mr. Thomas H. Hall (BRS 1018), 59, Tresham Street, Kettering.

THE CROYDON RADIO SOCIETY

"The Transmission of Sound by Light" was discussed at a recent meeting in the Horse and Groom, Cherry Orchard Road, E. Croydon. The lecturer was Mr. V. H. Gilbert, who began by describing the Raycraft bridge and its uses with a relay, such as when light on to the bridge was interrupted, the relay was closed. Thus was it used for burglar alarms, and similar applications. In transmitting sound by light, signals from a wireless set's output were modulated on to a light beam, obtained by a flash-lamp bulb. Then this modulated light was directed at the light sensitive cell, which, with associated amplifier, reproduced the signals as sound in the loud-speaker. The society's club set was used for the demonstration, its loud-speaker being disconnected from the output, and connected to the Raycraft bridge's amplifier. Excellent signals were heard, and experiments were suggested, such as conversing by light across the street, and even invisible-ray messages might be sent, using the infra-red portion of the light.

Hon. sec.: E. L. Cumbers, Maycroft, Campden Road, S. Croydon.

SLADE RADIO

A lecture and demonstration was given by Mr. S. H. Cohen at the meeting of the above society held recently. Commencing with a description of Class B amplification and the problem which it had set the designers of eliminators he gave a demonstration in which the latest type of eliminator and also an experimental valve of British manufacture were used. The volume proved ample, the quality very good, and the current consumption exceedingly small. Iron core H.F. coils, and also Litz wound coils were then dealt with after which some details were given of a new type of loud-speaker which is being developed. A demonstration of this was given, the results portending great possibilities for the future. Anyone who would like details of the society and advance programme of meetings, etc., is invited to write to the Hon. sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

ILFORD AND DISTRICT RADIO SOCIETY

The meeting held on March 16th was a very enjoyable one, and members co-operated to make a very interesting series of demonstrations, which were as follows: Mr. Largen demonstrated the use of a mains valve as a light-operated cell, which operated a series of relays and associated apparatus, when a light beam from a torch was impressed on the grid. There was a slight lag as compared with a photo-cell, but a definite rise in anode current in the valve in proportion to the distance of the source of light. Some amusement was caused by a demonstration of his "Coal-scuttle Three," a three valve R.C.C. amplifier, using lumps of domestic fuel for the necessary resistances, with 6,000-volt coupling condensers, but, nevertheless, it worked well. A number of Giesler tubes were worked by Mr. Dennis, the phasing of which were most impressive, and some high frequency experiments were then made. Details of the society may be obtained from the Hon. sec., Mr. C. E. Largen, 16, Clements Road, Ilford.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

In order to correspond more readily with members in foreign speaking countries the Anglo-American Radio and Television Society and associated society, the International Radio Society, have organized a committee of members who have a good knowledge of foreign languages. This committee, known as the Foreign Committee, is proving of great service. The readiness of members to join this committee when it was first suggested is a sure proof of the goodwill and fellowship these big radio societies foster. Mr. Karl Halpern has organized a New York City Branch of the A.-A. R. and T. S. and I. R. S. The headquarters of the societies are at 11, Hawthorn Drive, Willowbank, Uxbridge, England. Hon. Pres.: Leslie W. Orton.

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CAR WIRELESS INSTALLATION, and other innovations are all dealt with in a clear and practical manner.

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THE LEADING HOME-CONSTRUCTORS' WEEKLY!

Practical Wireless

3D

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The "SELECTONE" A.C. RADIO-GRAM TWO

VOLUME CONTROL
ADDING A VALVE
MAKING COIL FORMERS
WIRING EFFICIENCY
THE DOUBLE-DIODE-TRIODE
OPERATING THE BETA FOUR Etc., Etc.

ROUND *the* WORLD *of* WIRELESS

Good News for Battery-Set Users

A CELL that will hold its charge for a longer period has been the dream of accumulator experts for years past. At last that desirable goal has been realized by the introduction of the new Edison "Extralife" accumulator. In developing the new cell, Ediswan have made use of a new principle. It is called by them "balanced capacity." By special designing of the plates, an exact electrical balance is maintained between the positive and negative elements of the cell. This has the effect, not only of conserving the charge, but also of prolonging the life of the cell, even under adverse conditions. A range of these trouble-saving accumulators has recently been placed on the market at the same prices as ordinary accumulators.

Two Stations for Christmas Island

THE value of wireless communications to highly-developed countries has been so widely demonstrated in recent years, during which a vast network of radio telephone and telegraph services has been established between practically all the principal nations of the world, that, paradoxically enough, the special value of wireless to isolated communities is less emphasized to-day than in the earliest period of Marconi's inventions. Yet modern wireless apparatus has attained a degree of efficiency and reliability, combined with simplicity of operation, that renders it an essential part of the equipment of any settlement that is outside the world's established communications systems.

A typical example of such a community, and the utility of wireless to its members, is the small British settlement on Christmas Island, in the Indian Ocean. Christmas Island lies some 800 miles south of Singapore and 1,000 miles north-west of the Australian continent. It is served by no cables, and it is far from the regular shipping routes.

Without wireless, its inhabitants would be isolated from contact with the outside world, except through the medium of trading ships.

Pentode Output Stage

THERE are a number of circuits about showing a pentode output stage coupled by means of a choke fed transformer. While this circuit undoubtedly gives excellent results we wonder how many listeners realize the danger of using such an arrangement. Should the detector-valve heater suddenly break, which it must at some time, the following set of events takes place. The anode current, which was passing through the choke to the valve, suddenly stops, with the result that the magnetic field round the choke suddenly collapses, which sets up an abnormal voltage across it, say, 10 volts. Assuming a 3 to 1 transformer, this 10 volts will become 30 across the secondary. Allowing the pentode moderate magnification of 40, the 30 volts will become 1,200 volts between anode and cathode of the pentode. Granted this voltage will only be present for an infinitesimal part of a second, it is often long enough to blow every condenser in the power pack. To prevent such an unhappy occurrence, a resistance should be connected across the choke. The value may be anything between 50,000 and 200,000, and will not alter the quality of reception if the value is chosen with some regard to the inductance of the choke.

NEXT WEEK:

SOMETHING ENTIRELY NEW IN LIGHTWEIGHT CLASS B PORTABLES

New German Interval Signal

TO commemorate the Potsdam celebrations in connection with the re-opening of the German Reichstag on March 21st last, the Königs Wusterhausen (Deutschlandsender) has adopted as an interval signal the first bars of the patriotic hymn, *Ueb' immer Treu und Redlichkeit*, played on the carillon of the Potsdam Garrison Church. As the sounds are reproduced by a musical box of the barrel-organ type, they do not sound like bells but closely approximate the tones of a piano.

Radio Luxembourg and Istanbul

MANY readers have been puzzled by a call from the super-power Luxembourg station, which has led them to believe that they were also hearing a broadcast from Istanbul (Constantinople) on a neighbouring wavelength (1,200 m.). There should be no confusion between these two transmitters; the announcement given in a feminine voice is not *Ici Radio Istambul*, but *Ici Radio Luxembourg*—the last word being pronounced *Lix-am-boor*. The Turkish studio does not possess a woman announcer.

Hungary's Seven Transmitters

CONSIDERABLE developments have taken place during the past few months in the Hungarian broadcasting system which now comprises a network of seven stations. The Budapest main programme is broadcast through the Lakihegy 18.5 kilowatt transmitter on 550.5 metres, and also through three 1½ kilowatt relays installed at Magyarovar, Pecs and Miskolc which work on a common wavelength (209.8 metres). In addition, the same wireless entertainments are taken by Nyiregyhaza (6.25 kilowatts) on 267.2 metres. An alternative programme for the Hungarian capital is now transmitted through the old Csepel station on 840 metres, with a power of 3 kilowatts. For experimental purposes only tests are made with a small mobile plant at Craciunelu on 2,000 metres.

A Royal Birthday Broadcast

TO celebrate the birthday anniversary of Princess Juliana of Holland on April 30th, a special programme will be broadcast by the A.V.R.O. association

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

through Hilversum station on 296.1 metres on May 1st. As this date in previous years was always conceded to the V.A.R.A. Socialist Clubs for their Labour Day wireless entertainments, these celebrations will be postponed to the following week.

Atlantic Ice Patrol

FOLLOWING the sinking of the s.s. *Titanic*, on her maiden trip in April, 1912, when she collided with an iceberg, the United States coastguard service instituted a regular iceberg patrol in the North Atlantic. As the movement of these bergs from the Polar regions has already begun, special vessels from New York and Norfolk are already patrolling the international shipping routes to locate the icebergs, the positions of which are wirelessed at regular intervals throughout the day and night.

The Strasbourg German Programmes

PTT STRASBOURG since its installation has always broadcast in both French and German in view of the mixed population in the Alsace province. In view of the fact that complaints by listeners are made regarding anti-French propaganda put out by the neighbouring German stations, the authorities are considering a suggestion to make Radio Strasbourg an all-French studio, and to cut out German entertainments and announcements.

Listen to West Regional

THE new West Regional transmitter at Washford Cross is now ready to operate and listeners may hear the station testing from April 24th, when from that date it will be on the air daily between 11.10 and 11.50 a.m. The B.B.C. also proposes to broadcast the late dance music through this station. The wavelength is the one at present used by Cardiff, namely, 309.9 metres.

The Awakening of the Orient

COMPLETE re-organization of the French broadcasting system in Northern Africa is to take place during the next eighteen months. Radio Algiers will be completely rebuilt in order to house a 75-kilowatt transmitter and a 60-kilowatt plant will also be installed at Tunis. Radio Maroc (Rabat) may also see its energy considerably increased by next autumn and plans have been drawn up for the erection of two further relay stations. According to reports, work on an official Egyptian transmitter at Cairo is making good progress and a second station may be built at Alexandria. Even Jerusalem in the near future will broadcast wireless programmes, with a short-wave relay transmitter at Tel-Aviv, to make the entertainments available to the New World.

Bringing the Orient to Italy

IN order to give listeners an impression of native life in the Italian-African Colonies, the E.I.A.R. intends to relay running commentaries from the native "souks" in Tripolitania. A well-known journalist and two radio engineers have been sent to the capital, Tripoli, to study ways and means. The relays would probably be carried out by short-wave transmission to Rome and then re-broadcast over the Italian net.

INTERESTING and TOPICAL PARAGRAPHS

HOW IT IS DONE!

The Columbia van at Marble Arch recording an organ recital from inside the cinema.

The Moscow Foreign Broadcasts

ON 1,000 metres (300 kc/s) and 50 metres (6,000 kc/s) broadcasts in foreign languages are carried out by the Moscow (Old Komintern) transmitter according to a regular time schedule as under:—From 8.0–9.0 p.m. B.S.T., in German, on Sundays, Mondays, Thursdays and Saturdays; from 10.0–11.0 p.m., in Dutch, on Fridays; and between 8.0–9.0 p.m. on Tuesdays; from 10.0–11.0 p.m. on Thursdays and Saturdays in Swedish; in Spanish (Sundays); Magyar (Tuesdays) and in Czech (Wednesdays and Fridays). Moreover foreign talks are also transmitted by the Trades' Union station in English on Monday, Wednesday, Friday, Saturday and Sunday, and in French on Tuesday, Thursday and Saturday, between 9.0 and 11.0 p.m. B.S.T. These are also relayed on the short-wave transmitter working on 46.6 metres.

Man-Made Statics?

AUSTRIAN papers report that in order to prevent German listeners from hearing the Polish broadcasts, the German authorities have deliberately jammed the Warsaw transmissions. Interference on the Moscow wavelength is also said to be due to the same cause. Similar complaints have been levelled against Italy by the Jugo Slavian studios and in particular by Ljubljana, of which the transmissions on several occasions were destined for the Trentino districts. All quiet on the ether front!

The Monte Ceneri Tests

OWING to an unforeseen "technical hitch" the first broadcasts to be carried out by the new Tessin station on 680 metres may be postponed for another three weeks. The wavelength has been temporarily adopted and may be changed for a more favourable channel at a later date.

Regular Night Programme from Zeesen

AS already stated in these columns, DJC, Zeesen, is now carrying out a nightly broadcast between 1.0 and 3.0 a.m., B.S.T., on 49.83 m. (6,020 kc/s). This special transmission is destined to German residents in North and South America and in order to favour reception beam aerials will be used. The station will no longer act as a short-wave relay for Berlin or other German studios, but will put out original programmes of special overseas interest.

The Ether Controllers

IN addition to the special station designated by the International Union of Broadcasters to check the wavelengths of all European transmitters, there exist other "listening posts" acting for individual States, such as Tatsfield (England), the Telegrafen Technisches Reichsamt (Berlin), Csepel (Hungary), Mojauk (U.S.S.R.); Sesto Calende (Italy), Noiseau (France) and recently-opened radio laboratories at Madrid, Warsaw and Stockholm. Officials appointed for the purpose measure the transmissions at regular intervals during the broadcasts with a view to assisting the transmitters to maintain their allotted positions in the waveband.

SOLVE THIS!

Problem No. 31.

A rather peculiar fault had developed in Smith's three-valve set. This employed a grid leak rectifier, resistance-coupled to the next valve which was in turn transformer-coupled to the output valve. When the set was switched on it gave good signals for about one minute and then the strength fell to about one-third of normal, at which it would remain constant for the rest of the evening. When, however Smith was looking for the fault and testing the soldered joints he suddenly touched the grid terminal of the second valve and signals were immediately restored to full strength. What was wrong with the set? Three books will be awarded for the first three correct solutions opened. Address your solutions to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark your envelopes "Problem No. 31." Do not enclose any other correspondence with your solution.

SOLUTION TO PROBLEM No. 30.

Blackman should have inserted the S.G. valve into the detector socket (ignoring the anode connection), and connected the aerial, *via* a small fixed condenser, to the junction of coil, tuning condenser and grid condenser.

The following three readers received books in connection with Problem No. 29.

A. Feakins, 37, Rosebery Road, Brixton Hill, S.W.2; M. H. Hayton, 11, Park View, Harton, South Shields; W/O L. H. Metz, Fighting Area H.Q., R.A.F., Uxbridge.

ADDING A VALVE TO YOUR SET

By W. B. RICHARDSON

If You are Thinking of Altering Your Receiver to Include Another Valve You Should First Read This Article. It Tells You When the Alteration Would be Advisable and Gives the Pros and Cons of the Various Possible Arrangements.

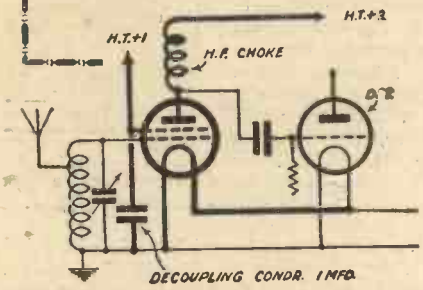


Fig. 1.—Adding an untuned H.F. stage. Heavy lines indicate the new parts required.

SOMETIMES the home constructor possessing a two-valve or three-valve set feels he could do with a little more "punch," or with rather greater range. Must he scrap his present receiver, he asks, and make or buy a more powerful one, or can he add another valve to it and thus achieve the desired result without any great additional expense?

The answer to such a question depends on a variety of things. Perhaps the most important is the type of set. If it is a commercial receiver it is usually practically impossible to alter it; but if it is home-constructed it may be possible. The amount of space available will probably be the deciding factor.

H.F. or L.F.?

The first thing to decide is whether the valve is to be an H.F. or L.F. amplifier. Broadly speaking, adding a screen-grid valve will give increased selectivity and greater range, while an L.F. valve will increase the volume.

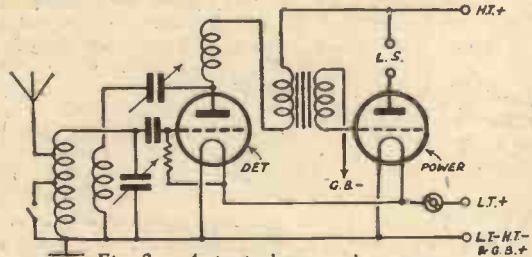


Fig. 3.—A typical two-valve circuit.

Before dealing with the practical side of the problem it will be just as well to have a look at the theory of the thing and find out the pros and cons of the two possible arrangements, for needless to say, there are many subsidiary points which need consideration.

Taking the question of H.F. amplification first, we find that there are two possible ways of coupling the additional valve. An H.F. choke can be used as in Fig. 1, or an extra tuned circuit as in Fig. 2.

Increasing Sensitivity

The first method is the simplest, but suffers from the drawback that it does not increase selectivity. In fact, owing to the increase in sensitivity the selectivity may appear to be actually worse than without it, since both the wanted and any unwanted stations are amplified alike. In this respect it is similar to L.F. amplification. However, it differs from the latter in that it is able to increase the range of the set. This is due solely to the imperfections of the detector.

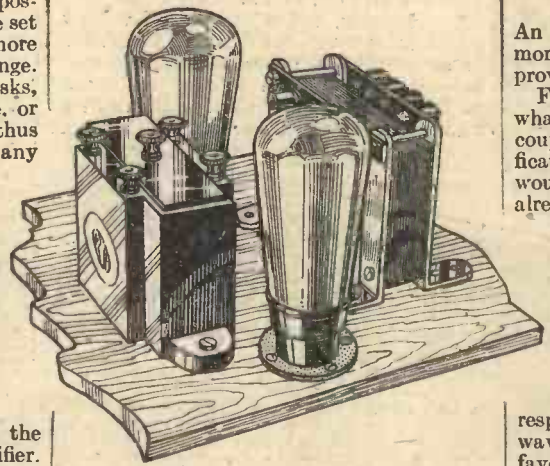


Fig. 6.—One way of adding a valve is to connect it in push-pull with the existing output valve. The lay-out for such an arrangement is shown here.

The average detector is unresponsive to very weak inputs. This means that weak or distant transmissions provide only the most feeble rectified outputs, while powerful stations give signals out of all proportion louder. The screen-grid valve in Fig. 1 being placed before the detector amplifies the feeble H.F. currents set up by the distant stations so that they are made powerful enough to be properly rectified.

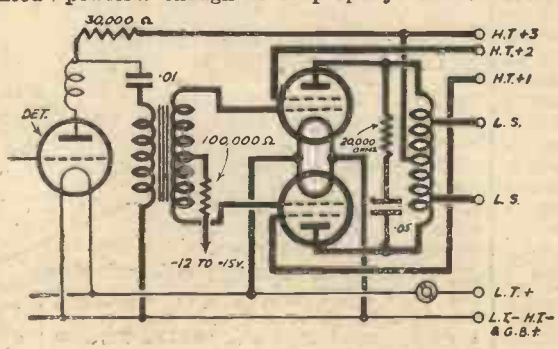


Fig. 5.—Circuit for pentodes in push-pull.

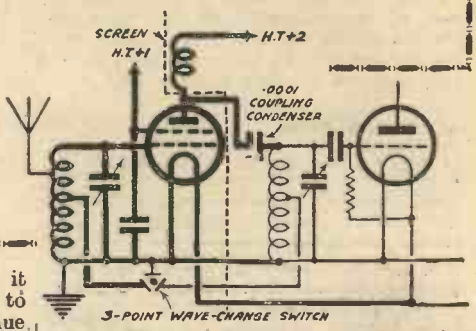


Fig. 2.—Circuit showing how to add an S.G. valve.

An L.F. valve on the other hand cannot do more than amplify what the detector provides it with.

From the foregoing it is easy to see in what circumstances the addition of a choke-coupled or untuned stage of H.F. amplification would be desirable. Briefly, it would be useful where the selectivity is already quite sufficient, but where the sensitivity is poor. Such conditions might be found where a small indoor aerial was in use, or where the receiver was situated many miles from the nearest broadcasting station. One fact which recommends its use with a short aerial is that it gives better amplification on the long waves, thus compensating for the naturally poor response of such an aerial on the upper wave-band. Other strong points in its favour are its cheapness and simplicity—no extra coils or condensers are necessary and thus no extra tuning is involved.

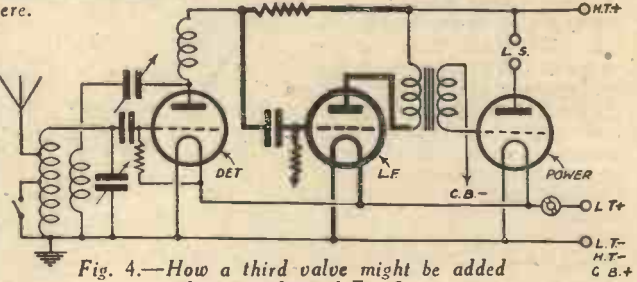


Fig. 4.—How a third valve might be added to the two-valver of Fig. 3.

Adding a Tuned H.F. Stage

Owing to the great power of the local stations, it is not often that the selectivity of a set is more than sufficient. It is usually the reverse, and it is here that the addition of a stage of tuned H.F. amplification is useful. The circuit is shown in Fig. 2. The thin lines represent the original circuit, and the heavy ones the additional part.

The advantages are as follows: First, there is the increase in selectivity. This is due to the extra tuned circuit. Each additional tuned circuit in a receiver provides an additional barrier against the unwanted stations. Next, there is the increase in sensitivity. This is greater than with the choke coupled arrangement, especially on the medium waves.

Effects of an Extra L.F. Valve

Now for L.F. amplification. This is

(Continued overleaf.)

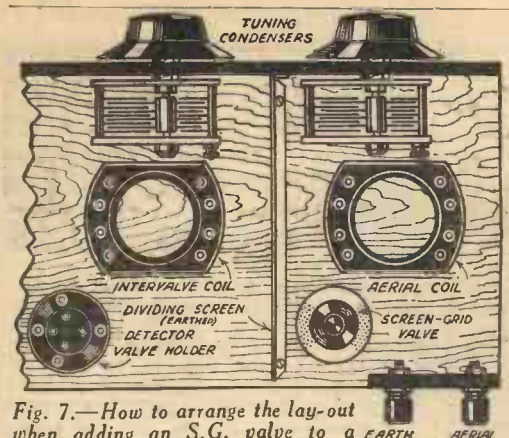


Fig. 7.—How to arrange the lay-out when adding an S.G. valve to a receiver.

(Continued from previous page.)

undoubtedly the best method of increasing the volume from the loud-speaker. It will not increase the selectivity for the reasons already mentioned, nor will it mean a great increase in the volume of the *very* weak stations, but it will certainly add plenty of "punch" to all others. The extra parts necessary to make the conversion are comparatively cheap and do not require a lot of extra room, or any special positioning or screening as with H.F. amplification. This means that in quite a large number of cases the same panel and baseboard can be used by altering slightly the position of the present components to accommodate an extra valve and transformer, and possibly a decoupling condenser.

Now let us take one or two examples of typical receivers and see how and where the extra valve should be added. First of all there is the popular two-valver, consisting of det. and power valve, or pentode. If it has a power valve, undoubtedly the cheapest conversion is to add an additional resistance-coupled stage between the detector and the output valve. The extra parts required will be an anode resistance of about 100,000 ohms, a .01 coupling condenser, a ½ or 1 meg. grid leak, a valve holder, and an L.F. type valve. The original circuit is shown in Fig. 3 and the conversion in Fig. 4. The heavy lines represent the new part of the circuit.

The Extra Valve in Push-Pull

Adding a valve in this way although cheap to fix up, and unlikely to introduce any howls or other unforeseen accompaniments, has its limitations. It will increase the volume from all stations, but it must be remembered that the maximum volume depends on the capacity of the last valve. If the transmission from the local station already loads this to the limit, the addition of an intermediate valve will not increase the volume beyond this limit but will merely overload the last valve. Therefore, if it is more power from the local which is required, not only must an intermediate valve be added but the output valve must be replaced by one capable of handling more power. Of course, if it is found with a two-valve set that the output valve is more than fully loaded by the local transmissions, and it is desired to increase its power handling so that the full volume may be turned on without fear of distortion, then the best way to add another valve is to connect it in push-pull with the output valve. Adding a valve in this way, unlike the method shown in Fig. 4, will not give any increase in the volume of the weak and medium powered transmissions but will allow full volume to be obtained from the local station for a very modest consumption of H.T. current. Instead of having to keep the volume of the local throttled down to avoid distortion it will now be possible to turn it right up. When adding a valve in push-pull it must, of course, be identical with the one at present in the set and with which it will be used. The circuit in the case of two pentodes is shown in Fig. 5, while a view of the usual lay-out showing the disposition of the input transformer and the output choke is given in Fig. 6.

Incidentally, where the output valve of a two-valve set of the det. and 1 L.F. type is a pentode, the push-pull arrangement is the only practical way of adding an additional L.F. valve, since to interpose an additional stage between the detector and the pentode would almost certainly overload the latter.

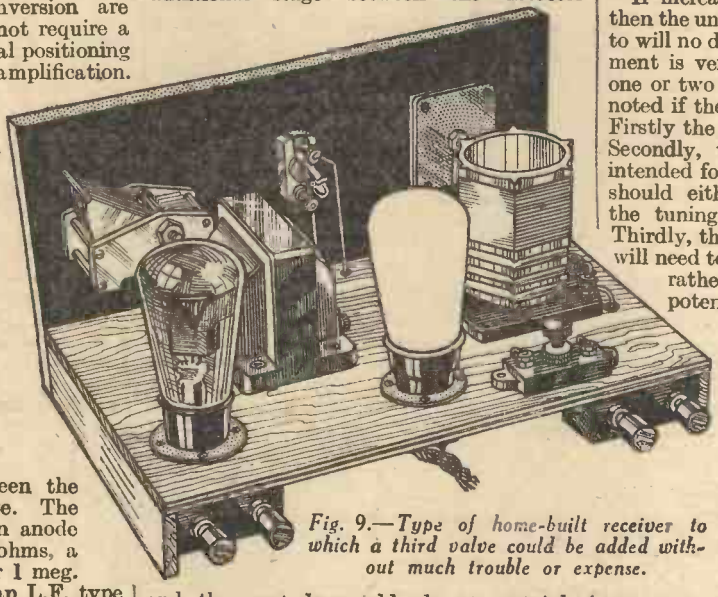


Fig. 9.—Type of home-built receiver to which a third valve could be added without much trouble or expense.

How to Get More Stations

Many users of two-valve sets find the volume quite sufficient for domestic purposes, but desire an increase in range. They wish to receive a few "foreigners" at full loud-speaker strength. In this case the only possible solution is to add a tuned screen-grid stage. Without doubt this will mean a larger panel and baseboard to accommodate the extra valve, coil, tuning condenser and choke, etc. Fig. 2 shows the circuit, with the additional part in heavy lines. Fig. 7 shows how the high-frequency end of the receiver should be arranged. The new baseboard and panel should be long enough to accommodate another tuning condenser and tuning coil each of the same make and type as the ones already employed. It will be noticed that a single metal screen is erected between the two coils and condensers, so as to completely separate the two tuned circuits. This screen is, of course, earthed. The coils should both be the same distance from either side of the screen. In the case of two-inch coils, this should preferably be not less than 2in. The screen-grid valve, which should be metallised, is placed on the aerial coil side of the screen. If the wave-changing with the particular coils used is carried out by shorting the long-wave turns, then a single three-point switch will suffice to operate both coils.

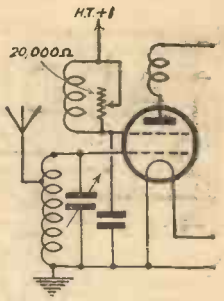


Fig. 8.—Reaction from the screening grid.

Of course, if the original coil in the set is of the screened type, then another similar one should be purchased and the dividing screen will be unnecessary, also they may be placed as close together as desired.

A Simple Way of Adding an H.F. Valve

If increased sensitivity is only required, then the untuned H.F. stage already referred to will no doubt fill all needs. This arrangement is very easy to fix up, but there are one or two practical points which should be noted if the best results are to be obtained. Firstly the S.G. valve should be metallised. Secondly, the H.F. choke must be one intended for use with screen-grid valves and should either be placed well away from the tuning coil or else screened from it. Thirdly, the voltage on the screening-grid will need to be only about 30 volts. Being rather critical it is best to use a potentiometer control, unless the H.T. can be tapped at intervals of not more than three volts round about the 30-volt mark. Fourthly, it is usually better to take the reaction from the plate of the S.G. valve than from the detector. Another method is to take it from the screening grid. A circuit using this method is given in Fig. 8. It is that employed by the Ferranti Co., Ltd., in one of their designs and being the subject of a patent must not, of course, be used on a set intended for re-sale without their consent.

Converting a Three-Valver to a "Four"

When it comes to adding another valve to a three-valve set, the decision as to its position depends chiefly on the circuit

(Continued on page 204.)

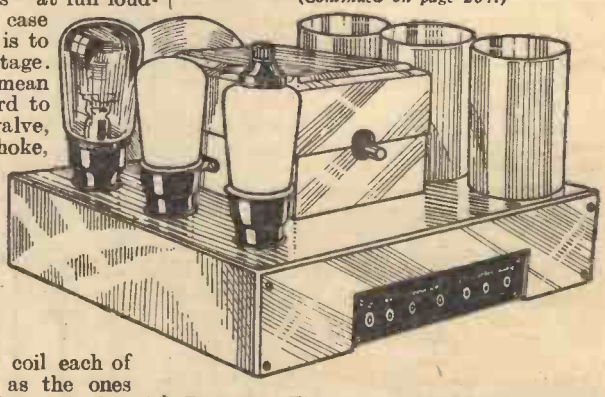


Fig. 10.—The compact type of commercial receiver which does not lend itself to any additions or alterations.

Forms & Methods of Volume Control

Simple and effective means of obtaining it are briefly described in this article by J. B. SKETCH.

CONTROL of volume may be effected in a dozen or more different ways, but each system of control has its good and bad points. The reason for volume control is either to prevent overloading in one of the valve stages, or to permit the listener to vary the sound emanating from the loud-speaker to suit his own particular taste. In either case

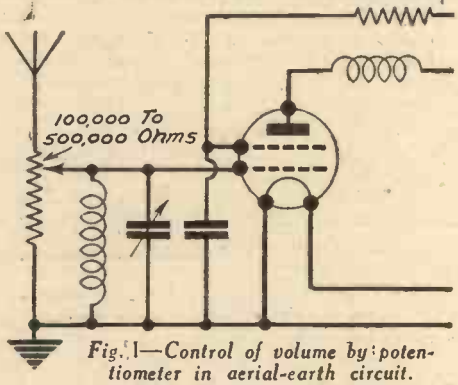


Fig. 1—Control of volume by potentiometer in aerial-earth circuit.

volume may be controlled by limiting the high-frequency signal input to the first stage of the receiver or by adjusting the degree of amplification in one of the high or low-frequency stages.

Limiting High-frequency Signal Input

The high-frequency signal voltage applied to the grid of the first valve, which is usually a screen-grid, may be controlled by the adjustment of a potentiometer connected between the aerial and earth as in Fig. 1. The value of the potentiometer depends upon the strength of the local transmissions, but it will be found that any potentiometer with a value ranging between 100,000 and 500,000 ohms will be found quite satisfactory. Another important point concerning this type of volume control is, it is preferable to use a wirewound potentiometer as the carbon or other form of resistance element becomes very erratic in operation after a certain amount of use.

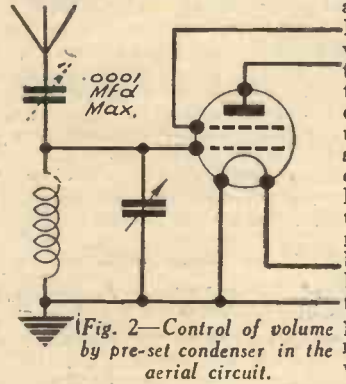


Fig. 2—Control of volume by pre-set condenser in the aerial circuit.

Control by Pre-set Condenser

The next form of volume control is obtained by inserting a pre-set condenser (.0001 mfd. max.) in the aerial input circuit, in Fig. 2. This is a similar form of control as the previous one (i.e., limiting H.F. signal input), its disadvantage is noticeable when it is used in sets having ganged circuits; it will be found that when the pre-set condenser is varied, it upsets the ganging of the circuits and alters the tuning of the set. It then becomes necessary to retune the set slightly.

Control of High-frequency Amplification

The third form of volume control is effected by varying the temperature of the filament of the screen-grid valve by inserting a variable resistance of about 20 or 30 ohms in the filament circuit of the valve, Fig. 3. When the temperature of the valve is lowered the sensitivity of the valve is reduced, which in turn reduces the high-frequency amplification or stage gain. This type of control is very fierce in operation and is not to be recommended before other methods to be described.

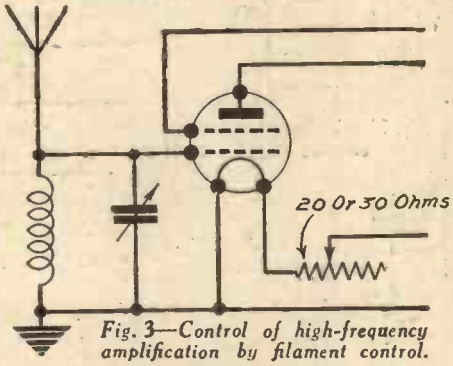


Fig. 3—Control of high-frequency amplification by filament control.

Variation of Screen Voltage

A system of control which possesses a much smoother variation of volume is by varying the voltage applied to the screen of the screen-grid valve. The connections for a battery set may be seen in Fig. 4, and the mains set in Fig. 5. The constructor will not encounter any difficulties with this arrangement in general practice, but if too big a voltage variation is used even this type of control will produce its disadvantages, such as self oscillation, and possibly become unstable in operation and produce distortion. This form of volume control also varies the high-frequency amplification.

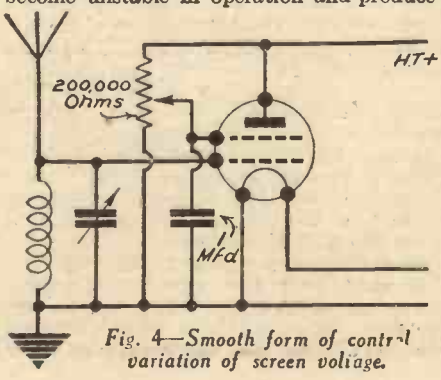


Fig. 4—Smooth form of control variation of screen voltage.

Control of Volume by Variable Mu Valves

The most successful of all methods of volume control is made possible by the use of variable mu valves, which have only been introduced within the past few years. The method used is to vary the amount of grid bias applied to the grid of the vari mu valve.

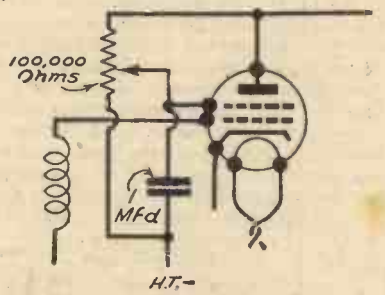


Fig. 5—Variation of screen voltage mains connections.

The amount of variation is from 0-15 volts in the case of a battery set, and from 1.5-40 or 50 volts in the case of a mains set. It may be well to insert here a brief description of the working of the variable mu valve. The variable mu valve is a new and special form of screen-grid valve. The special feature of the valve is that it is possible to vary its mutual conductance (which in simpler terms means its amplification). To vary the mutual conductance of a valve we vary the grid bias applied to its screen grid. If we wish the valve to amplify to its maximum, we must reduce the grid bias to nil or to a very low value. As we gradually increase the value of the grid bias applied to the valve, its amplification is reduced until when the maximum grid bias has been applied, no signals will be heard from the receiver. The connections for the battery set will be seen in Fig. 6. The value of the potentiometer is about 50,000 ohms.

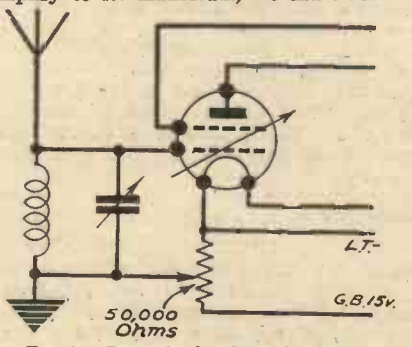


Fig. 6—Control of volume by battery variable mu valve.

A.C. Variable Mu Valves

The arrangement of the mains variable mu volume control is a little more complicated. It is to be seen in Fig. 7. It has been stated that the amount of grid bias

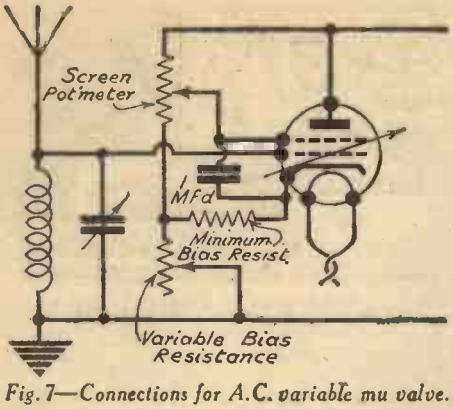


Fig. 7—Connections for A.C. variable mu valve.

required for a mains variable mu is about 40 or 50 volts, thus it would be impracticable to supply this from batteries as in the battery arrangement of the variable mu. The easiest method of obtaining this voltage is to use automatic grid bias, by connecting a resistance between the high tension negative and the cathode of the variable mu valve. The anode current of the valve passes through this resistance and a voltage drop is set up across it, making the

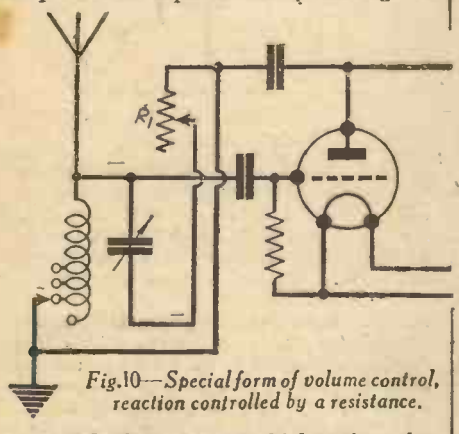


Fig. 10—Special form of volume control, reaction controlled by a resistance.

potential of the cathode higher than that of the grid by the amount of the voltage drop across the bias resistance.

To avoid grid current in the variable mu valve it is essential not to lower the grid bias voltage lower than 1.5 volts, and to do this it is necessary to have the bias resistance in two separate units, one of permanent value calculated to allow the minimum bias value (1.5 volts) and the other variable to allow control above this limit. It is difficult to give any definite values for these resistances as they vary with the many characteristics of the various valve makers. However, most valve makers state on the operating slip the best values to use.

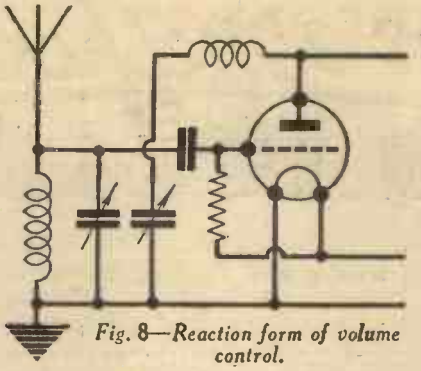


Fig. 8—Reaction form of volume control.

Control of Volume in Detector Stage

The simplest way of controlling volume in this stage is by reaction. Only two forms are shown (Figs. 8 and 9), as reaction is not a good form of volume control, for if it is improperly used it will oscillate and cause interference and distortion. Another method of volume control in the form of reaction control is shown in Fig. 10. The control is effected by variation of the resistance R1. Both these forms of reaction volume control are quite satisfactory in operation and are only included for the sake of completeness.

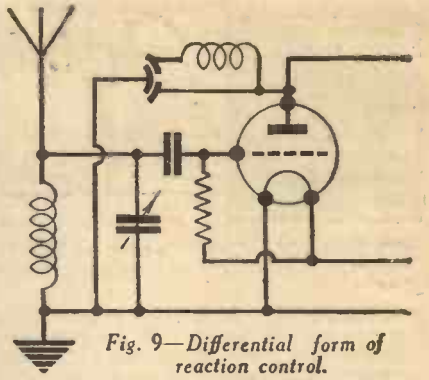


Fig. 9—Differential form of reaction control.

Control of Volume in Low-frequency Stages

One of the most common methods of volume control in low-frequency stages is shown in Fig. 11, which is a transformer coupled stage. Control is effected by variation of the potentiometer connected across the low-frequency transformer, the same idea being used in the resistance capacity coupled stage in Fig. 12. In Fig. 13 the input from the gramophone pick-up is controlled by the potentiometer connected in parallel with the pick-up.

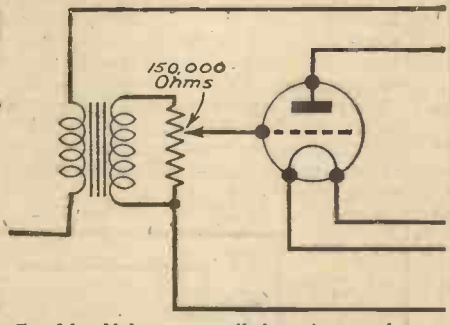


Fig. 11—Volume controlled in the transformer coupled stage by a potentiometer.

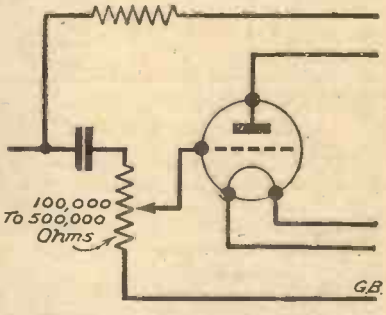


Fig. 12—The same method is used here as in Fig. 11. Resistance capacity stage.

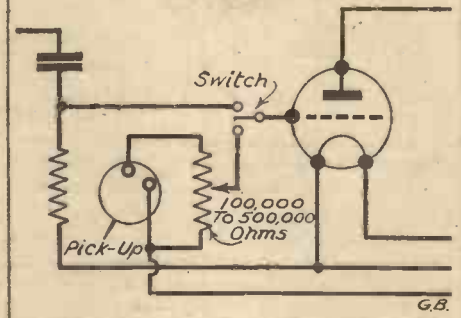


Fig. 13—Control of input from pick-up by a potentiometer.

In all three cases the input to the grid of the valve, thus effecting the amplification or stage gain, is controlled by the potentiometer.

BOOKS RECEIVED

TELEVISION for the Amateur Constructor, by H. J. Barton-Chapple, Wh. Sch., B.Sc., etc.; 12s. 6d. net; Demy octavo; 234 pages. Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, W.C.2.

Television, which is now on the threshold of success, is a subject on which literature is all too scanty. The author of "Television for the Amateur Constructor" has already covered the general principles, the history, and the development of television in a companion volume entitled "Television—To-day and To-morrow," which was recently reviewed in these columns. The present volume is essentially practical. The first chapter forms a brief but complete introduction to the general theory of television, but from that point the author plunges straight away into the practical avenues of his subject. The cohesion of the chapters and the scheme of the book may be gauged from the following list of chapter headings :—

A Workshop in the Home; The Vision Wireless Receiver—H.F. and Detective Stages; The Importance of the L.F. Side; Suggested Experimental Circuits; H. T. Power for Television; A Wireless Set for Television Reception; Further Practical Details of Wireless Apparatus for Television Reception; Building the Television Apparatus; and Making Vision Apparatus. The last chapter deals practically if prophetically with future developments. The extremely lucid and simple style adopted in the text is rendered even more understandable by the generous proportion of excellent illustrations in half tone and line which punctuate it at almost every page. This is not a work for the highbrow; it gets down to the level of the man who wishes to build television apparatus at small cost and with limited income, and I can thoroughly recommend it. A word of congratulation to the publishers for the attractive manner in which they have presented the book. It is similar in size, style, and binding to "Television—To-day and To-morrow."

MORE ABOUT— INTERFERENCE

A Practical Article Explaining the Various Causes of Interference and the Best Means for Dealing With It.

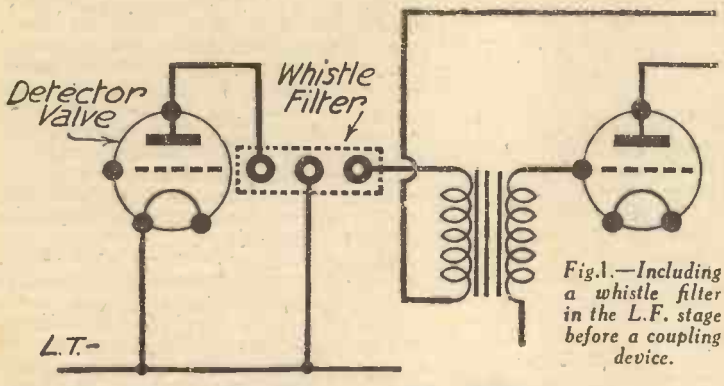
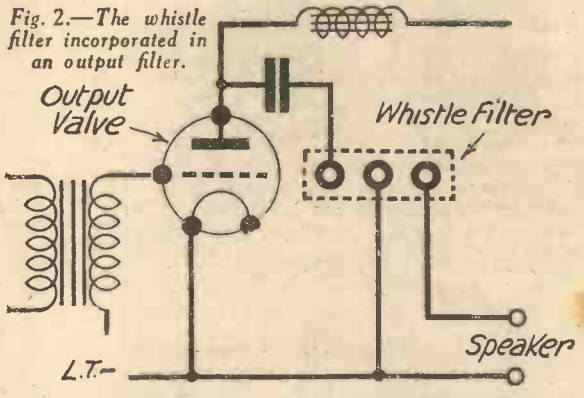


Fig. 1.—Including a whistle filter in the L.F. stage before a coupling device.

Fig. 2.—The whistle filter incorporated in an output filter.



THE modern wireless receiver, in conjunction with a good moving-coil speaker, is capable of giving clear and faithful reproduction of the broadcast, with almost complete absence of background noise. Interference with reception is unpleasant under any circumstances, but when a high level of quality has been attained, interference due to local disturbances is still more annoying and unpleasant, as the effect of the interference seems to be accentuated by contrast with the quality and clarity of the reception obtained.

Interference may come from three sources—from the set itself or its associated components, from natural static charges known as atmospherics, and from artificial static charges sometimes termed "man-made statics." The latter may be divided into two categories, distant and local.

At the present time, the prevention of interference from natural atmospherics provides an insoluble problem. Although they are practically untuned, atmospherics are usually found to be less troublesome on the medium than on the long wave-band. Fortunately, reception in this country is not seriously marred by atmospheric disturbances, this form of interference being generally confined to short periods during the summer months. A type of this interference only experienced very occasionally, is that set up by electrically charged raindrops, falling on the aerial. This is due to the rain having recently passed through an electrically charged atmospheric area and, on precipitation, carrying with it small individual static charges.

Heterodyne Whistles

Distant interference is usually caused by morse from broadly tuned transmitters, or heterodyne whistles produced by stations' carrier-waves overlapping each other. The morse trouble can generally be removed by sharper tuning of the receiver, but even the sharpest tuning may not completely eliminate the heterodyne whistle. It can, however, be fairly effectually cured by fitting a whistle filter to the set. The filter can be purchased as a complete unit, and is best connected to the detector circuit, so that the low-frequency stages do not have to handle the high notes unnecessarily. Fig. 1. If, however, difficulty is experienced in connecting it to the detector circuit, it may be connected to the output stage, in the speaker circuit, Fig. 2. Heterodyne whistles are usually more pronounced on moving-coil speakers, owing to their better response to the upper register.

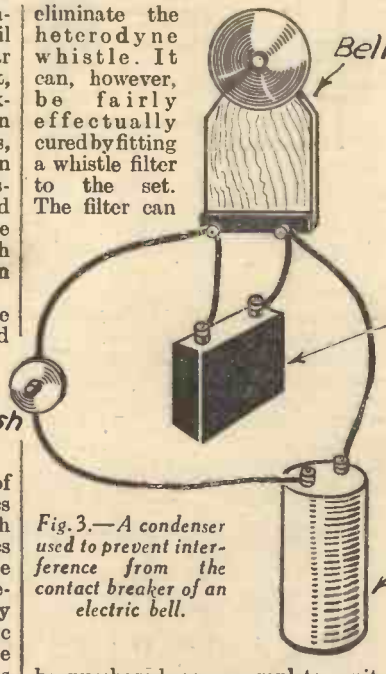


Fig. 3.—A condenser used to prevent interference from the contact breaker of an electric bell.

When persistent or recurring interference exists, the first step in its elimination is, of course, to discover its cause or origin. The aerial connection to the set should be removed, and, if the trouble ceases or is greatly reduced in intensity, it may generally be taken for granted that the source of the trouble is outside the set. The method of testing by temporarily removing the aerial connection, is not as easy in the case of sets with built-in aerials, and it is better to short circuit the frame aerial rather than disconnect it.

Tracking Internal Causes of Crackling Noises

If the trouble is found to be located somewhere in the set, the best method for its detection is by a process of elimination. That is, taking each circuit or component in turn and testing for faults in the usual way, beginning with the H.T. battery if the receiver is battery operated. Loose terminal connections, badly soldered joints, faulty resistances, intermittent contacts between the plates of a variable condenser, valve legs making bad contact in their holders, faulty switches (some push-pull types are rather prone to give trouble), "burnt out" low-frequency transformer winding, or a defective grid leak, are possible sources of crackling noises.

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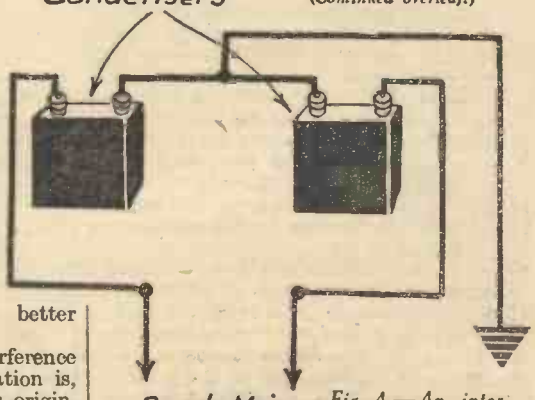


Fig. 4.—An interference eliminator connected across the supply mains.

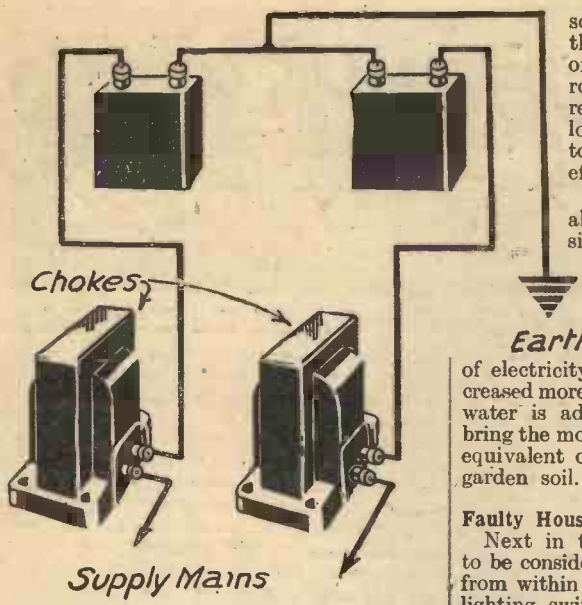


Fig. 5.—To prevent interference from machinery, etc., special chokes may be used as shown here.

(*Continued from page* 181.)

Other possible causes of noise from within the set are interaction between components through bad layout, over-loaded mains unit, or insufficient decoupling of the high-tension feeds to the valves. Either of these causes may result in what is known as "motor-boating." A run down H.T. battery causing feed-back may also give this trouble. Motor-boating or low-frequency instability, is not usually difficult to overcome. Microphonic noise is often more difficult to cure owing to the difficulty of definitely locating the cause, particularly in the case of receivers with powerful built-in speakers. The usual cause is through lack of rigidity in the electrodes of the detector valve. The sound waves from the speaker impinging on these electrodes set up vibrations which produce a singing noise in the speaker, which in turn causes sympathetic vibration of the valve electrodes, and so a cycle is established which results in the building up of a ringing volume of sound which eventually blots out the programme.

Placing two rubber bands round the bulb of the valve, or binding a jacket of cotton wool round it by means of rubber bands will often effect a cure. Caution is advised, however, in using this method in the case of mains valves, owing to temperature rise which may cause scorching of the cotton wool, and internal damage to the valve due to overheating. It is sometimes found necessary to mount each of the valves on sponge rubber feet, or else to fit rubber pads under that part of the receiver upon which the valves are mounted. Microphonic noises may also be produced by other causes such as vibrating condenser vanes, or even the walls of the cabinet containing the set may be the cause of the trouble.

Defective Earths

A defective earth is a prolific source of crackling in a receiver. If the earth lead is a long one, interference may be caused by induction in the wire from the house-lighting mains. The lead should be carefully soldered to the earth tube, and not just bound round it. Unless the wire is soldered, the surface of both the tube and the wire becomes oxidized and sometimes corroded, which results in a high resistance earth with consequent losses. The lower the resistance to earth the greater will be the efficiency of the receiver.

The earth tube or plate should also, if possible, be placed in a situation where it will be maintained in a moist condition. Recent tests carried out by the National Physical Laboratory, indicate that while dry soil is a poor conductor of electricity, the conducting power is increased more than one thousand times when water is added in sufficient quantity to bring the moisture content of the soil to the equivalent of that usually found in normal garden soil.

Faulty House-lighting Fittings

Next in the order of interfering noises to be considered are those which may come from within the home itself. Faulty house-lighting switches may cause trouble, and this can be ascertained by operating each of the switches in turn. If a faulty switch is found it can be corrected by removing the switch cover, and slightly closing the switch contacts with a *wooden* handled screwdriver. Another possible source of trouble is the electric light bulbs. When these have been in use for some time and are approaching the period for replacement, the filament sometimes becomes defective and produces intermittent cracklings in the receiver when the bulb is in use. Trouble from this cause can be located in the same manner as in the case of the faulty switches.

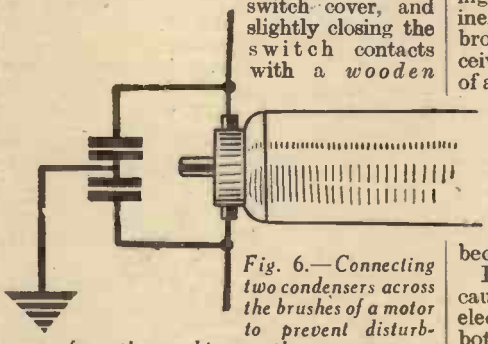


Fig. 6.—Connecting two condensers across the brushes of a motor to prevent disturbance from the sparking on the commutator.

Electric vacuum cleaners, refrigerators, heat regulators, hair driers and fans, are also probable offenders, and in purchasing household electrical apparatus of this description, a definite guarantee should be obtained from the supplier that interference with wireless reception will not be caused by their use. Trouble from electric bells may be cured by connecting a 1 mfd. condenser in the bell circuit, in the manner shown in Fig. 3.

Stray high-frequency currents find their way into the supply mains from outside sources and may cause H.F. trouble in the receiver, especially if it is operated from the mains. This form of interference is difficult to definitely identify, but if the presence of H.F. currents in the mains is suspected, two 2 mfd. condensers (400 working voltage type) should be connected across the mains supply, with the centre point earthed, as in Fig. 4. Where serious high-frequency interference is experienced it may be necessary also to connect chokes in series with each of the supply mains leads, Fig. 5.

Interference from Electrical Equipment

Turning next to interference from external sources, an opinion was recently expressed in the technical Press to the effect that owners of electrical equipment which caused interference should not be called upon to take any steps for its elimination, as wireless users, being the last comers, should so arrange their apparatus as to render it unsusceptible to unwanted influences. This view, however, is a debatable one.

External interference is generally of an intermittent nature, and varies in character from humming or buzzing of differing pitch and strength, to crackling or tearing noises, or even loud cracks reminiscent of the sounds of minor explosions. The nature and intensity of the interference reproduced by the speaker depends upon the character of the equipment from which the trouble emanates and upon the type of receiver which is subjected to its influence. It is often possible to identify the character of the offending equipment from the nature and recurrence of the interference.

Interference from another wireless receiving set in the immediate neighbourhood is inexcusable in these days of high power broadcast transmissions and sensitive receivers. This form of disturbance consists of a high-pitched howl, or if the set is working very close to the oscillation point without actually breaking into oscillation, the result is a low-pitched moaning noise. The interference is caused by the use of excessive reaction, which converts the receiver into a miniature transmitter. Fortunately trouble from this source is becoming much less prevalent.

Electrical equipment which may be the cause of considerable interference includes electric trams and trolley buses, flashing signs both ordinary and of the Neon lamp type, automatic traffic signals, violet ray apparatus, arc lamps used as spot lights for cinema or theatrical purposes, sparking at the commutator of accumulator charging sets or of motors or generators in workshops and factories, and leakage currents from the earth return system on tramway and trolley bus routes. With the exception of emanations from tram and bus overhead wire conductors, and earth leakage currents, the other sources of interference do not usually extend beyond a radius of 250yds.

High-frequency emanations are caused every time an electrical circuit is broken, and sparking is not necessarily an accompaniment of their production, but in the case of interference from motors or generators, sparking at the commutator or the slip

(*Continued on page* 212.)

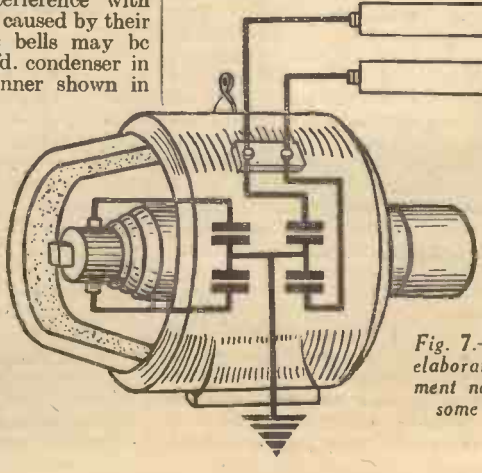


Fig. 7.—A more elaborate arrangement necessary on some motors.

SELECTONE A.C. RADIO-GRAM TWO

A HIGH-CLASS AND EFFICIENT INSTRUMENT AT A REASONABLE PRICE.

By FRANK PRESTON, F.R.A.

IT has often occurred to me that there must be hundreds of mains users who would like to have a really good all electric radio-gramophone, but who are debarred from such a luxury by reason of the expense of the normal instrument of this type. Most radio-gramophones on the market, as well as those which have hitherto been described in the Radio Press, are multi-valve models, designed essentially as "de-luxe" articles and, in consequence, costing upwards of £25. For the latter reasons I have enjoyably spent not a little time designing the simple all-mains radio-gramophone which I am about to describe. As the name implies, it is a 2-valve job, which is comparatively inexpensive to build and of simple construction. This instrument has been designed for a definite and special purpose, which it fulfils in what I consider an ideal manner. The purpose is to give really fine quality of reproduction from more or less local stations as well as from gramophone records. It can be used either with or without an external aerial, and in both cases will give sufficient volume for all ordinary purposes. I am not going to describe the "Selectone Two" as a long distance set, although it will most certainly afford excellent reception of a good number of stations when operated with care, and after a little experience of tuning.

Selectivity

Selectivity is of a high order, but is not so great as to make tuning at all difficult, even to the entirely inexperienced user. Moreover, the degree of selectivity can be varied over wide limits to meet the demands of all average requirements.

Tone Control

The receiver embodies a refinement which I consider a necessary part of any modern receiver, namely, the provision for varying the tone of reproduction from deep bass (often referred to as "mellow") to the highest treble, or "brilliance." the tone control is of great value, not only because it enables the reproduction to be adjusted to a suitable pitch in any room, and permits of the elimination of most forms of heterodyne interference, but because it makes possible the easy elimination of record needle scratch, and allows extra amplification to be given to the lower frequencies which are necessarily somewhat curtailed in the recording process.

No Mains Hum

"Hum," which is often considered an unavoidable source of trouble with receivers taking their power supply from the electric lighting mains, has been almost completely cut out by the use of a very ample H.T. smoothing system. Indeed, hum is quite inaudible when the weakest transmission is tuned-in, whilst, when the set is "off tune," only the very slightest amount can be detected. This latter statement applies particularly to the A.C. supplies upon which the set has been tested, but as some of these have been notoriously "rough" I can safely say that interference from this source is most unlikely to present itself when the set is used on any mains supply in any part of the country.

Cost

It can be seen from the list of components that the "Selectone Two" when made up either as a broadcast receiver pure and simple, or as a complete radio-gramophone, is not expensive. At the same time it does not come under the heading of a cheap set, nor would I like it to, for it is unquestionably a "quality" instrument using first-rate and fully guaranteed components throughout. It is a very unwise practice to employ any but the very best parts for an instrument which is to be connected to A.C. mains, since inferior quality in this direction is bound to lead to trouble and possible breakdown sooner or later. In making this set the constructor may rest well assured that it will perform with every satisfaction, not only for the next few months but for many years to come.

Current Consumption

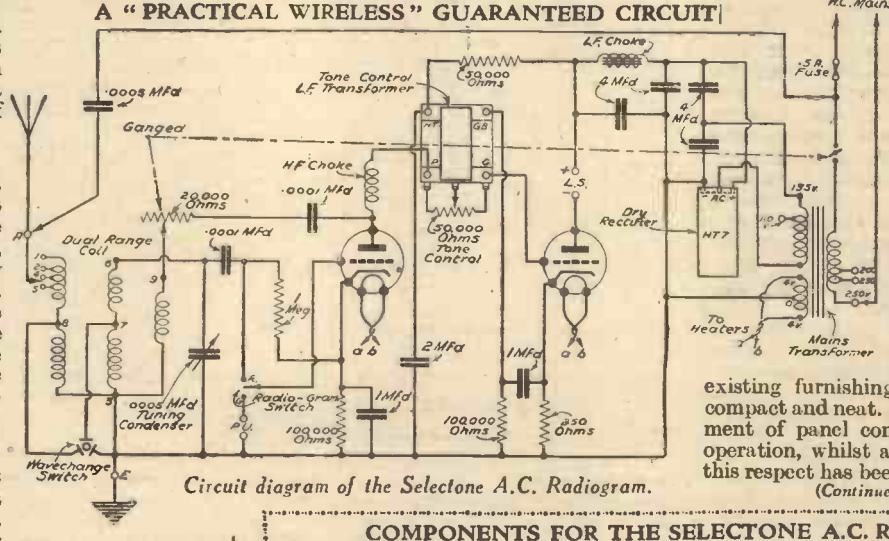
One point which has not yet been mentioned, and which is frequently overlooked, is in regard to current consumption. This is extremely low in the present case, being in the region of 12 watts per hour for the receiver itself and well under 50 watts for the gramophone motor. In other words, the receiver will give over 80 hours service per unit of electricity, whilst the combined radio-gramophone can be used for over 10 hours continuously on the same amount of current—I think these figures speak for themselves.

Simple Lay-Out

Matters of appearance and simplicity of lay-out have not been forgotten, and the whole instrument is decidedly handsome. The cabinet is very robust and of such pattern that it will harmonize with any existing furnishing scheme, and yet it is compact and neat. A symmetrical arrangement of panel controls makes for ease of operation, whilst a further improvement in this respect has been obtained by combining

(Continued on page 186.)

A "PRACTICAL WIRELESS" GUARANTEED CIRCUIT



Circuit diagram of the Selectone A.C. Radiogram.

COMPONENTS FOR THE SELECTONE A.C. RADIOGRAM

1 Polished Plywood Panel, 10in. by 7in. (supplied with Cabinet specified).
1 5-ply Baseboard, 15in. by 14½in. (supplied with Cabinet specified).
1 Utility "Mite" .0005 mfd. Condenser with disc drive.
1 "Wearite" 3-point Wavechange Switch (Type G.W.C.).
1 "Wearite" Changeover (Radiogram) Switch (Type G.C.O.).
1 "Wearite" 20,000 ohm volume control with combined Mains Switch.
2 Lotus 5-pin Valve Holders.
1 Colvern Type "T.D." Coil.
2 Dubilier .0001 mfd. Fixed Condensers.
1 Dubilier .0005 mfd. Fixed Condenser.
1 Graham Farish Ohmite 1 megohm Grid Leak.
1 Graham Farish Horizontal Grid Leak Holder.
1 Wearite Screened H.F. Choke (Type H.F.P.).
1 Lissen "Hypernik" L.F. Transformer.
1 Lissen "Tone Compensator."
3 Belling-Lee Terminal Mounts.
6 Belling-Lee, Type "R" Terminals, 2 marked "Pick-Up" and 1 each marked "A," "E," L.S.+, L.S.—.
1 Heayberd, Type W.25 Mains Transformer, giving outputs of 135 volts, 70 mA. and 2—0—2 volts, 4 amps.
1 Heayberd, Type 751, Smoothing Choke.
1 Westinghouse, Style H.T.7 metal Rectifier.
4 Dubilier (400 volts D.C. working) 4 mfd. Condensers.
1 Dubilier (400 volts D.C. working) 2 mfd. Condenser.
2 Dubilier (400 volts D.C. working) 1 mfd. Condensers.
1 Belling-Lee Fuseholder with .5 amp. fuse.
1 Graham Farish Ohmite 100,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 50,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 1,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 250 ohm, 1 watt Resistance.
1 Heayberd Mains Flex with Lamp Adaptor.
2 Coils Glazite, screws, short length flex.
1 Mazda A.C.2 H.L. valve metallized.
1 Mazda A.C.P. Valve.
1 Simpsons Electrical Turntable.
1 Becker Q.M.B. On-Off Switch.
1 B.T.H. "Minor" Pick-up.
1 Celestion "Soundex" Speaker Chassis.
1 "Camco" Selectone-Tablegram Cabinet.

MAKING COIL FORMERS WITH CARDBOARD

A Practical Article Describing the Construction of a Highly Efficient Set of Low-loss Band-pass Coils

By F. THORNE

TO the average constructor, the making of these formers, and the winding of the coils, will present very little difficulty and, as the whole thing can be made and finished off in a couple of nights at a total cost of less than 2s. 6d., it will provide the practical man of modest means with a ready solution of how to bring his wireless set up to date. The first step is to procure some pieces of pliable cardboard, the actual thickness used in the model about to be described was about $\frac{1}{16}$in. and was part of a large carton.

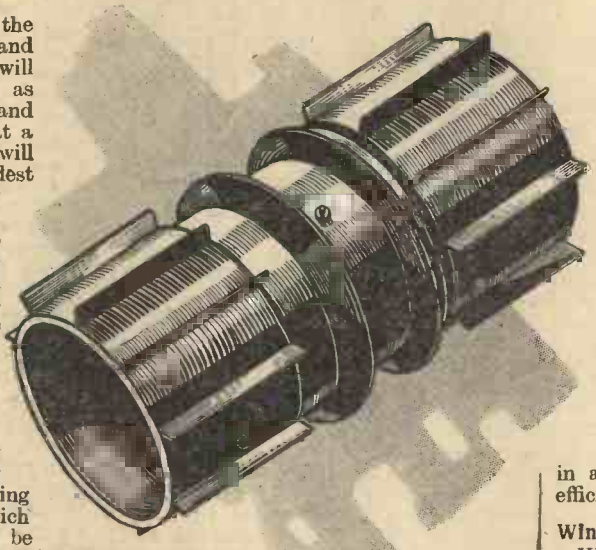
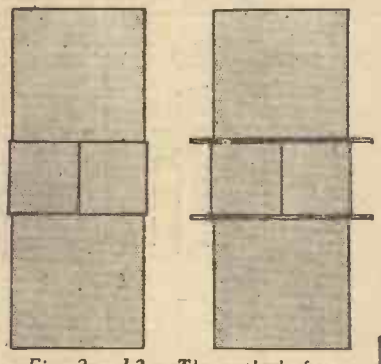


Fig. 1.—The complete dual former.

Constructional Details

After procuring your cardboard, cut a piece 6½in. by 5¼in., and carefully bend it into a tube 5¼in. long by 2⅛in. outside diameter, leaving an inside diameter of 2in. Something which is about 2in. diameter on which to bend the tube will readily be found knocking about the house. A washing stick or rolling pin will just about suit the purpose.

After making the tube, do not stick the edges of it together, but cut another piece of cardboard 1¼in. by 6⅞in., and bend this around the tube to shape it, and then Seccotine or glue it in the position shown in Fig. 2. A piece of wire wrapped around near the top and bottom edges of this piece will keep it in position till set. The next operation is to cut two rings 2⅞in. outside diameter and 2⅛in. inside diameter; slip one of them over the top and one over the bottom of the tube so that they rest, Seccotined, against the edges of the last piece put on, as in Fig. 3.



Figs. 2 and 3.—The method of building up the former.

Two pieces are now cut 1$\frac{11}{16}$in. wide, and these are built on to the tube one at the top, and one at the bottom, flush with the ends. The joints of these should face the same way as the centre piece previously put on, and should be opposite the joint of the tube. A space of ¼in. should now exist between the rings and the pieces just fixed on. Another two 1$\frac{11}{16}$in. pieces are now cut and put on at top and bottom of the tube as before, but with the joints the opposite way round; again, two 1$\frac{11}{16}$in. pieces are cut and put on in a similar manner to the last two pieces, the joints again being put opposite. The former should now appear as shown in Fig. 4, having the dimensions indicated.

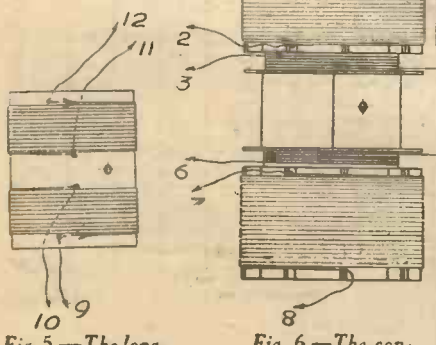


Fig. 5.—The long-wave coil.

Fig. 6.—The connections.

Now cut a few lengths of card, of such a width that when stood on edge along the biggest diameters of the formers and running parallel with the centre of the tube, they will be level with the top of the rings already in position; this width will be about ¼in., according to the thickness of cardboard and the amount of adhesive used in the previous operations. The strips are now cut into eighteen pieces 1$\frac{11}{16}$in. long and fixed with adhesive, nine at the top of the former, the ends being level with the top of the former, and nine at the bottom, the ends again being made flush. All these pieces are to be equally spaced around the larger diameters of the former as shown at Fig. 4. Do not cut these pieces with scissors or they will bend in cutting, in fact a sharp knife and the use of a straight edge is the way that all the cardboard should be cut, if flat edges and straight lines are to result.

The formers are completed by making a tube 2¼in. long by 1$\frac{11}{16}$in. outside diameter, from a piece of board 2¼in. by 6in., Seccotined along the joint and kept in position until set, by pieces of wire; any surplus adhesive showing on the outside of the tube after setting should be removed with sandpaper. The formers can now be well coated with shellac varnish, but, should it be the constructor's idea to use cotton-covered wire to wind them, this operation can be deferred until after winding the coils, when the wound formers can be rotated in a shallow bath of shellac varnish and completely saturated, after which a good baking (not burning) in an oven will result in a very highly efficient set of low-loss band-pass coils.

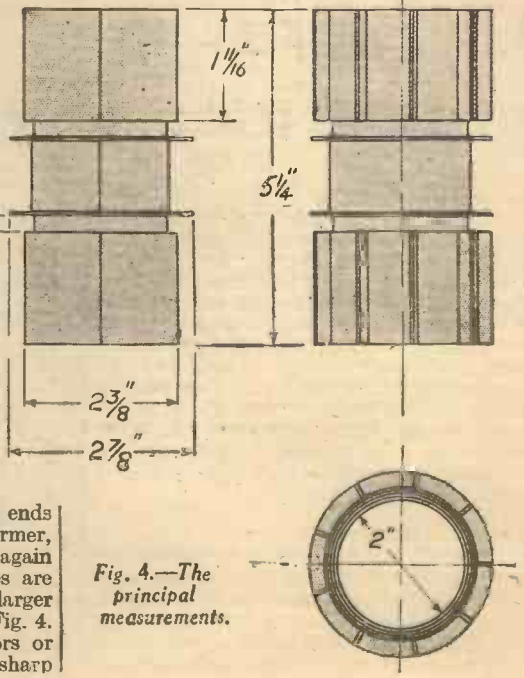


Fig. 4.—The principal measurements.

Winding the Coils

Winding the coils by hand is not difficult, and a start on this part of the job is made by first piercing an anchoring hole ⅛in. from the ring end of a rib at each end of the large former. These anchoring holes, by the way, should be made near to where the ribs are fixed on to the former so that the tension exerted in winding the wire will not pull the rib over. After threading the wire through one of the holes to the length of 6in. or so, make a half-hitch to fix it, then, in the direction indicated in Fig. 5, wind on 38 turns of 26 or 28 D.S.C. or D.C.C. wire. Before going further, it is advisable to point out that D.S.C. wire is to be preferred on account of the silk having greater resisting powers to the absorption of

(Continued on page 186.)

(*Continued from page 184.*)

moisture. Keep the wiring close and uniform, finishing off by making another anchoring hole and passing through about 6in. of wire and half-hitching it as before. The other end of the former is wound with the same gauge wire, having exactly the same number of turns, and is wound in the direction shown in Fig 5. This completes the medium-wave sections.

The Long-wave Section

The long waves are catered for by winding on 130 turns of 34 gauge D.S.C. or D.C.C. wire in each of the slots or grooves at the bottom of each section of the medium-wave windings, and in the direction shown in Fig. 5.

Anchor the ends in any convenient manner, again leaving 6in. or 7in. at beginning and ends of both windings. A start is now made on the small tube, and two separate coils of 36-gauge wire, one of 50 turns and one of 70 turns, are wound on it, each commencing 1in. from opposite ends of the tube and in the direction shown in Fig. 6, leaving about 8in. or 10in. of wire at the beginning and end of each winding.

After completing the winding of the short tube, a central hole is made through it, then a corresponding hole is made through the centre of the large former, and, after carefully sliding the small tube into position inside the large former, a bolt is pushed through the holes from the inside, and the two formers clamped together by putting a nut on the bolt from the outside and lightly tightening up.

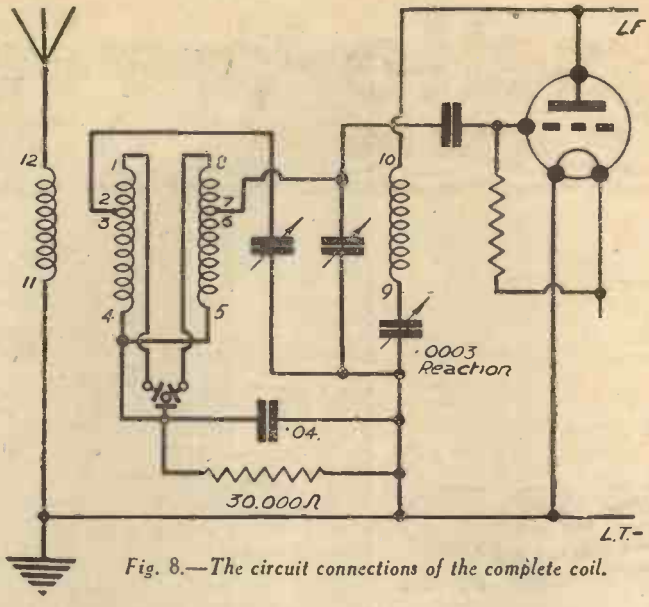


Fig. 8.—The circuit connections of the complete coil.

Fig. 7 shows the coils connected in a detector band-pass circuit, and it will be noted that the wires numbered 2 and 3 are twisted, or soldered, together, so are 4 and 5, and also 6 and 7. That is, we now have only five ends of wire on the large former instead of the eight as shown at Fig. 5. Plenty of room has been left between the ribs for terminals to be inserted, either at the top or bottom, or both, but of course the small former must be fixed in position before any terminals are thought of. A thin ebonite or fibre base can be fixed on the bottom with a 3-point switch mounted in the centre, and this would make the coils panel mounting. However, these and other refinements are left to the discretion and ingenuity of the constructor, as all the wire ends can be taken direct to their respective positions as shown in Fig. 7.

With regard to Figs. 5 and 6, the coils are shown here in the position that the small former will occupy when placed inside the large former, that is, the reaction coil of 70 turns will be towards the bottom, the other or top coil of 50 turns is the aerial coupling coil. After trying the coils out, connected as shown, a reversal of the aerial coil connections can be tried, leaving it connected in whichever way the constructor thinks he gets the best results.

Ganged condensers of .0005 capacities are ideal for tuning these coils, thus providing a one knob tuning arrangement, but of course two separate .0005 condensers can be used if desired.

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the on-off switch and reaction control in a single instrument. The constructional work involved is particularly straightforward, and can successfully be tackled by the veriest novice. One large baseboard accommodates both the receiver and power supply units, so that wiring between the two is easy and direct. It might be thought by some that this form of construction is somewhat out-of-date, but it has been followed with the idea of attaining utmost simplicity, combined with maximum efficiency.

"Quality" and "Punch."

Quality of reproduction is particularly good and will meet with the approval of the most fastidious music lover. This has been ensured by employing a sound circuit design and also by the efficient loud-speaker "baffle" provided by the comparatively large and rigid cabinet. At the same time an ample volume is available, since the maximum undistorted output is in the region of 1,250 milliwatts. Actually an output of this order can easily be obtained from gramophone records with the volume control a little more than "half-on." The same power can be obtained on "radio" when the set is used within ten miles or so of a B.B.C. transmitter, but even at a hundred miles the volume is more than ample for a very large room.

The Circuit.

Having run over the main features it it will be interesting to study the circuit diagram shown in Fig. 1. The dual range tuner has a tapped aperiodic aerial winding, so that by connecting the aerial to any one of four tappings selectivity can be varied over wide limits. Instead of using an external aerial the mains leads can be employed as a source of pick-up by connecting the aerial terminal, through a .0005 mfd. fixed condenser, to one side of

THE A.C. SELECTONE RADIOGRAM TWO

(*Continued from page 183.*)

the A.C. supply. The first valve is a detector working on the leaky grid principle, and provision is made for connecting a pick-up in its grid circuit as required. The wiring is so arranged that when the pick-up is brought into action a suitable bias voltage is automatically applied to the detector valve by the voltage drop across a 1,000 ohm resistance connected in its cathode lead.

Reaction is controlled in a rather unusual manner by means of a 20,000 ohm variable resistance connected between the anode of the detector valve and the reaction coil, a .0001 mfd. fixed condenser being inserted in the reaction lead to prevent a short circuit of the high tension supply. A tone control transformer feeds the audio frequency output from the detector to a three-electrode power output valve. The grid circuit of the latter is decoupled by means of a 100,000 ohm resistance connected between terminal G.B. on the transformer and earth. Grid bias is obtained automatically across a 250 ohm fixed resistance.

The power supply circuit is arranged on conventional lines, a metal rectifier being connected on the full wave principle to convert the A.C. to direct current. The smoothing system consists of a suitable choke and a pair of 4 mfd. condensers, whilst H.T. is fed to the detector valve through a 50,000 ohm. resistance. A .5 amp. fuse included in the mains lead safeguards against damage in case of an accidental short circuit. The mains Q.M.B. switch is ganged with the reaction control resistance.

The Components

A full list of the necessary components is given elsewhere, and I would add the customary warning that this should be duplicated exactly if maximum efficiency is to be obtained. I would further point out that the parts have been chosen with care, not only in regard to their suitability for the circuit, but also bearing in mind their cost. It is especially important that the types of condenser are as specified, since, if they were of lower working voltage, there would be a serious danger of their breaking down whilst in use. Incidentally, condensers used in any A.C. mains receiver should always have a peak working voltage of at least twice the maximum supplied by the rectifier under normal conditions of operation. The mains transformer is of a new pattern which has recently been brought on to the market, and consequently, constructors should see they are not supplied with one of the old type when obtaining the parts from a local dealer. The mains switch which is ganged with the reaction potentiometer may be obtained with either soldering tag, or terminal contacts; the choice will depend upon your own ideas and inclinations in regard to soldering.

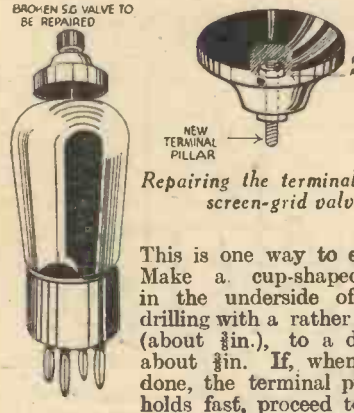
As a space of only 7in. is available for the loud-speaker it is essential that the unit specified should be obtained, unless some modification is made to the set. When a slightly larger unit is on hand it might be possible to accommodate it by reducing the panel height to 6in.; in any case the question of space should be borne in mind. Little need be said of the other components, except that they are all standard models which are readily available!

Next week I shall give full constructional details, so you may order the components now in readiness.

THE HALF-GUINEA PAGE — Radio Wrinkles FROM READERS

Fixing Terminal Tops to S.G. Valves

MANY readers probably have on hand an S.G. valve from which the top has been accidentally screwed off. To make a serviceable repair is not such a formidable job as one would at first think.

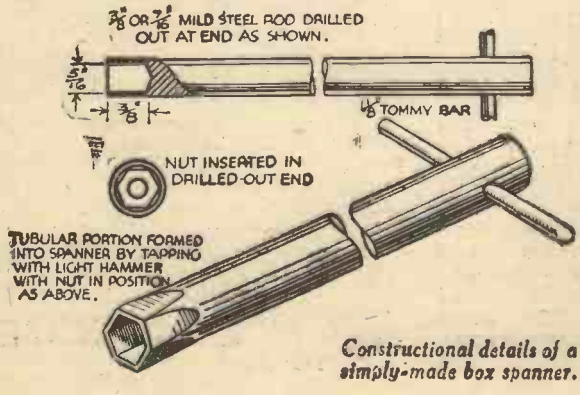


Repairing the terminal top of a screen-grid valve.

This is one way to effect it: Make a cup-shaped recess in the underside of top by drilling with a rather large bit (about ⅜in.), to a depth of about ⅜in. If, when this is done, the terminal pillar still holds fast, proceed to cement that part of the top which contacts with glass of bulb with either celluloid cement or white wax. Now, holding the top—carefully gripped upside down in a vice—perfectly upright, fill the recess to its utmost capacity with mercury, and replace bulb in as near its original position as possible. If sufficient mercury has been put in the glass bulb it will displace the superfluous quantity when pressure is made on it. This will ensure a perfect metallic connection between terminal pillar and the broken wire protruding from glass. Should the terminal pillar be damaged or slack, obtain a short length of threaded rod and place through the top, securing with a nut on either side, as shown in the illustration. Celluloid cement can be made by dissolving some clippings of celluloid in amyl acetate. If white wax is used, the whole job will require warming when making the final fixing. This method has been adopted with success when the wire of the bulb was broken flush with glass.—R. E. BEALL (Plymouth).

Making a Box Spanner

A HANDY box spanner to reach awkward corners, or places where terminals are close together, can be made by drilling a hole $\frac{7}{16}$in. diameter, in a piece of ⅜in. or $\frac{7}{16}$in. round mild or silver steel, or just large enough to take a terminal nut, and about ⅜in. deep. Put the nut in the edge of the hole and, with a light hammer, tap the steel rod on the flats of the nut, thus closing the metal in and forming a hexagonal opening. An ⅛in. hole drilled through the other end of the rod will accommodate a handle, as shown in the sketch. Where nuts are close to the side of components file off two sides, thus forming a kind of "claw foot" spanner.—T. URWIN (Monkseaton).



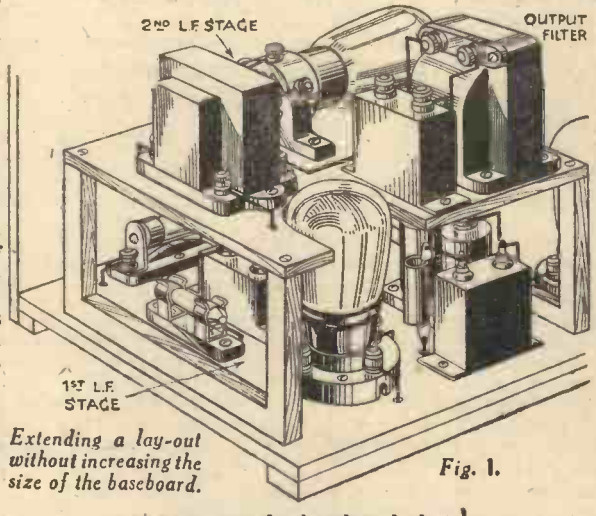
Constructional details of a simply-made box spanner.

THAT DODGE OF YOURS!

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

Mounting Additional Components

SOMETIMES at the L.F. end of a set it is desired to fit a filter or add an extra stage. It may be that there is no room on the baseboard, but this can easily be overcome by placing the additional components on a raised platform in the manner shown in the accompanying sketch. Valves can be mounted horizontally so that they will not project above the panel. First get two pieces of plywood, about 8in. by 3⅜in., and cut them to the shape shown in Fig. 2. The platform, which measures 8in. by 6in., can also be cut from a piece of plywood. The platform is screwed to the upturned ends of the brackets, which in turn are screwed down on the baseboard. Part of the platform can be cut away to clear a valve underneath, if necessary.—G. D. BRUCE (Edinburgh).

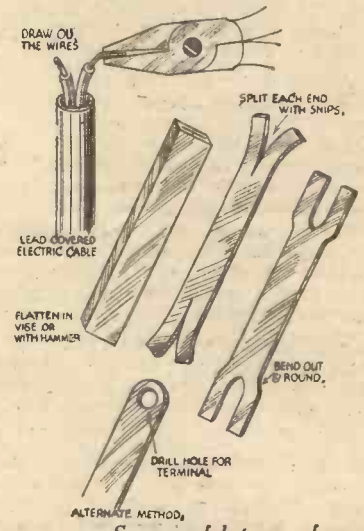


Extending a lay-out without increasing the size of the baseboard.

Fig. 1.

Useful Accumulator Connectors

THE lead covering on ordinary household electric cable is very convenient for making strip connectors or terminal lug extensions for accumulators. These can be made quite easily by flattening the lead covering after first removing the twin wires as shown in the illustration, then snipping off to the required length. Cut down the centre of each end for about 1in. and then bend round, as shown. The ends can of course be drilled, provided the terminal is not of too great a diameter. A word of warning might be in order here as to connecting up accumulators. These, unless of the same make and capacity, should not be joined up in *parallel*.—R. GRAPER (St. Albans).



Some useful types of accumulator connectors.

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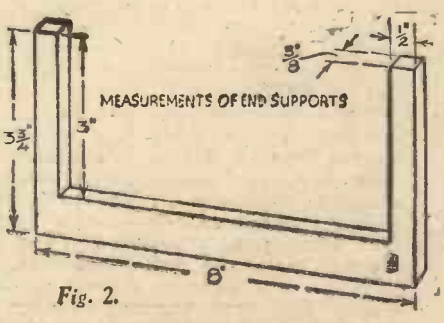
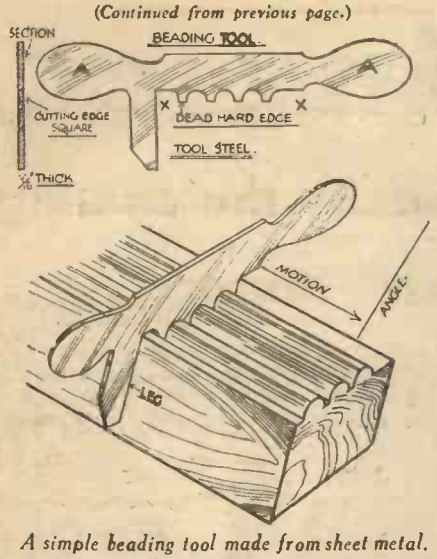


Fig. 2.

Details of the supports for the baseboard.

(Continued from previous page.)



A simple beading tool made from sheet metal.

A Handy Beading Tool

THIS simple tool will be found very useful for making beadings, as shown in the illustration. It can be filed to shape out of $\frac{1}{16}$ in. tool-steel or mild steel, case-hardened. The edges for cutting should be left square and then the scraper can be used in both directions. The bead produced, if started gently until a groove is formed, is equal to any produced by machine. The tool is held in the fingers at A—A, pressing the leg to side of the wood. Depth is regulated by X—X, and the bead is left smooth when finished, requiring no sandpapering whatever.—G. W. BARRATT (Whetstone).

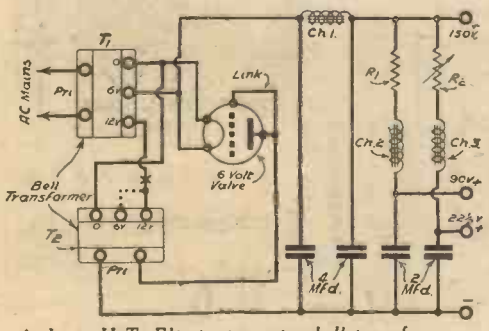
A Cheap Eliminator

SOME experimenters may not be aware of the fact that a very simple H.T. eliminator may be constructed at very little cost by the use of a couple of ordinary bell transformers, as shown in the accompanying illustration. These should be of a type which delivers 12 v. at two of its terminals, with a third connection at 6 v. The plate current requirements of a small receiver will be met if an ordinary 6 v. detector valve is used as a rectifier; its plate and grid being linked together, as shown. The output voltage for the output valve is the direct connection marked 150 v. plus; two additional, lower potential leads may be obtained through the use of a fixed resistor of about 15,000 ohms at R1 to deliver about 90 v., and resistor R2, variable between 0 and 5 meg., may be used to adjust the detector plate potential to exactly the correct voltage.

As illustrated, the choke coil shown may be the secondary winding of a "Ford" spark coil; the fixed condensers from these coils may be connected in parallel to form the required filter capacity shown by the 4 and 2 mfd. condensers.

Tracing through this circuit, we find that the main supply fed into the primary of transformer T1 is stepped down; 6 volts output from part of the secondary drops to a little over 5 v. when it is applied to the filament of valve.

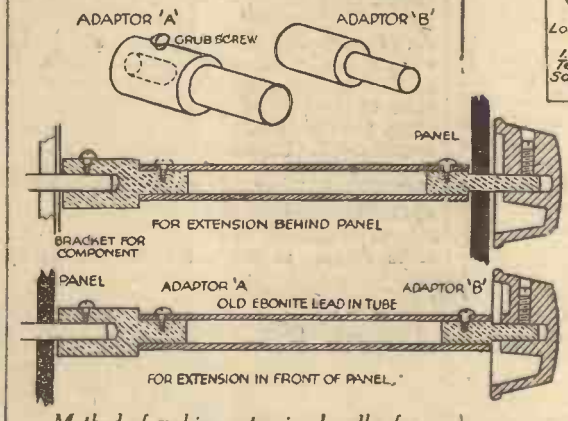
The 12 v. output of this secondary may be connected as shown by the solid lines, resulting in output voltages not exceeding the line potential; by connecting transformer T2, as shown by the dotted line, breaking the 12 v. lead at X, the output voltage may be doubled at a sacrifice in output current.—F. R. (Manchester).



A cheap H.T. Eliminator using bell transformers.

Extending Condenser Spindles

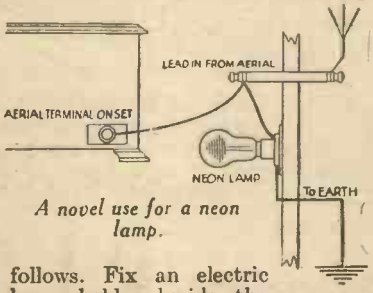
IN some short-wave sets, and especially in adaptors, where hand capacity gives trouble, it is not always possible to mount the condensers back from the panel, owing to the proximity of coils, valves, etc. The diagrams show how extension handles may be made from old discarded lead-in tubes about 6in. long. They are quite efficient, and cost very little. The two adaptors A and B are cut from wood, and are quite simply made. Care must, of course, be taken to keep the two sections and the spindle hole concentric, and the wood chosen must be capable of being bored easily, and taking a screw through a small thickness without splitting. The two holes in the ebonite tube may be burnt out with a hot bradawl.—R. NYE (Southampton).



Method of making extension handles for condensers in S.W. sets.

Novel Lightning Arrester

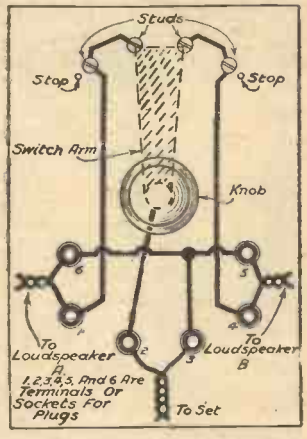
A NOVEL lightning arrester which not only protects the set but indicates the approach of thunderstorms some distance away can easily be rigged up as follows. Fix an electric lamp holder beside the aerial lead-in tube and connect up as illustrated. One terminal of the holder is joined to the aerial and the other is earthed. Insert a standard 240–260-volt neon lamp into the holder; most electrical dealers can supply these for about 3s. each. When a thunderstorm draws near the neighbourhood the lamp will indicate the fact by emitting dull red flashes corresponding to each flash of lightning. This is due to the aerial receiving oscillatory waves which are radiated by the lightning. The lamp will also glow if charged raindrops strike the aerial. Should a storm break overhead and the aerial be struck by lightning, the current, like the oscillatory waves, will pass between the electrodes of the lamp and direct to earth, this being the shortest path.—J. K. HOLMES (Gosforth).



A novel use for a neon lamp.

Switch for Two Loud-speakers

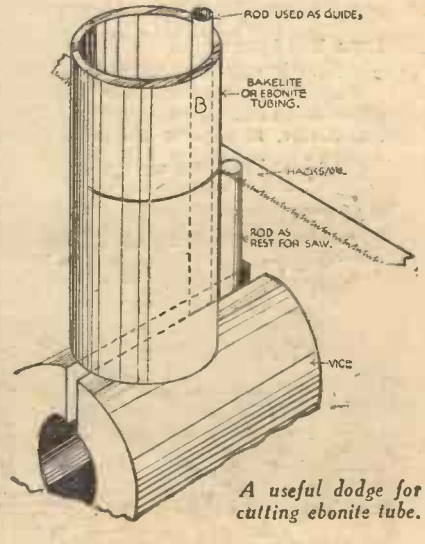
A LOUD-SPEAKER switch for one or two speakers, either single or coupled, can easily be made as shown in the accompanying sketch. The parts required, which are usually to be found in the scrap-box, consist of a piece of ebonite, 4 studs, 2 stops, and a switch arm from an old crystal set, together with terminals or banana plugs and sockets.—D. C. TOY (Ickenham).



A switching arrangement for two loud-speakers.

Cutting Ebonite Tubing

HERE is a simple dodge for cutting ebonite tubing squarely. A metal rod, B, is held firmly in the vice, and is used as a guide for the tubing, while another rod, on which the saw rests, can be adjusted to the length of tubing to be cut off.—A. G. PEACOCK (Southbourne).



A useful dodge for cutting ebonite tube.

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(2) prevents grid current distortion by employing a low resistance secondary.

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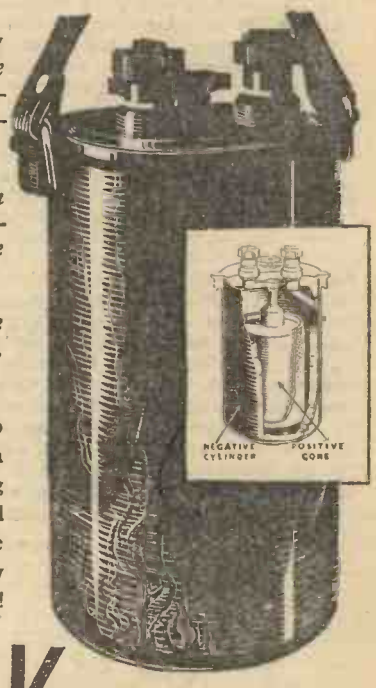

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About the Double-Diode-Triode

The Latest Development in Detection

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

THE first essential in a detector valve is that it should be a good detector. This sounds a very obvious statement, but it is a fact which is very often lost sight of because we have become so accustomed to the three electrode detector valve, which does other things besides detecting, that we are rather apt to neglect the detecting action proper.

In essence, the process of detection is simply that of half-wave rectification. Let me explain. Fig. 1 is the familiar representation of a modulated radio signal. The little waves vibrate at radio frequency—some hundreds of thousands or even several millions of times a second—and it is the *variations in strength*, as shown by the varying height of the waves, which constitutes the audio frequency signal. Now the "positive" and "negative" half waves follow each other so rapidly that, from the mechanical point of view they cancel each other out, so that, were they applied directly to a pair of telephones, the nett effect on the diaphragm would be nil, and no sound would be forthcoming.

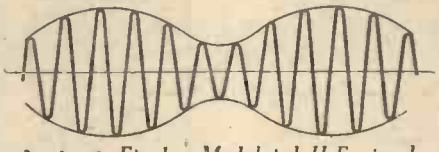


Fig. 1.—Modulated H.F. signal.

Suppressing the Negative Half Cycles

If, however, we apply the incoming signal to a device which allows current to pass in one direction but not in the reverse direction (see Fig. 2) the "negative" half cycles will be suppressed, and the so-called "rectified" signal will then appear as shown in Fig. 3. The signal is now in a form suitable to operate a telephone instrument or, after further amplification, a loud-speaker.

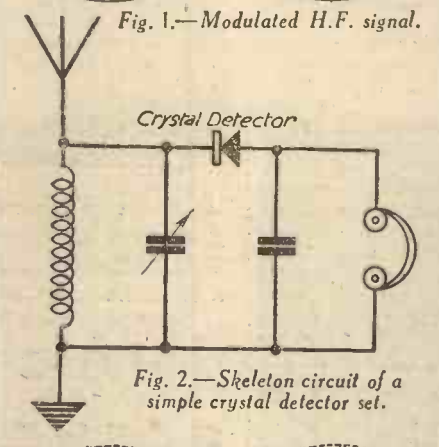


Fig. 2.—Skeleton circuit of a simple crystal detector set.

Fig. 3.—The result of half-wave rectification—the "negative" half-cycles have been suppressed.

It is just that phrase, "further amplification" which makes efficient detection so difficult. The original Fleming two electrode valve, and the crystal detector, are purely half-wave rectifiers, and give no amplification whatsoever. Under the most favourable conditions, the output of such a detector can only operate headphones, and that only on fairly strong signals. Moreover, this output generally is not sufficient to operate a power valve or pentode, so that if a loud-speaker is required to be used, two low frequency amplifying valves must be employed.

When the three electrode valve was developed, it was found possible to employ it in such a way that it acted both as a detector and as an amplifier at the same time. Two methods are available. In the anode bend detector the valve is biased to the bottom bend of its characteristic. It amplifies the positive half-waves of the high frequency signal fully, but the negative half-waves are amplified very little. The valve thus acts as a high frequency amplifier and detector combined.

Alternatively, in the leaky grid detector, the grid and filament act as a half-wave rectifier, suppressing or partially suppressing one half of each signal wave, after which all three electrodes come into play to amplify the signal at audio frequency.

Not Perfect

Although this sounds very satisfactory and efficient, it must be admitted that the arrangement is not perfect. Neither arrangement gives 100 per cent. rectification, so that the result is something less than perfect undistorted reproduction. The reason, of course, is that the conditions for good amplification are not ideal for perfect rectification. It is true that in a well designed wireless receiver, carefully adjusted as to operating conditions, detection with a three electrode valve can reach a high standard of excellence, but it is equally true that in many sets, more care has been taken to obtain a big degree of amplification in the detector stage than in ensuring distortionless rectification. Recently more attention has been paid to detection proper. Owing to the increased sensitivity of modern valves, a high degree of amplification in the detector stage is not quite so vitally important, and in a certain number of sets the designer has referred to the "diode" or two electrode valve as detector. Fig. 4 shows this principle. The "anode" of the diode rectifier may be, and usually is, the grid of a normal three electrode valve, the anode of which is not used in this circuit. (Then again we have the recently developed Westector unit whose action I have recently described in the columns of this paper).

A diode valve is merely a rectifier, and if it is employed, all amplification in a receiver must be obtained from high frequency and low frequency stages. For greater efficiency, two diodes are sometimes used to give a species of push-pull detection. The principle of full-wave detection can be seen from Fig. 5.

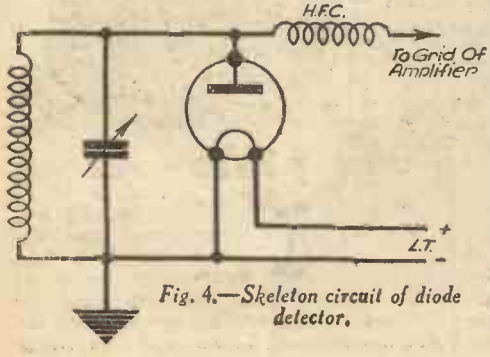


Fig. 4.—Skeleton circuit of diode detector.

Saving Space and Cost

But diode rectification, although giving wonderful freedom from distortion, does necessitate the use of an additional stage of low frequency amplification. This means, in the usual way, an additional valve and associated circuits, and results in increased low tension current consumption, and extra baseboard space, all of which cost money. What is required, therefore, is a method of combining diode detection with low frequency amplification in one valve, thus saving space and cost, and at the same time it is desirable to avoid the unsatisfactory features of the three electrode detector in which one set of electrodes have to serve the dual purposes of detection and amplification. For it is due to this double use of one set of electrodes—this compromise between two sets of conflicting conditions, that the triode detector just falls short of perfection.

The solution of the problem has now been found and will, before very long, be available to listeners generally. Valve designers have now succeeded in developing a valve which combines in one bulb one or two diode elements for detection, and also either a triode or tetrode (four electrode valve) for use as a low frequency amplifier. Not only this, but the two parts, although enclosed within one bulb, act entirely separately, so that working conditions for each part can be adjusted independently so as to ensure the highest efficiency for both functions.

Valve Details

So far, British valve manufacturers in general have not made known *full* details of their programmes with regard to these new valves, but it is probable that indirectly heated valves for use on A.C. electric

(Continued on page 207.)

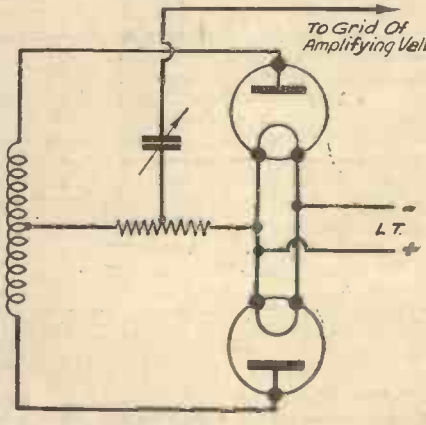
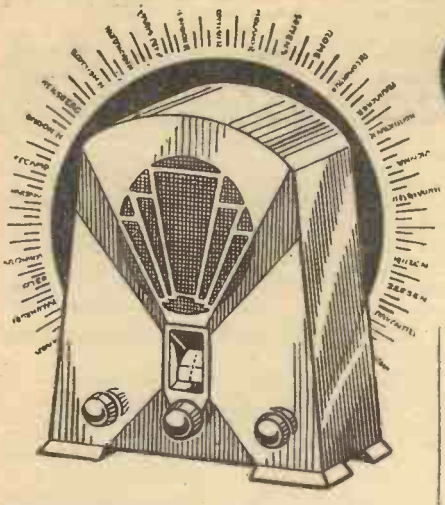


Fig. 5.—Push-pull diode detection. Instead of two diodes two triodes may be used, their grids being employed as the diode anodes and their anodes left disconnected.



OUR VIEWS ON RECEIVERS

THE LISSEN A.C. SKYSCRAPER

THE original Lissen Skyscraper is too well known to need any reference in these pages, and this receiver has now made its appearance in an all-electric form under the title of the A.C. Skyscraper. This is an all-mains (A.C.) receiver with the mains portion of the set separately contained in a metal box. It is put up in two cartons, one of which contains all the parts for building the receiver, with the addition of the four valves, each separately boxed. The second carton contains the complete mains unit, which you do not have to assemble. This method of separating the parts ensures that no damage will be done to some of the more delicate parts of the complete apparatus. To prevent some of the smaller parts from being lost or mislaid when unpacking the carton, some are fastened to a card, whilst others are enclosed in six separate envelopes. This shows a certain amount of care in putting up this attractive kit and gives no cause for complaint from the customer.

The Circuit

The circuit consists of a variable-mu screen-grid stage followed by a power detector which is in turn transformer-coupled to a pentode valve. The first two valves are of the indirectly-heated type, and the pentode is directly heated. A biasing resistance is included in the cathode lead of the detector valve and comes into operation when the gramophone pick-up is inserted in the sockets provided at the rear of the chassis. The standard Lissen screened dual-wave coils are used with a substantial two-gang condenser for tuning. This is provided with a concentric trimmer. The coupling between S.G. and detector valves is of the parallel-fed tuned anode arrangement with capacity-controlled reaction. To prevent parasitic oscillation in the output valve a resistance of 100,000 ohms is inserted in series with the grid lead. Three alternative aerial connections are provided, two being *via* small fixed condensers and one direct to the aperiodic aerial coil. In addition a plug is fitted to enable a mains aerial device to be employed.

Assembling the Kit

The Kit is extremely simple to assemble, the large chart which is supplied having very complete instructions tabulated into a number of Steps. Thus under Step 1 you are told how to assemble the metal chassis and mount the condensers, etc. In Step 2 you are instructed how to assemble the components on the upper side of the base and so on. In this way, and

with the special connecting wires supplied, it does not take long to make up the receiver. The mains unit is bolted to the chassis after the principal assembly is completed. An interesting point in the wiring is that you are told how long to cut the wires, and a rule is printed on one edge of the chart. It would appear, therefore, that everything has been thought of to assist the constructor in putting this receiver together in the easiest and most efficient manner possible.

Results

The receiver is remarkably efficient, and if you had any experience with the original Skyscraper (battery version) you will have some idea of what to expect in a mains operated version of the set. The sensitivity of the H.F. stage is very high indeed and stations simply roll in. The quality, due to the power rectifier, is very good, and is characterized by that crispness and good response to transients. The output from the pentode is ample and when used with a moving coil loud-speaker, correctly matched, the tone of reproduction is very good indeed. The number of stations which can be received on the receiver will, of course, depend on the locality, but with the mains aerial in use, in the heart of London a dozen stations could be easily tuned in at really good loud-speaker strength. When used with an outdoor aerial the range is vastly increased, and there are many stations to chose from. When used with a gramophone pick-up the reproduction is also of a high order, the detector valve having very good characteristics as an L.F. valve. It was found with the particular pick-up which we used, that a volume control was necessary across the pick-up input, and this fact is mentioned in the Lissen chart. The price of the Kit, with 4 valves is £7 19s. 6d. With table cabinet the price is £8 15s. For those who require a complete outfit, a consolette cabinet, with permanent magnet loud-speaker is obtainable, and this, with the complete kit costs £10 12s. 6d.

Special Features

It is always interesting to examine these commercial kits for points of interest and there are one or two small features included in the Skyscraper which we should like to mention before concluding. Firstly, the particular form of automatic volume and reaction control. This consists of a bakelite moulding carrying a circular resistance on one edge. Mounted on a central point is a small variable condenser of the bakelite dielectric type. Rotation of the control knob varies the setting of the reaction vanes as well as adjusting the grid bias on the screen-grid valve. Consequently as the sensitivity of the H.F. stage is reduced, the sensitivity of the detector stage is increased and this results in a very fine form of control over both volume and selectivity. A further interesting feature is the inclusion of a special fused combination outputplug from the

mains unit. This is of bakelite and in each lead from the mains unit is a fuse forming the connection from wire to pin. The two wires are enclosed in a single rubber covering and the plug has the usual 5-amp. wall socket pins

Building "A.C.T

Complete Constructional Details Receiver which was Introduced L

Compact, quickly assembled, and cheap—a star performer.

I SINCERELY hope that the preliminary notes which I gave you last week filled you with ambition to build this interesting two-valve set. I am certain there are hundreds of readers who will find that this receiver fills a long felt want. I will not go over again the essentials of the circuit, but will start right away on the instructions for building the set, a task which, while not difficult, is a little more complicated than the ordinary type of receiver. But as the finished product will bear the hall-mark of the factory-built receiver, this extra work will be well justified. Well then, the first operation is to purchase the cabinet, and this will be fitted with the side rails to take the shelf and the main baseboard. It will be noticed, by the way, that there are actually two baseboards, one which I will call the main base, upon which the principal parts of the receiver proper are accommodated, and the second, which is the upper shelf, upon which the mains portion of the set is built. As with all PRACTICAL WIRELESS receivers, the sub-baseboard of mounting is employed, and this is a most valuable feature as it enables the component parts of the receiver to be divided into two parts with wiring also split up. If you have never built a receiver on this principle you will find that it is a novel idea which greatly simplifies the wiring. The hole for the escutcheon will also be cut out of the front.

Commencing Construction

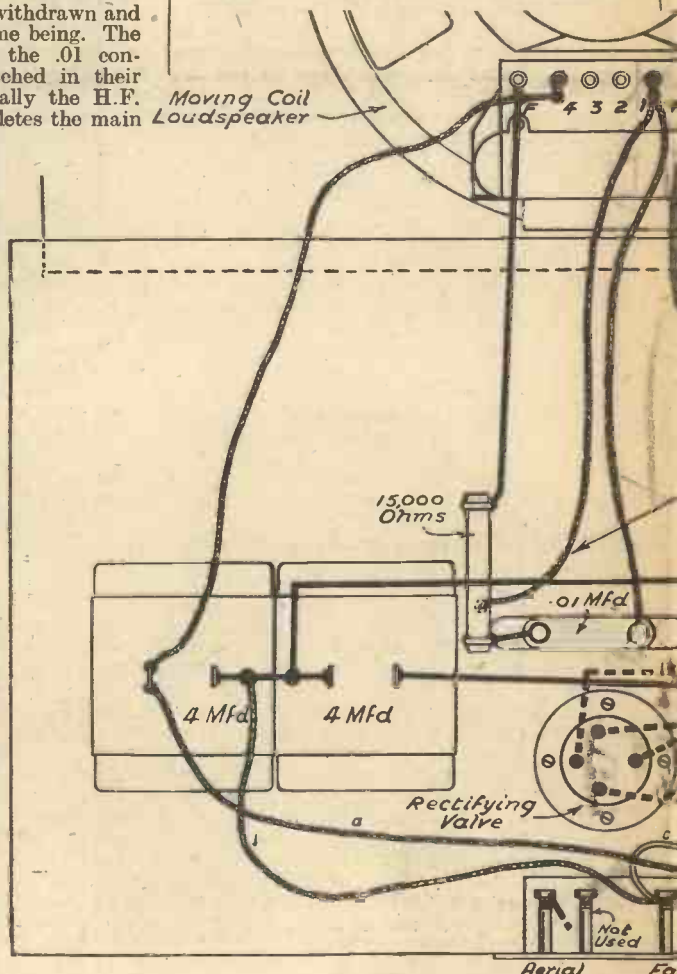
First of all, take the main baseboard and rule a line across the centre so that you can correctly position the Polar gang condenser. With the template which is supplied with this component, mark *very carefully* the position of the screw holes. If this condenser is mounted even slightly out of line the control knob will be found to set awkwardly outside the cabinet and the ivorine scale will not fit neatly behind the window of the escutcheon. Next mark out the positions for the valve-holders and the small cut-out on the right of the baseboard to accommodate the various leads. Next take the upper shelf and mark the position of the valve (on the centre line), and also the cut-out on the right, which is similar to that on the main base. If you wish to use a light behind the dial (a feature which I would definitely advise you to do), you will have to cut out a small section from the edge of the upper shelf to clear the bulb and its holder. This latter is held in position by the escutcheon bolts. A further piece is cut from the rear of the upper shelf to clear the small Clix socket mount. The holes for the valve-holders are 1in. clearance. Three holes will be found on the side of the cabinet, and these are for the on-off switch, the reaction condenser, and the wave-change switch.

Mounting the Components

With the wiring diagram of the underside of the main base before you (or the full-size blue print, which is obtainable for 1s.), carefully position the fixed condensers and the L.F. transformer. Now turn the base over and screw on the two valve-holders and the gang condenser. Measure a line 1½in. from the right hand side of the base, and with the switch rod on the centre line fit the Lewcos coil. The switch rod may then be withdrawn and placed on one side for the time being. The .0001 fixed condenser, and the .01 condenser should then be attached in their respective positions, and finally the H.F. and L.F. chokes. This completes the main base, and you may proceed to the upper shelf. The first part to attach here is the aerial and earth strip, and this is simply held in position with small wood screws. The two 4 mfd. condensers are next fitted, after which the .01 condenser should be attached close to the valve-holder. Fit the valve-holder, and then place the mains transformer on the right. The Bulgin mains plug and its mounting is the final component to be fitted to the shelf, and you can therefore attach the on-off switch and the reaction condenser to the side of the cabinet.

The Wiring

The constructional work so far carried out will have been found extremely simple, and the wiring, whilst not difficult, is a little complicated, and the following instructions should therefore be carefully carried out. First of all, attach a short length of Glazite from the terminal marked E on the Lewcos coil to one side of the .01 mfd. condenser, putting one wire of the 10,000 ohm resistor under the terminal head before tightening it up. Attach the other end of the resistor to the other terminal on this condenser, and at the same time connect a length of wire to the terminal and take this down through hole No. 1 in the base and join it to the .001 mfd. fixed condenser on the under-side of the base. From this terminal take a short lead to the nearest terminal of the 1 mfd. fixed condenser, and a further wire to the central terminal of valve-holder V.1. A wire must also be taken from this condenser terminal to terminal H.T. on the L.F. transformer, and this terminal is also joined to the G.B. — terminal on the transformer. From the latter terminal a wire runs to a terminal on the 1 mfd. fixed condenser on the left of the base, and this is in turn joined to the 2 mfd. condenser. A short wire is next attached to the terminal



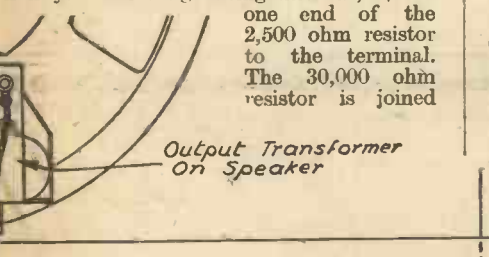
Wiring diagram of the power section of the A

...the ...WIN"

FIRST AGAIN! The First Two-Pentode Receiver

...or Making Up the Ingenious ...ast Week by W. J. DELANEY

on the rear of the gang condenser, and this is passed down through hole No. 4 and joined to the G.B. — terminal on the L.F. transformer. Now join the 400 ohm resistor across the 2 mfd. condenser, and connect the right-hand terminal of this condenser to the central terminal of valve-holder V.2. Two and a half inches of wire will join terminal G of the transformer to the grid terminal of this latter valve-holder, the normal plate terminal of which is joined to the 1 mfd. condenser, which is close handy. Before tightening this nut, attach one end of the 2,500 ohm resistor to the terminal. The 30,000 ohm resistor is joined by one end to terminal H.T. on the transformer, and by the other end to terminal P on the transformer, and a wire from this point is taken to the 1 mfd. condenser which is situated under the L.F. choke. From the other terminal of this condenser, a wire is joined to terminal 4 on the choke, whilst a 12,500 ohm resistor is joined from the same point to the normal plate terminal of valve-holder V.1. Now turn the base over and join terminal 4 of the L.F. choke to the rear terminal of the H.F. choke, and to the remaining terminal on this latter choke attach a 3in. length of flex, a 9in. length of flex and a 4in. length of Glazite. The Glazite is passed down through hole No. 3 and joined to the remaining terminal on the .001 fixed condenser, whilst the short length of flex is bared at its end for subsequent connection to the anode terminal on top of the valve. The longer piece of flex will be attached to the reaction condenser when the base is placed into its position. A similar remark applies to the short length of flex which is attached to terminal R on the Lewcos coil. An inch or so of Glazite is now used to connect together terminals 2 and 3 on the Varley choke, and a short length of wire is joined to terminal 1 on this choke for connection to the free end of the 2,500 ohm resistor. This connection may be made by soldering, or using one of the Erie special connectors.



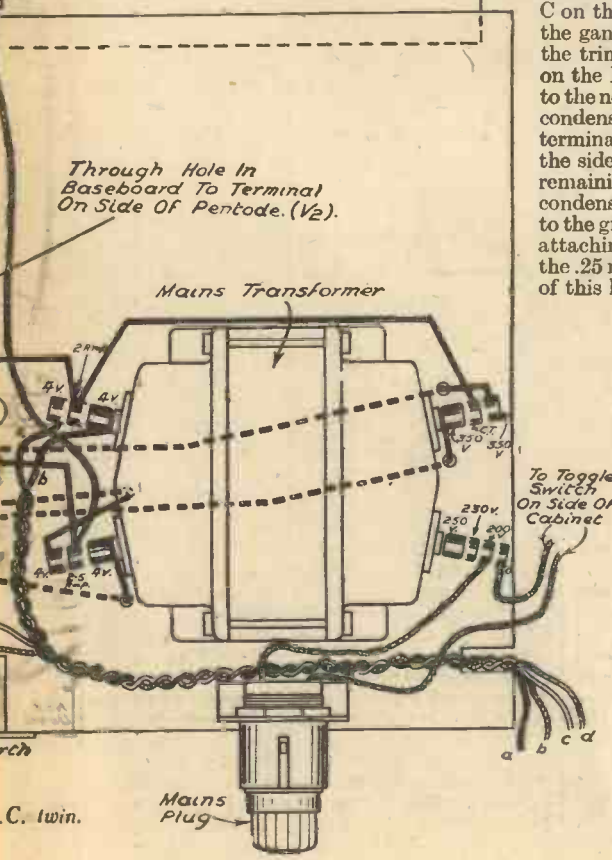
Completing the Wiring

Only one or two wires remain, and the next to attach is that from terminal C on the Lewcos coil to the terminal on the gang condenser which is just below the trimming wheel. From terminal G on the Lewcos coil a wire is taken down to the nearest terminal on the .0001 mfd. condenser, and a further wire joins this terminal to the remaining terminal on the side of the ganged condenser. The remaining terminal on the .0001 fixed condenser is now joined, *via* hole No. 2, to the grid terminal on valve-holder V.1, attaching at the same time one end of the .25 megohm grid leak. The other end of this leak is joined to the terminal of the .001 condenser, which already has two wires on it. Before tightening this up, attach a 2ft. length of flex, and in order to identify this, strip off the cotton covering, so exposing the rubber. Now tighten up the terminal, and this part of the wiring is finished, and the base may be put on one side whilst the shelf is wired up.

The Mains Unit

Join together the two centre terminals of the two 4 mfd. condensers, and attach at the same time a 9in. length of flex and a similar length of Glazite. The flex should be attached to the earth socket on the Clix

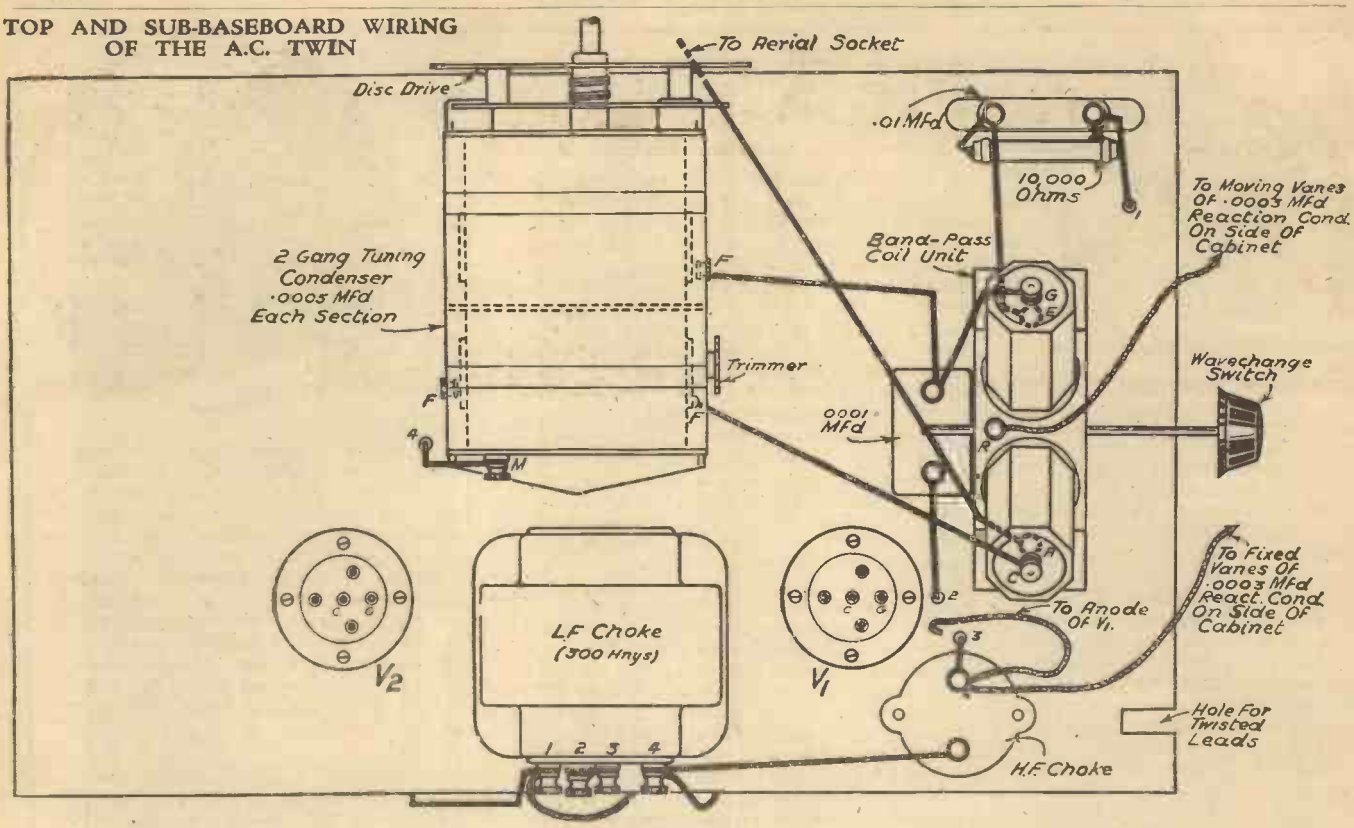
(*Continued overleaf.*)

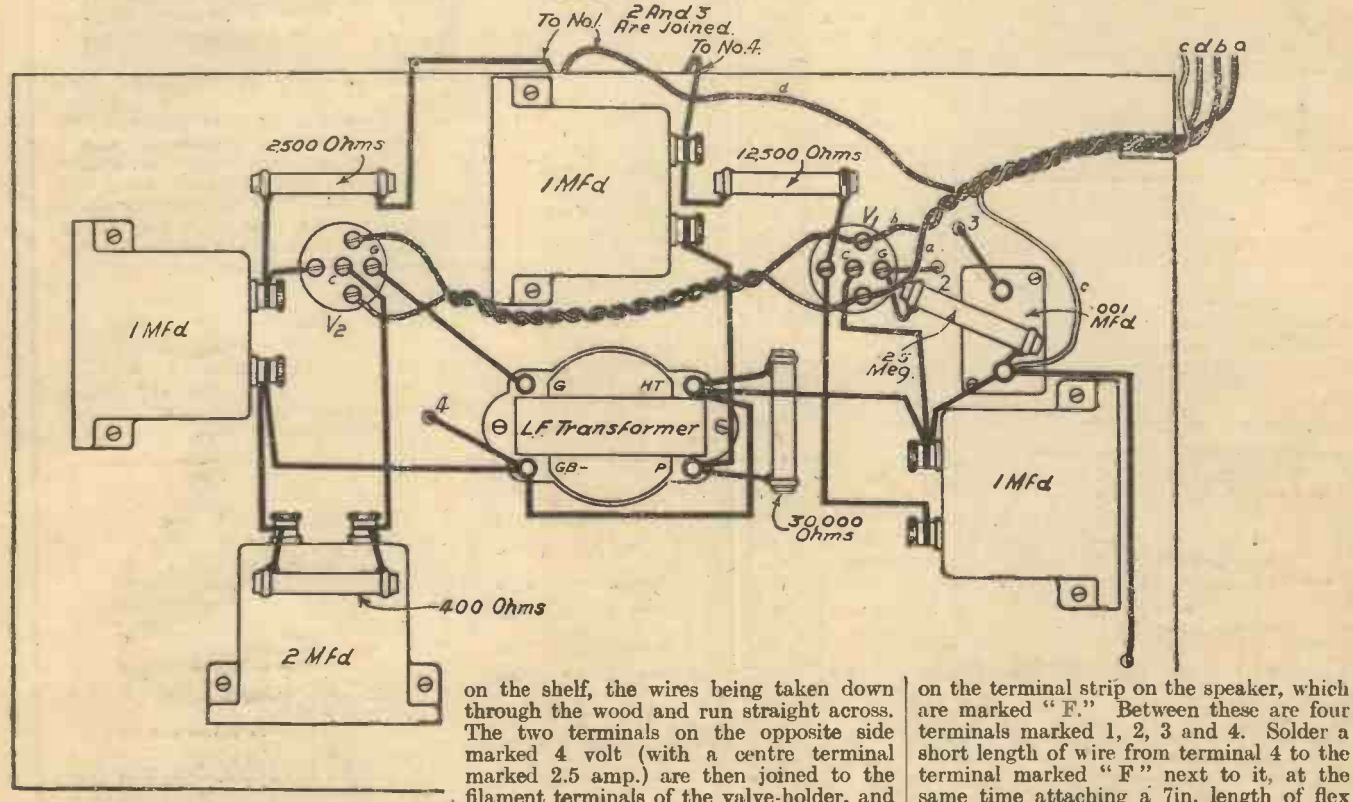


COMPONENTS FOR THE A.C. TWIN

- One Lewcos Band-Pass Filter, Type 51, B.P.F./R.
- One Polar Uniknob 2-Gang Condenser, .0005.
- One Igranic Transformer, Type T/24/B.
- One Lotus .0003 Reaction Condenser.
- One Bulgin Standard H.F. Choke (H.F.9.).
- One Varley 300 Henry L.F. Choke (D.P.16).
- One .0001 fixed Condenser (Type S), T.C.C.
- One .001 fixed Condenser (Type S), T.C.C.
- Two .01 fixed Condensers (Type 34), T.C.C.
- Three 1 mfd. fixed Condensers (Type 50), T.C.C.
- One 2 mfd. fixed Condenser (Type 50), T.C.C.
- Two 4 mfd. fixed Condensers (Type 84), T.C.C.
- Two 5-pin valve-holders (Clix Chassis type).
- One 4-pin valve-holder (Clix Chassis type).
- One ½ megohm Erie Resistor.
- One 12,500 ohm Erie Resistor.
- One 400 ohm Erie Resistor.
- One 2,500 ohm Erie Resistor.
- One 30,000 ohm Erie Resistor.
- One 10,000 ohm Erie Resistor.
- One 15,000 ohm Erie Resistor.
- One Heayberd Mains Transformer (Model A.C. Twin).
- One Grampian Energized Speaker, Type E.1.
- One Bulgin Mains Toggle Switch, Type S.80.
- One Bulgin Small Mains Connector, Type P.21.
- One Clix Terminal Strip.
- Two Clix Wander Plugs (One black and one red).
- One Cossor 442 B.U. Rectifying Valve.
- One Cossor MS-PEN-A (H.F. Pentode Valve).
- One Cossor MP-PEN (Pentode Output Valve).
- One Smith Lyric Cabinet.
- One coil Glazite, 3 yards red and black flex, screws, bulb for panel light, etc.

TOP AND SUB-BASEBOARD WIRING OF THE A.C. TWIN





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strip, whilst the Glazite is joined to the centre terminal of the group of three on the mains transformer marked 4 volts 2 amps. From this latter terminal a wire is run round the transformer and joined to the centre terminal on the opposite side, marked CT. The terminals on each side of this latter, marked 350, are now joined to the normal grid and anode legs of the valve-holder on the shelf, the wires being taken down through the wood and run straight across. The two terminals on the opposite side marked 4 volt (with a centre terminal marked 2.5 amp.) are then joined to the filament terminals of the valve-holder, and the centre terminal joined to the nearest terminal on the 4 mfd. condenser. Two 6in. lengths of flex are now connected to the terminals on the Bulgin mains connector, and the shelf may be placed on one side whilst the loud-speaker is prepared.

As has already been pointed out, the speaker field acts as the smoothing choke for the mains unit, and it will be seen that there are two terminals (one at each end) on the terminal strip on the speaker, which are marked "F." Between these are four terminals marked 1, 2, 3 and 4. Solder a short length of wire from terminal 4 to the terminal marked "F" next to it, at the same time attaching a 7in. length of flex and one end wire of the 15,000 ohm resistor. To terminal 1 attach a 12in. length of flex and a 4in. length, whilst to the remaining "F" terminal a 6in. length of flex should be soldered. Now position the speaker behind the baffle and screw it into place. Fix a 2in. length of flex to one terminal on the on-off switch and attach this to the side of the cabinet. Now attach the ends of a

(Continued on page 201.)

The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

Conducted by F.J. CAMM

THE BEGINNER'S A B C OF WIRELESS TERMS

(Continued from April 15th issue, page 156.)

Coulomb

THE name given to the unit of *quantity* of electricity. It is the amount of electricity conveyed in a second by a current of one ampere. To take an example: suppose the accumulator of a multi-valve set were supplying current to the filaments of the valves at the rate of exactly one ampere as measured by an ammeter connected in the circuit. How many coulombs of electricity would be used in, say, ten minutes? Well, as the rate of flow is one amp., therefore one coulomb must flow every second (See "AMPERE"). Thus, in ten minutes, six hundred would be used. If the current used were half an amp. for five minutes then the quantity of electricity consumed would be half a coulomb every second, that is, one hundred and fifty coulombs in five minutes.

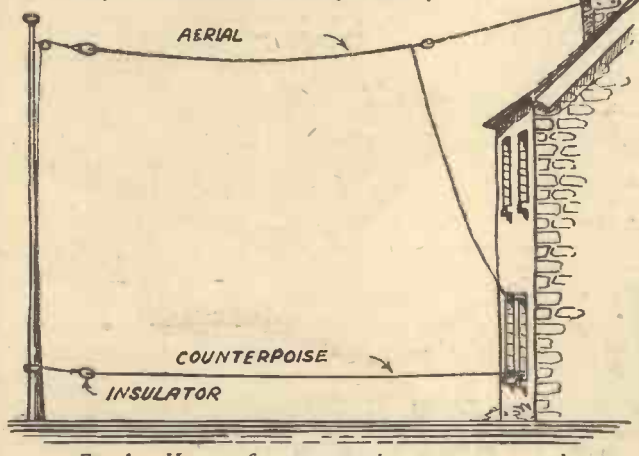

Fig. 1.—How to fix up a simple counterpoise earth.

Counterpoise

A wire or network of wires suspended a foot or so above the ground which is used as the earth connection to a wireless or transmitting station, instead of making direct connection with the earth itself. A proper counterpoise earth is insulated in the same way as the aerial, and is usually placed directly under it. It has certain advantages over the ordinary type of earth connection. For one thing it gives more consistent results and is less affected by the seasons, change in temperature, dampness of soil, etc. It sometimes helps towards the reduction of interference caused by atmospherics. An example of how simple a counterpoise can be fixed up by the amateur is shown in Fig. 1. This arrangement is worth trying where disturbance of reception is caused by near-by electrical machinery. It is insulated in exactly the same manner as the aerial, porcelain insulators and a lead-in tube being used.

A counterpoise is one of many types of what are called *capacity earths*. They depend for their action on the fact that the wires or plates used form, with the earth, a huge condenser. Its capacity being large, it offers a very ready path to the high-frequency currents and is, therefore, as efficient as if actual contact were made with the soil. Some forms of capacity earth, unlike the counterpoise, are not insulated from the ground, so that in wet weather the contact is near enough direct while, in dry weather, they function almost entirely by virtue of the capacity effect. A piece of wire netting spread on the ground is a good example of this type of "earth."

Countersinking

The act of making a conical recess to a screw hole, so that the head of the screw may sink in to the wood, ebonite or other material, and thus lie flush with the surface. Countersinking gives a much better finish to a job than is obtained by just boring a plain hole for the screw. It should always be resorted to when fixing brackets to ebonite panels and such-like jobs. The usual method of carrying out the work is to first drill the hole for the screw and then to countersink it by means of a special countersinking drill or bit. The process is shown in Fig. 2. The inset shows a typical drill used for this purpose, which may be obtained for a few pence. The fixing holes of many components supplied to the constructor are already countersunk but where they are not this should either be done by hand or else roundheaded screws should be used. To screw an ordinary wood screw down really tight into a bakelite flange when the hole is not recessed may split off the flange. Thus, you see, there is a structural reason for countersinking beside the question of appearance.

Coupled Circuit

In a receiving set this term is used to refer to two circuits, which by means of inductance, capacity or a resistance are able to influence one another, so that electric currents fluctuating in the one circuit induce currents in the other. The two circuits thus combined or "coupled" together are spoken of as a *coupled circuit*. The aerial circuit of a receiver, that is, the circuit which receives the incoming wireless waves, is often a coupled circuit. The reason in this case is that the coupled circuit gives greater selectivity than a single circuit.

Coupling

Coupling is the connection between two circuits, by means of which the energy is transferred from one to the other. There are three methods of obtaining coupling, namely: directly, inductively, or capacitatively.

Direct coupling simply means that there is a metallic connection between the two circuits. A modification of this method employs a resistance, and is accordingly called resistance coupling.

Inductive coupling, which is the form most commonly met with in wireless, is obtained by arranging the two circuits

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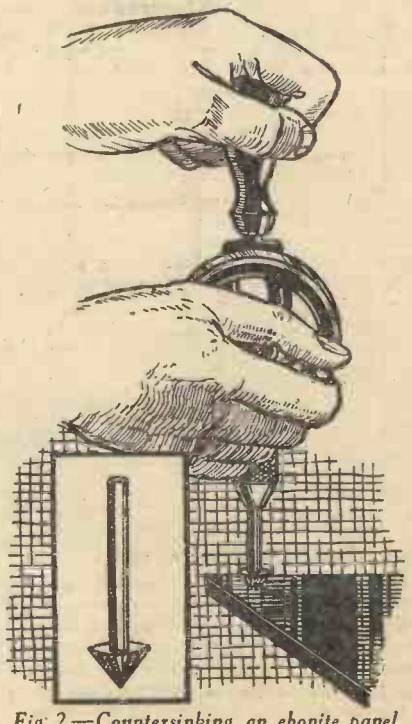

Fig. 2.—Countersinking an ebonite panel. Inset, countersink drill.

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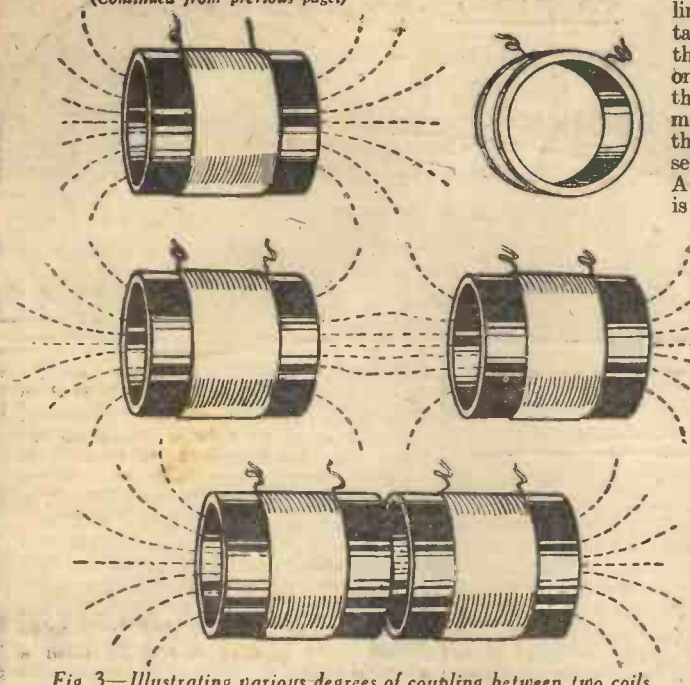

Fig. 3—Illustrating various degrees of coupling between two coils.

so that the magnetic fields around them interact. This is illustrated in Fig 3, which shows two coils coupled together in varying degrees.

When a current is passed through a coil a "magnetic field" is produced round the coil, that is to say, the space round the coil exhibits magnetic properties. A compass held near the coil is a good means of detecting this, for whereas the compass would normally point North yet when it is held near the coil it will point in different directions, according to where it is held. The direction of this magnetic force round a coil is represented by the dotted lines in Fig. 3. Now, when two coils are placed near together their respective fields will interact and some of the lines of force will join up so that they are common to both circuits. The amount to which they do this depends not only on the nearness of the coils to one another, but also on their relative positions. If you look at the top coils in Fig. 3 you will see that they are at right angles to one another. In this position there is little or no interaction. In other words, there is no coupling, or else it is very *loose*. The centre coils are shown end-to-end some little distance apart. Here there is more linking up and the coupling is said to be *tighter*. In the third position the coils are placed as close as possible. This ensures the maximum transference of energy from the one end to the other and the coupling is *tight*.

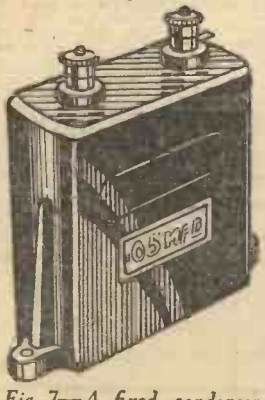

Fig. 7—A fixed condenser as used in coupling circuits, particularly band-pass circuits.

Tight coupling is often obtained by winding the two coils on one former so that the turns of wire may be closer than they would be if on separate formers. A coil of this type is shown in Fig. 4. It is a commercial short-wave coil with three windings. Two of these are used at a time, the third one being cut out of circuit by means of a switch.

It is often desirable to vary the coupling between two circuits (See "COUPLED CIRCUIT" and "SELECTIVITY," etc.), and so various methods have been devised to accomplish this. Fig. 5 shows one of them. Here one coil is made smaller than the other and is mounted on a spindle so that it can be rotated inside the larger one. Turning it so that its windings are at right angles to those of the stator coil gives the minimum or loosest coupling, while turning it so that both coils point in the same direction gives maximum or closest coupling.

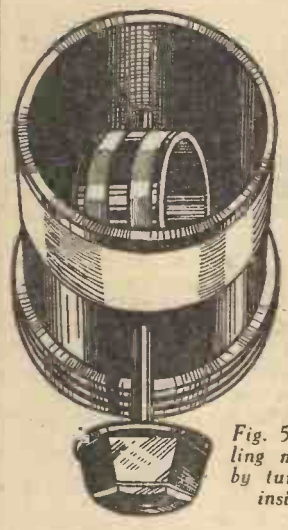

Fig. 5.—How coupling may be varied by turning one coil inside another.

Coupling by means of capacity means that the two circuits are joined with a condenser. According to the way the condenser is connected up, a large condenser will give tight coupling and a small one loose coupling, or *vice versa*. The method of connecting, which gives the latter effect, is shown diagrammatically in Fig. 6 (right-hand sketch).

Two coils of wire may be either inductively coupled, capacitatively coupled, or both. Examples of the first method are shown in Figs. 3, 4 and 5. In the second method the coils are either so far apart as to have no inductive coupling, or else are screened from one another by means of a sheet of metal to attain the same object. They are then joined by a condenser, such as the one in Fig. 8. The coupling is then purely capacitative. If the coils are allowed to have some magnetic interaction as well as being joined by a condenser, then the coupling is not pure but mixed. The three different methods all have their various merits and drawbacks with which we need not concern ourselves here.

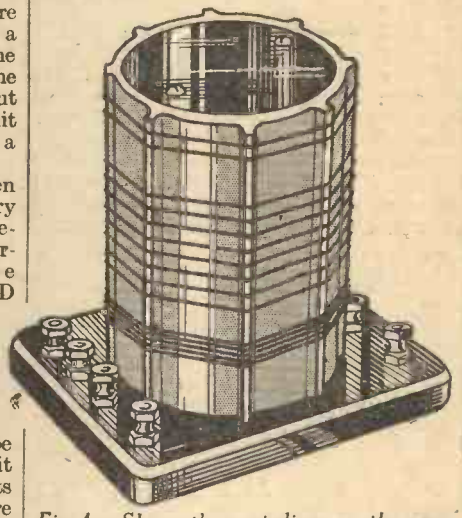

Fig. 4.—Shows three windings on the same former. The coupling here is fairly tight.

Intervalve coupling, which refers to the method of joining together the various valves in a set, may be divided into three classes, namely, *Resistance-capacity, Choke* and *Transformer coupling*. They are dealt with under their respective headings, which see.

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REGULAR readers of PRACTICAL WIRELESS should carefully peruse the announcement on page 200 of this issue. It is a tedious task to have to wade through twenty-six issues of a paper to find a particular article. Every reader should collect his issues together and have them bound in the attractive binding case, together with the title page, and index, which we have had prepared as a service to the reader. This can be done at a special bargain price of 5s. 6d., and the completed volume will provide you with a remarkable work of reference.

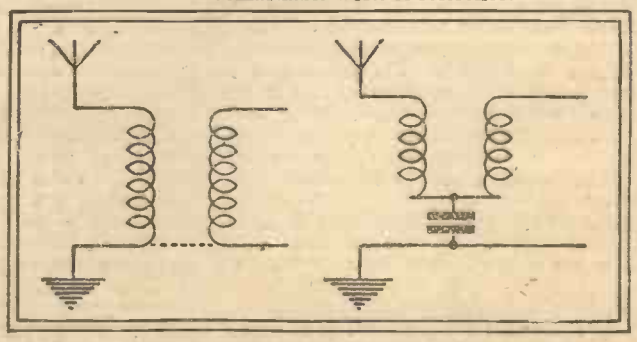

Fig. 6.—Diagrams showing inductive coupling (left) and capacitative coupling (right).

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1 Lewcos B.P.F./R Coil	12	0	
3 Specified Valves	2	15	0
1 Smith Lyric Cabinet	1	15	0
1 Grampian Energised Speaker, Model E.1	1	10	0

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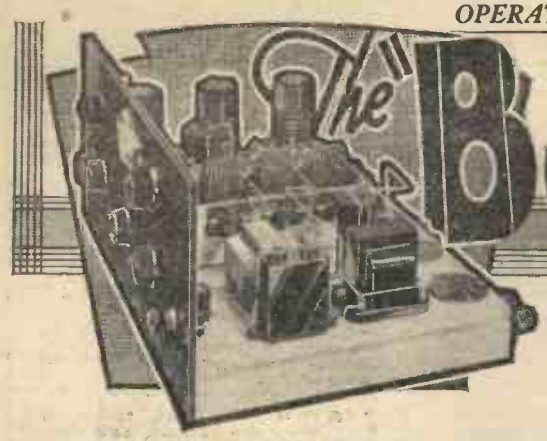


The "Beta" Universal Four

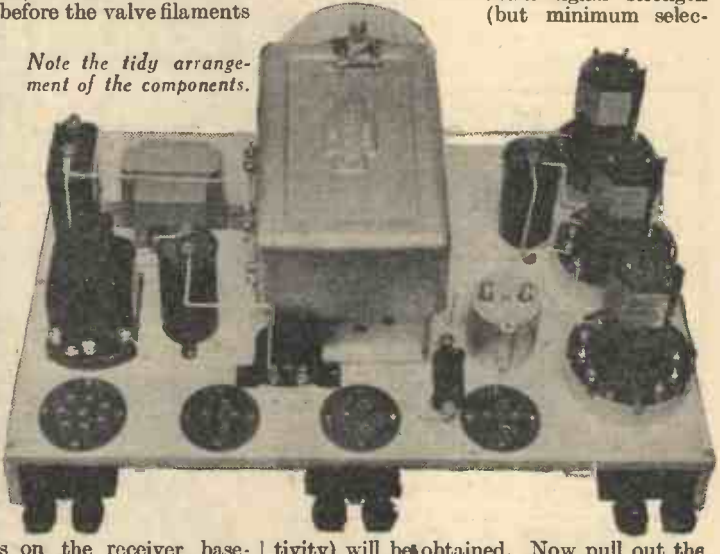
How the Beta Should Be Handled to Bring You Music from all Parts of Europe, with Any Tone You Desire

BEFORE we give detailed instructions for handling this interesting four-valve receiver, there are one or two points which may be explained at more length than was done last week. First of all, the coil L.3 (see page 154 of last week's issue) should be earthed, and owing to a draughtsman's error this was not shown on this diagram. Therefore, a wire must be joined to terminal 6 on this coil, and the other end of the wire taken across to the earth terminal. It is also preferable, in some cases, to connect the switch rod and the cans of the coils to earth, and for this purpose a bare wire should be attached to this terminal (No. 6 on coil 3), and the end of the wire placed below the metal base of the coil before tightening up the screws. As the switch rod bears on a small spring which is in contact with the case, the remaining two screening cases will also be automatically "earthed." This point should not be overlooked, as it prevents hand-capacity effects and also assists in ganging.

Connecting the Batteries

The battery connections are simple, as stated last week, but to assist those who are new to wireless, the following detailed hints are given. The Lissen battery is marked with a minus sign at one end and a plus sign at the other. The two battery leads carrying the plugs marked H.T. — and H.T. + should be inserted in these two sockets, the H.T. — plug being inserted in the end marked with the minus sign, and the H.T. + plug in the other end of the battery. The grid-bias battery will have three plugs inserted in it normally, and a fourth when the pick-up is employed. The lead from the potentiometer is inserted in the negative end of the grid battery, that is, the 16-volt tapping. The lead joined to the filament leg of valve-holder V.1 is inserted in the opposite end of the grid battery, and the lead from the Multitone transformer should be inserted in the socket marked 7.5 volts. The L.T. leads are joined to the accumulator, the L.T. — lead being joined to the black terminal and the positive lead to the red terminal. Before the receiver will work, a fuse bulb must be inserted in the special holder on the on-off switch on the panel. It is important to note that unless this bulb is in position no high-tension supply is in circuit. Do not use an ordinary flash-lamp bulb for the purpose, as there is a risk that this will not blow before the valve filaments in the event of a short-circuit occurring. Obtain one of the special Belling-Lee, or Bulgin fuses, and obtain one of the correct rating, which is .150 amps. On the transformer fitted to the speaker will be found three soldering points, and lengths of flex should be attached to these. The centre lead must be joined to the battery plug H.T. +, and the remaining two leads are then joined to the L.S. terminals on the receiver baseboard. The inclusion of the lead to the centre terminal is most important, as the set will not work without this.

Note the tidy arrangement of the components.



Testing Out

Now, before switching on, turn the knob of the potentiometer half-way between its maximum and minimum positions, and set the reaction control so that the vanes of the condenser are all out. That will be with the knob turned to the left as far as it will go. The knob immediately above the reaction knob should also be set to a mid-way position, although this control is not important at the moment. If you now examine the rear of the aerial-series condenser (above the potentiometer) you will see a small arm, which rotates with the control knob, and the knob should be set so that this arm is touching the lower contact on the condenser. In this position the condenser is short-circuited, and maximum signal strength (but minimum selectivity) will be obtained. Now pull out the switch, and you should hear a certain amount of rushing noise from the loud-speaker. If there is no sound at all, rotate the reaction knob, and if nothing at all happens, switch off, as some connection is faulty, or the set is not correctly wired up. Check over, therefore, and get everything correct so that this rushing is heard when the switch is pulled out. Now rotate the dial until the wavelength corresponding to your local station is in line with the pointer, and you should hear the station

(*Continued on page 201.*)

LIST OF COMPONENTS FOR THE BETA UNIVERSAL FOUR.

One Pair Telsen Band Pass Coils (Type W.290).
One Telsen Single Matched Coil (Type W.216).
One Telsen Three-gang Condenser with Disc Drive.
One Telsen Aerial Condenser with shorting switch.
Three 4-pin chassis-type valveholders, Clix.
One 7-pin chassis-type valveholder, Clix.
One .02 Dubilier fixed condenser, type 9200.
One .001 Dubilier fixed condenser, type 670.
One .002 Dubilier fixed condenser, type 670.
One .05 Dubilier fixed condenser, type 9200.
One 1 mfd. Dubilier fixed condenser, type BB.
One .0002 mfd. Dubilier fixed condenser, type 670.
One .1 mfd. Dubilier fixed condenser, type 9200.
One 10,000 ohm spaghetti resistance, Lissen.
One 20,000 ohm spaghetti resistance, Lissen.
One 30,000 ohm spaghetti resistance, Lissen.
One Bulgin H.F. Choke, Type H.F.9.
One Lissen standard H.F. Choke.
One .0005 mfd. reaction condenser, Lissen.
One Multitone Toco 1-4 L.F. Transformer.
One Multitone Graded Potentiometer.
One Benjamin Class B Driver Transformer.
One Busco three-point switch with fuseholder.
One Lewcos 20,000 ohm Potentiometer.
One Becol Ebonite Panel, 15in. by 7in.
One 1 megohm Lissen Grid Leak with wire ends.
One Lissen 16-volt Grid Bias Battery.
One Lissen 120-volt H.T. Battery.
One Lissen 2-volt Accumulator.
One Rola Loud-Speaker, Type F.6/PM/O1/Class B.
One 5-Ply Baseboard, 15in. by 10in.
One Cabinet, Peto-Scott.
One Cossor 220 VSG valve (metallized).
One Cossor 210 Det. valve (metallized).
One Cossor 215 P. valve.
One Cossor 240 B. valve.
Three Belling-Lee Terminal Mounts.
Six Belling-Lee Type B Terminals (Aerial, Earth, Pick-up, Pick-up, Loud-Speaker, Loud-Speaker).
One Belling-Lee Four-Way Battery cord.
Three Wander Plugs, G.B.+, G.B.1 and G.B.2.
Sundry Screws, Fuse Bulb, Coil of Glazite, Flex, etc.

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BETA UNIVERSAL FOUR

(*Continued from page 198.*)

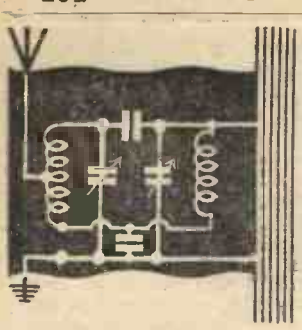
if it is working. If not, rotate the potentiometer control, and also the reaction control, until you hear the station. Now carefully turn the series-aerial condenser knob and see if any increase in signal strength is obtained. If so, then the small star-wheel on the variable condenser nearest the panel should be carefully turned with a long, thin piece of wood. Now, with one hand holding the main tuning-knob, swing the condenser backwards and forwards over a few degrees, and at the same time rotate the other two star-wheels in order to gang the three circuits. This is a tedious business, but must be carried out carefully, if you are going to receive distant stations, as two or three degrees difference on two sections of the condenser will result in a weak station not being heard at all. The idea is to get the three wheels adjusted so that the movement of any one wheel, either forwards or backwards, results in a weakening of the station. When you have carried out this operation, turn the dial to a reading at the other end of the scale and try and pick up a station there, and see if any further adjustment is needed. If not, the receiver is ganged, and may be now installed in the position it is to occupy.

The method of handling all the knobs is really quite simple and should be carried out in the following manner. Suppose you wish to try and receive Rome. From Data Sheet No. 15, or other source, you see that the wavelength of Rome is approximately 441 metres. The first thing to do, therefore, is to set the dial to give this reading. Now take the reaction knob in the right hand and the potentiometer knob in the left hand and turn the two together until you hear the station (if it is transmitting at the time). You will find that as the reaction is increased probably Stockholm also can be heard, but then by reducing the potentiometer setting the two stations will fade away. An increase of the reaction condenser will bring back the Rome station, but the Stockholm signal will be weaker. When these two controls have been juggled to get the very best, without oscillation, the Rome station should be received quite clear of interference. It may happen, however, that you are situated in such a position, or your aerial is arranged in such a way that it is impossible to get rid of Stockholm. In this case, and in other cases where an interfering station cannot be got rid of, the following procedure is carried out. The reaction and potentiometer are adjusted for maximum results as just described, and when the best setting has been found the left hand should be transferred to the knob above the potentiometer, and this should be slowly turned anti-clockwise. At the same time, the reaction should be increased to make up for the loss in signal strength. If it is found that the condenser value has to be so reduced that the H.F. valve oscillates, the potentiometer should be turned back a degree or so. You will find, however, that these three controls may be handled quite easily, and it is possible to get most stations clear of interference. Naturally, the series-aerial condenser only requires adjusting when interference is experienced, and the reaction is only wanted when a distant station is required. When the station is received at its best, the tone control may be called into use to vary the reproduction, but it will probably be found that for most types of reception, the knob may be turned to a midway position, where it gives a practically uniform response. If a heterodyne whistle is heard or a soprano is screeching away, the top may be removed by turning the control towards one end. On the other end, if a violin lacks "bite," due to, perhaps, an excessive use of reaction, the knob may be turned the other way to remove some of the lower notes and give brilliance.

BUILDING THE A.C. TWIN

(*Continued from page 194.*)

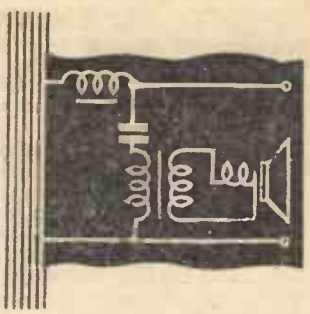
length of twin flex to the filament terminals of valve-holder V.2 on the main base, connecting them also to the filament terminals on valve-holder V.1. Take a length of flex with red cotton covering and attach this to terminal No. 1 on the Varley choke and plait together the twin filament leads, this red-covered lead and the plain rubber lead which you attached to the .001 mfd. condenser. Pass them up through the slot on the right of the base and carefully slide the base into the cabinet. When right home, attach the two leads (from H.F. choke and R terminal on coil) to the terminals on the reaction condenser, and push the wave-change rod through the hole into the coil base. Attach the condenser knobs to the spindle.



RADIO RAMBLINGS

By JACE

Jottings from my Notebook



H.T. Current and Volume

IT is surprising to find how mistaken ideas, especially in regard to wireless matters, manage to circulate so freely before they are corrected. I make this remark after being entertained to tea by some friends who have owned a battery-fed radio receiver for the past seven years. The "wireless" was switched on after tea and I was rather horrified at the very poor volume and "thin" tone. On tactfully making reference to this, however, I

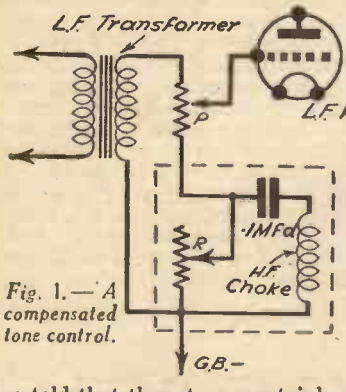


Fig. 1.—A compensated tone control.

was told that the set was certainly capable of much better things but that the batteries were rather low and might not last the night out if the volume was turned full on. It was a little difficult to see the meaning of this statement at first, but I gathered that my host was under the impression that the set's current consumption depended upon the signal strength obtained from the loud-speaker.

The time was not an opportune one for correcting this wrong impression, but if by chance any new readers are under the same misapprehension I would like to emphasize the fact that, with most sets at any rate, the consumption of either H.T. or L.T. current is scarcely affected by the volume of reproduction. The only slight difference which does occur is that the H.T. current to a leaky-grid detector *falls* as the signal strength applied to it is increased. Thus when the programme is made louder by increasing reaction the set consumes rather *less* H.T. current than otherwise.

When a variable-mu valve is employed the H.T. current consumption certainly does rise when volume is increased by reducing the V.-M. grid bias, and in that case there is some justification for keeping down the volume in the interests of economy. The same thing applies to a set using a Q.P.-P. output stage—H.T. current consumption is then almost proportional to the volume level.

Compensated Volume Control

THIS reminds me of another effect of reducing the loud-speaker volume below certain limits. You have probably noticed yourself that when the strength is turned down "quality" becomes worse. The reason is that the ear is less responsive to both high and low notes, especially at low sound levels; as a result the "middle frequencies" are heard quite well, but the high and low ones can scarcely be detected. Under such conditions music seems to lack all "punch" and "vigour," so that most of the enjoyment in listening is lost. This effect is so noticeable that one or two American receivers are fitted with what is called an "Acoustically Compensated Volume Control." The name is something of a mouthful, but the principle of operation is perfectly simple and can easily be tried in any set fitted with a potentiometer volume control. A circuit diagram showing how the idea is applied is given in Fig. 1, where the extra components required are enclosed by a broken line. P is the usual potentiometer volume control and R is an additional variable resistance. When the potentiometer is set to "full volume" the tone compensating circuit has no appreciable effect, but it comes into play as volume is reduced. Since the choke and condenser "tune" to the middle frequencies they allow these to "leak away" to a certain extent and emphasis is thus given to the higher and lower notes. By experimenting with the setting of resistance R a position can be found with which the tone is automatically balanced for any setting of the potentiometer. You might care to try this idea for yourself if you have the necessary parts on hand.

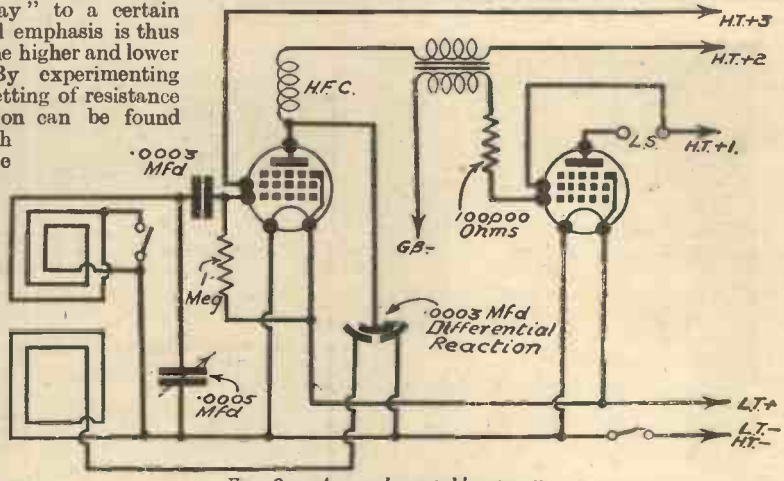


Fig. 2.—A novel portable circuit.

S.W. Superheterodynes for the Colonies

IN view of the previous references on this page to the dearth of battery-operated S.W. superheterodynes suitable for Colonial listeners, it is interesting to note that two such instruments have recently been put on the market by two well-known firms. Both of these instruments are exceptionally well made and specially designed for the conditions under which they are likely to be used. One model has a zinc-plated chassis which is proof against all climatic variations, whilst both employ a special insulating material for the coil formers, etc., which has been found to withstand the disintegrating effects of heat and humidity.

The other set is interesting in that it has a built-in moving-coil speaker arranged side by side with the set instead of being above or below it as is more usual; this gives a particularly pleasing and business-like appearance.

The 1933 Portable

TALKING of summer time and portables reminds me that I have not yet finished working out the final design for my 1933 model (portable, I mean). This I am sure of, it will have "Class B" L.F. amplification and in all probability one of those small permanent-magnet moving-coil speakers. I would also very much like to use Ferrocart coils because of their high efficiency and compactness, but at the time of writing I understand that they are only available in sets of three, whereas only one, or possibly two, would be required. A portable designed on the above lines and fitted with an H.F. pentode should make an almost perfect outfit for, unlike most sets of this type, it would provide really ample volume for open-air and picnic use. I am afraid it would be rather on the heavy side, but it need not be much worse in this respect than many of the sets which are already very popular. It would at least be *trans*-portable and could easily be carried into the garden or stowed in the car.

A Suggestion for a Lightweight Portable

THIS brings us back to the old question: "When is a portable portable?" I must confess that I do not know of any set on the market which I should care to carry for more than a few hundred yards—at least, not for pleasure. But I have just rigged up a simple two-valve receiver which I think could be made up in portable form at an inclusive weight of 16 pounds or so. It uses a pentode detector, followed by a pentode output valve and really does give quite good loud-speaker volume up to 30 or 40 miles of the Regional stations when used on a small frame aerial. Should

you care to try this excellent arrangement for yourself I give the circuit diagram in Fig. 2. As can be seen, it is straightforward enough and entirely devoid of "frills." The frame aerial contains two windings, one for tuning and the other for reaction, and is wound in the manner described on page 950 of PRACTICAL WIRELESS No. 20. Three separate H.T. tappings are provided to save the necessity for decoupling resistances and condensers; these should receive voltages approximately as follows: "H.T. +1," 100 volts; "H.T. +2," 70 volts and "H.T. +3," 30 to 50 volts. Using two pentodes of the high efficiency type (such as Cossor 220 HPT) the total H.T. current consumption is only about 6 milliamps and can economically be derived from the smallest size of high-tension battery.

Detector Overload

I DARESAY that very much of the distortion found in the average S.G.—D.P. receiver is due to the detector valve being overloaded, and yet this source of trouble is very rarely suspected. The point is that if a power valve is to be fully loaded the detector must supply a large output or else be coupled through a fairly high ratio transformer. When the transformer is not of high step-up the detector is liable to overload long before the power valve. If the latter fault is suspected it can be checked fairly easily by tuning in a loud station and observing the effect of increasing and decreasing reaction; if this makes practically no difference you can be fairly certain that overloading is taking place. The cure is to fit an aerial-input volume control or to increase the detector H.T. voltage. Maximum volume will naturally be reduced when the former method is employed, but it can be brought back to its previous level by using a higher ratio L.F. transformer or changing over to resistance-fed transformer coupling.

Excessive Oscillation

EVERYONE who handles a wireless receiver should be able to recognise the signs of self-oscillation, as H.F. instability is still the most fruitful source of trouble in receivers with H.F. amplification.

For instance, in some cases, when the potentiometer volume control of a set is advanced to "maximum" the signal strength drops considerably. This is almost a certain indication that, when loading is removed from one of the tuned circuits, the H.F. valve passes into a state of violent self-oscillation, with the probable result that the succeeding detector-grid circuit is choked.

Summer-Time Reception Conditions

WITH the advent of "Summer Time" we can expect to find conditions for long-distance reception considerably worse than they have been during the last few months. I give this timely hint because about this season every year for the last decade I have been inundated with questions such as "What can be wrong with my set? I used to be able to get scores of foreign stations and now I can hear nothing of them." If this is your present trouble I can only make three suggestions. One is that you add an extra H.F. valve, another is that you build a new set specially designed for long-distance reception (you can't beat the "Fury Four") and the third is that you try the short-waves.

ADDING A VALVE TO YOUR SET

(*Continued from page 178.*)

already employed. If it is a det. and 2 L.F. circuit, then the most obvious addition is a screen-grid stage. The only exception might be in the case where the receiver was used chiefly for local reception and gramophone records, from which extra volume was required, when the extra valve could with advantage be used in push-pull with the existing output valve.

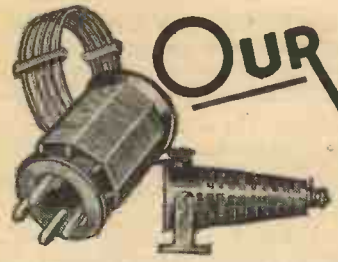
With the S.G.-det.-pentode type of receiver, the position of the additional valve is not quite so obvious. As with a two-valver, there are again two possible positions, namely, before and after the detector. However, there are certain difficulties which would not be met with in the case of the two-valver. These are chiefly connected with the pre-detector arrangement. First of all, the addition of another screen-grid stage would make the input to the detector rather large, with the consequent risk of overloading it on the loud stations. There are two ways of avoiding this. One is to use a variable-mu valve as the additional amplifier so that large inputs can be reduced by using the usual grid bias volume control employed with these valves, and the other is to adjust the working characteristics of the detector so that it will handle larger signals than with the normal arrangement. This is, of course, power grid detection and consists of using instead of a 2 meg. leak and .0003 mfd. condenser, a .25 or .5 meg. leak and a .0001 mfd. condenser, together with a high anode voltage.

If there are already three tuned circuits in the set, namely, band-pass input and a tuned intervalve circuit, then another tuned H.F. stage is unlikely to be necessary except in the very worst cases of interference and will in any case add to the tuning difficulties, so that the best use for the extra valve is either as a choke-coupled H.F. amplifier between the present S.G. valve and the detector, or as an extra L.F. amplifier. In the former case it will add to the sensitivity of the receiver and also assist the ganging, since the third tuned circuit will now form the grid circuit of the new valve instead of that of the detector. The removal of the damping imposed on this circuit by the detector will mean sharper tuning and better ganging.

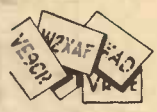
Pros and Cons

On the face of things the inclusion of the additional valve after the detector has much to recommend it. For instance, there is no likelihood of H.F. instability, there is no need for extra tuning and no possibility of detector overload. On the other hand, however, adding an L.F. stage, either R.C.C. or transformer coupled, means replacing the pentode output valve with a power or super power type. To retain the pentode as the last valve would mean overloading it. Again the additional L.F. stage would most likely call for extra decoupling, especially where the high tension current is derived from the mains.

A method of adding an extra L.F. valve which will appeal to many, especially those using battery sets from which a large undistorted output is desired, is to connect it in push-pull with the existing pentode, as suggested for the two-valver. Of course, there will be the added expense of the necessary push-pull transformers or chokes, but against this must be reckoned the fact that only one extra valve will be needed and no extra decoupling. Of course the push-pull method is not confined to pentodes. Triodes may be used equally well.



OUR SHORT WAVE SECTION



SIMPLIFYING TUNING ON THE SHORT WAVES

A Practical Article Explaining the Band-Spread System and How to Improve Reception.

By K. E. BRIAN JAY

SHORT-WAVE work has always excited a great deal of interest, and in many people a sort of awed wonder, by reason of the remarkable long-distance reception that is possible with quite reasonable consistency, and since the opening of the new Empire transmitters it has been more in the limelight than ever. Incidentally, it is curious that, since short-distance signals are seldom strong on short waves, the new Daventry transmitters should have caused such a burst of activity in this country, since they will probably be heard worse in England than in Dominions five thousand miles away! In spite of their possibilities, however, many people fight shy of short waves for no better reason than that they believe them to be "tricky sort of things," as they put it, having the impression that anything under 200 metres cannot possibly obey the same laws as govern the action of longer waves. Yet these same people will cheerfully tackle the construction of a super-het., complete with band-pass tuning, provided that there is no suggestion of short waves about it! Personally, I would never think twice about building an ordinary short-waver, but the complications of ganged tuning and band-pass filters on ordinary broadcast waves do cause me to "gang warily," literally as well as figuratively!

At the same time, one is bound to admit that a certain percentage of those bold enough to try short-wave work do find it tricky, and in some cases give up in despair. It is my purpose in this article to diagnose one of the principal causes of this complaint and prescribe a remedy. Before going on to specific circuit details, let me mention one or two effects that occur in short-wave work and are responsible in part for its reputation for devilry. In the first place, the signal strength of any station working on short waves will vary enormously more during a period of twenty-four hours than it would if the station was operating on either the 2,000 or the 200-550 metre band.

Elusive S.W. Transmissions

Consequently, if, say, W8XK is heard R8 on its 19-metre transmission when the set is first tested one Saturday afternoon and later the set is tried on the same station in the evening, the listener will almost certainly blame the receiver, valves, batteries, and general perverseness of short waves, severally and collectively, when he finds not so much as a whisper of the American, although he knows that he is on the air. And yet this is quite in order, at any rate, in the winter, when the fade-out may occur as early as four o'clock in the afternoon, although in the summer the same station may be audible at midnight. Then again, not only is there a very great daily variation in signal strength, but conditions for reception vary much more from week to week and month to month on short waves than on long, so that while one week you may be able to listen day after day to a certain station, a week later you can hardly hear him, even at the most suitable time of the day. As an example of this, quite recently

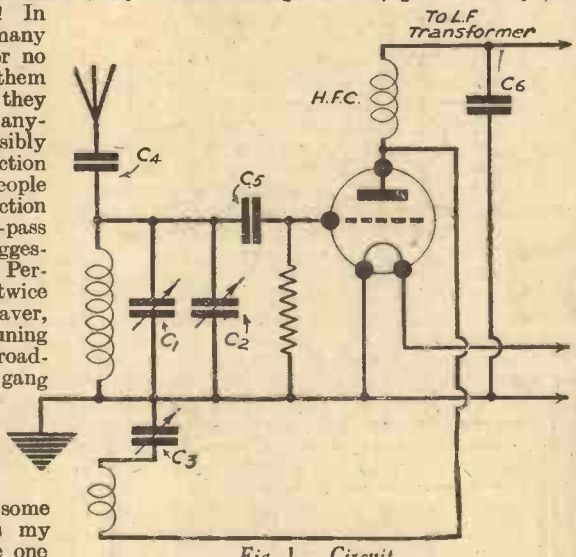


Fig. 1. Circuit.

American amateur transmitters were audible on the 40-metre band as early as 6.30 in the evening, and by nine o'clock there were so many that it was difficult to separate them enough to read their call-signs; but a week later, on listening at 9.30 p.m., not a single one was heard; the band was as quiet as a graveyard.

It is effects like these, then, that give short waves their name for trickiness, although actually, the same thing happens to some extent on long waves, but because, generally, one does not listen to stations more than a few hundred miles away, the variations are not so noticeable. Unfortunately, however, many constructors and designers add to their difficulties by a wrong choice of apparatus in their receivers, and especially is there a tendency to choose a variable condenser for tuning that is much too large for the job. Let me illustrate what I mean.

A certain, commercially-produced, dual-range short-wave coil is supposed to cover, approximately, from 19 to 80 metres on the two ranges, when used with a .0003 mfd. variable condenser. By way of a test, a few rough measurements were made on the lower range of one of these coils, using a .0003 mfd. condenser, and it was found to cover from rather below 19 metres to 50 metres, approximately. Superficially, this seems very nice; most of the principal stations lie in this range, and the rest are covered by the long-wave winding, the total range appearing to be quite small compared with the usual 200 to 550 metres. But let us compare these ranges, not in terms of wavelengths, but of frequencies. Take the 200 to 550 metres band; this, in terms of frequency, is from 1,500 kilocycles to 545 kilocycles, *i.e.*, a range of 955 kilocycles. Now 19 metres is the same as 15,790 kilocycles, and 50 metres as 6,000 kilocycles; that is to say, the short-wave range is equivalent to 9,790 kilocycles, *over ten times as great* as the range of the broadcast band. In short, tuning on the short waves will be ten times as sharp as tuning on the long waves. Suppose, on the long waves, you use a slow-motion dial with a ratio of 10 : 1, by no means a high ratio for comfortable tuning; in order that tuning shall be equally easy on short waves, a ratio of at least 100 : 1 will be needed, and only a very good dial will provide this ratio without backlash. Furthermore, even if such a dial is obtained, tuning will be a very weary process, because broadcasting stations are not distributed evenly over the whole band as on long waves, but are in little groups placed at intervals. Consequently, although a high ratio will be needed when a group is reached it will be a great nuisance when tuning from one group to the next.

Reception of Amateur Transmissions

This trouble arises in a very much more acute form in the reception of amateur transmissions which take place in very small bands of frequencies, the most popular being from 7,000 to 7,300 kilocycles and 14,000 to 14,400 kilocycles. Consider, for example, the case of anyone chiefly interested in amateur transmissions on the latter band. This band lies in the 19 to 50 metre range of our coil, and was found actually to occupy little more than 5 degrees on the dial, into which space there may be crowded as many as a hundred stations all working together, a prospect calculated to appal the most expert operator!

A similar state of affairs would exist on any of the other bands and clearly something has to be done about it. The simplest thing to do is obviously to use a smaller variable condenser, but this alone is not sufficient to spread each band over 180 degrees of the dial, and so various methods of band spreading have been devised. Of these only one is of interest to listeners to short wave broadcasting stations, because all the others require the use of plug-in coils, or tapped coils of non-standard sizes, and their band spreading is so effective that the frequency range is more limited.

(*Continued on page 206*)

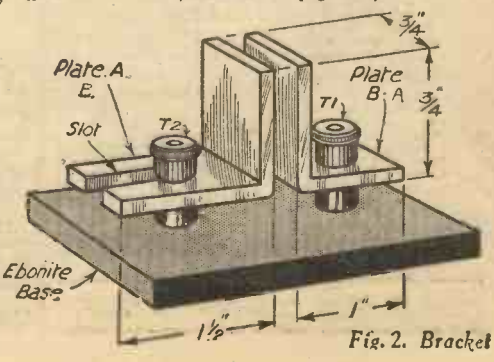


Fig. 2. Bracket

SHORT WAVE SECTION

(Continued from previous page.)

Band Spread System

The method referred to is absurdly simple and consists merely in using two variable condensers in parallel, one being smaller than the other. These condensers are marked C_1 and C_2 in Fig. 1, and may be respectively .00005 and .0002 mfd. capacity; C_1 should never be more than .00005 mfd., but C_2 should be chosen so that the total capacity of the two condensers together is equal to that recommended by the makers of the coil. Thus, for example, if the wavelength range of a coil is specified as being obtained with a .0002 mfd. condenser, C_2 should be .00015 mfd. when C_1 is .00005 mfd. C_1 is the main tuning condenser, but because of the band spreading effect a slow motion ratio of no more than 16:1 is quite satisfactory. C_2 is called the band spreading condenser and need not be fitted with a slow motion dial at all.

Before describing the *modus operandi* of this band spread system (not to be confused with band pass) let me say a word in answer to those who may think, and say, that this is a lot of fuss about nothing, and the same effect could be obtained merely by using a smaller condenser. Within limits this criticism is justified, but let us consider a concrete case. Using the same coil a .0001 condenser was substituted for the .0003 mfd. instrument and the frequency range was now found to be from 15,790 kilocycles to about 8,000 kilocycles (37.5 metres). We have, therefore, lopped about 2,000 kilocycles off the range, which is a little help, though not very much, but has introduced the further complication that we shall need at least one extra coil to tune down to our previous lowest frequency of 6,000 kilocycles. On the longer wave range the difference would be a little greater, but still not very much better, and another extra winding would be required. We shall, incidentally, find that the amount of spread available on C_1 will be greater the longer the wavelength, that is to say that stations will be more crowded on the dial of the small variable condenser on the shortest wavelengths than on the longest. In this respect C_1 might well be as little as .000025 mfd. on 20 metres, but this capacity would be found inconveniently small on 50 metres; the size suggested is therefore in the nature of a compromise.

The band spread system is quite simple in use. C_1 is set to the middle of its scale and C_2 is tuned until a station is heard; fine tuning is then completed on C_1. Since the broadcast stations are grouped together at intervals over the short-wave spectrum several other stations will be found nearby and tuned in on C_1 only, and the much greater ease of tuning will be at once appreciated. Even with a band spread arrangement, however, always obey the golden rule in short-wave reception and tune slowly. When each group of broadcasting stations has been located the dial reading for C_2, which places the centre of the group in the middle of the dial of C_1, should be noted so that the receiver can be retuned quickly to any group. This is another point in favour of the band spread arrangement, since each group can be found quickly without the laborious dial twisting which the use of a high ratio dial involves in getting from one reading to another some distance away. As a matter of fact, with a modification of this method I have been able to use an ordinary direct drive dial on both condensers quite comfortably down to 18 metres.

S.W. Station Groupings

The principal groups of broadcasting stations on short waves are located at:—

from 17,750 to 17,780 kilocycles, or 16.90 to 16.87 metres.
from 15,075 to 15,330 kilocycles, or 19.90 to 19.56 metres,
from 11,180 to 11,905 kilocycles, or 26.83 to 25.20 metres
from 9,500 to 9,860 kilocycles, or 31.58 to 30.43 metres
from 6,000 to 6,667 kilocycles, or 50.00 to 45.00 metres

with a number of odd stations scattered between them and on wavelengths up to 80 metres (frequencies down to 3,750 kilocycles).

Condenser Capacities

Now a word about the kind of condensers to use. The points to look for in any short-wave tuning condenser are rigidity of bearings and frame, small physical dimensions, absence of dielectric material, good, well-insulated pigtail connection, smoothness of action, and low minimum capacity with reasonably well-spaced vanes. If you do not possess a .00005 mfd. condenser for C_1, try reducing the size of one you have by you. Remember, double spacing reduces the capacity to one-quarter of its nominal maximum, since you are both doubling the spacing and halving the number of plates; if plates are removed and the spacing kept the same, the approximate resultant capacity will be:—

$$\text{Original maximum capacity} \times \frac{\text{Number of plates left in}}{\text{Original number of plates}}$$

For C_2 any good air dielectric condenser can be used, and in order to save panel space midget condensers may be preferred; this condenser should be mounted close to C_1.

In choosing the reaction condenser C_3, the chief thing to look for is, as before, good bearings, in order that the condenser shall be noiseless. For this reason air dielectric instruments are preferable to the small bakelite or mica dielectric type, The capacity may be from .0001 to .0003 mfd., and a slow-motion dial with a high ratio, say, about 8 : 1 is helpful, but not essential.

With regard to the other condensers in the diagram there are a few points worth noting. The aerial series condenser C_4, for example, must be quite small, or the damping of the grid circuit will be so great as to prevent the receiver from oscillating. Quite often even a .0001 mfd. pre-set condenser has too large a minimum capacity for use here, since actually something of the order of .00001 mfd. is required. A semi-variable condenser suitable for this position can be made very easily from two ¼in. or ⅜in. wide strips of brass or aluminium in the manner indicated in Fig. 2.

The grid condenser C_5 should be smaller than the standard value of .0003 mfd. used with leaky-grid rectification; .0001 mfd. is ample for C_5, and it should preferably be of small physical dimensions. The value of the grid leak may often be increased to five megohms or more with considerable improvement.

(Continued from page 190.)

light systems will be among the first to appear. For the sake of economy in low tension supply, a single cathode will be employed and will be shared in common by all the elements of the valve. For the diode portion—whether one or two diodes are incorporated—the anode for each will consist of a metal ring or rectangle surrounding but not touching the cathode. Above the diode anodes a metal screen will be fitted, to shield the triode portion from the diode. The amplifying section of the valve will consist of a grid and anode, arranged very similarly to the electrode system of the ordinary indirectly-heated three electrode valve. Those valves in which the amplifying element is of the four electrode variety will have, of course, two grids instead of one. Some little uncertainty recently existed, also, regarding the type of valve base which will be employed. It now appears that seven terminals are required for each valve, and how the pins are arranged was shown in last week's issue.

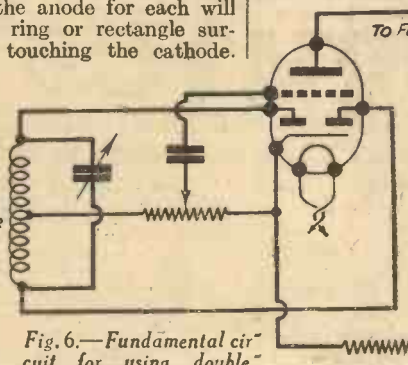


Fig. 6.—Fundamental circuit for using double-diode-triode as full-wave detector and L.F. amplifier. For the sake of clearness all decoupling components have been omitted.

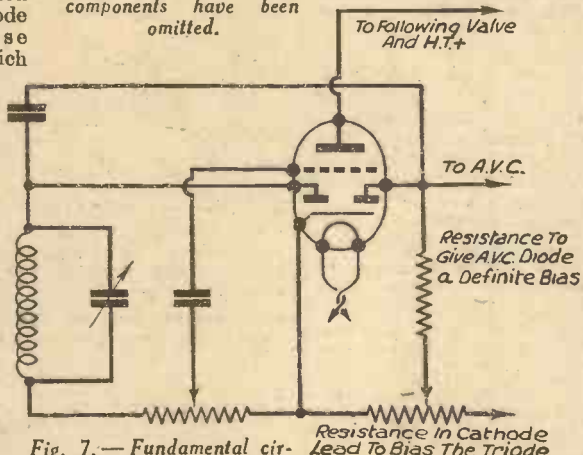


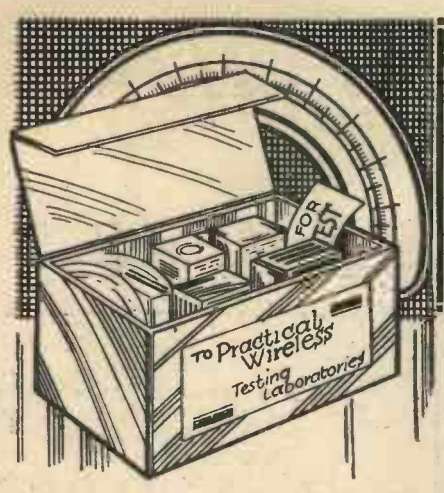
Fig. 7.—Fundamental circuit for using double-diode-triode as half-wave rectifier, L.F. amplifier and delayed automatic volume control valve.

There are several different ways in which valves of this type may be employed, and some of these are indicated below. It is, of course, not possible at present to give full practical circuits, as the actual characteristics of the valves have not yet been published. As the double-diode-triode type of valve seems the one most likely to be adopted, the diagrams reproduced in Figs. 6 and 7 refer to this class of valve.

Fundamental Circuits

In the first diagram, the valve is employed as a full wave rectifier and a low frequency amplifier. The drawing is self explanatory and it is easy to trace the detector arrangement and the way in which the combined output of the two diodes is led to the grid of the amplifying portion. Possibly a more useful way of applying the double-diode-triode, however, is that shown in Fig. 7, where only one of the diodes is employed for detection (as a half wave rectifier). The second diode is used for applying the automatic gain control or volume control biasing voltage to previous high frequency stages fitted with variable-mu valves. Several variants of this automatic volume control circuit are possible, some of which are capable of adjustment so that a delayed action occurs, whereby no extra biasing voltage is applied to the variable-mu valve or valves until the signal has reached a predetermined minimum strength. In another circuit the triode portion also plays a part in the automatic volume control, for the biasing voltage itself is amplified so that a small variation in signal strength will give a comparatively large control voltage.

Sufficient has now been written to enable the reader to judge of the application of these new valves, and it only remains to see how they may be applied to new receivers which have already been described in these pages. One of the principal points which the reader wishes to know is, of course, the price, but so far no details are available, and it is not, therefore, possible to say whether the valves will prove popular. It is hoped, however, that the valve manufacturers will see their way to produce these valves cheaply.



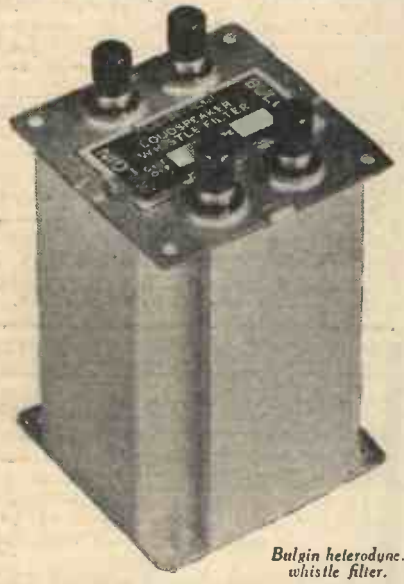
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

BULGIN HETERODYNE WHISTLE FILTER

THE filter illustrated is of great value where the annoying whistle which accompanies some transmitting stations is so marked as to spoil reception. There are many whose hearing prevents them noticing the higher notes in the musical scale, but to others, especially in the younger generation, the heterodyne whistle can prove a real nuisance. The inclusion of a filter in the circuit results in all frequencies above a



Bulgin heterodyne whistle filter.

certain value being cut off, and Messrs. Bulgin have developed two different types of filter, one cutting off at 3,250 cycles and the other at 4,750. As the normal moving-iron loud-speaker is not so sensitive at the higher parts of the scale the former is recommended for use with that type of speaker, whilst the latter should be used on receivers employing moving-coil loud-speakers, and having circuit arrangements which do not cut off the top notes. The now standard Bulgin universal type of case is used for the filter which is about 4in. high. The provision of fixing holes at top and bottom enables the filter to be mounted on the top of a baseboard, or beneath a metal chassis, with the terminals protruding through four specially-drilled holes in the chassis.

Four terminals are provided, two of which are to be joined to the L.S. terminals on the receiver, and the loud-speaker then joined to the other two terminals on the filter. Inside the filter is a special tuned series circuit, with parallel paths, and it therefore forms the link between the receiver and the speaker. In use it is very effective indeed, and by fitting a double-pole change-over switch it is possible to demonstrate quite clearly the effect of this component, which really does do the job it is intended to. The price, for either type, is 10s. 6d.

"Fotos" nipper transformers.

NEW CLIX WALL PLUG

NO doubt the majority of readers are familiar with the ordinary type of 5 or 15 amp. wall plug, intended for connecting apparatus to the two-pin sockets fitted in the house. The majority of these plugs are not too easily fitted up, the method of connecting the ends of the flex, and of reassembling the plug, being anything but simple. The new Clix plug is a most marked advance in the design of this type of plug, and possesses several remarkable features. First of all, it is finished in neat black bakelite and only one retaining screw is employed. This is mounted between the two pins, and to take the plug to pieces to wire it up takes but a second or two. In place of the usual small screws with a small diameter hole in which to force the flex, Messrs. Lectrolinx have included an enlarged version of their wander plug for this particular plug. This is, as we have mentioned before in these pages, in the form of a large split, or linch-pin, and it forces down through a hole in the bakelite plug base. To anchor the ends of the flex they are simply passed through the large loop in the top of the pin, and the pin then pressed home. A small brass fitment then locks the wire in the loop. To prevent strain on the leads they are fed round through a circular groove in the base and given a turn round a bakelite pin, after which they are passed out through a side slot. The circular groove is amply proportioned, and will take the thickest of flex, and the cover does not prevent any number of leads being used with the plug. The particular type of split pin enables it to give perfect contact in practically any sort of wall socket, and there is a very sound contact with the wire when the cover of the plug is drawn down by means of the retaining screw. Finally, the price is only 9d., and it marks one of the most interesting developments in electrical equipment that we have seen for some time.

The new Clix wall plug.

PETO SCOTT GUARDIAN Q.P.-P. KIT

IN our issue dated April 1st, on page 88, we reported on the Pilot Guardian Kit, and it was stated that a chart of this receiver was available for 1s. We should like to correct this statement, as we are informed that Messrs. Peto Scott will supply this chart, together with full-size blue print and details concerning this wonderful kit, gratis. A postcard is all that is necessary, and this should be sent to 77, City Road, London, E.C.1.

FOTOS "NIPPER" TRANSFORMER

THIS is a particularly neat and cheap transformer, costing only 4s. 6d., and being obtainable in ratios of 3 : 1 or 5 : 1. It is of extremely small dimensions, the base being less than 1¼in. wide by about 2¼in. long, and the overall height being 2in. The performance is quite large compared with its size, and it gives very good results for a component of the cheap type. The overall response is quite good, and the resonant points are not so marked that they detract in any way from its reproduction. The bass is quite clear, and the higher notes are reproduced without screech. We passed up to 10 mA. through the primary without noticing any ill-effects, although naturally this small type of transformer is not intended for such loads. For the builder of a really cheap set, where price is a consideration, this transformer will be found to satisfy all normal requirements, and can thoroughly be recommended for this purpose. We have also received a series of valves made by the same firm, and we shall have more to say about these in a later issue.

Have Your Copies Bound, See page 200.

SIEMENS BATTERIES FOR Q.P.-P. SETS

IN the various descriptions of the Quiescent and Class B amplification which we have given, we have explained how the current rises on the arrival of a strong signal, and we also gave figures in the case of one of our receivers showing the maximum current taken. It will be appreciated that the maximum current taken will be quite large in the case of a very strong signal, and furthermore, as a current is a fluctuating value all the time the signals are being received, there is a great necessity to use one of the triple capacity, or specially-designed batteries for the purpose. Messrs. Siemens manufacture a very suitable H.T. battery for this purpose in the Power Type, which costs 12s. for the 60-volt size, and 20s. for the 100-volt size. The capacity of this type of battery is more than double that of the standard type, but it costs less than double, and therefore, is a very economical line. For those who intend to use the larger types of pentode or super-power valve on the Class B principle, there is a still larger battery obtainable in the Super Radio battery, which costs 20s. for 45 volts. This will stand up to the very largest of valves and may be depended upon for really hard wear.

BELLING-LEE FUSE-HOLDER

THE illustration shows one of the neat fuse-holders made by the Belling and Lee Company. This is obtainable in two types, a single fuse-holder and a twin fuse-holder. As the names show, one takes a single fuse, which is included in one lead, whilst the other takes one fuse in each lead. The base is of neat moulded bakelite, and inside at either end is a standard wire attachment. This is of the "telephone terminal" type, with a small pillar having a transverse hole, and a screw tapped down into the top of the pillar: The side of the case is drilled with a hole in line with the hole in the side of the pillar. The end of the lead is, therefore, pushed through the pillar from the outside of the case, and the screw tightened down on the wire. In this manner no bare wires are accessible outside the fuse-holder. The lid, as can be seen in the illustration, has two clips at the extreme ends, and two smaller clips are raised from the same piece of metal a little nearer the centre. The latter two clips accommodate the standard Belling-Lee fuse, and the outer clips fit over the metal pillars at the end of the base. Therefore, when the lid is pressed into place the fuse makes connection from one end of the lead to the other, and removal of the lid breaks the connection. It is thus possible to remove the lid to replace a fuse without having to disconnect any leads. The twin fuse-holder inserts a fuse in each lead, and at least one of these holders should form part of the equipment of all mains apparatus. The single holder costs 1s. 6d., complete with 1 amp. fuse, and the twin holder costs 2s. 6d., fitted with twin 1 amp. fuses. The particular fuses which are fitted may be exchaged at the time of pur, chase for any other value. Readers should note that if the holders are purchased without fuses the above prices are increased by one-third.

Belling-Lee fuse-holder, showing how the cartridge fuse is held.

Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by correspondents.

Readers Abroad and Advice Bureau Coupon

SIR,—I am pleased to have your free gift Handy Metal Gauge given with the January 28th issue of your valuable journal, for which I thank you. Your paper furnishes all the necessary informations for amateur wireless enthusiasts. May I bring to your notice that the time you allow for free advice bureau coupon is too short for people in India, as the post takes more than fifteen days to reach London? Under the circumstances, I trust you will be in a position to extend the time stipulated, especially to your Indian readers? I am reading every issue of PRACTICAL WIRELESS with great interest, and wish it every success in the future.—P. V. RANGAM (Madras, India).

[*The correct extension of time for receiving Advice Bureau coupons from readers residing abroad is always allowed.*—ED.]

A Wonderful Volume

SIR,—Being a regular and satisfied reader of PRACTICAL WIRELESS, allow me to thank you for the Encyclopædia, which is a wonderful volume. It is certainly packed with the good things we amateurs enjoy. More power to PRACTICAL WIRELESS.—E. F. ASHTON (Romford).

A Fine Book

SIR,—Permit me, as a regular reader of PRACTICAL WIRELESS, to thank you for the Wireless Constructor's Encyclopædia. After even a brief examination it is obvious that it is a fine book. Wishing PRACTICAL WIRELESS every success.—R. SQUIRES (Rotherham).

Of Great Value

SIR,—It is a really splendid book, both with regard to the reading matter and the binding. The book will be of great value to the amateur wireless constructor.—E.B. (Leeds).

A Store House of Information

SIR,—I have been so interested that I have not had time to write before. It is a store house of wireless information, those who have not subscribed do not know what they have missed.—E. W. C. (Birmingham).

The Development of Tuning Coils

SIR,—I am somewhat surprised at Mr. Barton Chapple's reply to my letter re "Coils." May I point out that with regard to his plea that he intended his remarks to be construed as meaning that the new coils are "New," inasmuch as they are only now "commercially possible" is entirely wrong. Had he read the paragraph in the book to which I referred him he would have discovered that not only is the idea not new, but on the page facing the description of the coils "tuned with a core of finely divided iron," he would have seen the photograph of a "Commercial" receiver (Marconi Co.) employing this idea. As I pointed out, a visit to the Air Port (GED) would have shown one in use.

How about a really good short-waver in the near future. (Not a converted medium-long-wave, please!)—ALBERT L. BEEDLE (Balham, London, S.W.).

A Scottish Reader's Appreciation

SIR,—Many thanks for answering my queries re suitable values of resistances and condensers in connection with my three-valve short-waver, employing a S.G. valve as detector.

I have followed your suggestions and the result is that I now have a really "hot stuff" S.W. receiver. My first turn round the dial brought in W3XAL on 16.87 m. on a moving-coil speaker. I have the set fully decoupled, and even on such a low wavelength there is no hand capacity. Of course, I have my panel backed with tinfoil. I found the set gave best results with the reaction circuit connected to the screening grid. I can vary the current at will by means of a potentiometer, and I have also a 400 ohms potentiometer between L.T.+ and grid leak. This, in conjunction with a variable condenser, gives me perfect reaction control.

When I first put the set together I used two high-class transformers of well-known make. The first one was parallel fed, and when I switched on I got the finest imitation of a motor-cycle race that one could have wished for. I had the cores at right angles and the metal cases were earthed. Well, I replaced the first transformer with an old "Hedgehog," and the set at once behaved like a gentleman. I made no other alteration to the circuit. Perhaps you will find space sometime to explain the reason for this. It has puzzled me.

For a short-waver I could wish nothing better, and on some nights the 49-metre Yankees come in at R7 to 8 on the loud-speaker. Zeesen on 31 metres, and Moscow on 50 metres usually wipe out everything in their immediate vicinity. In fact, I could tune in Zeesen on good 'phone strength without any aerial at all. In concluding, I would just like to say how much I appreciate PRACTICAL WIRELESS. It is practical in every sense of the word, and although I have made about a score of sets in my time, there's not a week passes but I learn something new from your columns.

I was very much struck with the "Fury Four," but as I expect some startling developments in radio before another winter, I will "wait for it."

Wishing PRACTICAL WIRELESS continued success.—ALEX. HENDRY (Longside, Aberdeenshire).

Exceeds Anything I Expected

SIR,—Please allow me to thank you for the Wireless Constructor's Encyclopædia, just received. It far exceeds anything I expected, and I am more than delighted with it. I am looking forward to some really pleasant hours reading.

It's a pity every amateur constructor cannot possess one. I am very grateful for mine.

Wishing PRACTICAL WIRELESS and its staff every success.—A. HUDSON (Erdington).

Another Reader's Appreciation

SIR,—Allow me to express to you my appreciation of the Wireless Encyclopædia, safely to hand. It has far exceeded my expectations and will, I am sure, be the most useful book of reference I possess.

(*Continued in col. 2 overleaf*).

CUT THIS OUT EACH WEEK.

DO YOU KNOW?

—THAT a temporary small value fixed condenser may be made up by twisting two short lengths of ordinary flex together.
—THAT the readings of a meter may be increased but they cannot be reduced.
—THAT Luxembourg now provides high-power programmes on a wavelength of 1,191 metres.
—THAT Class B amplification renders the design of a portable more efficient.
—THAT portable receivers may now be fitted with moving-coil loud-speakers in view of the above.
—THAT long-distance reception is not so reliable in the longer summer days.
—THAT the cause of the falling off in signal strength is the absorption effect of the sun's rays.
—THAT the new Ferrocart coils should be fitted where they are well away from high-power valves or other sources of heat.
—THAT we may expect great things from a "three-valve set" next autumn.

NOTICE.

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

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

PRACTICAL LETTERS
(Continued from previous page.)

May I conclude with the following lines: An excellent "volume" with perfectly "controlled" "output," which no amount of "amplification" can do justice to. It is an "accumulator" of facts which requires no "re-charging." In which you can "switch" over from query to query and run them all to "earth."—A. R. WOTTON (Altringham).

A Useful and Interesting Book

SIR,—Very many thanks indeed for your splendid Encyclopædia just received. It is a very useful and interesting book, which, with your Data Sheets, enable amateur wireless enthusiasts to successfully tackle jobs they could not otherwise do without professional help. Wishing your paper every success.—F. J. FREEGARD (Bishop's Stortford).

"More than Satisfied"

SIR,—Just a few lines to say I have received the Encyclopædia quite safe and am more than satisfied with it. Of course I have not been able to fully explore it yet, but from what I have read I find there the same consideration for beginners as given in PRACTICAL WIRELESS which I have taken from No. 1. I have found this journal most helpful in explaining to me a lot of what was to me the mysteries of wireless. Apart from this I think the Encyclopædia, by its external appearance a welcome and pleasing addition to any bookcase or shelf. I will close wishing your publications the success they deserve.—C. SHEMELD (West Wittering).

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.

ILFORD AND DISTRICT RADIO SOCIETY

On March 23rd a talk and demonstration was given by Mr. R. M. Weston on "Meters and Measuring Instruments." Practical details were given which would enable members to construct their own instruments, and to adapt their meters for other purposes. The acquisition of a good standard instrument to start with was advised.

Mr. Weston had brought a large array of apparatus and meters, and with these before him was able to explain their construction and use, and they included micro-ammeters, a valve voltmeter, and many types of A.C. and D.C. meters, complete with multipliers. A pick-up was measured for output, and the signal from constant frequency records was measured through an amplifier showing stage gain and voltage output. A Dynatron modulated oscillator was demonstrated, also. On March 30th a sale of apparatus was held. —Hon. Sec., C. E. Largen, 16, Clements Road, Ilford.

THE SOUTHALL RADIO SOCIETY

The winter session of this society closed with the Annual General Meeting. The session has been one of the most successful in the life of the society, and the retiring officers expressed their appreciation of the interest shown in the society's winter activities. During the summer it is proposed to arrange social events and visits to places of technical interest. Intending members are cordially invited to communicate with the Hon. Secs., Mr. G. Lee, 261, Beaconsfield Road, Southall, and Mr. A. J. Stephens, "Buena Vista," Pole Hill Road, Hillingdon.

THE CATFORD AND DISTRICT RADIO AND TELEVISION SOCIETY

At a meeting of this society held recently, Mr. Radford gave an interesting lecture on the "Acoustic Side of Radio Reprodnction." This difficult subject was very simply explained and illustrated by means of lantern slides. Many problems which hitherto puzzled the wireless enthusiast were admirably explained. Various studios at Broadcasting House were put on the screen and their points of interest explained, also a studio at Budapest was shown. The discussion that followed all went to prove that the members had been following the subject with close interest.—Hon. Secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23.

MERSEYSIDE AMATEUR TRANSMITTERS' SOCIETY

This society have now acquired premises in a central position in Liverpool which are being prepared as a club-room in which a transmitter and receivers will be installed, and also a workbench for the use of members. Further particulars of the society can be obtained from the Hon. Sec., J. Davies, 13, Exeter Road, Wallasey.

THE CROYDON RADIO SOCIETY

Mr. H. Bevan-Swift, President of the Radio Society of Great Britain, presided over a recent meeting, the occasion being a lecture-demonstration entitled "The Output Stage," by Mr. F. Youle. He discussed, firstly, harmonic distortion, and explained very clearly why second harmonic distortion came in the triode valve and the third in pentodes. Measuring the permissible distortion was also very fascinating, it being seen how its percentage was derived, using load lines and a valve's characteristic curves. He said much about quiescent push-pull, ordinary push-pull, and Class B amplification. Finally the lecturer's special amplifier was demonstrated, using quiescent push-pull.—Hon. Sec., E. L. Cumbers, Maycourt, Campden Road, Croydon.

BLACKPOOL AND FYLDE RADIO SOCIETY

The inaugural meeting of this society was held at the Café Suisse, Queen's Square, Blackpool, on Friday, March 24th, at 8 p.m., and eighteen prospective members were present, Mr. Gray taking the chair. The offices of President and Treasurer were left in abeyance until a more representative meeting could be held, but Mr. Howard was elected Secretary and a committee consisting of five members, together with the Secretary, was formed. Subscriptions were fixed at 10s. 6d. per annum for senior members (that is, over eighteen years of age) and 5s. per annum for junior members. An interesting programme is being compiled by the committee and will be published in due course, and the society will welcome any new members who may be interested. All communications should be addressed to Mr. Howard, 43, Cumberland Avenue, Blackpool.

SLADE RADIO

A recent meeting of the above society was devoted to "How *you* can win the D.F. (Direction Finding) Cup." Mr. G. T. Peck gave some very interesting details covering the procedure to be adopted from the commencement to the finish of a test. These were based on his own experiences in past tests, and as he has been successful on several occasions some very useful information was given. Details of the types of sets which can be used were given, and also a number of questions were dealt with. Anyone who is interested in D.F. work is invited to write to the Hon. Sec., who will be pleased to give details of the society's activities in this particular branch. Address: 110, Hillarics Road, Gravelly Hill, Birmingham.

SUGGESTED RADIO CLUB FOR SOUTHPORT AND BIRKDALE (LANCS)

All amateurs residing in these districts who are interested in radio, television or gramophones are invited to communicate with C. H. Turner, 62, Zetland Street, Southport, sending stamped envelope for reply concerning the first meeting, which will be arranged as soon as enough members can be got together.

WIRELESS TERMS TRAVESTIED—6.

Resistance Feed.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE

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

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

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

DIODE AND REACTION

"I have recently been trying out the diode method of detection, and whilst I heartily endorse all claims made for its purity, I find there is a sad loss of volume. The diode is preceded by a variable-mu valve, and followed by a pentode, but the distant stations are now lost to me. Is there any way of boosting the strength of this form of detector so that I can get a few foreigners? I do not want to add another L.F. stage if I can help it, as I am using a mains unit and it is already fully loaded."—(W. D., Edgware.)

We presume that you are using the valve which originally served as the detector for your diode, and this may be used to provide signals quite as loud as previously. The grid of the valve should be used for the diode, and the anode ignored. We do not know whether this is the arrangement you are using, or whether you have bonded the grid and anode or are using the anode alone. However, use the grid as above-mentioned, and then connect the anode to the reaction condenser (which we presume you previously used). A further H.F. choke will, of course, be required to connect the anode to the H.T. supply, but the reaction will act as with an ordinary valve and will give you the advantage of distant reception. The quality does not appear to suffer from this method of using a diode.

CLASS B.

"My receiver is a bit ancient, but has stood the test of time. It employs a neutrodyne H.F. stage, anode bend detector, and three resistance-capacity stages. Would you think the addition of a Class B stage in the last socket would be an improvement? I get very pure signals, but not much punch, and I think the Class B arrangement would be worth while, but I should like your advice first."—(U. C. B., York.)

It is not very easy to give you a reply to this question, U. C. B. Presumably, from the circuit arrangement, you have gone all out for quality, irrespective of high stage gain. Therefore, the input to your third L.F. stage is quite small. Class B requires a fairly strong signal to be passed through the primary of the driver transformer, and it is probable that even now, after all your R.C. stages, the output valve does not handle a sufficiently large signal. We think, therefore, that probably the best arrangement would be to scrap the two last L.F. stages, fit a really high-class L.F. transformer with high ratio between the detector and the first L.F. valve, and to follow this by the Class B stage driver. This would give you the punch, and would not give bad quality. In view of the three stages you are now using, however, we would hesitate to recommend you to add the Class B and driver after the present set, as there would be a great risk of L.F. instability.

AERIAL INSULATION

"I have just moved from a flat into a house, and have now for the first time got the chance of building an outdoor aerial. I am not clear as to the best arrangement of the insulators for an outdoor aerial, and I notice from a catalogue that there two types of china insulator, one like a reel and the other called the 'egg.' Which is the best, and would I want more than one at each end? They seem to be rather small to me."—(A. L., Weston-super-Mare.)

The principal consideration in arranging aerial insulation is to provide a long leakage path. Therefore, you may use either of the types of insulator you mention, but more than one is required. The best arrangement is to obtain a dozen insulators, and to wire them in two chains of six. The wire which you use for the aerial may be used to join them together, and the space between each insulator should be about 3 or 4in. Pass the joining wires through opposite holes so that there is no metallic connection from one insulator in the chain to the next. Then fit one chain to the aerial pole and the other to the chimney or house end of the aerial, and suspend the aerial between the two chains. The aerial should be lowered periodically and the entire chain thoroughly washed in warm soda water and brushed with a wire brush to remove the sooty deposit which coats it.

TRIPLE RANGE COIL

"I like making my own coils, and have used for some time now a very efficient dual range coil. I also have a spare set which is wound for short waves, and I like to listen on the 10 metre band now and then.

DATA SHEET No. 31

Cut this out each week and paste it in a Notebook

UNITS AND THEIR EQUIVALENTS

One foot-pound	1lb. raised 1ft. high
One B.Th.Unit	1lb. of water raised 1° F. 778.8ft. lb. 1,005 joules.
One H.P. hour	0.746 kW. hour 2.545 B.T.U.'s.
One kW hour	1,000 Watt hours. 1.34 H.P. hours. 3,412 B.T.U.'s. 2,654,200ft. lbs. 3,600,000 joules.
One H.P.	746 watts. 0.746 kW. 33,000ft. lb. per minute. 550ft. lb. per second. 2,545 B.T.U.'s per hour. 42.4 B.T.U.'s per minute. 0.707 B.T.U.'s per second

Could I wind a coil to take me over the whole range and so save myself the trouble of disconnecting one set when I wish to change the range? I should like winding data, if this is possible, and to receive your valued advice."—(A. I., Wood Green.)

It is quite possible to make up a coil of the type you mention, but it is not very efficient. As you have probably found, the short waves require very careful treatment, and the use of a three-range coil means that the medium and long-wave coils have got to be short-circuited when listening on the short waves. This may introduce losses which will prevent the maximum efficiency being obtained. A much better arrangement is to build a complete short-wave detector stage in one part of your cabinet, and to arrange a switch in the anode circuit of the valve. This should connect to the L.F. coupling arrangement so that the short-wave detector or the ordinary detector could be coupled to the L.F. stages. A separate filament switch would also be advisable to switch out the unused valve.

SCREENING A LEAD

"I am afraid I am getting hum from the pick-up leads in my set and should like to try the effect of screening them. As I am not sure that it is this which is causing the trouble I do not want to buy screened leads until I have found out the actual fault. I think I could carry out screening by winding some copper wire round and round the rubber covering of the pick-up leads and connecting this to earth. Is this so?"—(W. J., Crystal Palace.)

You could screen the wire by this means, but there is one serious snag. If you wind the wire round and round (and use ordinary covered wire for the purpose) you will have an inductive covering over the wire and this may give rise to even worse troubles. You could overcome this by using bare wire and winding it so that each adjacent turn touched and so short-circuited the inductance, but it would tend to open and when the lead was bent the turns would not be in contact and this would lead also to trouble. It does not cost much for the screened cable and it is a much more satisfactory arrangement. You can get three feet of cable, with all clips and earthing tags for 1s., and this is therefore the better course to adopt.

WOODEN PANEL

"I have just finished my radio-gram, and I want to fit the set into it. I have fretted out a neat vignette in the front of the cabinet, but as this is of walnut I do not like the look of a sheet of ebonite inside it. Could I mount the panel controls on a piece of the walnut so as to match the cabinet, or is there any reason why wood is not good enough for the purpose?"—(B. H., Highbury, N.)

A great deal depends upon what controls are mounted on the panel. If only components which are connected to earth, or which have an ebonite fitting are attached to the panel, then wood may certainly be employed. In some parts of the circuit it is still possible to use wood, provided it is quite dry and that metallic bodies in contact with the wood are separated by a good space and are in parts of the circuit where there is little risk of inter-action. You will, therefore, have to study your circuit and note what controls are mounted close together. An alternative, of course, is to use a very thin ebonite panel and mount the components on that, with a facing of walnut veneer with clearance holes cut in it.

AUTOMATIC GRID BIAS

"I have read all your articles on grid bias and I am now going to build up a set employing this method of biassing. Which method, however, do you recommend me to adopt? There are several methods, apparently, and I am not sure which is best."—(P. R. V., Manchester.)

This is a question which it is not possible to answer. First of all, you do not state what circuit arrangement you are proposing to use. Secondly, you do not say whether battery-operated or mains valves are in use. As you know, the bias resistance may be inserted in the cathode lead of an I-H valve, or in the common negative lead. You must, therefore, study the articles again and adopt the method which best suits your circuit arrangement.

D.C. MAINS SETS

"I have built a circuit shown in your book, and am using it with a home-made D.C. mains unit. When I switched it on at first it sounded all nice and clear, but when I went to adjust the loud-speaker after a few minutes I found it was almost red-hot. I switched off and examined the output choke arrangement, and this appeared to be O.K., but after switching on again the same thing happens. What can be the reason of this? The unit is a good one and the circuit seems all right.—(W. G., Kentish Town.)

As you have made up an ordinary circuit and connected it to an ordinary D.C. mains unit, you have probably overlooked one point. The receiver should not be joined direct to earth. It should be earthed *via* a large fixed condenser, say 2 mfd. It is also advisable to fit a 2 mfd. fixed condenser on each side of the loud-speaker if this is fed from an ordinary output choke arrangement. These remarks only apply, of course, to D.C. mains receivers.

FREE ADVICE BUREAU
COUPON

This coupon is available until April 29th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 22-4-33.

CATALOGUES RECEIVED

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

THE COSSOR MP/PEN

WE have received a leaflet giving full particulars and curve diagrams of the new Cossor A.C. mains pentode valve which has several advantages over an output valve of the triode type, including improved bass response, higher power sensitivity and larger output. The valve is designed for a heater voltage of 4 at 1 amp. and a maximum anode voltage of 250. A copy of the leaflet can be obtained from A. C. Cossor, Ltd., Highbury Grove, London, N.5.

BRYCE POWER PACK

IN a leaflet issued by W. Andrew Bryce and Co., details are given of this useful unit for converting a battery set to all-mains working and supplying the field current for a moving-coil speaker. The pack consists of a mains transformer, L.F. smoothing choke, valve holder, fixed condensers, and sheet steel chassis, complete with sockets clearly marked with input and output voltages. Two models are obtainable, one giving a smoothed H.T. output of 350 v. 80 mA. and L.T.-A.C. 4 v. 3 amps, the other giving 500 v. H.T. at 120 mA. and L.T.-A.C. of 4 v. 2-3 amps. The address is Woodfield Works, Bury, Lancs.

MAGNACORE COMPONENTS

FULL particulars of a Quiescent Push-Pull Transformer and a Q.P.P. Output Choke, are given in a folder we have just received from Magnacore, Ltd., 57, James Street, London, N.W.1. The transformer has a ratio of 8.5 to 1, with a D.C. primary resistance of 050 ohms, each half of secondary having a resistance of 525 ohms. The choke, which has a total primary D.C. resistance of 840 ohms, can be obtained with a ratio of either 1 to 1, 1.8 to 1, or 2.9 to 1, for matching, to any ordinary type of speaker. Both components are priced at 7s. 6d., with an additional 1s. 6d. royalty on the transformer.

GRAHAM FARISH COMPONENTS

A COMPLETE range of the latest components made by Graham Farish, Ltd., is given in a booklet issued recently by this firm. A new potentiometer volume control, the "Megite," has an element of fine nickel-chrome wire embedded in bakelite. The action is through a slipper plate, giving a smooth, silent operation. Among the other components listed are a new H.F. choke, grid leaks, "Ohmite" resistances fixed and variable condensers, valve holders and "Filt," the new percolative earth. The address is Masons Hill, Bromley, Kent.

FERRANTI POWER UNITS

THE construction of mains units calls for a certain amount of technical knowledge and experience. Messrs. Ferranti, of Hollinwood, Lancs, have specialised in such apparatus for years, and have prepared an interesting and useful folder, No. Wa. 522. This contains constructional details for several different types of mains units, with theoretical diagram, wiring diagram, chart of D.C. output, list of components, and valuable technical details. In addition there is a chart showing at a glance the value of resistance required to drop practically any voltage at any current. Copies of this folder may be obtained by readers by sending threepence in stamps to Messrs. Ferranti at the address given above.

Replies to Broadcast Queries.

DIGGER (Leicester): Ship telephony on about 200 m. M. SYMANS (W.12): (1) Norddeich (Germany) calling S.S. Cap Ancona; (2) regret, cannot trace: (3) possibly W2XA, New York, on 48.9 m.; (4) DJA; Zeesen, on 31.381 m. F. G. CHARLTON (Southgate), (1) G8A, Empire Broadcaster on 49.586 m.; (2) DJC, Königs Wusterhausen, on 49.83 m. TWO VALVE (Jedburgh): G6YJ is the call sign of Mr. F. R. Canning, "Crindan," Newport (Mon); he would like your report on his transmission. POP (Birmingham): (1) W2PP is the call sign of W. F. Scott. 207 N. 11 St., Newark (N.J.); (2) G5IS; call sign of P. Johnson, 49, Carson Road, Dulwich, S.E.21; (3) cannot trace; (4) this would be the call sign of a coastal station, but we cannot trace it in lists.

MORE ABOUT INTERFERENCE

(*Continued from page 182.*)

rings is usually the cause. Sparkless commutation is the first thing to be aimed at by careful bedding of the brushes, and condensers should be connected in series across the brushes, with their centre point earthed, Fig. 6. In obstinate cases a heavy duty choke, capable of carrying the full current of the machine, should also be connected in each of the mains leads, together with condensers, in the manner shown in Fig. 7.

Interference from overhead conductors of trams and trolley buses is now being dealt with by some municipal authorities, and although at present it has not been found possible to completely eliminate the trouble, a great reduction of the annoyance has been brought about by the fitting of protective devices on each vehicle.

Earth Leakage Currents

All the sources of interference already enumerated, with the possible exception of earth leakage currents, may be quietened down without much difficulty, if suitably dealt with, each case requiring its own particular treatment, and in cases where the interference has been reduced, but not completely removed by this treatment, altering the direction of the aerial so that it is at right angles to the direction from which the interference is coming will usually have the desired effect.

Earth leakage currents present a more difficult problem. They may cover a wide area, and although regulations are laid down for their control, these are not always effective from the wireless user's point of view. Where this type of interference is experienced, the most effectual remedy is the use of a counterpoise in place of the usual earth. This, however, is not always to be recommended, as in the case of mains operated receivers the use of a counterpoise may introduce hum, which may possibly be as unpleasant as the interference which it is desired to cure.

The B.B.C., in collaboration with the Post Office engineers, has carried out a great deal of research, and has done much valuable work in the investigation of problems connected with interference to wireless reception, and over 10,000 cases of complaints from listeners are being dealt with annually.

Where reception is suffering due to the influence of outside electrical disturbances, the origin of the trouble should be located if possible and the owner of the offending apparatus approached with a view to its cure. If difficulties arise, the complainants may with confidence look to the B.B.C. and the P.O. engineers for assistance.

No actual or legal responsibility for correcting the trouble rests with the owner of the apparatus, however, and whether he takes any steps in the matter is entirely a question of good will. The onus of responsibility in the future should really fall upon manufacturers of electrical equipment which is likely to cause interference, and the introduction of legislation to this effect is desirable. A decree on these lines has already been passed and is being enforced by the Belgian Government.

ADVERTISEMENT INDEX

P. W. Gift Stamp No. 30

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Practical Wireless

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Solving the Portable Problem

The First Completely Safe — Completely Practical —

ALL-ELECTRIC RECEIVER

for the Home Constructor!

The LISSEN ALL-ELECTRIC A.C. SAFETY "SKYSCRAPER"

Here is the All-Electric "Skyscraper."
So phenomenal has been the success of the Battery "Skyscraper"—so universal the delight expressed by its builders in its simplicity, in its great power, in its wonderful ease of operation, that *Lissen could not bear to give this famous name to an All-Electric set* UNTIL ABSOLUTE SAFETY—the one feature for which the home constructor has previously looked in vain in any Mains-driven set—had been achieved by the Lissen designers. IT TOOK MONTHS, BUT HERE IT IS. There are two chief safety features in this set. First, the Lissen "Skyscraper" Power Unit . . . . so completely enclosed and protected in sheet metal, so rigorously designed within for safety as well as electrical efficiency, so simplified, that YOU USE IT JUST LIKE A BATTERY. *Actually you connect up the terminals of this "Skyscraper" Power Unit exactly as though they were the battery terminals of a battery set.* Second, THE SAFETY FUSE PLUG. You simply plug in to the mains from which you are going to draw your power, and instantly the set is completely protected. For in *each* lead from the mains inserted ingeniously into the plugs is a tiny fuse, which adequately protects the receiver from harmful effects of excess current. Thus, when you have built the All-Electric "Skyscraper" you and your set are perfectly protected.

HOME CONSTRUCTORS MAINS SET WITH ALL THE FEATURES OF LUXURY COMMERCIAL RECEIVERS
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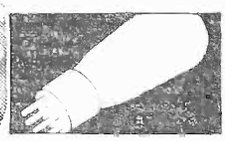
No harmfully powerful current can possibly flow from your mains to your A.C. Skyscraper. The special safety fuse plug completely protects you by introducing a small valve fuse into each lead.



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The four valves of the A.C. Safety Skyscraper are matched to each other and to the rest of the special circuits to give the utmost power, utmost range, utmost fidelity of reproduction.

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Send for this coloured new constructional chart—every detail is explained—every single stage of construction is shown by coloured photographs. Post the coupon below and see for yourself how easy it is to build this wonderful new All-Mains receiver.

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Please send me FREE copy of the Chart of "All-Electric Safety A.C. Skyscraper."

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POST THIS COUPON

SKYSCRAPER SAFETY

ROUND *the* WORLD *of* WIRELESS

Fighting for the Long Waves

IT would appear that seven European countries to whom wavelengths in the medium band were originally allotted have now put forward claims to broadcast on channels above 1,000 metres. As, at present, the upper band can only accommodate eleven transmitters on wavelengths already allocated to some of the older established transmitters, it is very doubtful whether, and how, the Lucerne Conference will see its way to satisfy all applicants.

More Russian Stations

IF news from Finland is to be believed, when Moscow has launched its 500-kilowatt broadcaster on the air the Soviet authorities will begin the construction of a further twenty high-power transmitters with a view to flooding Europe with official news bulletins. These transmissions will be carried out in various languages. As capital is required for this further development of the Russian broadcasting system, with the exception of members of the Red Army, all owners of wireless apparatus will now be compelled to pay an annual radio tax. It is stated that, in view of the fact that Germany has suppressed all communist organizations, including newspapers, the new super-power Noghinsk transmitter will devote most of its time to propaganda and special bulletins destined to that country.

Radio Vatican Time Table

AS we have received a number of queries from readers in respect of the Vatican broadcasts, it may be of interest to detail the transmissions carried out by this Italian station. On 19.84 m. daily a bulletin is issued at 11 a.m. G.M.T. for missionaries throughout the world. It is given out in various languages, namely, Italian (Monday and Friday); English (Tuesday); Spanish (Wednesday); French (Thursday); and German (Saturday). Every evening Papal *communiques* are broadcast in Italian at 8.0 p.m. G.M.T. on 50.26 m. On Sundays, between 11.00 and 11.30 a.m. on 50.26 m. prayers are transmitted in Latin and French, followed by an Italian sermon. They are destined to the sick and chronic invalids who cannot attend Mass. This transmission occasionally closes down with a short programme of Sacred Music.

Jugoslavia Wants More Stations

DURING the course of the present year the Belgrade station is to be endowed with a 40-kilowatt transmitter, and the older plant will be transferred to Subotica, as a relay. Another 8-kilowatt station is to be erected at Skolpje. Zagreb also will transfer its existing transmitter to Spilt (Spalato) and will replace it by a broadcaster capable of radiating some 20 kilowatts. With this development of the system Jugoslavia will control a network of five stations.

Tune in to Caracas

IF you care to search the 49-metre band towards 3.0 a.m. G.M.T., you should have no difficulty in picking up YV1BC, Caracas, on 49.02 metres. During intervals between somewhat oldish numbers of gramophone records you will hear an English announcement: *This is the station YV1BC broadcasting on a frequency of 960 kc/s (312.3 m.) and also on 6,120 kc/s (49.02 m.). We are located in Caracas, Venezuela, and welcome reports from foreign listeners, which are acknowledged.* The acknowledgment consists of a profusely illustrated booklet in Spanish and English with descriptions of the Venezuelan capital and the transmitting station, all complete with maps.

And Another Star Short-waver

W2XE, the Columbia Broadcasting System's new transmitter at Wayne, N.J., is now working at increased power. It is on the air daily alternately on three separate frequencies; namely, from 4.0 p.m.–6.0 p.m. G.M.T. on 15,270 kc/s (19.646 m.); from 8.0–10.0 p.m. on 11,830 kc/s (25.36 m.) and from 11.0 p.m.–4.0 a.m. G.M.T. on 6,120 kc/s (49.02 m.). The transmissions carried out on 19.646 m. (15,270 kc/s) are made with an aerial specially directional to Great Britain in order to assist in the reception of the broadcasts. They are very well heard towards 5.0 p.m.

Wireless for New Air Services

ALL the aircraft for the new air services operated by Hillmans Airways from their aerodrome at Romford are to be fitted with Marconi equipment, which will enable the pilots to keep in touch with aerodrome stations throughout their flights.

Experience has shown that air-and-ground wireless services of this kind are practically essential to the safe and regular operation of modern air routes, which are expected to operate to schedule under conditions when even land and sea transport services are sometimes severely dislocated. Wireless assists the pilot by keeping him informed of changing wind and weather conditions all along his route, the state of aerodromes, and other vital matters, while with the type of Marconi equipment installed in the Hillman aircraft the pilot himself can also "ring-up" the nearest air port and ask for any information he may require.

"Bulgin" is Now a Registered Trade-Mark

A. F. BULGIN & CO., LTD., have recently been notified by the Registrar of Trade-Marks that their name "Bulgin"

"PRACTICAL WIRELESS" DATA SHEETS
Data Sheet No. 19, given with this issue, completes the first series. A second series is in course of preparation, and an announcement concerning them will be made in an early issue.—ED.

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

is now registered as a trade-mark. It is on very rare occasions that a surname is granted this privilege.

In order to substantiate the claim that the name "Bulgin" was alone in the Radio Industry, and so justify the registration, it was necessary for the firm to obtain some hundreds of affidavits from wholesalers, dealers and heads of trade organizations, and from all the leading radio trade journals, wherein they started that the name "Bulgin" had been used for the past nine years, and that the name had never been used by anybody else connected with the industry.

Wireless at the Ideal Home Exhibition

AN interesting and unusual feature of this year's Ideal Home Exhibition at Olympia (which closes on April 29) is the special display entitled "Rooms of the Scientists."

This section of the Exhibition provides a glimpse of the studies and laboratories of some outstanding figures in scientific research and discovery, from Archimedes to Marchese Marconi.

Among such names as Newton, Lister and Darwin, the progress of electricity is represented by Faraday and Marchese Marconi.

Faraday's Laboratory

A CORNER of Faraday's laboratory at the Royal Institution has been copied with remarkable fidelity, while the reproduction of part of the wireless room in Marchese Marconi's famous steam-yacht *Elettra*—his floating laboratory—represents the most modern application of Faraday's basic discoveries.

The "Elettra"

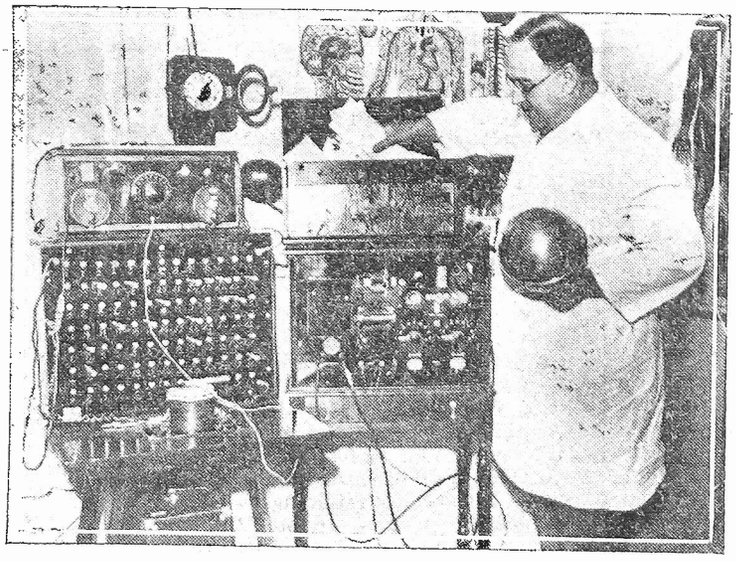
THE *Elettra* cabin has been furnished with a Marconi short-wave transmitter, Type SWB4, of the class used by Marchese Marconi for his early experiments in long-distance ship-and-shore wireless telephony, and also in March, 1930, for the transmission of the special signal from the S.Y. *Elettra*, lying off Genoa, which lit the lamps of an exhibition at Sydney, New South Wales. An example of the new Marconi micro-wave apparatus is also in the cabin. Other apparatus represents the newest developments in marine wireless equipment, such as the Marconi Type DFM4 direction finder and radiogoniometer, which operates with a small fixed loop aerial, a marine receiver, Type 394, which has a wave-range of 100-2,000 metres and is designed particularly for loud-speaker reception of telegraph or telephone signals, and a telegraph transmitter of the emergency type.

Sponsored Concerts from Athlone

ARRANGEMENTS have now been completed to broadcast sponsored concerts from the Athlone (I.F.S.) high-power station on 413 m. every evening between 9.45 and 10.45 p.m., B.S.T. The Irish Free State Army Band will be one of the regular features of these special entertainments.

INTERESTING and TOPICAL PARAGRAPHS

THE RADIO DOCTOR!



An American doctor has devoted his efforts to developing electro-therapeutic broadcasting devices by means of which he could cure body infections by remote control machines. He is seen in picture examining one of the 48 machines he has so far assembled.

It operates on a short wavelength, enabling him to give remote control treatments to 100 patients a day within a radius of 150 miles, without their knowledge that he is giving them treatment, as long as they are wearing his crystal receiving set (a small metal tin containing crystals composed of the various elements that go to make up the human body.)

Cyclones and Short-Waves

DURING April, when strong magnetic disturbances are to be expected, relays on short-waves from Europe by the American broadcasting nets are cut down to an absolute minimum. According to the Radio Corporation of America, during such periods atmospheric disturbances are such that considerable interference is experienced, even on short-wave channels.

Military Training by Radio

THE Spanish broadcasting stations have been instructed to include in their transmissions to schools special courses on military subjects and lectures relative to the physical training of Army cadets.

Radio Toulouse Partly Destroyed

A SEVERE fire recently greatly damaged the transmitting plant of Radio Toulouse; the studio was completely destroyed. As it is estimated that repairs to the building and plant will cost some £20,000, a request has been made to the authorities to bring the new St. Agnan station into operation for which, up to the present, no licence has been granted. So far permit has been refused, as it was feared that the broadcasts from a 60 kilowatt transmitter would interfere with those of the State station (Toulouse Pyrenées) in the same city.

More Wireless Telephony Services

IN addition to the public telephony service which was recently opened between Paris (St. Assise) and Bouffarik (Algiers), the latter has now initiated shore-ship communication with steamers in the Mediterranean and Atlantic. A wireless telephony service has also been officially opened between Great Britain and Palestine. On this side messages are transmitted *via* Rugby and received at Baldock; the corresponding stations being Abu Zabal (Cairo) and Mahdi, in Egypt. The route then taken to Jerusalem, Haifa, Jaffa, and Gaza is by land-line, with repeater stations at Ismaila and Lydda. All controls of the service are situated respectively at the London and Cairo Telephone Exchanges.

Belgium and Congo Broadcasts

THE Belgium Government is carrying out tests in an endeavour to relay the Brussels wireless programmes to the Congo, *via* the Leopoldville station. The experiments are being made by the Ruysselede (Bruges) short-wave transmitter.

No Summer Time in Portugal

BEAR in mind that as Portugal has *not* adopted Summer Time this year, if you wish to hear the broadcasts from CT1AA, Lisbon, on either medium or short-waves, they must be tuned in one hour later than their usually advertised G.M.T. times.

SOLVE THIS!

Problem No. 32.

Miller made a one-valve set using an all-metal chassis, wooden panel, and a baseboard mounting type of anti-microphonic valve-holder. The receiver was completed, the valve plugged into the socket, and the on-off switch pulled out. Immediately, the fuse blew. A new fuse of higher rating was inserted in the holder, and again it blew directly the on-off switch was operated. Valve and fuse were removed, and careful tests were carried out in the circuit, but there were definitely no short-circuits anywhere. A fresh fuse was, therefore, tried, but with the same result. Even the highest value fuse obtainable was blown as soon as the set was switched on. The valve was perfectly in order. What do you think was wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to the Editor, PRACTICAL WIRELESS, Geo. Newnes Ltd., 8-11, Southampton Street, London, W.C.2, and mark your envelopes Problem No. 32. Do not enclose any other correspondence with your solution, and post to reach this office not later than May 1st.

SOLUTION TO PROBLEM No. 31.

The grid leak of the resistance stage in Smith's receiver was faulty, and therefore the coupling condenser was accumulating a charge which partially choked the first L.F. valve.

The following three readers received books in connection with Problem No. 30:—

L. C. Jones, 24, Whitworth Road, S. Norwood, S.E.25; A. E. Peck, 15, Pelham Road, Wood Green, N.22.; A. A. Dodd, 6, Ferndale Road, Banstead, Surrey.

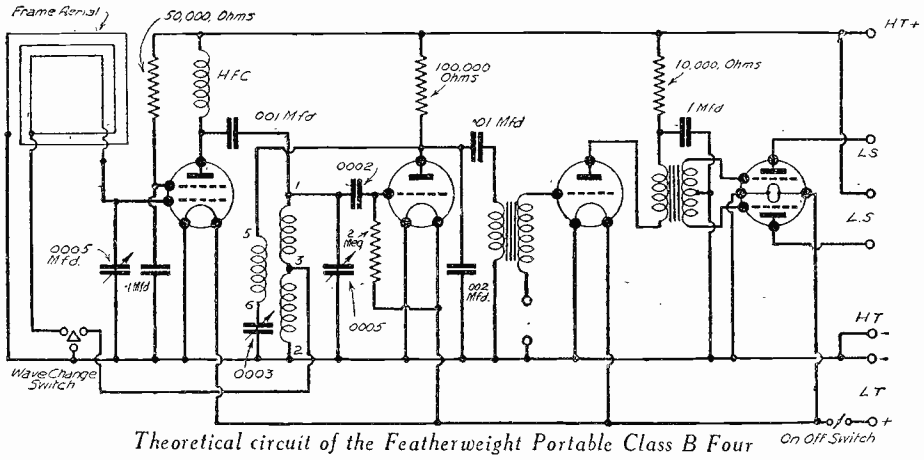
WE ALWAYS LEAD AND SHOW THE WAY!

Solving the Portable Problem

Advance Details of our powerful Featherweight Portable Class B Four-Valver, with many novel features, Blueprint of which will be given next week.

By F. J. CAMM

IT has become accepted by the radio industry that wireless is a seasonal hobby. It is my firm conviction that it has been seasonal in the past mainly because no one has taken the trouble to make it anything else. Obviously, in the brighter weather, people follow outdoor pursuits, but there is no reason why radio should not be enjoyed in the open as well, and at the same time. Portable sets with this idea in view have been produced which have merely given a new meaning to the word portable. Apparently it has been assumed that any wireless receiver which may be awkwardly humped a few yards is a portable receiver. Of course, it is absurd to expect anyone, especially in the hot weather, to carry a wireless receiver on a hiking tour, or even to the venue of a picnic, when its weight would give rise to the greatest discomfort, even admitting that all hikers and all those who wish to picnic were members of a race of Goliaths. It is fair comment to say that few portable receivers at present available are really intended for such use. As room-to-room sets, or for use in the garden, they may be ideal, but for taking on the river or on a picnic they would be useless. **Accordingly, when designing the Featherweight Portable Class B Four, which forms the subject of next week's free gift full-size Blueprint,** I determined to tackle the problem of weight reduction. A preliminary survey showed that weight was not a necessary appendage to first-class performance, for there are many extremely efficient but lightweight components such as transformers, valve-holders, condensers, etc., which lend themselves admirably for portable purposes.



Theoretical circuit of the Featherweight Portable Class B Four

SPECIFICATION OF FEATHERWEIGHT PORTABLE.

Two Utility Bakelite Condensers, .0005 Type W. 297.
One Wearite H.F. Choke, Type H.F.P.A.
One Lissen Dual Range Shielded Coil.
One Graham Farish Litlos Condenser, .0005.
One Graham Farish Ohmite Spaghetti Resistance, 15,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 50,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 100,000 ohms.
Three Clix 4-pin Chassis Type Valve-holders.
One Clix 7-pin Chassis Type Valve-holder.
One Bulgin On-Off Switch, Type S. 38.
One Bulgin Wave-Change Switch, Type S.36.
Four Bulgin Frame Aerial Spacers, Type I.12.
One Bulgin Senator Transformer, Type L.F. 12.
One Lissen Class B Driver Transformer.
One 2 megohm Grid Leak, with wire ends, Lissen.
One T.C.C. .01 mfd. Fixed Condenser, Type M.
One T.C.C. .0002 mfd. Fixed Condenser, Type M.
One T.C.C. .002 mfd. Fixed Condenser, Type M.
One T.C.C. .1 mfd. Fixed Condenser, Type 50.
One T.C.C. 1 mfd. Fixed Condenser, Type 50.
One T.C.C. .001 mfd. Fixed Condenser, Type M.
One Cossor 220 S.G. (Metallised) Valve.
One Cossor 210 H.F. (Metallised) Valve.
One Cossor 215 P Valve.
One Cossor 240 B Valve.
One Rola Loud-speaker, Type F.5-PM-14-Class B.
2 ozs. 24 D.C.C. wire and 2 ozs. 34 D.S.C. wire for frame.
One Ediswan 120 volt H.T. Battery, ref. 69706.
One Ediswan 9 volt Grid Bias Battery, ref. 69807.
One Ediswan 2 volt accumulator, E.L.M.2.
Four Wander Plugs, (H.T.+, H.T.—, G.B.+ and G.B.—).
Two Spades (L.T.+ and L.T.—).
One coil Glazite, flex, screws, wood for case, carrying handle, etc.

IT was revealed that the average commercial portable cabinet weighs anything between 10lbs. and 12lbs., and I decided that practically all of this could be usefully dispensed with whilst retaining the necessary rigidity. I therefore adopted the same methods of weight reduction as are used in the aircraft industry. The case of the Featherweight Portable Four is an easily-assembled structure made from 1in. by ¼in. stripwood which, when covered with thin cardboard, and finally with leather cloth, has produced a cabinet *which weighs only 1lb.* I carried the stripwood idea even farther, for the baseboard merely consists of three spaced strips of the same wood, between which the components are screwed.

Another problem which I sought to solve was the usual difficulty of assembling a portable set, for normally, with this type of receiver, it is necessary to fiddle about in the restricted space usually allowed in order to connect the components to the controls. This arrangement necessarily endows the receiver with numerous obscure corners in which it is impossible adequately to get the fingers in order to tighten terminals or attach wires. As a consequence, I decided that the stripwood baseboard should be attached to a fretted front built from ¼in. stripwood and that the frame aerial, speaker, and all components should be mounted on it as well. This front comprises the receiver proper, and the remainder of the case is merely a protective covering providing also accommodation for the small H.T. battery, grid-bias battery, and accumulator. The front, with all the components attached, is merely hinged at the bottom to the covering case, and is secured at the top with a simple swing hook which locks it. It is thus only necessary to release the hook in order to swing the set outwards on its hinges when adjustments may readily be carried out. I also decided that in order to reduce H.T. consumption, and further to enhance the compactness of the receiver, Class B amplification was necessary. The total consumption is only 8 milliamps, and bearing in mind that this is really a 5-valve receiver (the Class B output valve really constituting two valves in one) this is extremely economical. The overall size of the complete receiver is only 15in. by 12in. by 6in., and it may quite

(*Continued on page 246.*)

SELECTIVITY IN SIMPLE TERMS

Ways and Means of Increasing Selectivity in Ordinary Three-Valve Sets

By F. WHITE

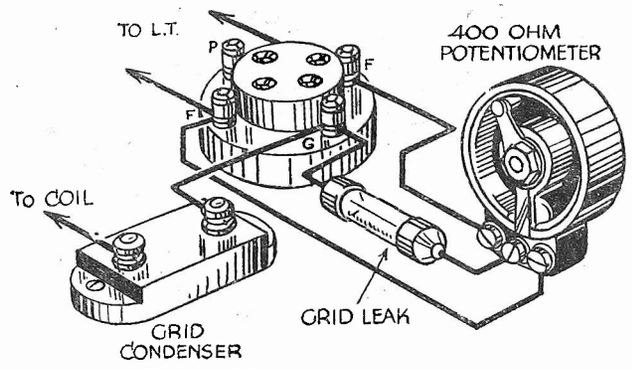
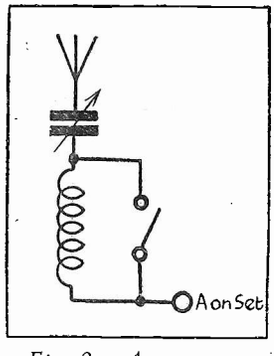


Fig. 1.—Obtaining smooth reaction.

TWO or three years ago the ability of a receiver to "get foreign stations" depended on its sensitivity more than its selectivity. Now that the position is reversed and there are numerous stations working at high power, selectivity is of vital importance.

The ideal method of obtaining the required selectivity is to use a multi-stage H.F. receiver with many tuned circuits. Such a solution is expensive and rather laborious if the receiver is home-constructed. It will be the object of the writer to show means of increasing the selectivity of a simple receiver. Let us consider a three-valve set—a detector and two L.F. stages.



Single Tuning Circuit

Such a set has only one tuning circuit (in absence of band-pass filter) and the most has to be made of this. The lower the resistance of the circuit and the higher its inductance, the greater will the selectivity be. Now the aerial and earth system adds to the circuit resistance, and so blunts the tuning to some extent. The earth should be a large buried object in moist soil. A water-pipe makes a good earth, and one should be used which goes directly to mains, and not one which runs all over the house and into the tank. Use a short stout earth wire.

The aerial should be as short as the sensitivity of the set will allow, but such a procedure will, of course, not favour the weaker stations. These will not then interfere with their powerful neighbours (in kilocycles), and surely it is better to receive a few stations clearly than many which interfere with one another.

The degree of selectivity is dependent on the coil employed. It has already been shown that a shield or screen on the coil in such a receiver is unnecessary and only blunts selectivity. Choose then a dual-range coil in which the long-wave portion is not wound right next to the medium-wave portion. If these two portions are very near then the long-wave coil (when shorted) exercises a damping effect on the medium-wave coil which blunts selectivity. Choose a coil which is tapped, or, better still, one which has several tappings. You can then use that tapping most suitable to your conditions. Alternatively use a coil with aperiodic aerial winding, *i.e.*, one which has a separate winding for aerial and earth. The degree of selectivity can then be varied by loosening or tightening the coupling between the two coils.

When the aerial is long, and the coil has only a centre tapping, greater selectivity can be obtained by the use of an aerial series condenser. This may be a solid dielectric type with a maximum capacity of .0003 mfd. It is connected between the aerial and aerial terminal of set. Unscrewing it increases selectivity, but decreases the volume. A satisfactory setting must be found by experiment. Signal strength may be increased by the use of reaction.

Reaction

Reaction is a good servant but a bad master. Used properly it will increase signal strength and also selectivity. If it is fierce or "ploppy," then it is of no use at all. Increasing it from zero to maximum should at some point result in a gentle hissing from the loud-speaker to be followed by oscillation as the reaction is advanced. Oscillation should cease (when *decreasing* reaction) at that point where it commenced. If the reaction dial has to be moved through several degrees before oscillation stops, then you are not obtaining the best results. You may be using an unsuitable valve in the detector stage. Try varying the detector tapping (on H.T. battery) to get smooth reaction. The best results are obtained when the grid-leak is returned to the slider of a potentiometer across the L.T. battery instead of being connected to L.T.+. Such an arrangement is shown in Fig. 1. The slider is slowly advanced to the negative side of potentiometer till the best position for working is found.

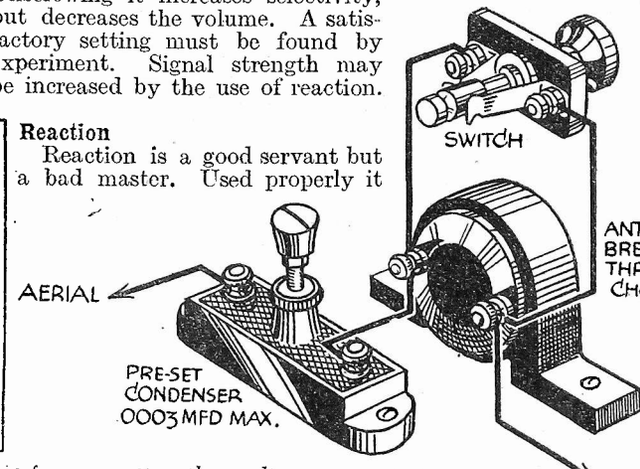


Fig. 2.—An arrangement for preventing the medium wave station breaking through on long waves.

On the Long Waves

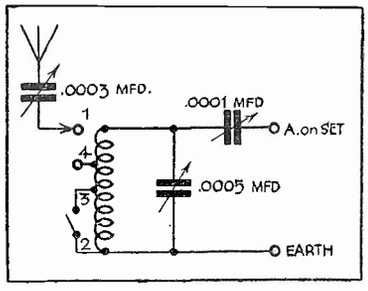
On the long waves a simple set (such as the type mentioned) suffers badly from lack of selectivity. What sometimes happens is that the two London stations (or two local stations) are heard together over half the dial. We will not go into the theory of this form of interference called cross-modulation, but a cure is given. It consists of the use of a specially designed H.F. choke, which is so designed that the impedance to medium waves (*i.e.*, to frequencies of about 1,500 kc/s to 600 kc/s) is very much greater than the impedance to long waves. Thus, while medium-wave signals are completely blocked, long-wave signals are passed through almost unchecked. The method of wiring the choke into circuit is shown in Fig. 2.

The switch is closed when the medium waves are worked and left open when long waves are received. The .0003 mfd. maximum condenser is set at a suitable setting, its value not being very critical. If greater selectivity is required another compression condenser may be added to the previously described unit. It is placed between the aerial and the terminal marked aerial on unit.

Double-Circuit Tuning System

So far the schemes for improving selectivity have been very simple. It is quite possible that after trying the aerial series condenser, and other simple devices, that

(*Continued on page 232.*)



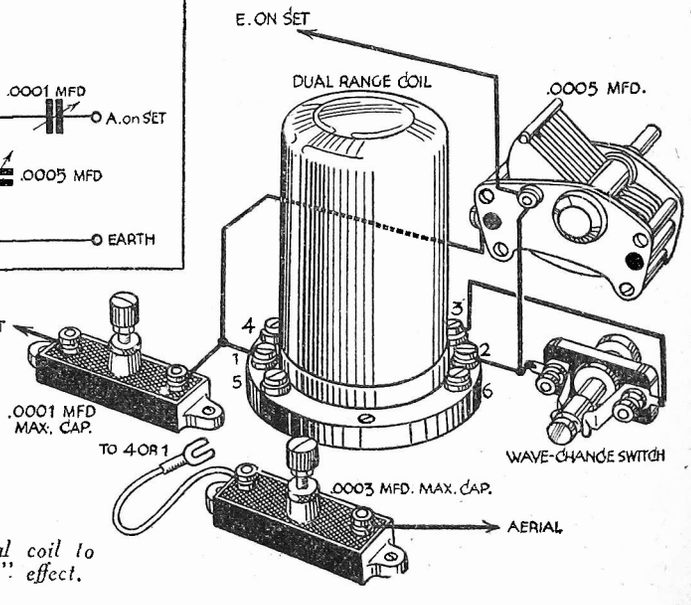


Fig. 3.—An additional coil to provide a "band-pass" effect.

SAFETY FIRST!

A Few Suggestions for Protecting the Receiver and its Accessories from Damage.

By FRANK PRESTON, F.R.A.

DESPITE the above title, I do not wish to suggest that by following our fascinating hobby we are at all likely to be electrocuted or injured in some other way. What I have in mind is the safety of the receiver and its components. I have heard it said—probably truly—that over fifty per cent. of the breakdowns and failures of certain components, especially valves, high-tension batteries, resistances, transformers, and even loud-speakers, are due to carelessness or lack of forethought. It is also said that "to be forewarned is to be forearmed," so perhaps I may be excused for giving a few friendly warnings and suggestions which might result in a saving of time, temper and money.

A switch for connecting the aerial to earth when the set is out of use is always recommended, its ostensible purpose being to protect the receiver in case the aerial is struck by lightning. The switch also transforms the aerial-earth system into an efficient lightning arrestor, which affords protection to the house. Of course, the probability of an average aerial being struck by lightning is extremely remote, but it is by no means impossible for atmospherics of the most powerful kind to cause minor injuries to components in the aerial tuning circuit, and on this score alone the aerial switch is justified.

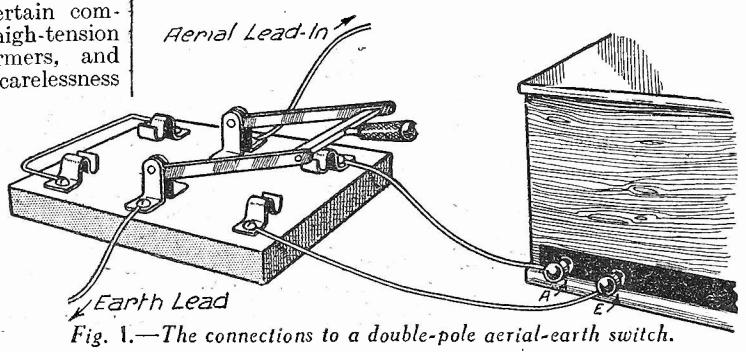


Fig. 1.—The connections to a double-pole aerial-earth switch.

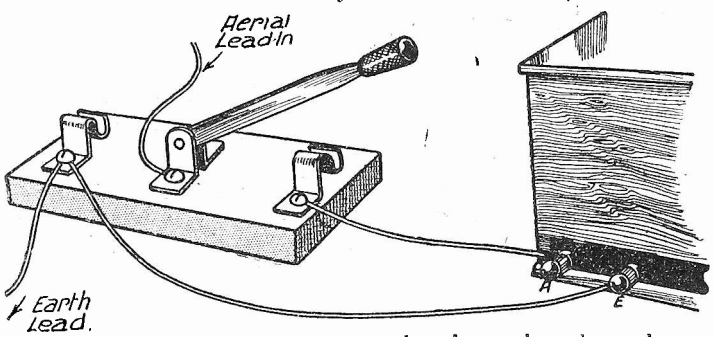


Fig. 2.—The connections to a single-pole aerial-earth switch.

Single-pole and Double-pole Switches

There are two principal kinds of switches in common use, one called a single-pole, and the other a double-pole change-over switch, and they are connected as shown in Figs. 1 and 2. When using the single-pole component the aerial is connected to the set (*via* the earth wire) even when the switch is "off," but with the other type both aerial and earth are entirely disconnected. It is because of this that we are often told that the single-pole switch does not offer real protection. Actually, however, it is perfectly "safe," provided that the earth lead is reasonably efficient, because any electrical charge which reaches the aerial will always leak away through the path of least resistance, which is, of course, the earth lead. The position of the switch is probably of greater importance than its type, and it should be mounted as near as possible to the aerial and earth leads-in. Theoretically, the best place would be outside the house on the window frame, but there are very few of us who feel like taking a walk in the garden last thing before going to bed. It is not necessary to do so, for, provided the switch is screwed to the window-sill near the lead-in wires, all will be well.

A Spark Gap

Quite apart from lightning discharges, it is probably not fully realised to what extent very powerful atmospherics can be harmful, especially when the set is in use. They act rather like strong signals, and, coming so suddenly, are liable to produce rapid voltage surges in the set which might even cause the breakdown of a transformer or valve. For this reason it is always wise to switch off when atmospherics become really troublesome. In any case, reception cannot be enjoyable, but one is sometimes tempted to hang on until a programme is finished. If for any reason it is particularly necessary to keep the set in use in spite of atmospherics, some measure of protection can be secured by fitting a spark gap between the aerial and earth leads; this will allow any exceptionally strong discharge to leak away without doing much harm. The gap may be made quite easily from the simple parts indicated in Fig. 3. Incidentally, it might be added that a number of aerial-earth switches are now fitted with a suitable spark gap of the type illustrated in the sketch of Fig. 4. In addition to serving the purpose mentioned above the spark gap is a good stand-by when one forgets to turn off the switch, for in case of lightning it will provide a reasonably low-resistance path between aerial and earth for electrical discharges, although having no effect on

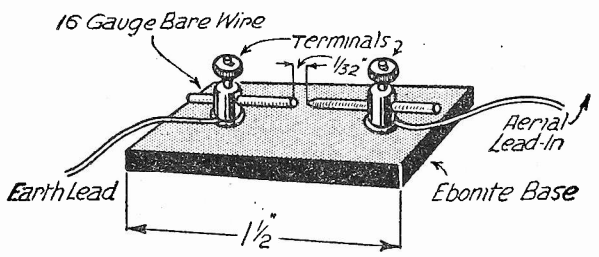


Fig. 3.—A simply made spark gap for connecting between the aerial and earth.

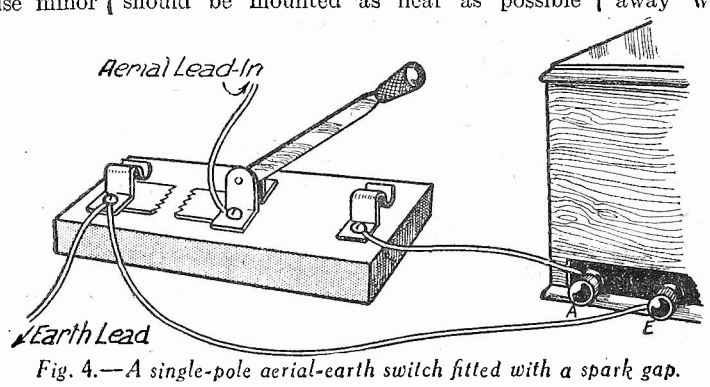
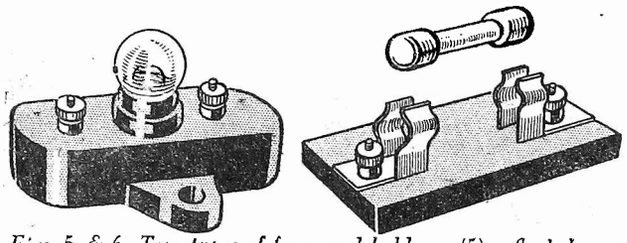


Fig. 4.—A single-pole aerial-earth switch fitted with a spark gap.



Figs. 5 & 6. Two types of fuses and holders: (5) a flash-lamp-bulb fuse and (6) a cartridge fuse

normal reception. For the benefit of newcomers to wireless I might mention that although atmospheric discharges are practically unknown in winter, they are frequently very troublesome during hot and sultry weather. Consequently, if an aerial-earth switch has not yet been installed it might pay to attend to the matter before summer comes along.

Fuses

Whenever one thinks of safeguarding the receiver the idea of fuses immediately comes to mind. And no wonder, because they are particularly useful, especially to the constructor and experimenter. We are none of us infallible, and little mistakes will occur; let the accumulator spade terminal fall on to the H.T. battery terminal and, unless a fuse is fitted, we must say good-bye to a set of perfectly good valves; it only needs a loose wire in the set to short-circuit the high-tension terminals to result in the ruination of the battery or eliminator. A newly-made set should never be tried out without making sure that a fuse is fitted in the negative H.T. lead.

There are two or three kinds of H.T. fuses, but of these the cartridge and flash-lamp bulb types, which are shown in Figs. 5 and 6, are most popular. Whatever kind is employed, it should be connected between the H.T. negative and L.T. negative terminals; one way of doing this is illustrated in Fig. 7, where the wire which has been removed is shown in broken lines. Another very convenient way of fitting a fuse to an existing set is to replace the ordinary H.T. negative wander plug with a special one of the type shown also in Fig. 7. The "Wanderfuse," as this plug is called, is of tubular construction, and is made to hold a cartridge-type fuse.

With a battery set the fuse should be rated at about 60 milliamps, which means to say that it will burn out when any current greatly in excess of the latter figure is passed through it. As a matter of fact, most fuses are designed to "blow" at a current 50 per cent. greater than that for which they are rated. It is unwise to use an ordinary flashlamp bulb as a fuse in a set having less than three valves, because it might possibly carry sufficient current to impair, even if not to burn out, the valve filaments. Special fuse bulbs are made, however, in ratings of 60 and 120 milliamps, which are suitable for all requirements. In addition to the fuse in the H.T. negative lead, it is often an advantage, especially with an experimental receiver, to fit one in all except one of the positive tappings. It can be seen that the latter tappings often have a sufficiently high voltage between them to damage the valve filaments in case of a wrong connection, and besides this, a short-circuit of even a portion of the battery might render the whole component more or less useless.

Fuses in Mains Receivers

In the case of a mains-operated receiver the question of fuses is a little more involved. Those of the flash lamp bulb type are practically useless since the contacts are so near together that the higher voltages (especially when A.C.) have no difficulty in "jumping" across them, so forming an electric arc which itself will carry sufficient current to do no end of harm. The shorter cartridge fuses are unsuitable for the same reason, and most firms make a special one having a length of about 1¼ins., and which is therefore proof against the latter potential source of trouble.

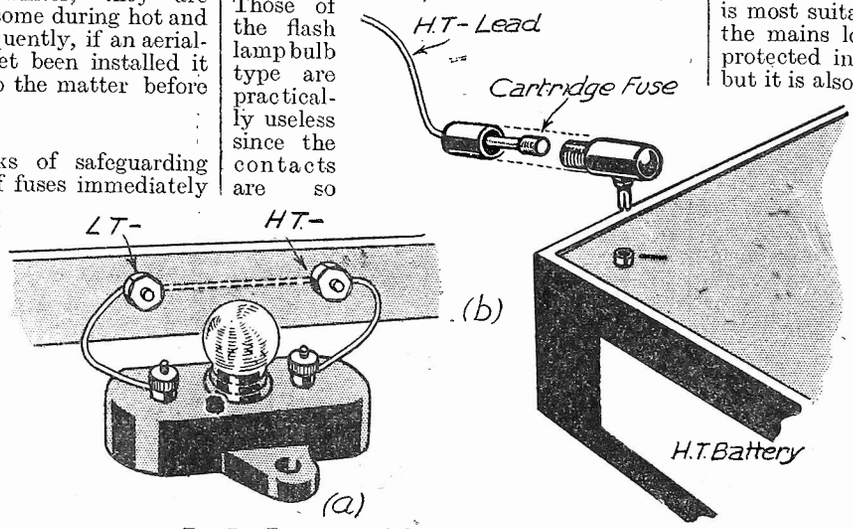


Fig. 7. Two ways of fitting a fuse to a battery set.

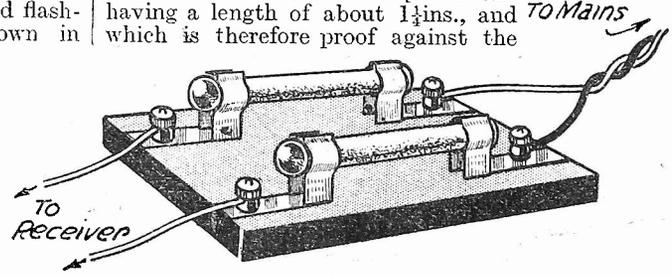


Fig. 8. A double mains fuse

A fuse should always be inserted in at least one of the mains leads to a receiver, eliminator or trickle charger, whilst with D.C. supplies it is generally preferable to include one in each lead. This applies in particular when it is not known which side of the mains is earthed. Double fuses, of the type shown in Fig. 8, are most convenient for the latter purpose.

Fuse Ratings

The beginner is often at a loss to know what size of fuse is required for any particular circumstance, but there is no difficulty in deciding this question. A simple rule to remember is that the fuse should have a rating of about twice the current it is normally called upon to carry; it will then burn out before sufficient current could be passed to do any harm, but will not be affected by the comparatively heavy surge which occurs on first switching on. As an example it can be stated that a .5 amp. fuse is just about right for any mains receiver having up to four valves. For a bigger set or a radiogram a 1 amp. component is most suitable. By connecting a fuse in the mains lead the set will be fairly well protected in the normal course of events, but it is also worth while to wire a second one on the output side of the rectifier to prevent damage to the latter component in the event of a condenser breakdown. Alternative positions for the fuse are shown in the circuits of Figs. 9 and 10, where a valve and metal rectifier are represented. (Fig. 10. is unavoidably held over this week, but will be included in the next article—Ed.)

Safety Connectors

Another useful "safety first" tip is to employ insulated connectors for the flexible wires which are used to make contact with the anode terminals of S.G. valves and with the priming grid terminals on pentodes. These wires are connected to high tension positive and it is an easy matter to let one slip on to a metal screen or the metal coating of a valve (which is, of course, joined to H.T. negative). If a fuse is fitted no real harm will be done, but the fuse will have to be replaced, and that means more expense. Safety anode connectors are made by two or three firms and an illustration of one of these connectors will be given next week. A plug contact is fitted inside an insulated tube and this fits into a corresponding socket which is screwed on to the valve in place of the terminal nut. These connectors are quite cheap and might effect a saving of many times their cost.

(To be continued.)

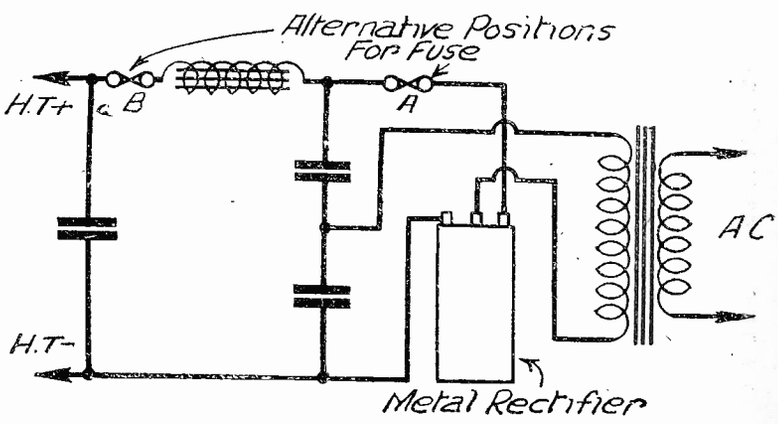
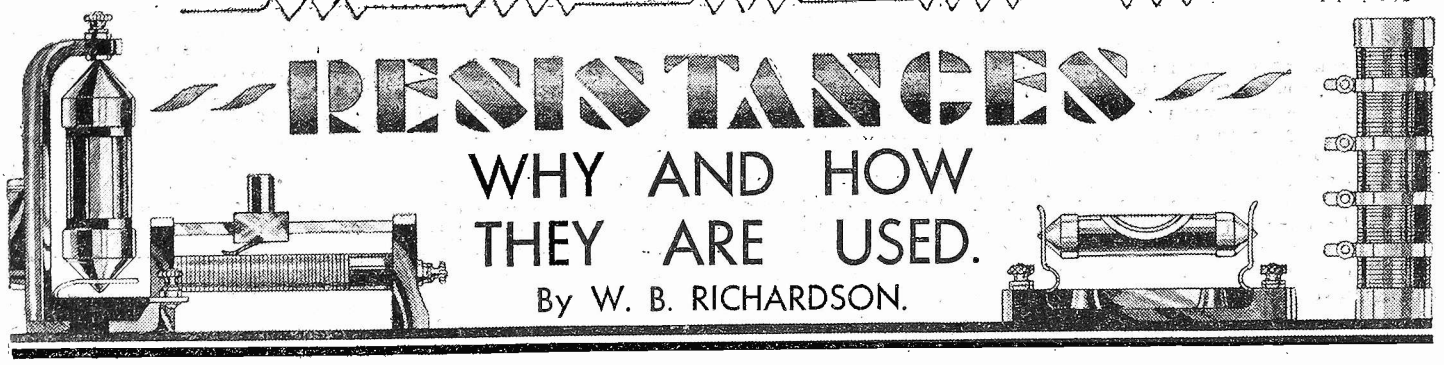


Fig. 9.—Fitting a fuse in a mains unit.



RESISTANCES

WHY AND HOW THEY ARE USED.

By W. B. RICHARDSON.

Part I: Resistances in a Battery Receiver

ONE very noticeable feature of modern design is the use of an increasing number of resistances of all kinds. Whereas a few years ago such things as decoupling and grid-bias resistances were almost unknown, nowadays receiving sets, especially of the all-mains type, seem to be positively bristling with resistances of all types and varieties. It is small wonder, then, that the home-constructor, when building a set requiring, perhaps, ten or twenty different grid leaks, fixed resistors, potentiometers and what not, is often a little confused as to the reason for so many. Again, in the case where he is building from a circuit diagram he may be in doubt as to the correct value and type to use in each position, since such details are not always given by the designer. It is for this reason this information is now given.

I am going to take two typical examples of modern receivers and endeavour to explain the use of all the resistances used therein, besides giving some practical hints on their values and the types to use in your own set.

I shall first deal with the resistances in a typical battery operated three-valver of the S.G.-det. pentode type, the circuit diagram of which is given in Fig. 1.

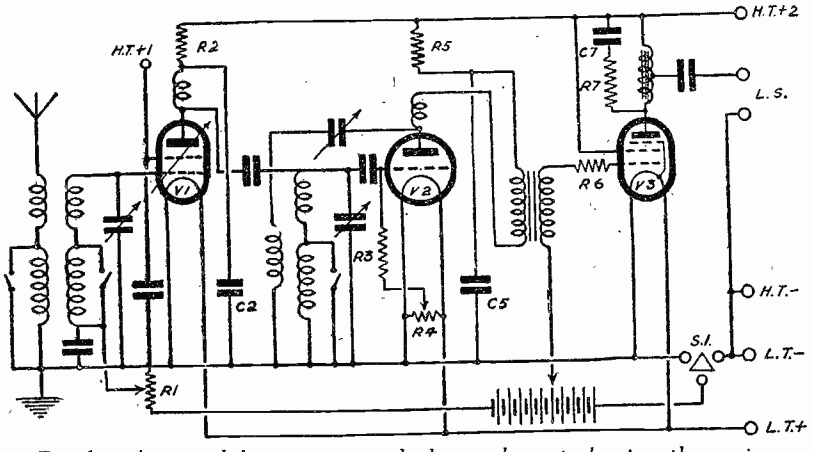


Fig. 1.—A typical battery operated three-valve set showing the various resistances used.

Bias for the Variable-mu Valve

Starting from the left of Fig. 1 the first resistance we come across is R1. This is a potentiometer controlling the grid bias of the first valve, a variable-mu. If you follow out the circuit you will see that it is placed across the ends of the grid-bias battery. Naturally, in this position current will flow through the resistance all the time it is in circuit. In order that the grid bias battery shall not be rapidly discharged the resistance is made very high, say about 25,000 ohms or 50,000 ohms. Of course, from the point of view of obtaining a variation of grid bias, for which it is intended, it does not matter much what its value is. It would be just as efficient if of 200 ohms as 20,000 ohms. The sole reason for making it of high value is, as I say, to prevent undue wastage of current from the grid bias battery. Another precaution, with the same object in view, is the provision of the 3-point switch S1, instead of the usual 2-point filament switch. The third contact enables the resistance R1 to be disconnected from the grid-bias battery directly the set is switched off; thus the battery does not discharge when the set is not in use.

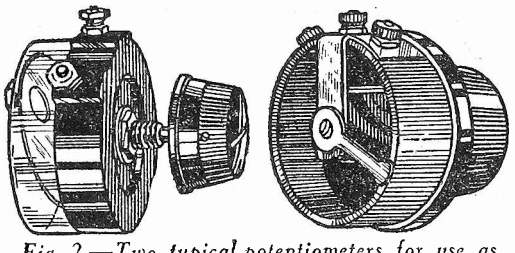


Fig. 2.—Two typical potentiometers for use as volume controls with variable-mu valves.

Why a Potentiometer is Used

Now let us see how R1 works. As you know, variation of the grid-bias on a variable-mu valve provides an almost ideal volume control, thus, when the bias on the grid is zero, that is, at the same potential as the earth-cum-filament connections, the valve gives maximum amplification, but when it is gradually made negative so the amplification is reduced until at about 15 volts negative it is very small indeed. To obtain a variable control the grid of the valve is connected (*via* the secondary of the tuning coil in this case) to the slider of R1. Now as one end of R1 is connected to the positive end of the 15-volt G.B. battery (which is at the same potential as earth) and the other to the negative end, it stands to reason that one end of the resistance is at zero, and the other end at 15 volts negative. Therefore, any intermediate point along the resistance must be at some potential between 0 and —15 volts. By moving a slider along the resistance any voltage between these two points may be obtained; hence the reason for connecting the grid of the valve to the slider.

As you know, the resistance, complete with slider, is called a potentiometer. It is also sometimes called a "volume control." This latter term is not a very good one to use as there are various types of volume control. "Potentiometer," on the other hand, has only one meaning.

Two types of potentiometer, each of which would be suitable as R1, are illustrated in Fig. 2. A very suitable value to choose is 20,000 ohms. This is quite high enough to ensure very small current consumption from the G.B. battery, and will not give rise to the slight crackling noises which sometimes occur when operating a 50,000 or 100,000 ohms instrument. If you care to work out the consumption of current you have only to apply Ohms' law. Thus, in the case of a 20,000 ohms resistance the current from a 15 volt battery would be $\frac{15}{20,000}$ amps=.00075 amps!

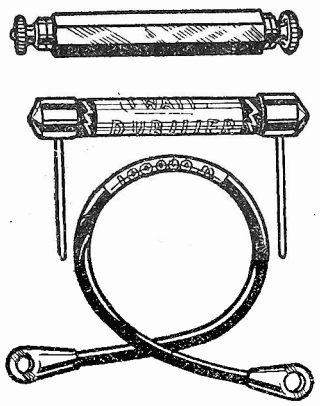


Fig. 3.—Three types of resistances suitable for decoupling purposes in the early stages of a battery set.

Decoupling Resistances

The next resistance we arrive at is R2. This in conjunction with condenser C2 is used for decoupling purposes, and prevents instability in the H.F. stage. The condenser C2 is large (1 mfd.), therefore, a very high resistance is unnecessary. One of 500-1,000 ohms is quite suitable. It should preferably be non-inductive, although so long as it is not placed right next to an unscreened coil or choke, it does not matter very much. Three suitable types are shown in Fig. 3. There is no objection to using higher values than 1,000 ohms, except that it cuts down the voltage on the anode. If this is already only just sufficient as supplied by the H.T. battery you can see that it must not be too large if the valve is to operate under the best conditions. Not all sets are fitted with R2 and C2, as, if the circuit and layout is well designed, there may be no need for them.

Current-carrying Capacity

With resistances such as R2 which are placed in the anode circuit of a valve there is always the question of current-carrying capacity, that is to say, they must be able to pass the maximum anode current the valve is likely to develop without overheating or breaking down. The current in the anode of the valve V1 is unlikely to be more than 4 milliamps, in which case the normal spaghetti, composition, or metallized resistance, would be working well within its capacity. A glance at the makers' catalogues shows that the average

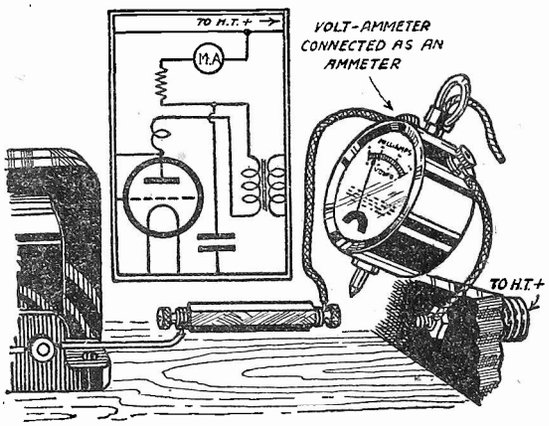


Fig. 4.—Testing the current passing through a resistance in the anode circuit of a valve.

resistance of 1,000 ohms in any of these types will stand a current of about 30 milliamps, so there is more than a sufficient margin of safety. It may seem rather superfluous to mention this point here, but all examples do not work out quite so satisfactorily as this one. Sometimes, on calculation, you will find that the resistance you were about to use would be seriously overloaded, and you are then able to substitute one of heavier rating before any trouble occurs. It is usually with the higher values that overloading is likely, since with most makes the higher the resistance is the smaller is its current-carrying capacity. As an example, I have before me a table of the ratings of a series of resistances of well-known make. I see that a 100 ohms component will stand 100 milliamps. The equivalent 1,000 ohms resistance will safely pass 31 milliamps; but the 50,000 ohm one will only stand 4.6 milliamps.

While on the subject of rating it may be mentioned that some resistances are sold as 1-watt, 2-watt, 3-watt types and so on. This rating indicates the power which may be dissipated with safety through the resistance. The power in watts is arrived at by multiplying the maximum current permissible by the maximum voltage. For example, a 10,000 ohm resistance may pass 10.00 milliamps without overload. It would, of course, require a voltage of 100 to pass this current through it. (By Ohms' law voltage = current × resistance $= \frac{10}{1{,}000} \times \frac{10{,}000}{1} = 100$ volts.) The power rating of such a resistance would thus be 1 watt. ($\frac{10}{1{,}000}$ amps × 100 volts = 1 watt.)

Grid Leaks

Taking them in numerical order the next resistance in the circuit is the grid leak R3. Here the question of current carrying ability does not arise since the grid current is of infinitesimal proportions. However, the value of the leak is of some importance. It used to be the common practice to use a 2-megohm leak in conjunction with a .0003 mfd. condenser as striking the happy medium; but it is found that with a screen-grid stage before the detector this value is somewhat too high for the heavier transmissions so that during the loud passages the grid charge does not leak away fast enough. In extreme cases the grid may become so heavily charged that the valve refuses to function for a fraction of a second.

To avoid any possibility of this it is usual to use a .0001 mfd. condenser and a 1 meg. or ½ meg. leak. With this arrangement the detector may not be quite so sensitive to very weak transmissions; but gives better reproduction from the louder ones.

The potentiometer R4 is a refinement which is not often found in a receiver but since it *may* be there I will say a few words about it.

Its function is precisely the same as that of R1, namely, it is used to control the grid-bias. In this case, of course, it is the bias on the detector. When there is no potentiometer fitted it is usual to connect the grid leak return to L.T.+ thus making the grid 2 volts positive in respect of the earthed end of the filament. This connection is better as regards sensitivity than connecting the leak to L.T.—, but is inclined to give "ploppy" reaction. The best connection is somewhere between these two points, but is not so critical that a slider is essential. In fact a fixed potentiometer with one or two tappings is practically as useful as one with a slider. Taking the grid-leak return to one of these points provides just the happy mean between the two extremes and is a great help in smoothing the reaction. A tapped potentiometer is illustrated in Fig. 5. It has four terminals, two of which are connected to the filament leads while the other two are the tapping points.

The value of the potentiometer, whether of the sliding or fixed type, need not be greater than 1,000 ohms, since there is only 2 volts across it. Many instruments sold for this purpose are, in fact, only about 400 ohms. There is, of course, no wastage of current when the set is not in use as the potentiometer is connected across the filament leads and is thus put out of action as soon as the valves are switched off.

Overcoming Battery Resistance

Resistance R5 is a low-frequency decoupling resistance. Together with the condenser C5 it performs in the L.F. part of the set much the same function as R2 C2 does in the H.F. part. The idea behind its use is to prevent coupling between one valve and another through the common impedance of the H.T. battery. It is usually due to the internal resistance of the H.T. battery that a set starts to howl or "motor-boat." You will notice that it is always when the battery is running down that the howling is most likely to occur. This is because when the battery is "on its last legs" it has a very high internal resistance. This resistance being common to the plate circuit of all the valves tends to produce an undesirable coupling between them. To prevent this the resistance R5 is used in conjunction with condenser C5. The resistance offers an impedance to the passage of L.F. current and the condenser provides an alternative path. For full benefit to be derived from this device the impedance of R5 must be large compared with the impedance of the H.T. battery, and also with that of C5. Generally speaking the condenser should not be smaller than 1 mfd. With this a resistance of 30,000 or 40,000 ohms would be suitable. If a 2 mfd. condenser is employed then the resistance may be reduced to 20,000 ohms.

Voltage Drop

The idea of using a lower resistance with a larger condenser is to keep the drop which would naturally occur in the H.T. voltage applied to the valve as small as possible, otherwise a higher voltage H.T. battery would be necessary to make up for the volts lost across the resistance.

There still remains the question of the current varying capacity of R5, but as the anode current of the detector valve is unlikely to exceed 3 milliamps the usual 1-watt type of resistance will be quite up to the job. If the valve V2 were a power valve it would be a different matter. The current taken by such a valve would be considerably more and might very easily overload a low rated resistance.

Controlling Tone with a Resistance

R6 is what is called a grid-stopper resistance. Its purpose is to prevent any H.F. currents which may have got past the H.F. choke in the plate circuit of the detector valve from arriving at the grid of the pentode V3. A suitable value is 100,000 ohms, but if it is desired it can be increased up to 250,000 ohms, when it will act to a certain extent as a tone compensator by offering a higher impedance to the upper frequencies and so counteracting the over-emphasis of the high notes which is peculiar to a pentode. As it is in the *grid* circuit of the valve the question of current carrying

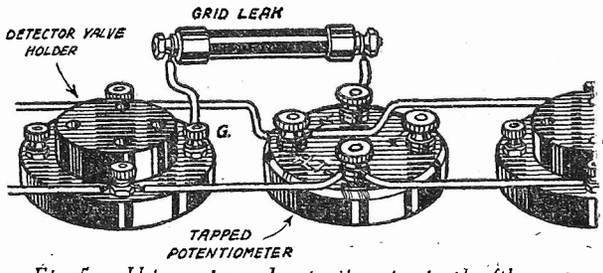
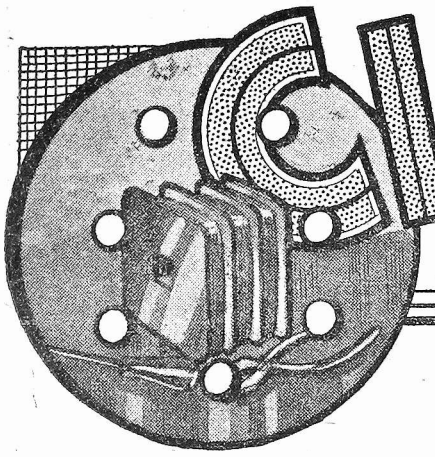


Fig. 5.—Using a tapped potentiometer in the filament leads.

ability does not arise. A resistance of the grid-leak type is quite suitable.

R7 used in conjunction with C7 is the tone control proper. Its value may be from 20,000 to 50,000 ohms according to the tone required. The lower the resistance the more the high notes are reduced. The value of the condenser is .01 mfd. If it is desired to vary the tone while the set is in operation then a potentiometer of the type shown in Fig. 2 may be used instead of the fixed resistance. Connection would then be made to the slider and one end of the resistance element, the other end being left free. If a fixed resistance is used then one of those illustrated in Fig. 3 would be suitable. A "power" type is not necessary as there is no D.C. passing through it.

In the next article the resistances in an all-mains set will be dealt with.



Class "B" components!

In this Practical and Explanatory Article, All Necessary Particulars are Given for the Construction of a "Driver" Transformer and an Output Choke.

THERE is no doubt whatever that Class "B" amplification has come to stay. That it offers undoubted advantages in the way of large signal output for a most economical input of H.T. current cannot be denied, whilst the excellence of the results to be obtained (previously described in PRACTICAL WIRELESS) is beyond question. Perhaps the greatest deterrent to the immediate adoption of Class "B" is the necessity for special components, namely a "driver" transformer and output transformer or choke. Admittedly, a number of manufacturers have already produced suitable components, and at prices which are by no means high, but many constructors will not feel disposed to buy the new parts when this will involve scrapping old ones which are on hand.

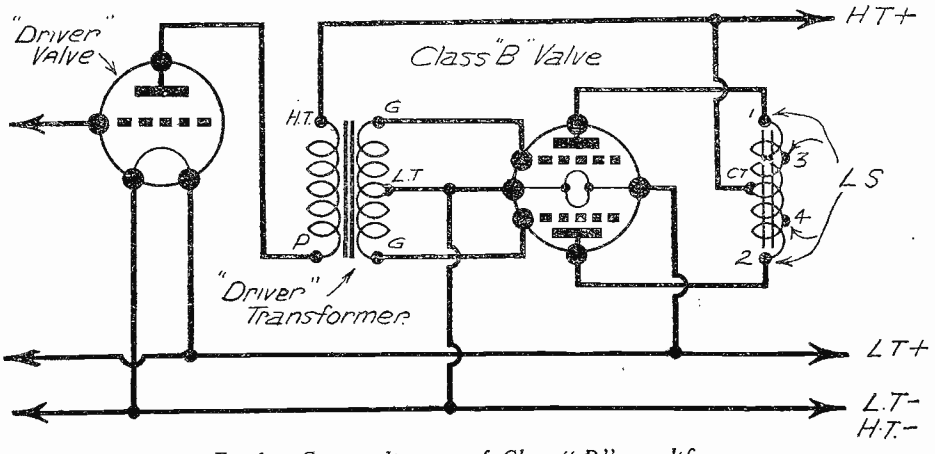


Fig. 1.—Circuit diagram of Class "B" amplifier.

The Cost of a Class "B" Amplifier

The total cost of converting an ordinary three-valve set for Class "B" works out at something like forty-five shillings, inclusive of the necessary valve, but anyone who cares to make his own transformers can just about halve this expenditure. In the hope that a large number of PRACTICAL WIRELESS readers may take full advantage of the latest system of L.F. amplification it is proposed to give constructional details of the necessary apparatus. It must be pointed out in the very first place, however, that the home-made parts will neither be quite so efficient nor so neat as the factory-produced articles but they will not fall far short if care is expended on their construction. Moreover, the making of the parts will prove extremely interesting and also instructive.

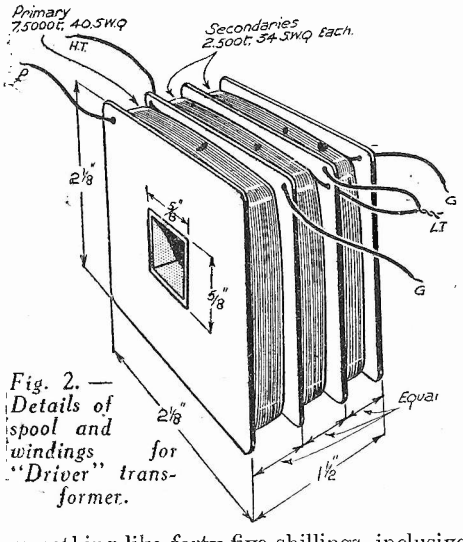


Fig. 2.—Details of spool and windings for "Driver" transformer.

Circuit Requirements

Before passing on to the actual constructional work, it will be as well to sum up the position and study the requirements of the circuit arrangement. The latter is shown in Figure 1, where it can be seen that a "driver" valve (this may be the first L.F. amplifier of the existing set) is used to feed the special push-pull transformer which supplies the grids of the Class "B" valve. The "driver" valve may be one of the small power type and it is normally biased to a point at which its anode current is between 2 and 3 milliamps. Under these conditions its "optimum load" will approximate to some 10,000 ohms, and therefore the primary of the transformer must be designed to provide this load. The secondary has to supply power (not merely voltage as in the case of an ordinary L.F. transformer) to the output valve, and therefore it must be of low resistance. In practice a resistance of not more than 150 ohms on each side of the centre tap is found to be required. Additionally, to enable the transformer to supply the necessary power it must have a *step-down* ratio of between 2 : 1 and 3 : 1 to each half of the secondary. Expressed in other words, the turns ratio between primary and the *whole* secondary must be from 1 : 1 to 1.5 : 1.

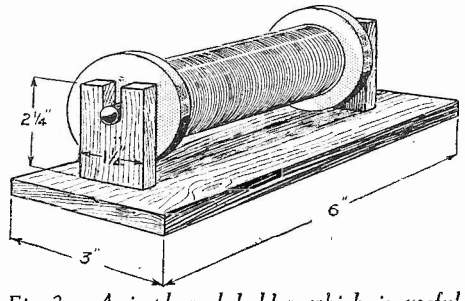


Fig. 3.—A simple reel holder which is useful when winding the spools.

The output from the Class "B" valve must be supplied to the loud-speaker through a push-pull output transformer or a centre-tapped choke. Both methods of coupling are equally effective but since the choke is rather easier to make we shall assume the use of this component in the present case. The choke must, of course, be centre-tapped to feed both anodes of the valve and it should offer a total impedance of approximately 10,000 ohms at average audio frequencies. To enable the valve to be matched to different moving-coil speakers two tappings are taken so that a step-down ratio of about 2 : 1 can be obtained. Although the output choke carries an average D.C. current of 8 milliamps or less it has to deal with "peak" values up to some 50 milliamps and it must therefore be capable of handling the latter current. Another requirement of the choke is that its D.C. resistance shall not exceed about 400 ohms, otherwise there will be a loss of signal output.

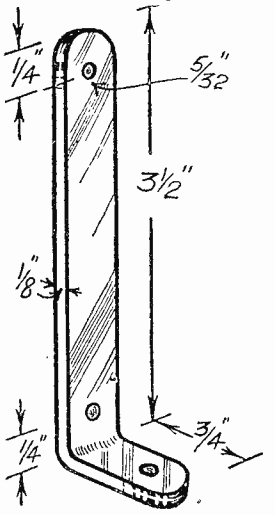


Fig. 4.—Dimensions of transformer core clamps—four are required.

Designing the "Driver" Transformer

In working out the design of the "driver"

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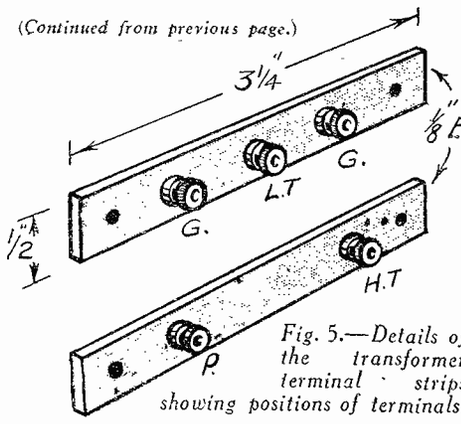

Fig. 5.—Details of the transformer terminal strips showing positions of terminals.

transformer for amateur construction it is very difficult to comply exactly with all the requirements without making the component unwieldly or using extremely fine wire which is difficult to handle. Consequently some compromise has been made with a result that the transformer to be described has the following characteristics :—Primary Inductance under working conditions, about 25 henries ; Primary Turns, 7,500 turns of 40 gauge enamelled wire ; Primary Resistance (D.C.), 1,350 ohms ; Secondary Turns, 5,000 turns 34 gauge enamelled wire ; Secondary Resistance (each half), 125 ohms ; Step-down Ratio (to each half of the secondary), 3 : 1. The transformer is perfectly satisfactory for use after a Cossor 215 P or similar "driver" valve and can be made for about five shillings. The materials required are : 3 doz. No. 5 Stalloy stampings ; piece of mild steel hoop 18 in. by ½in. by ⅛in. ; four 1½in. by $\frac{5}{32}$ in. bolts and nuts ; 4 ozs. 40 gauge enamelled wire ; 9ozs. 34 gauge enamelled wire ; sheet of fibre, $\frac{1}{16}$ in. thick ; strip of ⅛in. ebonite, 6½in. by ½in. ; five 6 B.A. terminals ; odd pieces of flex, etc.

The Winding Spool

The first job is to make the winding spool, of which all dimensions are given in Figure 2 ; it consists of a square tube with four fibre cheeks. The tube is made by winding a strip of good cartridge paper (or, better still, presspahn in 10 mils thickness) round a ⅝in. square wooden rod. Thin glue is applied whilst winding so as to produce a fairly rigid tube having a thickness of about $\frac{1}{16}$ in. After winding, the tube should be removed from the rod and allowed to dry. Next, the four fibre cheeks should be cut out—with a sharp chisel or saw—to the sizes indicated and made to fit tightly in the tube, where they are held in position with glue. To prevent the possibility of the middle cheeks slipping due to side pressure of the windings a few turns of Empire tape should be wound round each section of the finished spool.

Windings

The windings must next be put on, and this job can be done most easily if a lathe is available. If not, a hand-drill held horizontally in the vice will make a good substitute. Should neither of the latter tools be available it is possible to do the work entirely by hand, but this will prove rather tedious. Whatever method of winding is finally adopted the spool must first be put on to the wooden rod so that it can be rotated without difficulty. Start with the primary and solder a 12in. length of thin flex to the end of the 40 gauge wire. Resin should be employed as a flux to avoid subsequent corrosion, and the joint should be covered with a spot of sealing wax. Pass the end of the flex through a small hole in the end cheek and wind it once round the spool. You can then continue to wind on the 7,500 turns required, taking care to arrange them as evenly as possible in layers. Try to keep an even and steady tension on the wire, but not sufficient to stretch or break it. There is no need to count the turns, since the exact number is not too important and will certainly not be far wrong if one section of the spool is just barely filled. After winding, the wire can be cut off and another length of thin flex soldered to it, taken once round the spool and anchored by passing it through a hole in the end cheek.

The secondary winding can now be proceeded with ; this actually consists of two equal windings of 2,500 turns each, which are arranged in the remaining slots. They are both wound in exactly the same way as the primary, but using the thicker (34 gauge) wire. To ensure that both halves of the secondary are alike it is well to count the turns with reasonable accuracy. It should be mentioned that the bobbin of wire from which the windings are taken must be mounted in some kind of holder so that it can rotate easily without any danger of the wire becoming entangled or broken ; details of a simple holder are given in Fig. 3. If a break *does* occur, the ends of the wire must be properly soldered and the joint covered with sealing wax, or a slip of paper, to prevent any rough edges scraping the insulation from adjacent turns. After the windings have been completed they should be covered with Empire tape, which will protect them from injury.

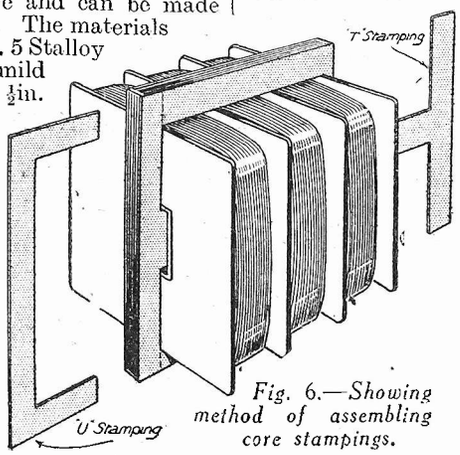

Fig. 6.—Showing method of assembling core stampings.

Core Clamps

The next step is to prepare the core clamps and terminal strips according to particulars given in the sketches of Figs. 4 and 5. Mild steel hoop is employed for the clamps, and this material is obtainable from any ironmonger's.

Lastly the core stampings can be fitted and the transformer completely assembled. The method of fitting the stampings is shown in Fig. 6, where it can be seen that a "T" and a "U" piece is inserted first from one end of the spool and then from the other until the "tunnel" is quite full. Fig. 8 shows the appearance of the complete instrument and the positions of terminals to which all connections are made.

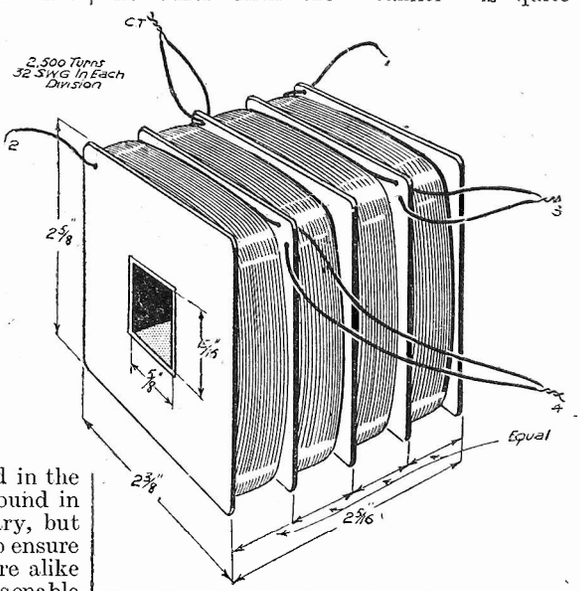

Fig. 7.—Details of spool and windings for output choke.

The Output Choke

In order to obtain a sufficiently high inductance combined with a low D.C. resistance the output choke is somewhat larger than the transformer and is built up round a core consisting of 3 dozen pairs of No. 4 Stalloy stampings. The other materials required are : 1½ lbs. 32 gauge enamelled wire ; piece of mild steel hoop, 20in. by ½in. by ⅛in. thick ; four 1½in. by $\frac{5}{32}$in. bolts and nuts ; sheet fibre $\frac{1}{16}$in. thick ; strip of ⅛in. ebonite ; 7½in. by ½in. ; five 6 B.A. terminals ; odd pieces of flex, etc. This component will have approximately the correct inductance and a D.C. resistance of about 250 ohms. The total cost of all materials works out at just over six shillings.

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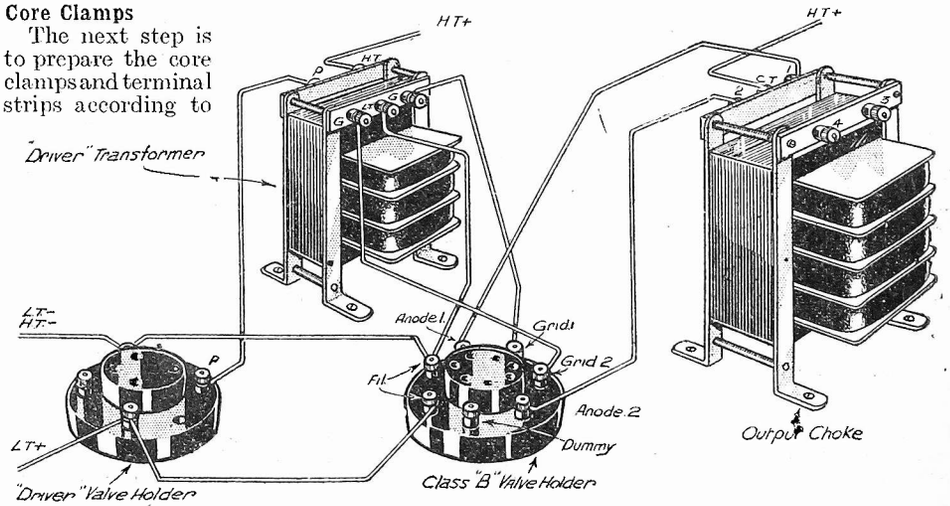


Fig. 8.—This sketch shows how the home-made components are connected up.

COMPLETING and OPERATING THE A.C. TWIN

By W. J. DELANEY

The Final Details for Constructing this interesting All-mains Two-Valve, Two-Pentode Receiver, with Operating Instructions

THE A.C. Twin is nearly completed, and before adding any more connections I must mention the dial light, which, although fitted in the original receiver, is not really essential. If you are installing the receiver in a dark corner of the room the light will greatly facilitate dial setting, but there is a much more important reason why I advise you to fit this light. When you switch the receiver on (by means of the switch on the side of the cabinet), you may forget to also set the room switch controlling the plug to which the receiver is connected. The result will be that you will stand waiting for the programme to come through, and may perhaps think that something has gone wrong. The light, however, will come on instantly the switch is operated, if the mains are connected, and you will then know that the receiver is "alive" and not perhaps miss an important item waiting for an unnecessary time with no supply to the receiver. The fitting for the light is supplied with the variable condenser, and before fitting it to the nut which retains the escutcheon window, you should solder two 8in. lengths of flex to the two soldering tags on the holder. Twist these lengths of flex together and then fit the lamp holder behind the retaining nut. Now carefully slide in the shelf, and before it is right home lift up the flex lead to the lamp so that it comes above the shelf, then push the shelf right home. The ends of the flex are attached to two terminals marked 4 volt, nearest to the loud-speaker, and these are not shown on the wiring diagram given last week. Pass the plaited length of flex, which comes through a slot in the lower base, up through the corresponding slot in the shelf and connect the four leads carefully, taking your guide from the letters on the diagrams in last week's issue.

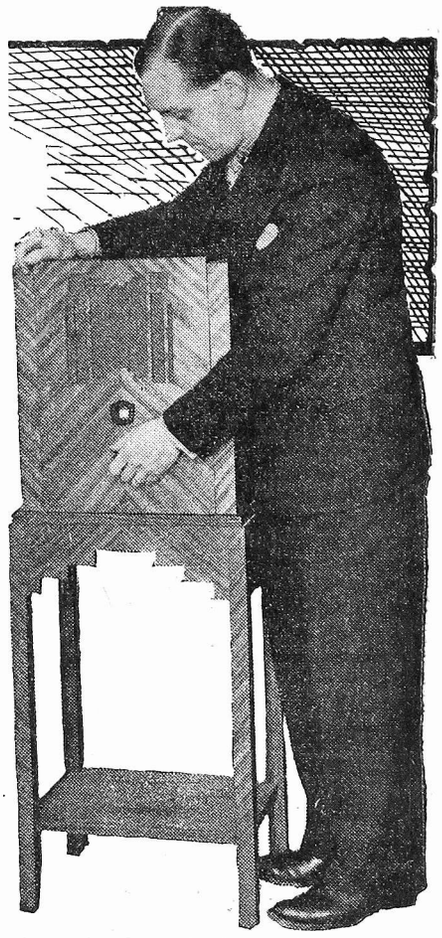
Mains Connections

The wire "d" is the H.T. positive lead and is attached on the main base to terminal No. 1 on the Varley choke. On the shelf this must be joined to the 4 mfd. condenser together with the flex lead which is joined to the left-hand terminal on the loud-speaker transformer. The twin flex supplying the heaters of valves V1 and V2 is next joined to the two 4 volt terminals nearest the speaker, and lead "c" is joined to the earth socket. One side of the mains connector is joined to terminal marked 50P. on the mains transformer, and the other lead on this connector is joined to the on-off switch. The short lead already attached to this switch must be joined to the terminal above 50P. which bears the rating of your particular mains. If there is no exact mark corresponding to this voltage you must use the nearest value above. For instance, if your mains are rated at 230 volts, you would use the terminal marked 240. Attach the 15,000 ohm resistance to the left-hand side of the .01 condenser, and join the short flex from the other side of this condenser to the loud-speaker terminal No. 1. The flex on right-hand terminal "F" on the speaker is next connected to the 2.5 terminal and the long flex on speaker terminal No. 1 is passed down through the hole in the shelf ready for connection to the pentode. A similar length of flex is now joined to the aerial terminal and taken down to terminal A on the base of the Lewcos coil.

A "Practical Wireless" Free Advice Guaranteed Set!

Connecting the Valves

The Cossor rectifying valve is inserted in the socket on the shelf and the S.G. valve (the metallized one) is inserted in the right-hand socket, marked V1. The L.F. pentode is inserted in V2, and the lead hanging from the shelf is joined to the terminal on the side of the base. The short flex on the H.F. choke must now be attached to the terminal on top of the S.G. valve and the receiver is now ready for its preliminary test out. The plug of the Mains connector must, of course, be supplied with a length of flex suitable for connection to the nearest mains socket in the house, and this should be plugged into the socket at the rear of the shelf. Now switch on, and the dial should light up. If all is well, after a short interval of about 15 seconds, a very faint hum will be heard from the loud speaker. If at the end of 30 seconds no hum can be heard with your ear quite close to the speaker grille, you should switch off and make quite certain that the house socket is alive and that all connections are intact. Remember, however, that the valves take at least 15 seconds to obtain the necessary temperature for emission, and that the receiver is "dead" for this period. As soon as the faint hum can be heard, the tuning knob should be slowly turned. The



main tuning knob is the section nearest the cabinet and the local station should soon be heard. When it is found, turn the front part of the tuning knob to obtain the best signal strength, and there should be a definite position for this, on each side of which the strength falls off. If you find, however, that this small knob has to be turned to its maximum position to either right or left, turn the cabinet round and with a thin piece of wood carefully push round the star-wheel on the rear of the variable condenser. This must be set so that on any station the rotation of the small condenser knob to right or left results in a decrease of signal strength. The wavechange switch on the side of the cabinet will enable the long or short waves to be received, and the upper knob on this side will bring up the strength of the distant stations. There are no other adjustments and the receiver is, therefore, an ideal one for general household use, being practically a one-knob receiver. At least a dozen stations can be heard by mere rotation of the tuning knob, although, as pointed out in the preliminary remarks, the receiver is designed primarily for those who wish to have a neat, small, self-contained receiver which will give a choice of two or three programmes at really high quality and good volume with a minimum of expense. As with all PRACTICAL WIRELESS receivers, if you are in any difficulty, drop a line to us, marking your envelope "A.C. Twin," and you will receive a reply by return, for which no charge is made. Finally, remember that this is yet another Guaranteed Receiver.

THE MOST NOVEL PORTABLE YET!

FREE FULL-SIZE BLUEPRINT NEXT WEEK!

COMPONENTS FOR THE A.C. TWIN

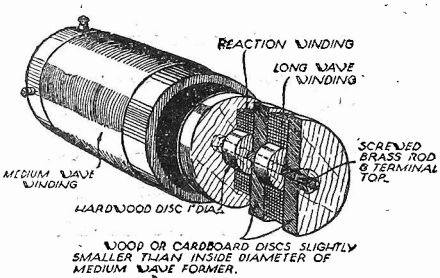
One Lewcos Band-Pass Filter, Type 51, B.P.F./R.
One Polar Uniknob 2-Gang Condenser, .0005.
One Igranic Transformer, Type T/24/B.
One Lotus .0003 Reaction Condenser.
One Bulgin Standard H.F. Choke (H.F.9).
One Varley 300 Henry L.F. Choke (D.P.16).
One .0001 fixed Condenser (Type S), T.C.C.
One .001 fixed Condenser (Type S), T.C.C.
Two .01 fixed Condensers (Type 34), T.C.C.
Three 1 mfd. fixed Condensers (Type 50), T.C.C.
One 2 mfd. fixed Condenser (Type 50), T.C.C.
Two 4 mfd. fixed Condensers (Type 84), T.C.C.
Two 5-pin valve-holders (Clix Chassis type).
One 4-pin valve-holder (Clix Chassis type).
One ½ megohm Erie Resistor.
One 12,500 ohm Erie Resistor.
One 400 ohm Erie Resistor.
One 2,500 ohm Erie Resistor.
One 30,000 ohm Erie Resistor.
One 10,000 ohm Erie Resistor.
One 15,000 ohm Erie Resistor.
One Heayberd Mains Transformer (Model A.C. Twin).
One Grampian Energized Speaker, Type E.1.
One Bulgin Mains Toggle Switch, Type S.80.
One Bulgin Small Mains Connector, Type P.21.
One Clix Terminal Strip.
Two Clix Wander Plugs (One black and one red).
One Cossor 442 B.U. Rectifying Valve.
One Cossor MS-PEN-A (H.F. Pentode Valve).
One Cossor MP-PEN (Pentode Out-put Valve).
One Smith Lyric Cabinet.
One coil Glazite, 3 yards red and black flex, screws, bulb for panel light, etc.

THE HALF-GUINEA PAGE

Radio Wrinkles FROM READERS

Home-made Coil Construction

A TYPE of dual wave tuning coil popular with home constructors is made with a paxolin former on which are fixed cardboard or plywood flanges between which the reaction and long wave windings are wound. No doubt many have discovered

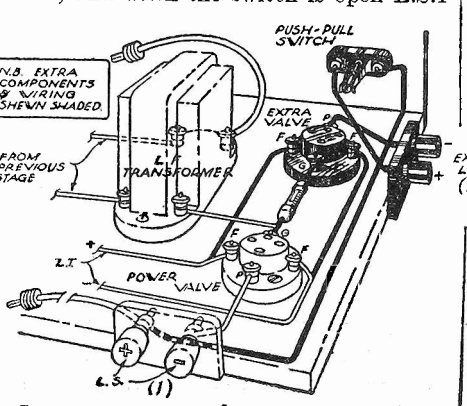


A neat method of making a dual-wave coil.

that cutting the flanges to fit well is a tedious job. A neater method is to make a bobbin on which to wind the long wave and reaction windings. To construct the bobbin cut three discs from cardboard or plywood the diameter of the inside of the former and two discs about 1in. diameter and ¼in. thick. The smaller discs may be cut from a cotton reel or a cork. Holes are made in all the discs which are then threaded on to a bolt, first a large disc, then a small one, and lastly the nut. The bolt should be about ¼in. longer than the thickness of the completed bobbin. The windings having been put on, the bobbin is pushed inside the former and the ends of the windings connected to the terminals on the former, allowing sufficient wire to enable the bobbin to slide from one end of the former to the other. This is a great advantage as it renders it possible instantly to find the position which will give the smoothest reaction. A terminal may be screwed on to the bolt by which means it is easy to slide the bobbin up and down.—READER (London).

Output Valves in Series Parallel

INSTEAD of using two ordinary valves in parallel with a negligible increase in volume, the following method may be of interest. An extra valve-holder, switch, and terminals are mounted, and connected in "series-parallel," as shown. Thus the speakers (2) are wired, one in each anode circuit, and when the switch is open L.S.1



Connecting output valves in series-parallel.

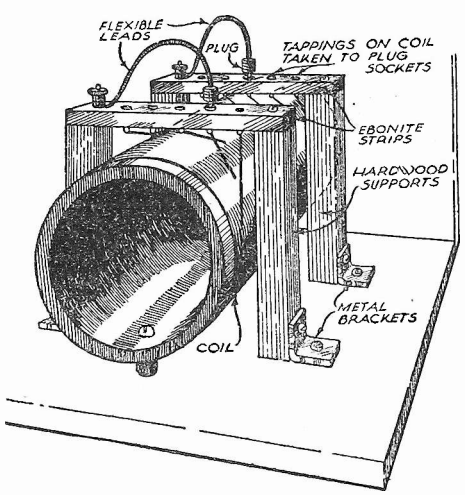
is working, and when closed, both valves and both speakers are working, with a consequent increase in volume. The second loud-speaker may well be mounted in another room, when the increased output will more than compensate for the long leads.—G. E. WALCHON (Derby).

THAT DODGE OF YOURS!

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

Tapping Home-made Coils

MANY constructors may have experienced a difficulty in tapping home-made coils, and I have found this little device very useful for the purpose.



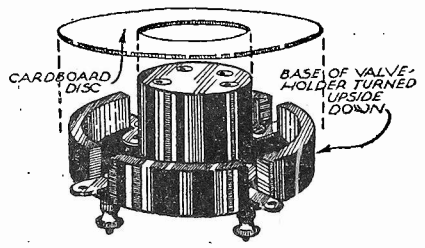
Mounting and tapping a home-made coil.

All it consists of is two strips of ebonite (about one inch wide and varying in length according to the size of the coil) mounted on some strips of wood, some sockets, and two ordinary plugs. The construction, as will be seen from the sketch, is very simple, and does not need very much explanation. After boring the holes and inserting the sockets in the ebonite, mount this on the strips of wood which have been previously fixed to the baseboard by means of small angle brackets. Wires can now be soldered from the required taps on the coil to the sockets. When another tapping is required on the coil, the plug is simply put into a different socket, according to the number of turns it is desired to take in.—K. F. FRIENDSHIP (Harpenden).

FREE FULL-SIZE BLUEPRINT OF A NOVEL LIGHTWEIGHT CLASS B PORTABLE NEXT WEEK!

Adapting Valve-holders for Chassis Mounting

WHEN wanting some chassis mounting valve-holders, but only having the ordinary kind on hand, I turned them inside out by removing the nuts and screws and taking the four-pin socket out of the



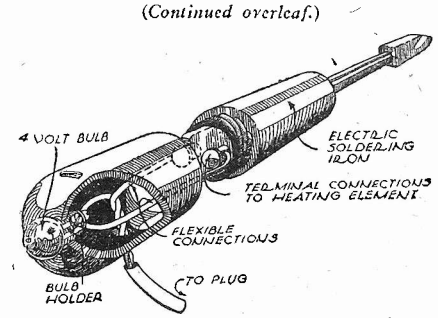
Adapting an ordinary valve-holder for chassis mounting.

terminal ring. I then turned it the other way round and screwed it back, as shown in sketch. If turned round the right way the grid and plate will go in their own places, only the filament pins being reversed. Most of these holders will fit a one-inch hole in the chassis, and on a metal chassis, to prevent shorts, it will be advisable to cut a cardboard ring to fit round the socket and over the springs.—H. CHURCHMAN (London).

For Users of Electric Soldering Irons

NOWADAYS, when one has to watch the pence totalling up on the meter, this threefold wrinkle should prove useful. It provides a visual indication that the soldering iron is on, prevents you wasting current and getting burnt, and acts as a local fuse, which is quickly replaced. Remove screw-cap and detach flex from terminals, drill out flex entry hole to fit a small saddle type torch bulb holder, remove saddle and connect one flex end to bottom terminal of bulb; connect about 2in. of flex to side terminal of bulb. Push holder into hole from inside cap until flush with outside, then connect the flex to the terminals on iron, as depicted in the sketch. A fresh entry hole for the flex can be drilled through the side of the cap. Assemble handle and insert a 4-volt torch-bulb, switch on and this will light up, whilst the iron is on. The average electric iron takes about 75 watts or .26 amperes at 240 volts., which is sufficient to light the bulb filament. Should your iron take more or less current, a little experiment in different sized bulbs will be necessary.—L. GEORGE (Margate).

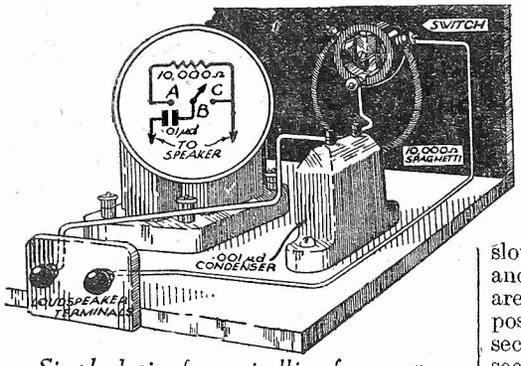
(Continued overleaf.)



Fitting an indicator to an electric soldering iron.

RADIO WRINKLES

(Continued from previous page.)



Simple device for controlling frequency response.

Controlling Frequency Response

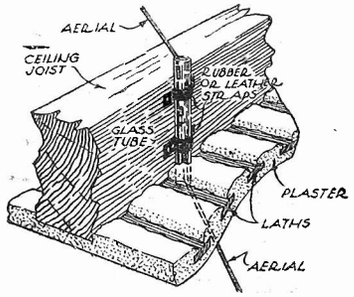
I HAVE recently discovered a simple device for controlling the frequency response of a receiver which uses a pentode valve. The novelty of this tone control lies chiefly in the method of control used, as the customary condenser and resistor form the basic circuit. The parts required are as follows:—

1 .01μ condenser.
1 10,000 ohm resistor.
1 Single-pole change-over switch.

The first two parts may be already incorporated in the receiver, when the switch only would be required. The condenser and resistance should be disconnected and wired as shown. When the switch shorts B and C, the tone will be deep and mellow; when it shorts A and B, the tone will be normal, but when the switch remains central, the tone will be brilliant, due to the uncorrected pentode valve. The two terminals should be connected across the loud-speaker, as indicated, or, better still, the output choke or transformer. It may be used in the first L.F. stage by connecting the terminals across the L.F. transformer secondary winding. This system is also applicable to Q.P.-P. when it is connected across the loud-speaker transformer input terminals.—A. MACIVER (Leicester).

Down-lead Tube for Loft Aerial

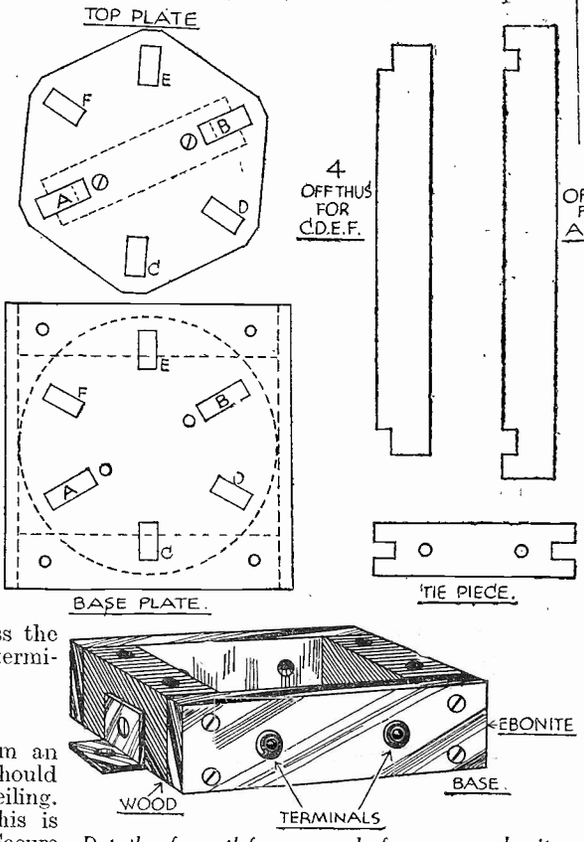
WHEN taking a down-lead from an aerial in the roof space, care should be taken in bringing it through the ceiling. A convenient method of doing this is shown in the accompanying sketch. Secure a strong glass tube, and make a hole in the ceiling, big enough to push the tube through, at the side of one of the joists and fix the tube as shown in sketch by means of strips of rubber or leather. The aerial can then be taken through the tube and led straight to the set without a break and without fear of damaging the plaster of the ceiling if the aerial should start swinging.—WILLIAM MUIRHEAD (Falkirk).



Method of taking a down lead through a ceiling.

Making Coil Formers from Scrap Ebonite

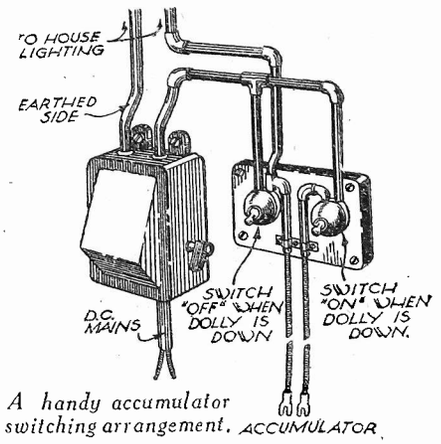
THE accompanying sketches show a method of turning scrap pieces of ebonite into a useful coil former. I have omitted all dimensions as these will depend on size of coil and thickness of ebonite, but it will be noticed that the slots in the top, and baseplate, marked A and B, are the full width of the strut. These are the fastening struts which are held in position by the notch at each end, and by a secured tie piece (marked in dotted lines) secured by two small bolts. Terminals can be fitted on the two ebonite sides of the base for the winding connections. To obviate filing the slots marked off top and baseplate, and drilled holes for tie pieces. The parts are bolted together with two small bolts. Drill two or three small holes where slots are required, and burn out to required size with a file tang heated in a fire; clean up and fit strut finally with a small file. With the aid of data sheets No. 5 and 6 any amateur should be able to make an efficient dual wave tuner.—J. W. HESLOP (Sunderland).



Details of a coil former made from scrap ebonite.

Switching Arrangement for Accumulator Charging

THE accompanying sketch shows a handy switching arrangement that I have successfully rigged up for accumulator charging from D.C. mains. The advantages of this arrangement are that standard tumbler switches are used; minimum cost; absolute safety is assured for operator; no interference with house lighting when changing over, and all connections are made in the switches themselves, thus avoiding outside connectors. It will be noted that one switch is inverted to enable the dollys to be raised or lowered together, thus facilitating a bar connector to absolutely ensure that accumulator is not shorted.—W. JONES (Smethwick).



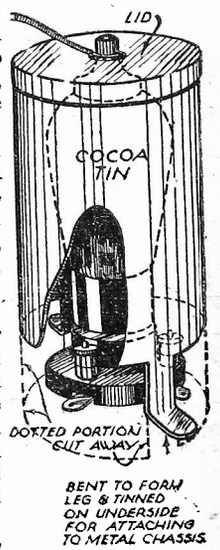
A handy accumulator switching arrangement.

Set Sales

ACCORDING to figures recently published, relating to the number of complete receivers sold in this country during the past year, battery and mains sets have sold in almost equal numbers—653,000 as against 684,000 to be exact. As one might expect, the three-valver has been most popular, and its sales have actually been greater than those of all other types combined. Surprising though it may seem, the two-valve set has proved to be second in popularity. It is interesting to note that the sale of superheterodynes has by far exceeded that of any previous year. This is hardly to be wondered at in view of their extremely low prices and undisputed advantage in the way of selectivity, and I should not be surprised to find the superhet. actually rivalling the three-valver in a couple of years or less. I believe that in America this kind of set is by far the most popular even at the present time.—F.P.

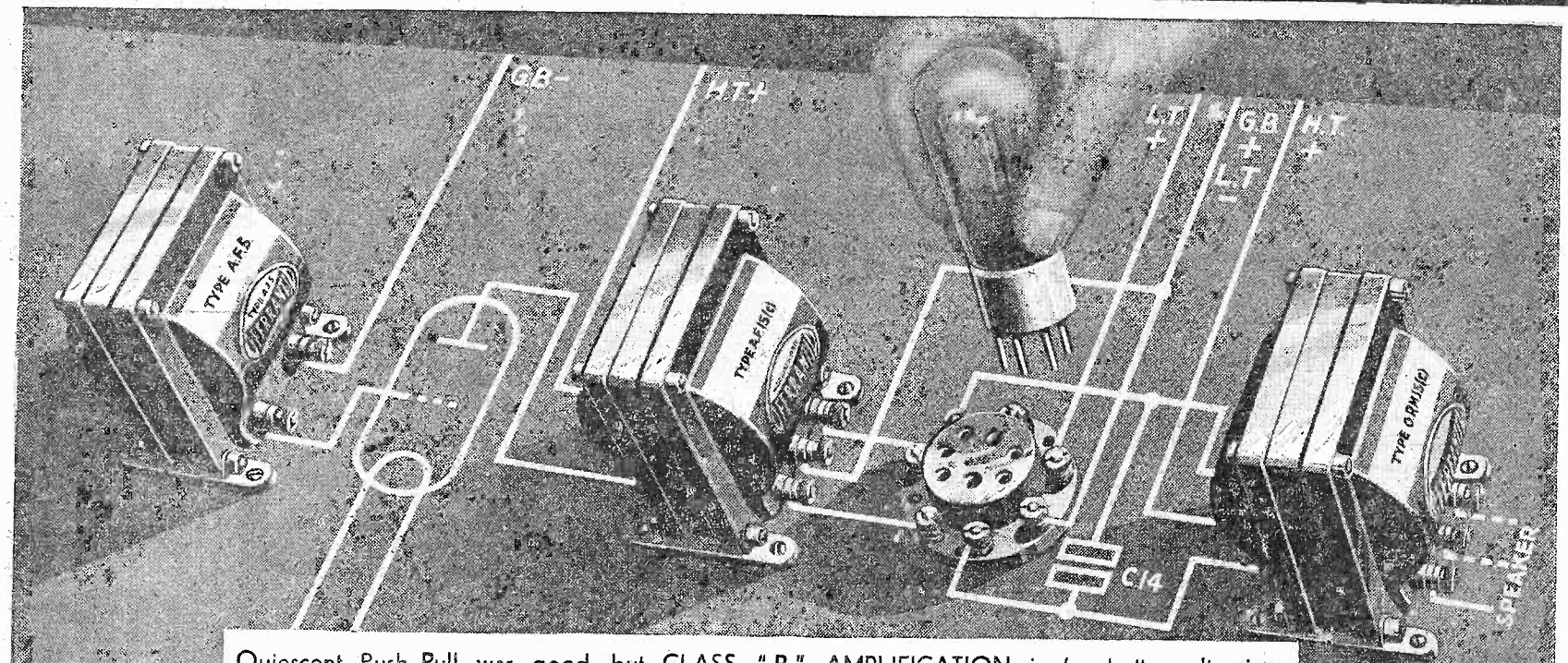
A Cheap and Efficient Valve Screen

HERE is a useful hint regarding valve screens that will be found most useful besides being economical. Procure a tall tin that will clear the soldering tags on the valve holder—a ½lb. cocoa tin meets these most useful requirements perfectly. Remove the paper round the tin, cut along the dotted lines as shown in sketch and then bend the two "legs" at right angles, about ½in. up. Tin the underside of each foot, smear a little flux on the chassis or metalled baseboard, press a hot iron on and then you have a securely fixed, efficient screen with ample room to get to the valve terminals, and a negligible danger of "shorts." To finish off the job, take off lid and hammer out the printing, drill a hole in the top just big enough to take the terminal stem or screened lead which will automatically earth itself against the lid.—A. S. HALE (Clapham).



A valve screening can made from a cocoa tin.

'CLASS B' AMPLIFICATION AND FERRANTI



Quiescent Push-Pull was good, but CLASS "B" AMPLIFICATION is far better. It gives double the volume of Quiescent Push-Pull; better quality, and freedom from the need of matching valves or balancing H.T. currents in the output stage.

Transformer. Type AF5. Ratio 1/3·5. Primary Inductance 265/75 henrys. 0/10 m/A., Price **30/-**

Push-Pull Transformer. Type AF15c. Ratio 1/1. Primary Inductance 62/17 henrys. 0/20 m/A. Secondary Resistance 80 ohms each half. Price **26/6**

Output Transformers. Type OPM 15c. Ratios 1/1, 1·6/1 and 2·7/1. For high resistance speakers and low resistance Moving Coil Types with built-in output transformers. Primary D.C. Resistance 110 ohms each half. Total Primary Inductance 35/10 henrys. 0/20 m/A. Price **26/6**

Type OPM 16c. Ratios 15/1, 22·5/1 and 45/1. For low resistance Moving Coil Speakers—5 to 20 ohms. Primary D.C. Resistance 110 ohms each half. Total Primary Inductance 35/10 henrys. 0/20 m/A. Price **26/6**

Also two lower priced models :—
Type AF17c. Ratio 1/1. Primary Inductance 18/12 henrys. 0/6 m/A. Secondary Resistance 120 ohms each half. Price **15/-** Type OPM17c. Ratios 1·6/1 and 2·3/1. Primary D.C. Resistance 125 ohms each half. Total Primary Inductance 29/9 henrys. 0/20 m/A. Price **15/-**

Recommended.
Driver Valve. Cossor Type **215P.**

Ferranti 7-pin Valve Holder. Massive Terminals Moulded in solid Bakelite, and flexible sockets, ensure freedom from loose terminals and bad contact troubles. Price **2/9**

Recommended.
"CLASS B" Valve. Cossor Type **240B.**

Compensating Condenser. Type C.14. Price **2/6.**

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FERRANTI COMPONENTS

The latest and greatest boon to the Battery-set builder.

By H. T. GODLEY, F.R.A.

In this article the author deals with the various methods of coupling, and tone control of modern pentode valves.

THE history of the development of the thermionic valve is marked by a series of achievements which stand out as milestones along the path of radio progress. One of these milestones, the Pentode, is now in universal use, and it is thought that a simple explanation of its construction and the way in which it differs from the ordinary output valve, may be of interest. Furthermore, as the full benefit from a pentode is not derived by merely inserting it into the last valve-holder, the various methods of coupling the pentode to the loud-speaker, methods of tone-control, etc., are discussed fully.

Evolution of the Pentode

Perhaps it will be as well to commence by explaining how the pentode came by its name. Any valve which contains only two electrodes, the filament and the anode, such as the early Fleming valve, and the modern half-wave rectifying valve, is known as a "diode." Hence the term "diode-rectification" in which a two-electrode valve is used for detection. The first really practical wireless valve, was actually the Fleming diode into which a third electrode, the grid, has been introduced. As the valve now possessed three electrodes, it became known as the "triode" which type of valve is still, of course, widely used. Then, in order to obtain extremly high amplification for high-frequency valves, an additional grid was introduced into the triode, and now having four electrodes, the valve was known as the "tetrode"—the familiar S.G. valve.

Attention then turned to the output stage, and in order to obtain much greater sensitivity and amplification than was possible with a triode output valve, the tetrode was modified by the addition of yet another grid, as will be explained later, and now possessing five electrodes, was logically enough, termed the "pentode." The pentode is then primarily an output valve possessing five electrodes, the filament, and anode, the control-grid, and two additional grids which are termed respectively the "screen" or "auxiliary" grid and the "earth" or "suppressor" grid, as shown both symbolically and pictorially in Fig. 1. I have said that the pentode is primarily an output valve; that is so, but pentodes are sometimes used as detectors, and even as H.F. amplifiers, but as such, their use is at the present time chiefly confined to America, where they are known as R.F. (radio-frequency) pentodes.

The general theory of the thermionic valve has already been fully discussed in previous articles, and it is therefore necessary for me to touch only very briefly on the functions of the usual three electrodes as contained in the triode.

Function of the Triode

The filament, upon being heated from an accumulator, emits a copious stream of negative electrical particles which are termed "electrons." Largely by virtue of the fact that the anode is maintained at a high positive potential, these electrons are attracted through the vacuum existing in the valve to the anode, and this steady electron stream is the "anode-current." The normal or "control" grid, is interposed in the valve in such a way that the electrons on their way from the filament to the anode, have to pass through the fine wire mesh or gauze of which the grid is composed.

When there is no signal from the preceding valve, this electron stream remains at a constant value, and is called the "standing" or "quiescent" anode-current. But when a signal is being received from the aerial or from the preceding valve, the grid potential becomes alternately positive and negative in sympathy with the signal oscillations. When the grid potential is negative, the presence of the grid tends to keep back some of the electrons, but when it is positive, the reverse is the case and the electron flow is greater than when no signal is being received. Thus the anode-current oscillates in sympathy with the signal oscillations impressed on to the grid, and therefore small voltage changes in the grid circuit produce comparatively large voltage changes in the anode circuit, and that is briefly the principle upon which the valve amplifies.

Now as I have already said, the grid is composed of fine wire mesh almost like a cage between the filament and the anode, and as the electrons have to pass through the grid, obviously the closeness of the mesh affects very considerably the characteristics of the valve. For example, the super-power valve is a "low-impedance" valve, *i.e.*, the mesh of the grid is so open that it offers little resistance or impedance to the electron flow which, in practice, results in the fact that such a valve will handle fairly large grid-swings and will deliver a considerable undistorted output, but it will not amplify to any great extent the signals impressed on its grid.

Therefore, the closer the mesh of the grid, the higher is the impedance and, consequently, the greater is its amplification factor. It follows, therefore, that an ordinary power valve with a fairly high impedance will have a larger amplification factor and will amplify weak signals to a greater degree than would a super-power valve. On the other hand, the super-power valve will handle a stronger signal input without distortion and will deliver a much greater undistorted output.

The pentode valve possesses the advantages of both types of valve—it is much more sensitive to weak signals than a low-impedance triode, and yet, for a given grid-swing, will deliver a much greater, undistorted output than the triode. This happy result is achieved by the use of the two additional grids already referred to, the "screen" and "suppressor" grids. In order to explain the functions of these grids, it is necessary to consider the S.G. tetrode.

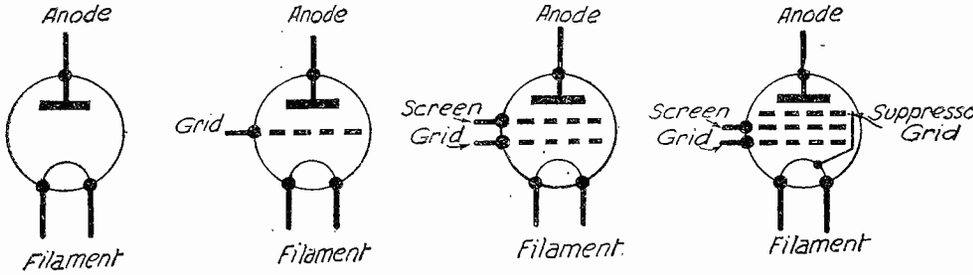


Fig. 1.—The evolution of the pentode valve.

Amplification Factor

I have already made it clear that the closer the mesh of the grid, the higher is the amplification factor, but it will be easily appreciated that in endeavouring to obtain extremely high magnification, a point occurs where the mesh is so close that it forms a definite barrier to the electron stream, thus preventing the flow of current from filament to anode and rendering the valve useless. This difficulty is overcome in the S.G. valve, by interposing between the control-grid and the anode an additional grid, the "screen." This additional grid is maintained at a potential of some 75 volts.

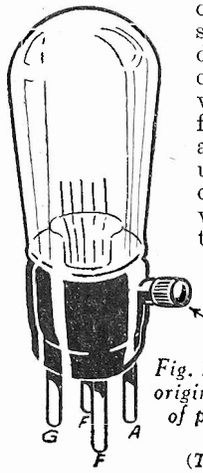
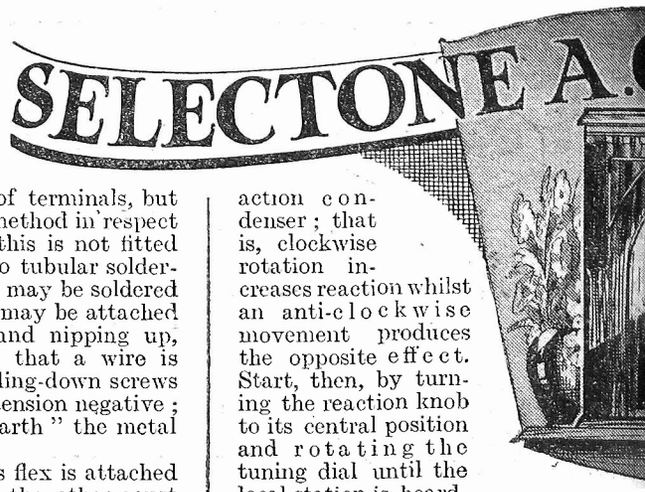


Fig. 2.—The original form of pentode.

(To be concluded next week—Ed.)

SELECTONE A.C



By FRAN

LAST week preliminary details of the "Selectone Two" were dealt with and simple instructions for building the instrument are now given.

The constructional work is perfectly straightforward, as can be gathered from the photographs and from the complete wiring plan, Fig. 3. It is best to commence by drilling the panel according to the scale drawing in Fig. 2. The positions of the four holes for the switches and tone control potentiometer are clearly indicated in the latter figure whilst those for the spindle and escutcheon of the tuning condenser are most easily obtained by using the metal template conveniently supplied with this component. The template should be laid on the back of the panel and the holes marked through by means of a scriber or sharp pencil. A circular hole is required for the spindle, and is made in the usual way with a brace and bit. The opening for the escutcheon plate, however, is of irregular shape and can best be made by drilling a series of small holes just inside the lines and then cutting between them with a sharp knife or chisel; the rough edge can finally be smoothed with a half-round file.

The arrangement of baseboard components can readily be followed by reference to the wiring plan and photographs. Half-inch screws are suitable for mounting everything except the L.F. transformer (to which the "Tone Compensator" is attached), and for this two 1¾in. (8's) screws are required. The only parts which are not screwed down to the baseboard are the four fixed resistances, which are mounted directly by means of their connecting wires.

Wiring

Little explanation seems necessary in regard to the wiring; it is straightforward, and there will be no difficulty in following it in Fig. 3. The majority of connections are made in Glazite insulated wire, but those between the filament terminals of the valve holders and corresponding terminals on the transformer are in twin flex. Two flexible wires are attached to the smoothing choke instead of the more usual terminals, and these are, of course, joined directly to the other components. Nearly all the wires are secured under the heads of terminals, but there is a variation of this method in respect to the tuning condenser; this is not fitted with terminals, but has two tubular soldering tags instead. The wires may be soldered to the latter, if desired, or may be attached by inserting them into, and nipping up, the tubular tags. Notice that a wire is taken from one of the holding-down screws of the H.F. choke to high tension negative; the object of this is to "earth" the metal screen.

One wire from the mains flex is attached to the .5 amp fuse, whilst the other must be taken to one of the three primary terminals on the mains transformer, marked "200v." "230v." and "250v.," respectively. Naturally, connection must be made to that terminal which is appropriate to the mains voltage available. In case the latter is not exactly the same as that marked on any terminal the wire should be joined to the one which most nearly corresponds to the mains voltage. For example, if the voltage were 220, the wire would be taken to the "230v." terminal, or if it were 240, connection could be made to either of terminals "230v." or "250v."

Operating Note

Having completed the constructional work you will be ready to give the set a thorough test. Insert the metallized valve in the left-hand holder and the power valve in the other one. Connect the earth lead and then an external aerial or the mains aerial tapping. It now only remains to put the plug of the mains lead into a convenient lamp-holder and to switch on. Switching is, of course, done by means of the bottom right-hand knob; the first slight movement closes the contacts, and any subsequent rotation affects reaction control. For "radio," the top left-hand switch knob is pulled out, when the lower switch sets the tuner for long waves (pushed in) or medium waves (pulled out).

Tuning

The method of tuning is the same as with any ordinary type of detector-L.F. set, and the variable resistance used for reaction is operated in precisely the same way as is a reaction condenser; that is, clockwise rotation increases reaction whilst an anti-clockwise movement produces the opposite effect. Start, then, by turning the reaction knob to its central position and rotating the tuning dial until the local station is heard. Next the strength can be adjusted as necessary by means of the

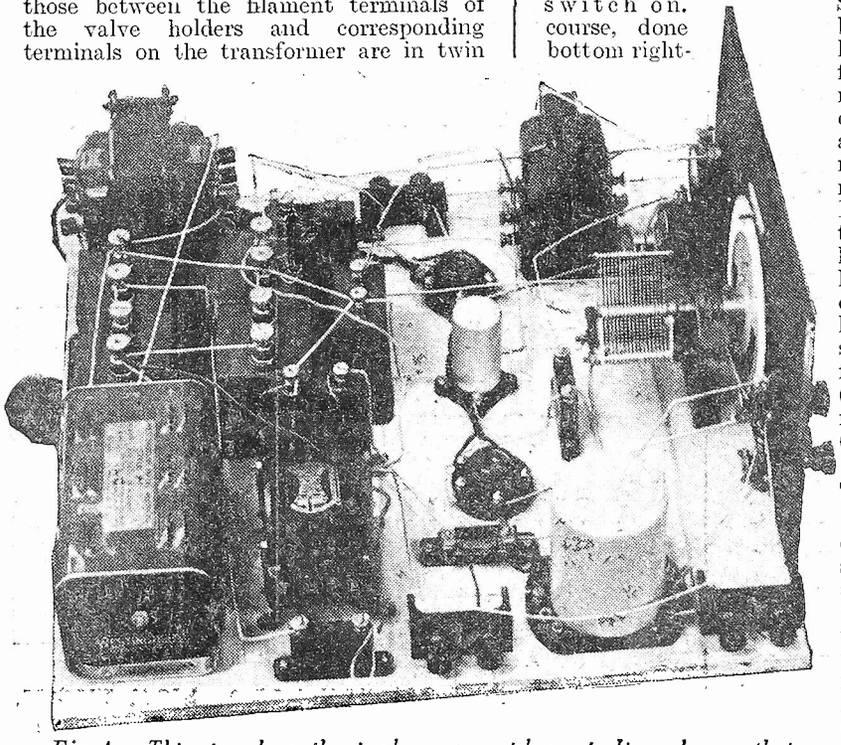


Fig. 4.—This view shows the simple component lay-out. It can be seen that the mains equipment is mounted all together at the back of the baseboard.

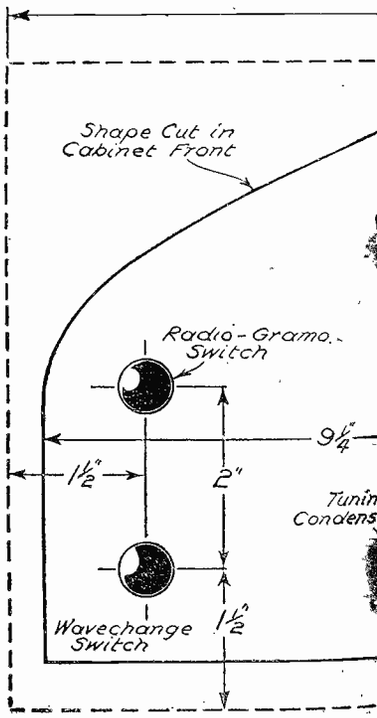
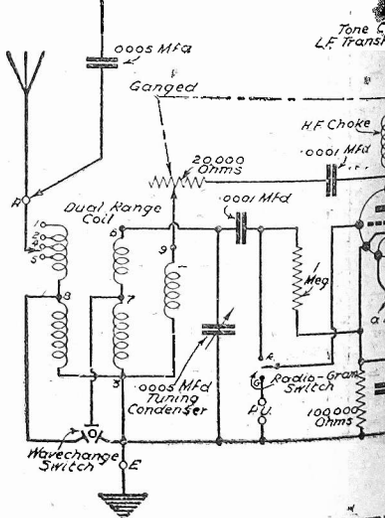
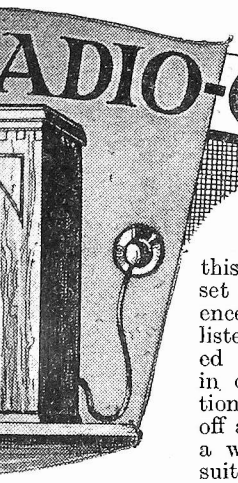


Fig. 2.—This drawing s

A "PRACTICAL WI

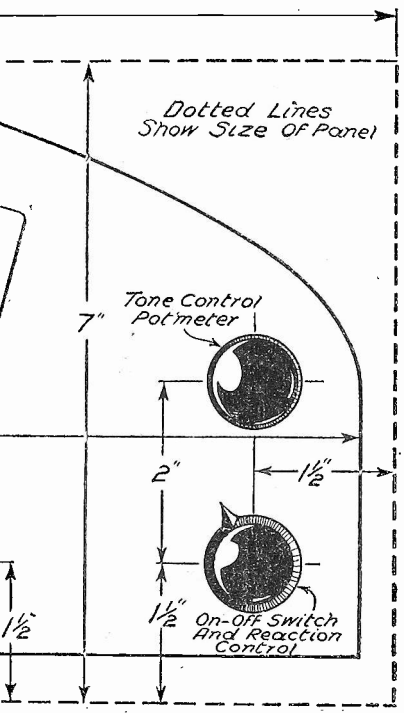


ADIO-GRAM TWO



ON, F.R.A.

reaction control. It might be added at this juncture that the set can cause interference to neighbouring listeners if it is allowed to oscillate, and, in consequence, reaction should be slacked off at the first signs of a whistle. Having suitably adjusted the volume, try the effect of the tone control. By turning the potentiometer knob to the right there should be an increase in high-note response and a consequent reduction in bass; rotating the knob in the other direction gives a reverse effect. It should be noted that variation in tone alters to a certain extent the overall volume, and this is at a maximum when the control is set to its midway position.



t of all panel components.

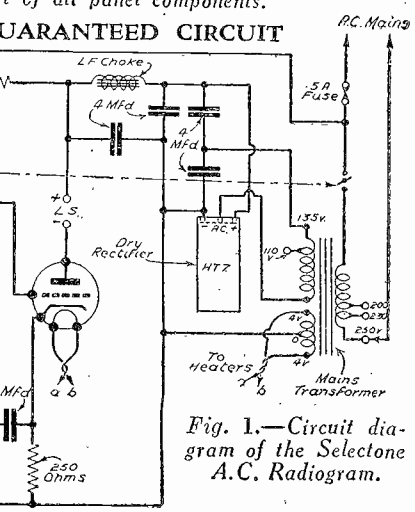


Fig. 1.—Circuit diagram of the Selectone A.C. Radiogram.

Adjusting the Selectivity

As previously mentioned, the degree of selectivity can be varied by inserting the coil plug into different sockets. The least amount of selectivity and, incidentally, the greatest volume, is obtained when the plug is in socket number "1"—by putting it into sockets "2," "4," and "5," the degree of selectivity is progressively increased and there is a corresponding loss in maximum volume. When using the mains as aerial it will probably be found best to put the plug into socket number "1," but in the case of an outside aerial its best position will be dependent entirely upon the length and characteristics of the particular aerial in use; a certain amount of experimentation will, therefore, be necessary in this respect.

Results

In describing the results obtained from the "Selectone A.C. Radio-Gram. Two" over fairly lengthy tests I am not going to give a long list of stations received. I have actually brought in a fair number even when using the mains aerial, but I much prefer to consider this set as an ideal "quality" receiver for local work. There has always been an ample volume of really good well-balanced reproduction from at least three stations (the two locals and Daventry); by setting the reaction control "full-on" the volume has been found to be more than sufficient easily to fill a very large room, whilst it could be reduced to little more than a whisper by slacking-off reaction and putting the coil plug into socket "4" or "5."

It might be of assistance to mention the approximate tuning positions of a few stations, since they will give you some idea as to where your own local transmitters are to be found. On th medium wave-band (switch pulled out), London National comes in at 60 degrees, Scottish National at 80 degrees, North National at 90 degrees, London Regional at 115degrees, Scottish Regional at about 120 degrees, Midland Regional at 135 degrees, and North Regional at 150 degrees. On long-waves, Daventry is received at about 150 degrees and Radio-Paris at 165 degrees.

Aerial and Earth

It has been found very important that a really good earth lead should be employed, but the aerial is of much less consequence, especially within thirty or forty miles of the local station; up to such distances the mains aerial is perfectly satisfactory and probably better than a short indoor one. At least, this has proved to be the case with the mains on which the set has been tested, but it should be pointed out that occasionally one finds that a particular mains supply is unsatisfactory for use as an aerial, due to the fact that it carries a good deal of H.F. current, which produces an unpleasant hum, or some kind of instability. In a case of this kind it is generally better to employ an external aerial, although an improvement can often be obtained by connecting a suitable H.F. choke in series with each supply lead—special chokes are made for this purpose, since those of the usual type are incapable of carrying the necessary current.

If you wish to make up these chokes yourself, you will require for each choke a piece of ebonite or paxolin tube 3in. long by 1¼in. in diameter. The winding of each choke consists of 100 turns of No. 22 D.C.C. wire. The ends should be anchored, and the two coils should be mounted at right-angles to one another, and then, to avoid the risk of shocks, they should be enclosed in a small wooden box. Two input leads, and two output leads of heavy flex, or, alternatively, an input and output mains socket, completes the unit.

The method of mounting and connecting the gramophone motor and pick-up will be described in the next article.

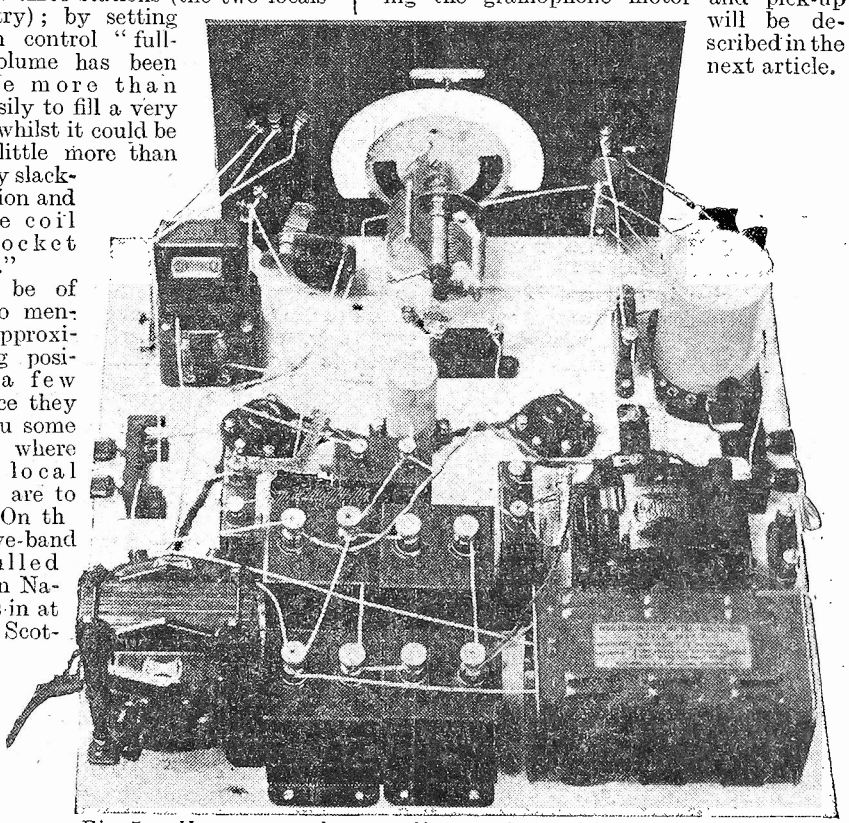


Fig. 5.—Here you see the set itself removed from the cabinet—Simplicity and ease of construction are the keynote.

COMPONENTS FOR THE SELECTONE A.C. RADIOGRAM

1 Polished Plywood Panel, 10in. by 7in. (supplied with Cabinet specified).
1 5-ply Baseboard, 15in. by 14½in. (supplied with Cabinet specified).
1 Utility "Mite" .0005 mfd. Condenser with disc drive.
1 "Wearite" 3-point Wavechange Switch (Type G.W.C.).
1 "Wearite" Changeover (Radiogram) Switch (Type G.C.O.).
1 "Wearite" 20,000 ohm volume control with combined Mains Switch.
2 Lotus 5-pin Valve Holders.
1 Colvern Type "T.D." Coil.
2 Dubilier .0001 mfd. Fixed Condensers.
1 Dubilier .0005 mfd. Fixed Condenser.
1 Graham Farish Ohmite 1 megohm Grid Leak.
1 Graham Farish Horizontal Grid Leak Holder.
1 "Wearite" Screened H.F. Choke (Type H.F.P.).
1 Lissen "Hypernik" L.F. Transformer.
1 Lissen "Tone Compensator."
3 Belling-Lee Terminal Mounts.
6 Belling-Lee Type "R" Terminals, 2 marked "Pick-Up" and 1 each marked "A," "E," L.S.+, L.S.—.
1 Heayberd Type W.25 Mains Transformer, giving outputs of 135 volts, 70 mA. and 2—0—2 volts, 4 amps.
1 Heayberd Type 751 Smoothing Choke.
1 Westinghouse Style H.T.7 metal Rectifier.
4 Dubilier (400 volts D.C. working) 4 mfd. Condensers.
1 Dubilier (400 volts D.C. working) 2 mfd. Condenser.
2 Dubilier (400 volts D.C. working) 1 mfd. Condensers.
1 Belling-Lee Fuseholder with .5 amp. fuse.
1 Graham Farish Ohmite 100,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 50,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 1,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 250 ohm, 1 watt Resistance.
1 Heayberd Mains Flex with Lamp Adaptor.
2 Coils Glazite, screws, short length flex.
1 Mazda A.C.2 H.L. Valve, metallized.
1 Mazda A.C.P. Valve.
1 Simpsons Electrical Turntable.
1 Becker Q.M.B. On-Off Switch.
1 B.T.H. "Minor" Pick-up.
1 Celestion "Soundex" Speaker Chassis.
1 "Camco" Selectone-Tablegram Cabinet.

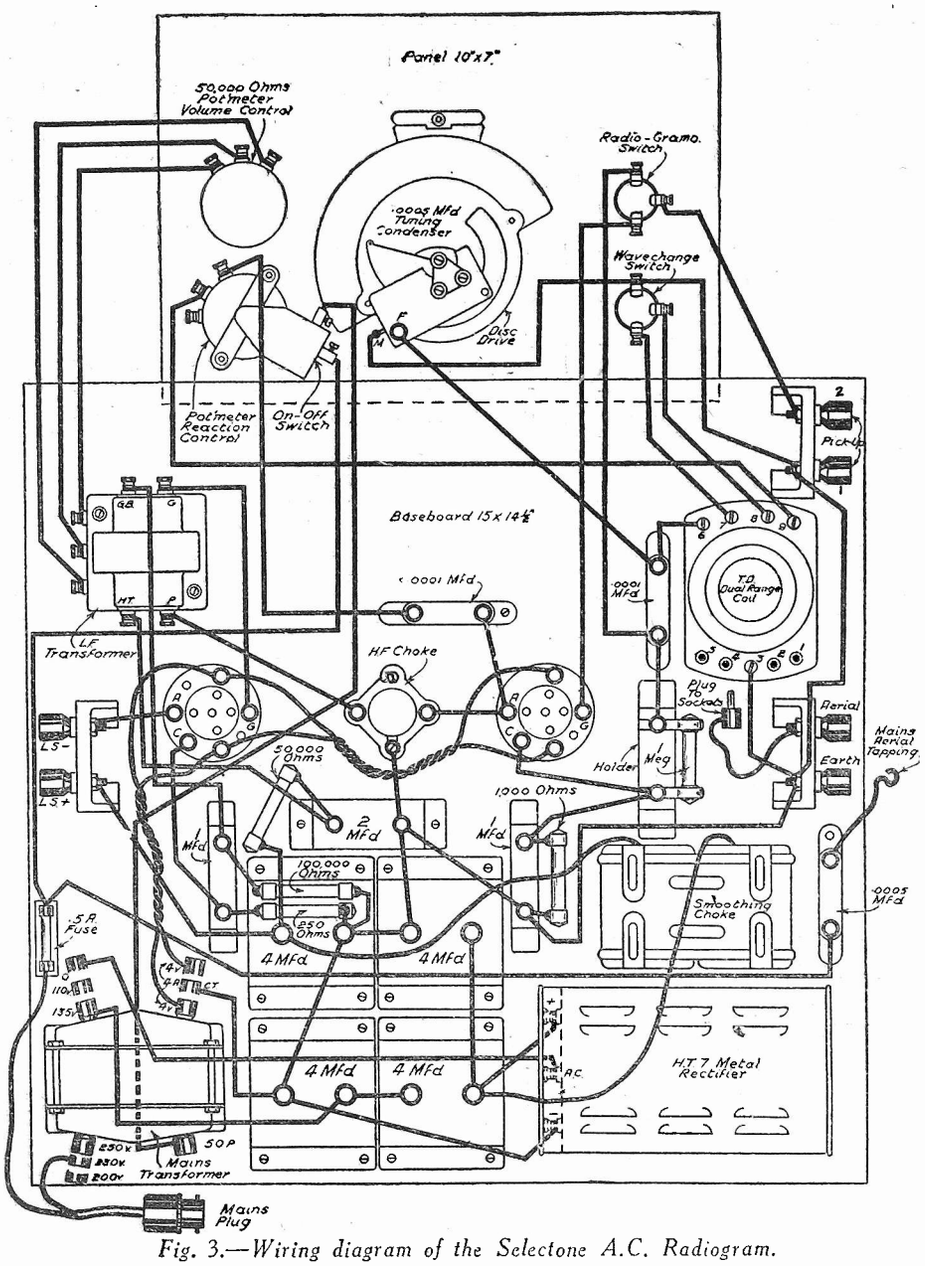


Fig. 3.—Wiring diagram of the Selectone A.C. Radiogram.

SELECTIVITY IN SIMPLE TERMS

(*Continued from page* 216.)

adequate selectivity is still not obtained, in which case a double circuit tuning system must be employed. This means that some form of band-pass tuning must be used. Now to buy a commercial unit and ganged condensers will cost anything from 25s. to £2. Few people will want to spend that amount and so an add-on circuit is here described. This unit will convert your present set into one with band-pass tuning.

The parts required are :—

1 .0001 mfd. compression condenser.
1 .0003 mfd. compression condenser.
1 .0005 variable condenser.
1 dual-range coil and wave-change switch, terminals and wire.

The dual-range coil must be totally screened and the screen earthed. This stipulation is made because direct coupling (which would otherwise upset tuning) between the two coils would be difficult to eliminate. Moreover, a screened coil enables greater compactness to be obtained.

The circuit and wiring diagram are shown in Fig. 3.

The aerial is connected to A. Terminal marked "A on set" is joined by a *short* wire to the aerial terminal on set. If tappings are used on coil in set they should be discarded, and the short piece of wire joined to the "grid end" of coil. Terminal marked E on set is earthed. The coil screen is earthed by terminal on top of screen.

This is connected to MV, terminal 2, or to the earthing terminal: whichever is more convenient. The aerial series condenser may be joined either to 4 or 1. Connection to 1 is to be preferred on the score of volume.

To use the unit tune in a station (one not too powerful) on both dials for greatest volume. If the station still persists even though condenser dials are turned through a space of five degrees the .0001 mfd. compression condenser must be slackened off till the station occupies one or two degrees on the dials.

A second station far removed (in frequency) from the first is then tuned in. The .0001 mfd. compression condenser is re-set to give the required results. Finally, this condenser is left in a position intermediate between the two settings. Stations are then tuned in on the two dials alone. If a powerful station comes in at two settings on the dial the .0003 mfd. compression condenser is slackened off till only one reading is obtained. Long-wave stations are received by opening the wave-change switch (*i.e.*, pushing it in). One last word on this arrangement. A short aerial is a disadvantage when used with this arrangement. You lose too much volume. This does not contradict previous statements on short aerials, as a moment's consideration will show.

An article on selectivity would hardly be complete without a word or two on wave traps. A wave trap needs to be very good. Good does not mean the ability to cut out one station only. There are plenty of good wave traps in that respect. Some of them reduce the strength of wanted stations very much; thus making the final state of affairs as bad as the first. When considering the use of a wave trap don't run away with the idea that you can use two—one for each local. Each individual wave trap functions perfectly by itself, but when the two are connected in series the probability is that they will couple with one another and upset each other's adjustment: thus making the use of two ineffective.

The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

Conducted by F.J. CAMM

Cowl Insulator

AN insulator so called because of its hollow conical shape. A good example is illustrated in Fig. 1. The object of such a design is twofold—firstly, it offers a long path to any currents which might tend to leak across the surface, and, secondly, by virtue of the cowl shape, the inside surface is kept dry in wet weather, so that even under these conditions the risk of surface leakage is small. Thus its insulating properties in the wet are comparable with those in dry weather.

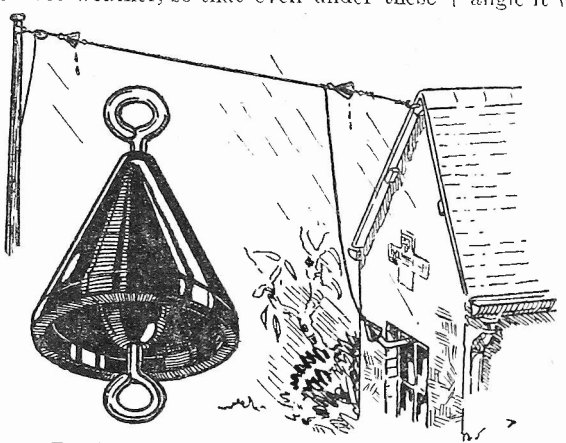


Fig. 1.—Cowl insulator showing method of use.

If you examine the illustration you will see that any current which may try to leak from one ring to the other must travel over the outside surface, across the edge, along the inside, and down the centre part. If it is only dry right up inside the apex of the cone it will offer a barrier to the current. Of course, the conical shape is also inducive to rapid draining as the water runs off from the edge.

Some types of lead-in are also fitted with a conical cowl similar to a cowl insulator. The lead-in is bent so that the apex of the cone points upwards, thus the underside is always dry. Cowl insulators, if kept clean, are as efficient as any, and more so than most.

Crystal Control

A method of controlling the wavelength of a transmitting station by means of a quartz crystal. This has nothing to do with the ordinary type of crystal used as the detector in a crystal set. A quartz crystal would be quite unsuitable for this purpose. The property of the quartz crystal which determines its use in a transmitter is that mechanical vibrations are set up in it by the passage of an alternating current of suitable frequency. By cutting the native crystal at a certain angle it will exhibit the desired characteristics when the current is applied to opposite faces. The thickness of the crystal determines within very fine limits the frequency to which it will respond, thus by cutting the crystal the right thickness and connecting it in a suitable manner in the transmitting circuit, the oscillations in the latter can be maintained at one frequency or wave-length all the time.

A quartz crystal in the various stages of cutting and grinding is shown in Fig. 2.

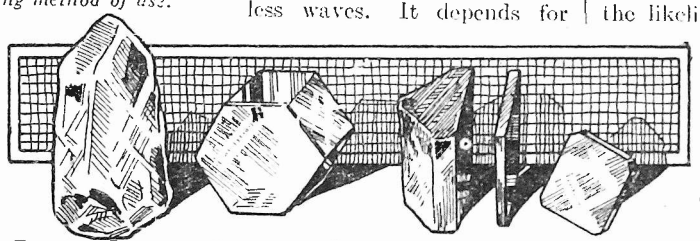


Fig. 2.—Stages in the cutting of quartz crystals as used for crystal control.

Crystal Detector

A device used for rectifying or "detecting" wireless waves. It depends for its action on the fact that the mineral "crystal" it contains permits an electric current to pass through it in one direction only. If an attempt is made to pass current through it in the opposite direction its resistance is very high indeed.

As you know, wireless waves arriving at the receiving aerial set up electric currents in the aerial coil of the receiver. These currents oscillate backwards and forwards so rapidly that if they were taken straight to the headphones there would be no response at all. That is to say, no sound would be produced. This is because as soon as the diaphragm of the 'phone started to move in response to the current in one direction the effect would be immediately cancelled by the current instantly flowing in the opposite direction. The crystal overcomes this neutralising effect by cutting out the reverse current. The telephones are then able to respond to a current always flowing in one direction.

The crystal used in the detector may consist of various natural minerals. A very popular one is galena, which is another name for lead sulphide. The type suitable for wireless purposes is a hard grey substance which when broken exhibits a bright metallic surface composed of small crystals. It is usually sold in pieces about the size of a large pea, and may trade under various high-sounding proprietary names usually ending in "ite." The crystal is held in a metal cup by means of set screws or plastic metal and the other contact is made by means of a thin coiled wire called a "cat's-whisker." The cat's-whisker is so mounted that it can be moved over the surface of the crystal until a sensitive spot is discovered. The object of the cat's-whisker is to give a very light contact. This is important, and the results obtained depend very largely on getting the setting of the whisker just right.

The need for careful adjustment and the likelihood of its being disturbed by a slight jar when once obtained is one of the chief drawbacks to crystal reception. Another is that no amplification of signals is obtained with a crystal as with a valve detector, so that the strength of reception is dependent entirely on the power picked up by the receiving aerial.

(Continued on page 234.)

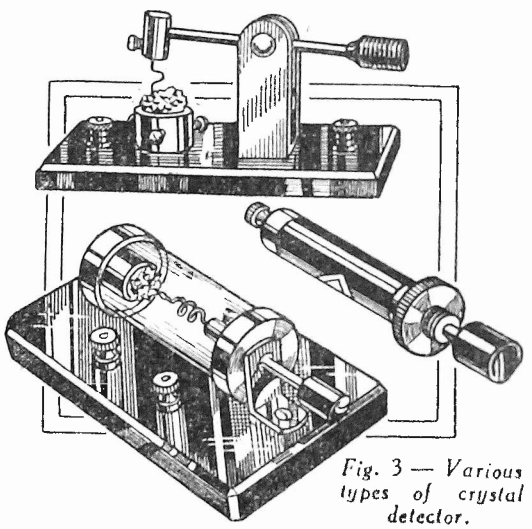


Fig. 3 — Various types of crystal detector.

THE BEGINNER'S A B C OF WIRELESS TERMS

Continued from page 196, April 22nd issue.

(Continued from page 233.)

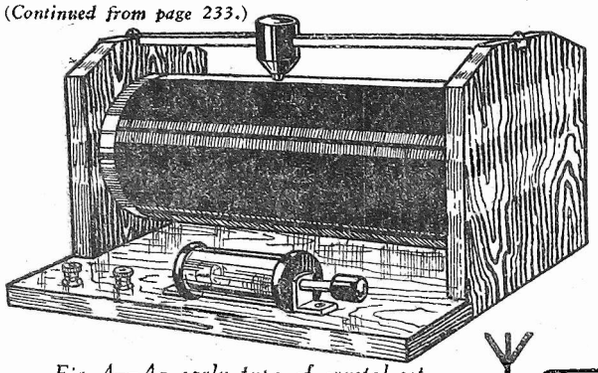


Fig. 4—An early type of crystal set.

There are other kinds of crystal than galena. Some of these do not require a cat's-whisker, and are therefore of a more permanent nature. However, although being more stable, they are usually less sensitive. Some well-known crystals are carborundum, zincite, and bornite, "Perikon" and silicon. Carborundum is used with a steel spring pressing on it instead of a cat's-whisker. Zincite and bornite are two other minerals which are used together. The two crystals are mounted in cups facing one another, and held in contact by means of a spring. "Perikon" is a similar pair, but using copper pyrites and zincite, while silicon is used in the same manner as galena.

Three typical examples of crystal detectors are shown in Fig. 3. The one above is of the cat's-whisker variety. It will be noticed that control of the whisker is obtained by mounting it on a small arm working on a ball joint. The crystal is held in place by means of set screws so that it can be moved easily and re-inserted another way round if it becomes insensitive after long use.

The detector in the centre is of the semi-permanent variety, and is intended to be mounted on the panel by the usual one-hole-fixing method. The knob allows of a limited amount of adjustment. The lower detector is similar to the top one, but the cup is mounted horizontally and totally enclosed by a glass or celluloid tube. This prevents the crystal from becoming covered in dust, which is a frequent cause of failing performance.

Crystal Set

A simple type of receiver employing a crystal detector instead of valves. Owing to the fact that a crystal does not give any amplification of the signals received, the use of such a receiver is limited to within a few miles of a broadcasting station. A crystal set necessitates the use of headphones, but it is generally possible to use several pairs without any very great loss in signal strength. This is the best way if several people wish to listen at once, as the use of a loud-speaker, even under the most favourable conditions, is practically impossible. There are admittedly one or two amplifiers of the microphone type still on the market which it is claimed will boost the signals sufficiently to make speaker reception possible, but the results do not in any way compare with the average cheap valve set.

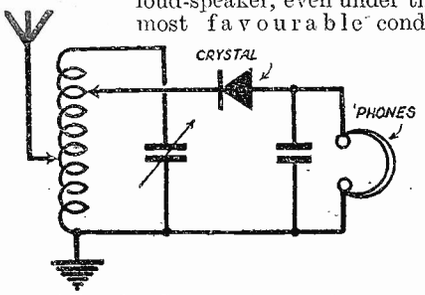


Fig. 5—Circuit of crystal set.

One of the early types of crystal set is shown in Fig. 4.

A circuit for a crystal set is given in Fig. 5. For best results the tuning coil must be of an efficient type wound on a fairly larger former, and not screened in any way. The aerial tapping is for the purposes of selectivity. The nearer it is taken to the earthed end of the coil, the sharper will be the tuning and the weaker the signals. The other tapping is used to adjust the circuit according to the resistance of the crystal used. The condenser across the 'phones is not absolutely essential, but is recommended by many designers. Its value should be round about .001 mfd.

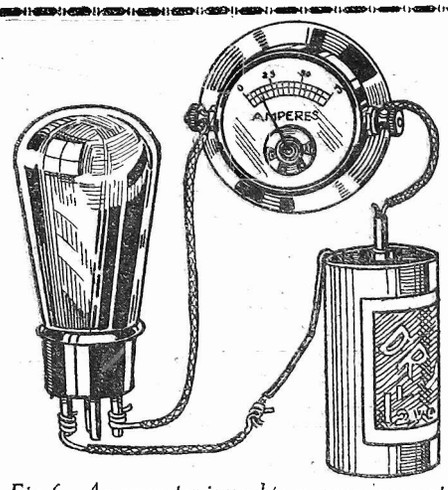
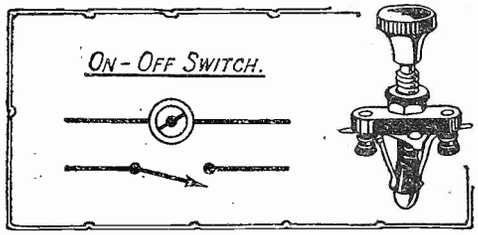


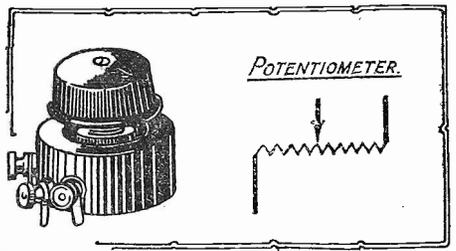
Fig. 6—An ammeter is used to measure current. The illustration shows a valve under test.

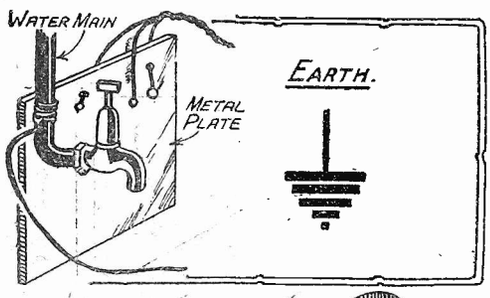
Current is the flow of electricity along a wire or other conductor. It may flow in one direction only, when it is called a *Direct Current*, or it may flow first in one direction and then in the opposite direction. In this form it is called an *Alternating Current*. Alternating current is again divided into two kinds. If the alternations or flow backwards and forwards is at a very fast rate, or "frequency," it is spoken of as a *high-frequency* current; but if it is comparatively slow, then the current is called a *low-frequency* current.

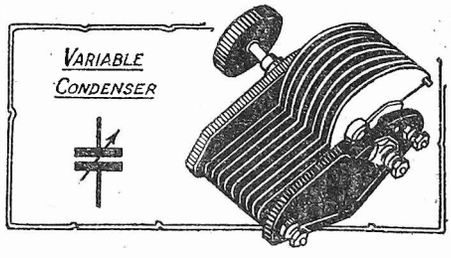
The rate of flow of current is measured by means of an ammeter, the unit of current being the *ampere*. Fig. 6 shows the current passing through a valve from a small battery being measured.

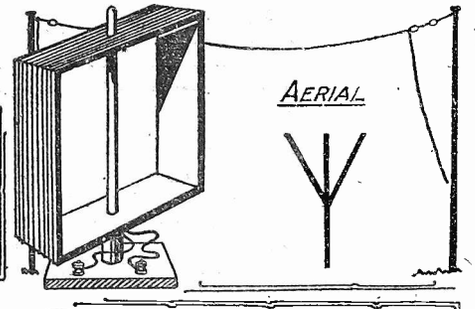
THE SHORTHAND OF WIRELESS—(*Concluded*)

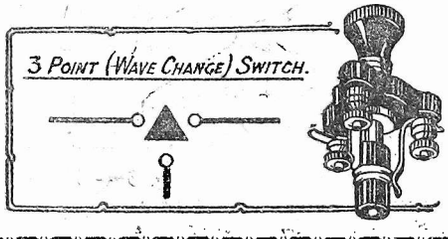


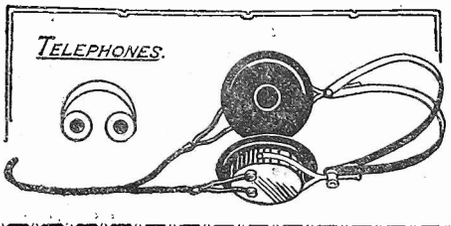


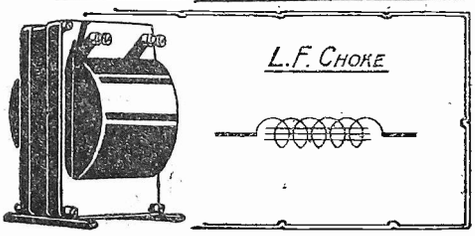












Auto-Tone Balance

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

In this article the author explains a method of counteracting distortion caused by reaction.

WHEN the sound emanating from a loud-speaker differs from that performed in the studio, it is said that "distortion" has been introduced. Distortion can occur in almost every stage of a receiver, but in most cases it is a simple matter to guard against it by using components of good design and high quality and by keeping a careful watch on operating conditions in order to ensure that valves and other apparatus are not overloaded, and that correct grid bias and anode voltages are applied.

There are, however, certain conditions under which a definite amount of distortion is inevitable. It cannot be prevented from occurring, and until recently distortion of this kind has had to be endured with what patience the listener could command.

The Use of Reaction

Distortion of the kind referred to is that due to the effects of reaction. Practically every receiver of reasonable efficiency is capable of reproducing at good volume the programme radiated by the local station without recourse to reaction, and a modern set employing a screened grid high-frequency stage should be able to give a fairly wide choice of programme without the reaction knob requiring attention. If the more elusive foreigners are to be picked up at comfortable strength, however, the additional fillip to sensitivity given by wisely applied reaction is of great assistance.

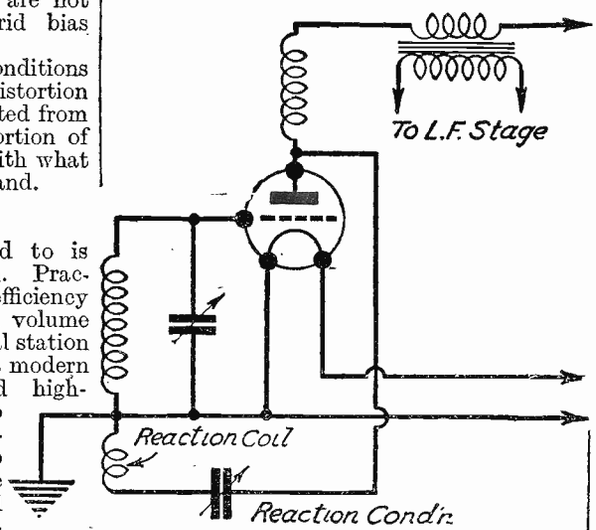


Fig. 1.—The conventional form of capacity reaction control.

As most listeners know, reaction is a process in which part of the energy in the anode circuit or "output" circuit of the detector valve is returned to the grid circuit and is re-amplified. The amount of energy so fed back is controlled, in a modern set, by a variable condenser, which passes more or less energy, according to the adjustment of the vanes, back to a reaction coil which is coupled to the grid coil, the normal scheme of connections being indicated simply in Fig. 1.

Now not only does reaction greatly increase the volume of sound from the loud-speaker, but it adds also to the apparent selectivity of the set, that is to say, the receiver can be more sharply tuned when a fair amount of reaction is applied than when the reaction control is turned back to zero. But undue sharpening of the tuning has the effect of cutting off some of those all important side bands which represent the higher tones of the musical scale. The reproduction, therefore, tends to become gruff and "drummy"; the brilliance of the treble notes and the "tone colour" due to the higher harmonics are reduced, and the programme quality becomes decidedly unpleasant.

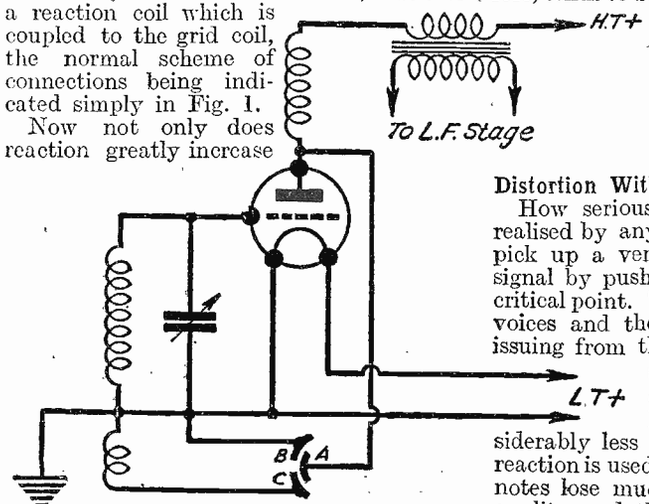


Fig. 2.—The slightly different connections when using a differential reaction condenser.

Distortion With Distant Reception

How serious this distortion can be is realised by anyone who has ever tried to pick up a very weak and distant signal by pushing reaction to the critical point. The hoarse, croaking voices and the travesty of music issuing from the loud-speaker are scarcely distinguishable as a programme. Even when a considerably less amount of reaction is used the "top" notes lose much of their quality, and this is quite understandable when it is stated that deterioration may well affect all notes above upper "C" on the piano, and even some notes between middle and upper "C."

As already stated, until recently no satisfactory method of counteracting this form of distortion has been available. It is now possible, however, to compensate almost completely for high note losses due to the use of reaction.

The method is, briefly, this: Since the losses in high notes become greater as reaction is increased, can we not find a piece of apparatus or a circuit arrangement in which the high tones are automatically strengthened as reaction is increased? The practical solution to the problem is a development of a method of balancing out losses, well known and practised frequently in the past with varying degrees of success. In the original scheme, known deficiencies in one part of a circuit were compensated by known increases in another part of the circuit, and by carefully choosing components with suitable characteristics, various elements of distortion and loss were cancelled out.

"Hit-or-Miss" Principles

Such principles are usually of the "hit-or-miss" type, and as examples mention may be made of the use of a pentode output valve in conjunction with a movin-coil loud-speaker known to be rather "boomy." Again, needle scratch in a pick-up circuit, which means in effect, the addition of extra and unwanted high notes, can be reduced by using a filter to divert all or a part of the notes above a certain frequency from the amplifying stages.

Usually, too, no attempt was made to ensure that these compensating devices should be self-adjusting. Based entirely upon the electrical characteristics of various pieces of apparatus, the arrangement was so planned that tolerably good quality

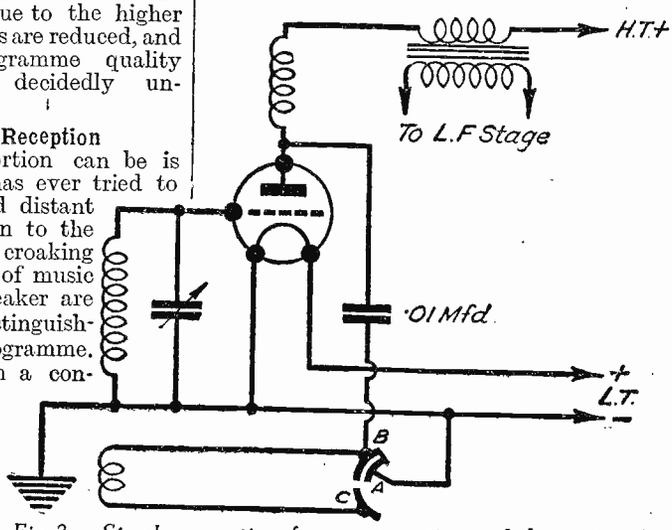


Fig. 3.—Simple connections for an automatic tone balance circuit.

RADIO RAMBLINGS

condenser (anything from 1 to 4 mfd. will do) is joined between that L.S. terminal which is connected to the plate of the output valve, and the loud-speaker. The second speaker terminal is joined to an odd length of metal tube, which can be pushed into the soil in the corner of a flower bed. This arrangement applies equally well whether the speaker is a moving-coil, balanced armature, or any other type.

The Popularity of S.W.

THE other day I happened to be talking "shop" (in every sense of the word) with a friend who owns a large radio store, and he was deploring the fact that business had fallen off rather considerably with the early approach of summer-like weather. I suggested that he might improve matters by booming short-wave sets and components, since these were bound to attract the interest of the D.X. "fan," who was deprived the pleasure of long-distance reception on the higher wavebands during the light weather. He rather astonished me by saying that he had tried this idea on previous occasions, but with negative results. In fact, he went so far as to say he had enough S.W. kits in stock to make a hundred sets, but there was very little call for them. It is amazing that this should be the case, because I should think that every reader of PRACTICAL WIRELESS knows that short waves are almost the only medium for long-distance reception, at low cost, in summer time. There is no doubt that a two or three-valve short-waver will give excellent reception of American and other distant transmissions all the year round, and the idea that wireless is of only seasonal interest is long since dead.

"Make or buy a short-wave set now and enjoy D.X. the whole year round!" would be a very apt slogan.

Tuning a Short-waver

THE same dealer friend told me of an incident he experienced a short time ago which had rather disgusted him. A customer had bought a short-wave adaptor, and, after having had it for a couple of days took it back to the shop saying it was faulty. The unit was examined and tested and found to be in perfect order. The owner thereupon took it away again, only to return with the same complaint. Eventually it was found that the only trouble was that he was unable to tune it—not because tuning was difficult, but simply because he had not appreciated the need for rotating the dial slowly enough. When one considers that on a wavelength of, for example, 30 metres (one that is very productive of signals just now, by the way), a movement of a quarter of a degree of the dial of a .0002 mfd. condenser covers the same band of frequencies as does a movement of about ten degrees of the condenser in an ordinary broadcast receiver, it can easily be appreciated that tuning must be carried out very slowly indeed if anything is to be heard at all.

"Wireless in the Car"

IN view of the recent article in PRACTICAL WIRELESS, on "Wireless in the Car," it is interesting to note that a suggestion has been put forward that the time is ripe for motor-car manufacturers to consider the possibilities of making radio receivers as standard fittings of cars coming within the "de-luxe" category. Apparently this would create a little difficulty, for it appears that if the set were made a "fixture" it would become necessary to obtain a broadcast receiving licence specially for it. Bearing this fact in mind, it seems that the most satisfactory solution would be to make provision for housing a portable set and to devise some means by which its power supply could be derived from the car accumulator. A compact receiver, without batteries, could then be used in the car when required, or operated in the house as a normal domestic receiver. In that case a loud-speaker could be built into the car as a permanency, and the bare set made to be easily portable.

I have been experimenting with the latter system and find it an easy matter to build a four-valve set in a shock-proof case, measuring only 6in. square by 12in. long. This can be mounted under the dashboard of quite a small car and held in position by stout elastic bands.

CLASS B COMPONENTS

(*Continued from page 222.*)

A spool must be made in similar manner to that for the transformer, but of different dimensions and having four sections; particulars are given in Fig. 7. To simplify the winding process the turns are arranged in four equal parts, which are connected together on completion. A total of 10,000 turns of 32 gauge enamelled wire are used, and the weight of this is approximately 1½lbs. Again, it is not essential to count the turns so long as each section is almost filled and contains as nearly as possible the same amount of wire. Core clamps and terminal strips are the same as those for the transformer, except that the former have a total length of 4¼in. and the latter of 3⅜in.

The transformer and output choke described above can be used in practically any Class "B" amplifier or any receiver using this form of amplification, but to avoid possible confusion a pictorial wiring plan is given in Fig. 8 of an amplifier using the circuit diagram of Fig. 1. The "driver" valve will normally be part of the receiver to which the amplifier is connected, and is that immediately following the detector. It will be fed in the usual way through a transformer or even an R.C.C. unit and should be a small power valve, such as a Cossor 215P, Mazda P.220, or a similar type in another make. As explained before, it may be biased rather more heavily than usual until its anode current is reduced to 2 or 3 milliamps. At the time of writing there is only one Class "B" valve on the market—the Cossor 240B.—but others are shortly to be introduced and the components described should be suitable in every case. Maximum loud-speaker output will depend very largely upon the H.T. voltage employed; for example with 90 volts H.T. an output of some 1,000 milliwatts are available, or approximately 2,000 milliwatts when the voltage is increased to 150.

As most readers will be aware, the Class "B" valve has seven pins and thus requires a special holder of which the connections are shown in Fig. 8; it can be seen that one terminal is a "dummy" and does not require any connection. When the loud-speaker is designed for use with a pentode it should be joined to terminals 1 and 2 on the output transformer, but if it is normally intended to work with a power or super-power valve it will be connected to terminals 3 and 4.

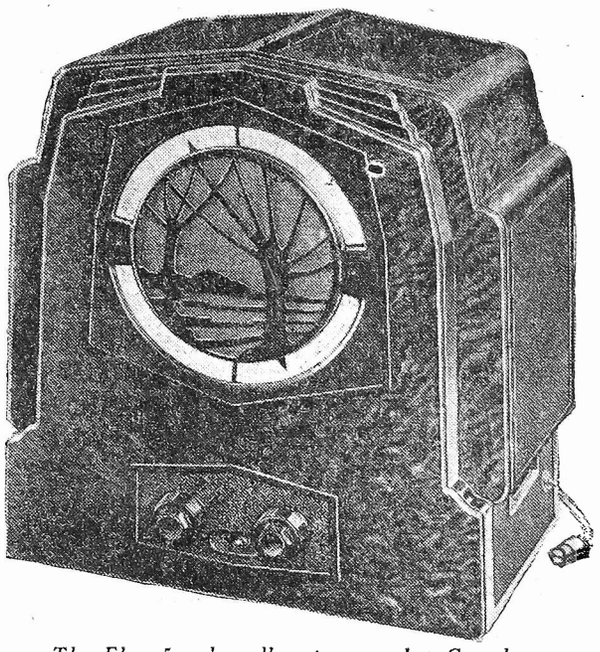
RECEIVERS AND THEIR RECORDS

Superhet Consolette (Model SH25)
Ekco 5-Valve All-Mains

So long as there exists a great number of high-power stations working on neighbouring wavelengths, the greatest degree of selectivity is required, and in these circumstances the superheterodyne circuit easily holds its own. Several makers have placed instruments of this type on the market, and of these, the Ekco model SH25 is an outstanding representative. Generally speaking, the circuit does not depart to any extent from conventional superhet practice, but considerable attention has been paid to the lay-out of components and to many minor details to which so much care is not always devoted. The receiver is very well constructed, and it is housed in a modern bakelite cabinet of prepossessing appearance. Possibly, the large station dial will be the first feature to attract attention; it indicates at a glance both the station and the respective wavelength to which the set is tuned. Although, at first sight, this patent tuning device, whereby a broadcast is actually selected by the name on the dial, may appeal to a certain class of listener, I do not think that it affords all the advantages claimed for it. There are over two hundred and thirty stations in Europe alone, and it is evident that no dial of reasonable size could possibly show all their names. Providing, say, twenty or thirty names were given on that portion of the dial allotted to the medium band, and which, with their corresponding wavelengths, would act as landmarks, it would be better practice to calibrate the rest of the dial in degrees *only*. In the receiver under test, I noticed that neither Leningrad nor Warsaw—both giant transmitters—were marked; in the same way, on the medium band, no mention was made of Bordeaux-Lafayette, Breslau, Stockholm, etc., whereas prominence had been given to such stations as Kosice, Cork, and so on—namely, broadcasting transmitters which are much less frequently heard by distant listeners.

The Ekco Superhet SH25, which can be supplied in either A.C. or D.C. mains-operated models, comprises five valves in superhet sequence, namely, variable mu 1st detector, and intermediate frequency stage, an oscillator, 2nd detector, and pentode output feeding a built-in moving-coil loudspeaker. In the A.C. version, a metal rectifier is used for the mains supply. The receiver is available in three types: A.C. 200/250 v. (40-80 cycles); 100/125 v. (40-80 cycles), and D.C. 200/250 volts. Either model can be easily adjusted to suit individual mains requirements.

The handling of the instrument has been rendered very simple and good results are immediately obtainable, even in the hands of the most unskilled novice. Actually, on the front of the receiver there are only two knobs; on the left, the main tuning condenser, on the right, a volume control. Smaller knobs concentrically mounted act respectively as a combined wavechange and gramophone selector, and also as a local and distance switch. In addition, to damp the higher frequencies, and at the same time assist in suppressing interference, there is a small lever which, bringing into operation a filter device to the second detector valve, effects a considerable alteration in the tone of the output. The ordinary "on" and "off" Q.M.B. switch is placed on one side of the cabinet.



The Ekco 5-valve all-mains superhet Consolette.

Best reception results, of course, are obtained with an outside aerial and earth of the standard type, but the receiver is also provided with an internal aerial, which will give excellent results with some of the more powerful transmissions. The volume control is very efficient on both the "short" and "long" wavelengths; its action is smooth and progressive. Provision has been made for the adaption of a pick-up for the electrical reproduction of gramophone records; it is essential, in this case, to use a separate control potentiometer, as the one incorporated in the receiver does not act when the change-switch is fixed at "gram." In the A.C. model under test, the electrical current consumed was roughly 50 watts—an economical figure—and one which compares very favourably with other receivers of the multi-valve class. In the matter of selectivity, the *Ekco Superhet SH25* reflected great credit upon its designers; it is an easy matter to log a large number of stations in a very short space of time, and the strength of the signals, even in the case of low-powered stations, is such that the majority of them can be listened to in comfort.

This up-to-date superheterodyne is made by E. K. Cole, Ltd., Ekco Works, Southend-on-Sea (Essex). At the price of twenty-four guineas, it will, without doubt, assist in establishing the popularity of what is really the only type of receiver which deals satisfactorily with the modern chaotic condition of the ether.

MY OPINION! By the Editor

8-11, *Southampton Street, Strand, W.C.2.*

Correspondence

IN the course of an interesting letter a reader makes the suggestion that we should offer a prize each week for the most interesting letter published in our correspondence pages. I cannot accede to such a request, for editorial correspondence should be a natural corollary to a paper. We are always delighted to hear from our readers. We like to receive their brickbats as well as their bouquets, for it is in the clash of intellect and the admixture of diverse opinions that is generated the dynamic spark which creates the driving force of a healthy publication such as PRACTICAL WIRELESS. Any attempt to force correspondence by the inducement of a prize rather asks for flattery; for no reader would feel that in expressing his true opinion (if it were an adverse opinion) of the paper, he would stand a chance of winning it. Our correspondence pages are always open to our readers, even if their opinions may clash with mine or my contributors'. Your brickbats may be hurled at the editorial cranium without the fear that they will be ignored. Nor have we need with our vast circulation, our leading position, and the esteem in which PRACTICAL WIRELESS is held by its readers, to offer such inducement. Our prizes are limited to practical ideas from our readers, many hundreds of whom have promptly benefited financially by submitting Wrinkles.

Specifications

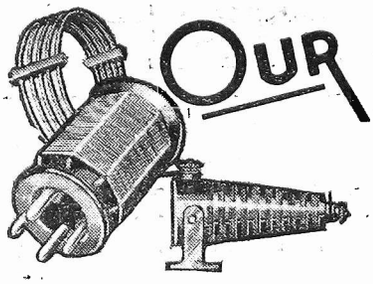
A READER tells me that it is refreshing to find a paper which actually tells the reader the correct parts to use in making a receiver. He is, of course, referring to our policy of specifying one make of component only for each item in the set. It is a policy which we shall continue with vigour.

Next Week's Free Blue Print

RADIO has become a seasonal hobby largely because very few, if any, have yet produced a portable receiver which could be carried without discomfort or fatigue. I have designed what I think you will judge to be a **novel type of lightweight portable receiver, a free blueprint for which will be presented with every copy of next week's issue.** The lightest cabinet on the market, so far as I am aware, weighs about 12lbs., which in itself places it outside the genuine portable market. I therefore set to work to apply some of the weight-reducing principles adopted in the aircraft industry, with the result that the cabinet of the Featherweight Class B Portable Four, which is the subject of the blueprint alluded to, weighs only 1 lb. Additionally, you do not need the fingers of a Houdini to assemble it. The total weight of the receiver is much less than anything before attempted in the home-constructor line. Full constructional details will be given next week, and advance information appears on page 215 of this week's issue.

F. J. C.

ORDER NEXT WEEK'S ISSUE NOW, AND MAKE CERTAIN OF YOUR BLUEPRINT!



OUR SHORT WAVE SECTION

SHORT-WAVE COIL CONSTRUCTION.

A Practical Article on Making Efficient Coils for Short-Wave Work.

By A. V. D. HORT.

TUNING coils for use on waves below about 150 metres can with advantage be of quite different design from those used on the broadcasting waves. This is not to say that compact coils of the

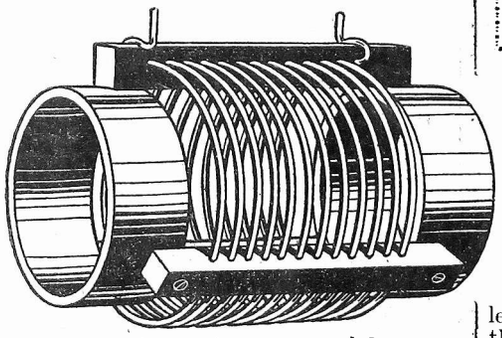


Fig. 1.—A neat short-wave coil design.

ordinary plug-in type will not function on short waves; but they cannot be expected to be very efficient. Possible losses of energy, due to the self-capacity of the coils and their high-frequency resistance, must be guarded against more and more carefully as the frequency of the currents carried increases. You might find that simple "hank" coils of a few turns of fine wire would enable you to receive signals on 100 metres, and even down to 20 metres. Signals would be comparatively weak, however, and your tuning range for one set of coils would be unnecessarily narrow. On lower wavelengths still, difficulties in persuading the detector valve to oscillate would become more and more pronounced. Substitute carefully designed coils, and, with the other components unaltered, you would at once obtain vastly improved results from the receiver, both in signal strength and in ease of handling.

The coils which are to be described do not claim to be the last word in super-

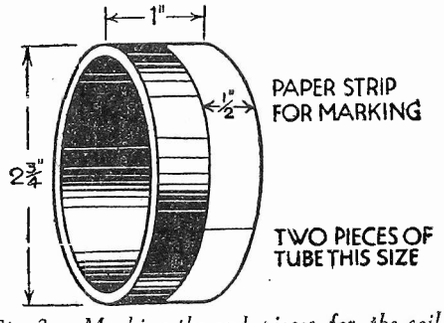
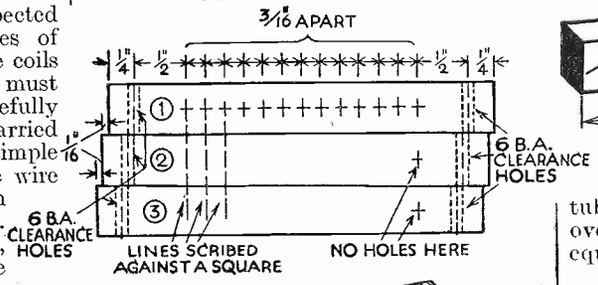


Fig. 3.—Marking the end pieces for the coil.

efficiency. They have, however, been in use in the writer's short-wave equipment for some time, and they have proved entirely satisfactory. The aim has been to make rigid coils, using bare wire with well-spaced turns, and with the smallest possible amount of supporting material. Large masses of ebonite or other insulating material are to be avoided in coils for short waves, as being potential absorbers of energy which should not be permitted to go to waste in this way.

Details of Construction

The coil illustrated in Fig. 1 is wound with bare 16 s.w.g. soft copper wire. Although wire of this gauge would stand up unsupported in a coil, the coil would not be at all rigid. The least vibration would cause variations in the wavelength to which the receiver was tuned. Hence the ebonite strips and tubes to support and space the turns.



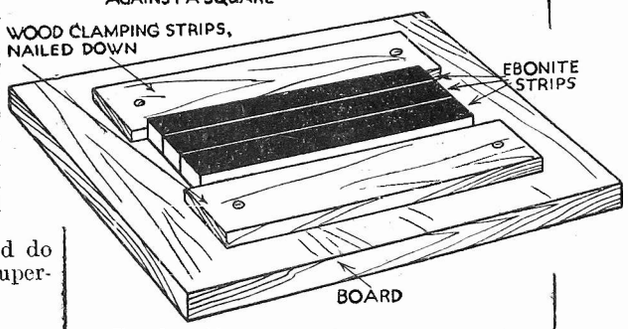


Fig. 2.—How to mark out and cut the coil supports.

You can make your coil of any length or diameter you wish, but you are advised not to make the diameter less than about 2 to 2½ inches. The illustrations show the dimensions for a 12-turn coil, about 3¾ inches in diameter, a useful size for a wide range of short waves.

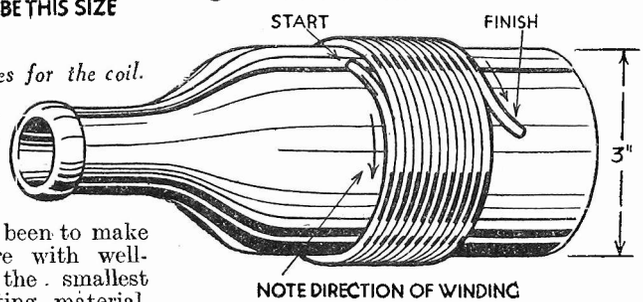


Fig. 4.—Winding the coil round a bottle.

First mark out the supporting strips. These are cut from ⅛in. ebonite sheet. Lay your strips on a flat board against a fixed wood strip, and fix another strip to hold them firmly together. Now slide them into the exact positions given in Fig. 2. Scratch the numbers 1 to 3 on them with a scriber. With dividers mark off the hole positions on strip 1 3/16 in. apart. Then with a square scribe lines right across all the strips from these marks. Punch-mark all the centres, and drill with a No. 43 drill. The holes at the ends of the strips are drilled 6 B.A. clearance and countersunk.

Next mark out the pieces of ebonite tube. The quickest way to do this is as follows. Wrap a strip of paper round the

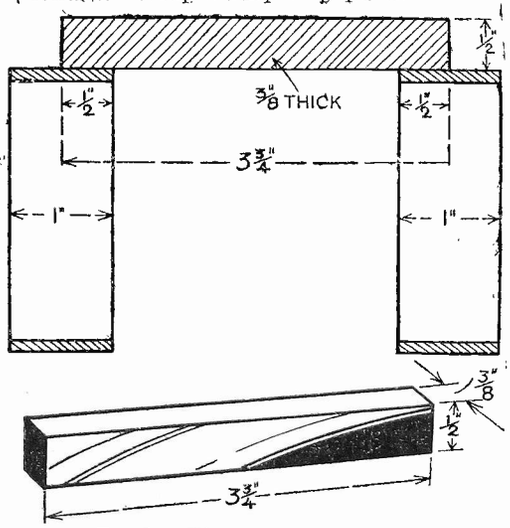


Fig. 5.—The supports, and method of fixing to the end pieces.

tube, and cut it exactly where the ends overlap. Divide the paper into three equal parts by measurement, putting a

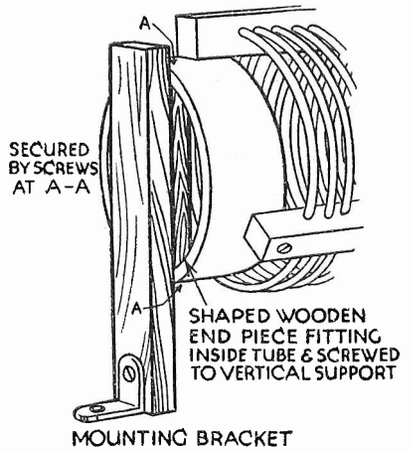
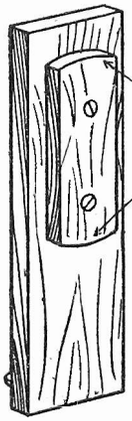
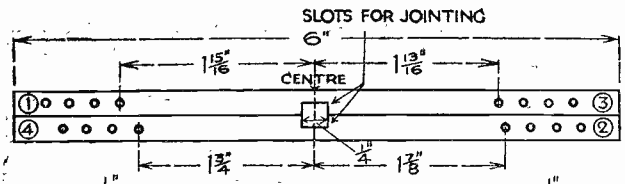


Fig. 6.—The coil supports and method of attaching the coil.



pencil mark at each point. Wrap the paper round the tube again, scribe a line round against its edge, and make a mark against each division point. This procedure gives you the positions for the strips. Place the strips in position in turn, in the order 1 to 3 round the tube, and mark on the tubes the positions

(Continued on page 243.)



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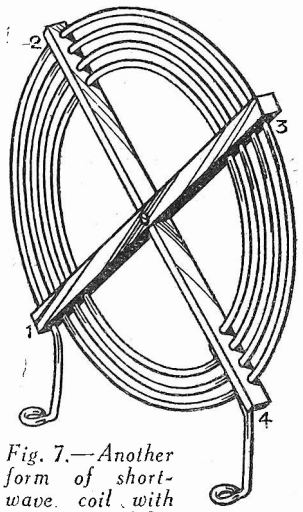


Fig. 7.—Another form of short-wave coil, with dimensions of fixing strips.

for the fixing screws. Drill and tap 6 B.A. for these. If you have no taps, drill 6 B.A. clearance holes. Now you are ready to assemble the skeleton former. Be careful to put on the strips in the right order, so that the turns of the coil will be carried forward in an even spiral from end to end of the strips.

For the coil you will need 11 feet of wire. Cut the length, put one end in the vice, and pull on the other end with pliers till the wire "gives" and comes out dead straight. You must straighten the wire before winding. Small kinks and bends in it would make it almost impossible to thread the wire into the former.

Winding the Coil

Wind the coil on a jar or bottle about

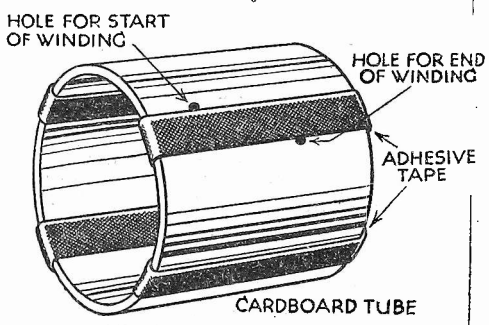


Fig. 8.—The former and adhesive strips for holding another form of coil.

2½ to 3in. in diameter, turns touching. Be sure to wind in the direction shown in Fig 4, or your coil will not go on the former. Hold the starting end all the time while you are winding, and release both ends at once. The wire will spring out a bit, and should give you a coil of even diameter of turns throughout its length. Thread one end through the end hole in strip 1, on through the end hole of strip 2, and so on. As you work along the strips, keep easing the wire through the earlier holes. Never use force, or you will break the ebonite. When you get near the end, be particularly careful to keep easing the wire through the holes near the centres of the strips. Otherwise these turns will be drawn tight as you feed in the last turns, and an ebonite strip may snap across one of the holes.

When you have finished the coil, of even diameter throughout, and without any twist in the strips, turn up each end of the wire at right angles to strip 1, and cut them off, leaving ½in. projecting.

You can mount the coil horizontally or vertically, by fitting in two or one wooden end pieces, as in Fig. 6. Make connections by soldering.

A more compact type of coil, useful where space is limited, is the helix. I have found this type of coil especially useful below 40 metres or so, as it enables one to obtain very tight coupling, if required, between aerial and grid, or grid and anode coils. The former you can make of ebonite or wood. Ebonite is harder to work and more fragile, but better electrically. If you use wood, soak the finished former in melted paraffin wax before putting on the wire, draining off all the surplus.

Now wind on a bottle a coil of 6 or 8 turns of 16 s.w.g. bare copper wire, as for the coil already described, but about 5in. diameter. Pass one end of this coil through the outside hole of No. 1 arm of the former, and thread it round and round in turns of gradually decreasing size.

The inner end is then brought down No. 4 arm and terminated in a loop. The outer end, on No. 1 arm, is similarly looped. Bend these two loops so that they lie horizontal when the coil is vertical.

The coils so far described are meant for use in any short-wave receiver intended mainly or wholly for short-wave reception. If you want to try short waves on a receiver which has ordinary plug-in coils, you will find that the following method of making coils will be of assistance.

Use as a former a short piece of cardboard tube, 2½in. diameter. Lay strips of adhesive tape on it lengthwise, sticky side upwards, as in Fig. 8. Fix them temporarily in place by turning the ends under inside the tube and sticking them together. Pierce a hole close to one adhesive strip. Using 18 s.w.g. D.C.C. copper wire, first straighten by pulling, wind tightly, with turns touching, a single-layer coil of not more than 15 turns. Push the starting end through the pierced hole, and finish at the other end in the same way, through a hole close to, but on the other side of, the same strip. Free the ends of the strips, lay them over the turns and stick them down. Draw them tight as you do so, but do not displace any of the turns. Now cut away pieces of the tube up to the ends of the coil, free the ends and slip the winding off gently. If you have any difficulty in removing the coil, crush the tube.

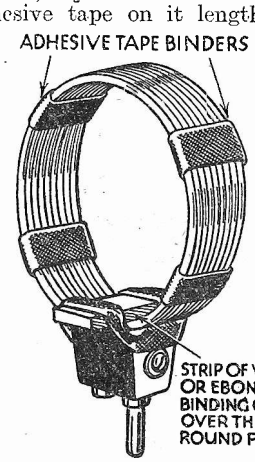
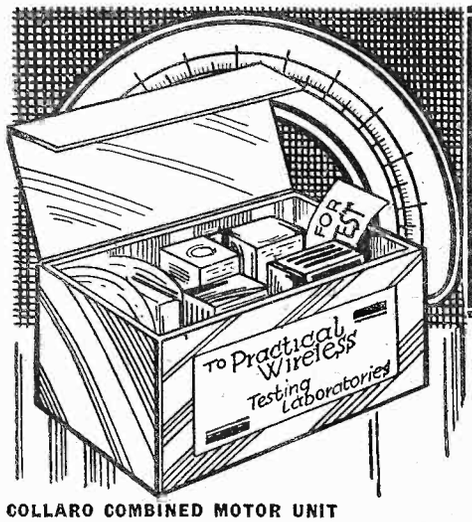


Fig. 9.—The coil wound on former shown in Fig. 8, and method of mounting.

Now mount your coil on its plug, binding it on with adhesive tape; insert a narrow slip of wood or ebonite at the bottom (Fig. 8), to project a trifle beyond each end of the coil. This will prevent the binding from distorting the coil. Make the connections to the plug contacts.



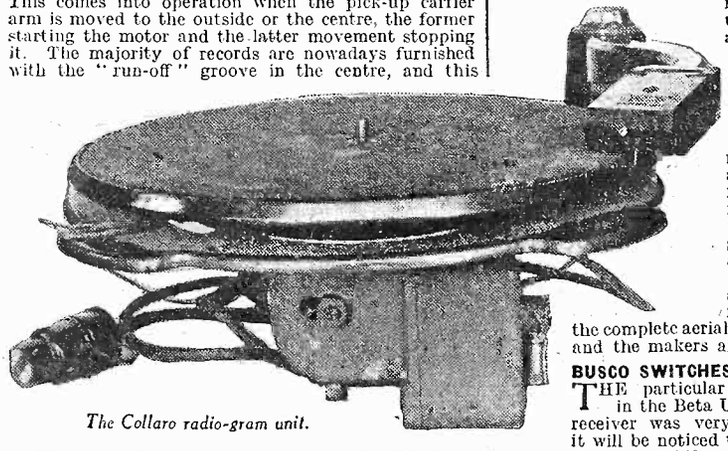
Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

COLLARO COMBINED MOTOR UNIT

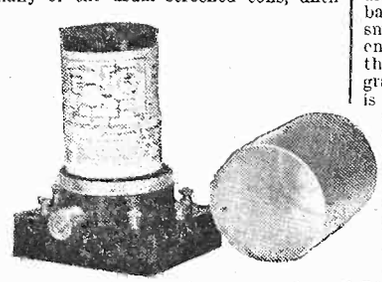
THE illustration below shows a very compact and useful radio-gramophone unit consisting of a pick-up with built-in volume control and induction motor, with fully automatic start and stop device. This is made by the Collaro Company who are, of course, very well known in the gramophone motor world. The particular instrument we have received bears evidence of very high-class workmanship and has functioned perfectly satisfactory on test. The motor is delightfully silent in operation and starts and stops very smoothly by means of the automatic device. This comes into operation when the pick-up carrier arm is moved to the outside or the centre, the former starting the motor and the latter movement stopping it. The majority of records are nowadays furnished with the "run-off" groove in the centre, and this enables the device to operate on all records without the necessity for resetting the stop according to the playing length of the record. The Pick-up has very good characteristics, the D.C. resistance being 4,000 ohms and the A.C. impedance (at 1,000 cycles) being 52,000 ohms. The average output (R.M.S.) is 1.1 volts, so that it does not require a very powerful L.F. amplifier to produce really good volume signals. The volume control is of the wire-wound type, and is quite noiseless in adjustment and provides a complete variation in output from inaudibility to maximum. The price of the complete unit is £4.



The Collaro radio-gram unit.

BULGIN DUAL-RANGE SCREENED MULTI-COIL

THE new dual-range coil which has just been perfected by Messrs. Bulgin is illustrated below It is completely different from this firm's previous coil, and the advance model which we have tested reveals very good characteristics. In appearance it resembles many of the usual screened coils, until the metal cover is removed. The first and principal difference is then apparent, for, instead of the windings being visible, they are enclosed in an ebonite cylinder, round which is pasted a paper bearing all the coil's details. This gives two circuit diagrams (in pictorial form for the non-technical user), one showing the use of the coil in the ordinary aerial circuit, and the other showing its use as an H.F. coupling coil. The connections are described, and the terminals are numbered for this purpose. One marked improvement over other coils of the dual-range type is the provision of a Q.M.B. wave-change switch. This springs into its position and definitely does change the range over which the coil tunes. It can be heard, as well as felt, when the knob is rotated, and it provides a really definite position for medium or long waves. The method of winding, and the choice of the values of the individual windings completely removes break-through, and the selectivity is of a high order. The wave ranges covered are 200 to 500, and 1,000 to 2,000 with a normal .0005 mfd. condenser. The price is 10s. 6d.



Bulgin new dual range coil.

HET INDOOR AERIAL

ANOTHER new idea in indoor aerials has just been submitted to us under the name "Het." This is a simple, but ingenious, arrangement, consisting of an inch wide adhesive *paper* strip upon one side of which is deposited a very thin metallic veneer. This is gold in colour. At one end is fixed a one-inch square of brass, fitted at the centre with a small terminal. The paper is doubled at this point and the brass plate is very firmly eyeletted. To use it, the brass plate is attached to the wall (fixing screws being provided) at a point adjacent to the receiver, and then the strip is stuck to the walls and carried where desired. Neat, right-angled bends may be made by folding, and with the gold surface it forms a very neat arrangement. It is quite effective in use, and appears to be as good as a thin wire aerial, and the large quantity which is supplied will enable a full-size aerial to be laid all round the house. The price of the complete aerial, with fixing screws, is 1s. 6d., and the makers are Univolt Electric, Ltd.

BUSCO SWITCHES

THE particular on/off switch employed in the Beta Universal Class B Four-valve receiver was very interesting in design, as it will be noticed that, although of the three-contact type, one of the contacts is supplied from its terminal *via* a fuse lamp. This is one of the interesting range of switches manufactured by Messrs. Busby and Co., of Birmingham. It has a non-rotatable contact, and this is a feature of the complete range of Busco switches. The operating arm is fitted at the end with two strips arranged at right angles, and one of these strips is bent round to form the contact-maker, whilst the remaining strip is of more springy material, and is bent to form a frictional grip with the moulded bakelite side of the switch casing. The result of this right-angle assembly is that the switch rod cannot be turned, and must therefore make a direct backward and forward movement. The contact strip fits into springy contacts connected to the terminals, and makes contact in the same manner as an ordinary "knife-switch." The contact is thus very sound electrically, whilst from a mechanical point of view the whole scheme is very sound. A three-contact switch is easily arranged by joining a terminal on the side of the bakelite casing and fitting a small piece of metal to engage the spring side of the plunger. For radio-gramophones a special switch is manufactured, and this avoids the troubles usually associated with long leads from the grid terminal. The plunger on this switch is about 3in. long, and a special slotted bracket is supplied with it. This bracket may be fitted on the baseboard of the receiver in any convenient position, and the switch locked (by means of its one-hole fitting) at any height on the bracket. The operating knob then projects from the panel, and by means of ebonite junctions the rod may be extended to any desired length. The price of this switch is 3s., and the special fuse switch is 2s. 6d. The on/off switch costs 1s. 3d. and the wave-change and radio-gram. switch each cost 1s. 6d.

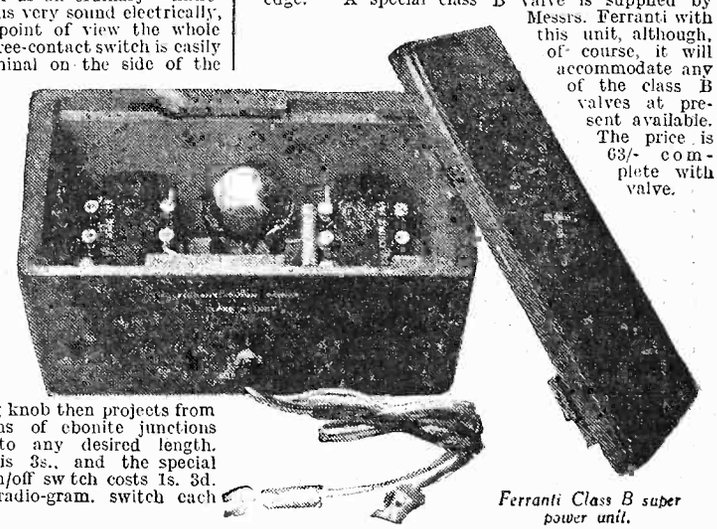
362 VALVES

A SERIES of valves produced by the 362 Radio Valve Company has been received for test. These comprise the more usual types of 2-volt valves, including screen grid, variable-mu, H.F., L.F., Power and Pentode. In addition, we were very pleased to note a valve of the class B type, and this was, in fact the first valve of this type to be received by us. It is not of the 7-pin type, but has a five-pin base, with side terminal. We understand, however, that 7-pin bases are being fitted in future to this type of valve. Tested in the Class B Adaptor, this valve gave splendid results, and on the point of tone, volume and economy of operation gave every satisfaction. The top notes were, as is usual with this type of amplification, splendidly reproduced, and it was found desirable to fit a small fixed condenser across the output transformer to limit the response slightly. The price of this valve is only 9s., which enables everyone to try out the scheme with a minimum of outlay. The other valves all stood up very well to test and the P.2, costing 4s., was found to be the most suitable driver, with a 1/1 driver transformer. The S.G. type of valve costs only 7s. 6d., and the pentode 10s., and the valves are entirely British.

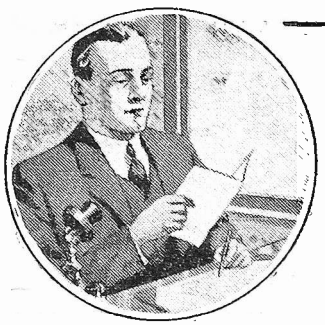
Two of the 362 valves.

FERRANTI CLASS B UNIT

TO enable users of existing receivers to add a stage of class B amplification Messrs. Ferranti have produced the neat unit shown herewith. This is finished in a very small cabinet with sliding lid and accommodates two transformers and a valve-holder. A tone compensator is fitted to the output transformer to limit the high note response, and battery cords are fed through a hole in the front of the cabinet. Holes are drilled at each end to facilitate connection to the input and output terminals, and the unit is extremely simple to connect up. On test it gave splendid results, the reproduction being very full with the top splendidly reproduced without "edge." A special class B valve is supplied by Messrs. Ferranti with this unit, although, of course, it will accommodate any of the class B valves at present available. The price is 63/- complete with valve.



Ferranti Class B super power unit.



Practical Letters from Readers.

The Editor does not necessarily agree with opinions expressed by his correspondents

Efficient Earths

SIR,—Referring to your "Queries and Enquiries" section in March 4th and the resulting further communications in "Practical Letters from Readers" in April 8th issue, may I hasten to draw the attention of your two correspondents to a fact which possibly may not have been considered seriously by them.

The object of an earth device, such as we manufacture, *i.e.* "Filt," is to provide a permanently moist area surrounding the metal contact to the set. We feel sure your readers will appreciate that common salt would not achieve this object, moreover it is extremely corrosive and we are afraid an earth tube which has received a weekly dose of two tablespoonsful of common salt would be non-existent after a month or two. Furthermore there are troubles other than corrosion to contend with, for salt rapidly washes away and is not such a good conductor as "Filt" chemical. The "Filt" chemical actually contains copper, and it is on this account that its operation is so satisfactory.

It may interest your readers to know that although upwards of half a million "Filts" have been produced, complaints to date are precisely three, and in these three instances satisfactory foundation for the complaint was not forthcoming.

In conclusion may I add that "Filt" chemical is not obtainable from any other firm, or under any other Brand name, nor are any firms licensed to manufacture this product.—p.p. GRAHAM FARISH LTD., T. GRAHAM FARISH (Bromley, Kent).

For the Veriest Novice

SIR,—I have just received my copy of the "Wireless Encyclopædia," and I must say that on perusal I find it far exceeds my expectations.

So far as I can judge at present, there is nothing that the "home constructor" of wireless sets need be afraid to tackle with such a book at his elbow, the details are given in such a plain and everyday manner that the veriest novice should find no difficulty whatever in delving into the "Innards" of Wireless in all its forms. Thanking you and wishing PRACTICAL WIRELESS every success for the future.—HAROLD S. SHAW (Huddersfield).

Why not a Handbook of Servicing Instructions

SIR,—Now that the manufacturers are preparing the designs of next season's sets it seems opportune to bring to their notice through the medium of your practical journal a very practical point which spoilt many a good set of this year. Several makes were so selective that a station is obtainable on each side of one of the lines on the tuning dial; yet there were spaces of one half-inch or more between the lines on the dial! How is one to log the numerous stations spread over this interval? Further, the difference between the readings of two such lines are often 30 or 50 metres, so that a mathematical problem has to be worked out before even an approximation could be obtained as to the actual wavelength of the station received.

Therefore, whatever the system employed, whether wavelengths, kilocycles, or names of stations, the greater the number of subdivisions on the scale the easier it is for one to log the stations. From this point of view, a semicircle divided into 180 degrees is better than one of 100 degrees because the subdivisions are finer, and therefore give a closer reading. Another practice that should be universal is to issue with each set a Handbook which includes full servicing instructions as in the case of a motor-car. The wise manufacturer realises that greater interest is taken in an instrument when one knows something of its internals. Many who would prefer to do their own servicing are handicapped through the lack of such a manual with the set. Whether it is advisable to do one's own servicing or not is surely a matter to be decided by the owner who has to bear the cost of repairs. At present, it is forced on the owner to send his set out to be repaired or adjusted however slight this might be.—A. A. (Liverpool).

CUT THIS OUT EACH WEEK.

DO YOU KNOW?

—THAT a filter circuit across the output choke of a pentode output valve is essential for gramophone reproduction.

—THAT in designing a mains unit, the total output must be the maximum required for the valves *plus* the voltage required for grid-bias.

—THAT the wattage dissipation rating of resistances must be studied when purchasing these components.

—THAT the reaction leads of a high-efficiency receiver may often advantageously be metal sheathed.

—THAT the impedance of a valve is varied as the grid-bias is varied.

—THAT Class B amplification makes the design of a portable receiver much simpler.

—THAT tone control L.F. stages are simple to build and very efficient in operation.

—THAT new types of valves will shortly appear on the English market.

NOTICE.

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

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

Improvements in Resistances

SIR,—As a regular reader of your valuable journal, I was deeply interested in the article by "Cynic" entitled "Some Snags and Suggestions," which appeared in the issue for March 11th, and more particularly the recommendation that resistances should be fitted with longer wire ends than is the present practice.

I have also experienced the difficulty referred to by the writer and it seems a pity that the flexible type of resistance which undoubtedly has many points to recommend it should have gone somewhat out of fashion. It is true that one serious disadvantage exists which may have lessened their popularity and that is the difficulty in joining the ends of a number of such resistances together. The usual method of accomplishing this end is by means of a nut and bolt, the junction being covered with insulating tape.

This no doubt is a very clumsy arrangement, but I have recently patented a neat connecting device which obviates all this difficulty. The latter has several other applications in the construction of wireless receivers and I shall be pleased to supply particulars with drawing to manufacturers or others interested, on application to me, c/o the Editor.—JAMES P. MCGLOIN (Rathmines).

Top Notch

SIR,—I beg to acknowledge receipt of your excellent, very clear and concise Encyclopædia, for which I thank you. I should also like to mention how much I appreciate PRACTICAL WIRELESS. Having taken most wireless periodicals at different times I find it well on top, in fact, "Top Notch." Thanking you again, and with best wishes for larger sales.—L. J. DAWES (Earlsfield).

Far Exceeds my Expectations

SIR,—Very many thanks for my copy of the "Wireless Constructor's Encyclopædia," which arrived in perfect condition. It far exceeds my expectations, and I am sure it will prove itself extremely useful in my work. I consider it a volume which every constructor should have by him for easy and precise reference.—LESLIE A. MOORE (Alexandria, Egypt).

A Reader's Thanks

SIR,—I wish to thank you and the staff for the splendid Gift Encyclopædia which I have received safely. As a regular reader of your weekly publication, PRACTICAL WIRELESS, I think it is the most interesting technical weekly on the subject. I wish your journal the greatest success in the future.—E. W. BLAKE (Southsea).

Fury Four: "Best Set I Have Handled"

SIR,—I am very pleased to state that I have made up the Fury Four, and that it is the best set that I have handled, I am more than pleased with it, and the first time that I put it into operation I received thirty-four stations on the medium-wave, and six on the long-wave. I have very little doubt that I will be able to tune many more in. All the stations were received at good loud-speaker strength.—J. CARR (Liverpool).

The "Fury Four"

SIR,—I wrote to you some few weeks back with regard to a fault in my construction of the above receiver, and after careful tests I found that the screening

(Continued overleaf.)

PRACTICAL LETTERS

(*Continued from previous page.*)

grid leg of the holder for V.2 was touching a shred of copper on the baseboard, the foil being very badly cut round the hole for the valve-holder. However, since remedying this error, I have achieved all the results that you claim, and am delighted with the performance of the set. On various evenings I have enjoyably listened to all the popular broadcasters in Europe, all of which have come over really well (subject to local conditions and fading, of course).

In conclusion, I would like to thank you for the assistance you have given, and congratulate you and your paper for keeping up its high standard.—K. H. CUDMORE (Ilford).

A Fine Book

SIR,—May I thank you for the "Wireless Encyclopædia" which I have just received? and from what I have read of it up to now I must say it is just what is wanted. The articles explain everything in terms which anyone can understand, and the diagrams are clear. It contains just what is required whether one is a beginner or a constructor. Again thanking you for this fine book.—A. HALCROW (Lerwick).

SOLVING THE PORTABLE PROBLEM

(*Continued from page* 215.)

comfortably be carried without any more fatigue or discomfort than with an ordinary attaché-case. Here again it scores, for the average portable set is at least 10in. from back to front, and considerably over 15in. by 12in. in height and width. To handle the output from the Cossor Class B valve a moving-coil speaker is, of course, necessary. Fortunately, an extremely light, small and efficient instrument, complete with transformer, is available in the form of the Rola, specified on page 215.

In the Featherweight Portable Class B Four I have made a genuine attempt—a successful attempt—to solve the portable problem. The quality of reproduction is really glorious, and it will receive quite a number of foreign transmissions.

An inspection of the design, which will be given next week, will bring you to the conclusion that this receiver more nearly approaches the dictionary definition of the word portable—"that may be carried about"—than anything which has been placed before the home constructor before. Look forward, then, to next week's free full-sized Blueprint.

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.

PROPOSED TELEVISION SOCIETY FOR BRISTOL

The progression of radio owed its success to the efforts of amateur enthusiasts, and it is with this in mind that we intend forming a Western England Television and Scientific Society. The formation of the Society, besides benefiting local traders, will be the cause of creating and sustaining more new industries. The object of the proposed Society is to form a body of enthusiastic amateurs interested in current research in connection with television, talking films, etc., and to provide facilities for research work and the publication of reports and affairs of interest to members. Further particulars can be obtained from the Hon. Sec., H. Montague Smith, Eden House, Eden Grove, Filton, Bristol, 7.

I.S.W.C. LEICESTER CHAPTER

At the above chapter's last meeting, which was held at The Foresters' Institute, St. Nicholas St., Leicester, a 5-metre receiving set was demonstrated by C. L. Wright, 2 B.H.A., also an 80-metre receiver fitted with a directional aerial. This receiver will be used by the club's members in their forthcoming direction-finding contest. The most popular item of the evening was the "junk" sale, at which every member disposed of his unwanted parts. Anyone interested in the Leicester Chapter should write to Hon. Sec., W. Glover, "Holmstead," Stokes Drive, Groby Road, Leicester, when full particulars of membership will be forwarded.

UXBRIDGE AND DISTRICT RADIO CLUB

A new branch of the Anglo-American Radio and Television Society will shortly be formed. It will be known as the Uxbridge and District Branch. There are a number of interesting features about this branch. It is not being formed merely as a technical club but it will include a social side which will provide a large part of its activities. A club room will be obtained as soon as possible, and this will be open nightly to members. A short-wave receiver will be installed, and probably a transmitter also. The latter would be employed to communicate with members of the A.-A.R. & T.S. throughout the world. Those interested should write to Leslie W. Orton (organizer), at 11, Hawthorn Drive, Willowbank, Uxbridge.

SLADE RADIO

There was a complete diversion from wireless at the meeting last week, when two lantern lectures were given. The first was entitled "Glorious Devon" and described a holiday tour in that county, a number of excellent slides being shown. The second, "The Sunny South Coast," also covered a holiday tour, and again the slides were of great interest. Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY (HUDDERSFIELD BRANCH)

At a meeting of the committee on Thursday, March 30th, it was decided to give non-members, an opportunity to visit the Empire Short-Wave Station at Daventry, on Sunday, May 21st. Any member of the A.A.R.&T.S. will also be welcome, but the total number will be limited to twenty. Particulars and fares can be obtained from the District Organizer: L. Goucher, 10, West Grove Avenue, Dalton, Huddersfield.

BURTON-UPON-TRENT AMATEUR RADIO SOCIETY

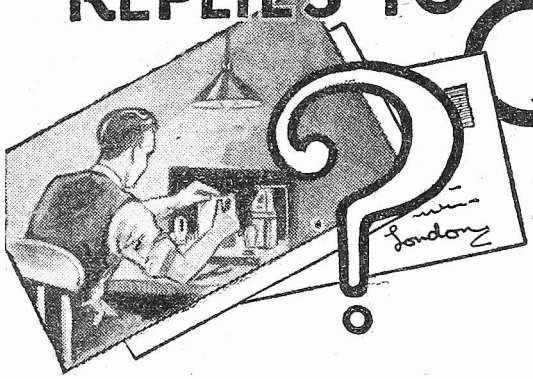
Before a very good attendance at a meeting held on April 4th, Mr. F. Grekley, gave a very interesting lecture on the commercial uses of photo-electric cells. He demonstrated their use by working models, in one instance he showed how the headlights of a car would open the doors of its garage and switch on the light. Another very interesting experiment was the starting and speed regulating of an electric motor with a variable condenser by means of a photo cell used in conjunction with a gas-filled relay. The Society would welcome new members, and applications should be sent to the Hon. Sec., "Addiscombe," Branston Road, Burton-on-Trent.

THE CROYDON RADIO SOCIETY

The Croydon Radio Society held its final meeting of the session on a recent Thursday, when it met at the house of the President, H. R. Rivers-Moore, B.Sc. He had a great deal of interesting apparatus to show members. There was, for instance, a novel two-valve set having the first valve as a variable mu H.F. amplifier, and the second, an A.C. Pentode, acting as detector, amplifier and automatic volume control for the first valve. Another interesting "exhibit" was Mr. Rivers-Moore's famous receiver, now containing automatic volume control. He explained how he had effected the conversion, and it was seen that the A.V.C. valve, an A.C.H.L., was in series with a potentiometer connected to the H.F. valve's grid. When a stray signal came in the resistance of the A.V.C. valve went down, current increased and so more bias was applied to the H.F. valve. He had the secretary's assurance that the average attendance figure for the past session had not stood so high for nine years, so great things are expected of next session commencing September. Hon. Sec., E. L. Cumbers, Maycourt, Campden Road, Croydon.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff



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

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

SPECIAL NOTE

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

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

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

INTERFERENCE

"I have just finished building my first set, the Fury Four, and must thank you for putting such a good set my way. The reproduction and everything is amazing, and there is only one point which perplexes me. Every night, almost punctually at seven o'clock, a horrible 'burring' starts in the loud-speaker and it keeps on till about ten o'clock. It is not loud enough to drown the signal, but is annoying. I do not see how it can start so regularly, especially as I do not always switch the set on at the same time. Can you tell me what it is?"—(J. R., Luton.)

The noise is not coming from the Fury Four, but from some outside source, and in view of the fact that it appears to commence just when daylight is failing and keeps on till ten o'clock points almost certainly to some form of electric sign. Take a walk round your neighbourhood (not more than a quarter of a mile radius) and see if there is a flashing sign or one of the modern neon signs which starts up about that time, and we think you will find that it is this which is causing the trouble. You can do nothing to your set to stop it, and the remedy rests with the owners of the sign.

REJECTOR CIRCUIT

"In reading through a wireless book the other day I came across the term 'rejector circuit.' Could you explain what this is, please? I presume it rejects something, but how it can do this I cannot see for the moment. I am sorry I have not got your Encyclopædia, as it is probably in that."—(P. V., Cardiff.)

Yes, the description is in the Encyclopædia. The rejector circuit is a circuit consisting of a condenser and coil so designed that it offers a high impedance to oscillations of a particular frequency, and a low impedance to oscillations of a different frequency. A very good example of the rejector circuit is a tuned anode circuit.

FAULTY SWITCH

"I find that I cannot get the short-wave stations on my two-valve set. I am using a Lissen dual-range coil and all the parts have been tested, but when I have the switch out I get Daventry and Radio-Paris, yet when I push the switch in nothing happens, and the set is dead. What can I do to find the cause of this?"—(W. G., Portsmouth).

The obvious cause is a faulty switch, although there is a remote possibility of the coil being faulty. To test the latter, short-circuit, with a piece of bare wire, terminals Nos. 2 and 3 on the actual coil base. This should enable you to hear the short-wave stations. If nothing can be heard the coil is disconnected, and it should be returned to the makers. If, however, signals are obtainable by this means, the contacts of your wave-change switch are faulty and this should be exchanged.

CLASS B STAGE

"Could I add a Class B stage to my receiver? It is a rather old pattern German set, and I am afraid I do not know the various parts, as they are not the same as English ones. The valves are English, but the condensers and resistances all look alike, and I cannot understand the marking. How could I use the new L.F. arrangement?"—(Y. B., Torquay).

The Class B stage may be added after any first L.F. stage, and you should therefore try and ascertain which is this stage in your receiver. The detector-valve will, no doubt, have a grid-leak and condenser joined to one terminal, and S.G. valves are obviously identifiable. You must, therefore, first trace out the types of valve, and add the Class B stage to the first L.F. stage, using in that socket a small power valve. If the receiver does not employ more than two L.F. stages, the Class B unit described in our issue dated April 8th could be added to the output terminals of your set, and this would save the trouble of tracing out the various stages. Read the remarks accompanying the article in question.

INDOOR EARTH

"As I am living in a flat I am rather awkwardly situated for aerial and earth. The water system comes from a tank in the roof, and I understand this is bad from the wireless point of view. I have fitted up a good indoor aerial, but would like a better earth lead. Can you suggest any way out of my difficulty. I am much too high up to run a wire down to the ground."—(L. F. S., Westminster).

A capacity earth would probably prove most useful to you. This consists of a large metal body, such as a copper gauze mat, or a number of thin copper wires running parallel, arranged under a mat or under the lino. If your receiver is a radio-gram, having a large cabinet, a very good idea would be to try the effect of a sheet of thin copper foil arranged inside the lid of the cabinet, using this as an aerial, and a similar sheet, arranged underneath the bottom of the cabinet, connecting this to the earth terminal. This may prove a much more selective arrangement than the indoor aerial and earth mat, and yet will not give an appreciable reduction in signal strength.

DATA SHEET No. 32

Cut this out each week and paste it in a Notebook.

COLOUR CODE FOR FUSES.

Colour	*Rating*
Black	60 mA.
Grey	100 ,,
Red	150 ,,
Brown	250 ,,
Yellow	500 ,,
Green	750 ,,
Blue	1 amp.
Lt. Blue	1.5 amps.
Purple	2.0 ,,
White	3.0 ,,

Q.M.B. SWITCHES

"Whilst looking through the advertisements in your pages I have once or twice seen reference to Q.M.B. Switches. I have been unable to see these described in any of your articles. What do the letters stand for and what is the application of this particular type of switch?"—(G. B. V., Littlehampton).

The letters stand for Quick Make and Break, which means that the mechanism is so arranged that when the switch knob is operated the contact is made quickly or broken quickly. The arrangement usually takes the form of the ordinary electric light wall-switch, which is a Q.M.B. switch. The necessity for quick contact is to prevent arcing. When a high current is passing through a switch contact, if the contact point is brought slowly away a spark will be seen to pass from one point to the other, and this "pits" the contact point and also gives a slight corroding. The result is that the contact point becomes poor and dirty, resulting in very erratic working. The switch should always be used, therefore, where fairly large currents are dealt with.

CHOOSING A METER

"After studying your various issues I have decided to set up a small workshop, and one of the principal things I shall need will be a meter. I cannot afford much, and would therefore like to have your ruling as to the best type of general purpose meter to buy. I shall want to try and carry out all sorts of tests, as described in your articles, and would therefore like the meter chosen with this point in mind."—(A. N., Llandudno).

The most useful meter will obviously be a small reading milliammeter. It will then be possible, by means of shunts and series resistances, to arrange for this to give you practically any reading in volts, ohms, and amps. You could, of course, buy one of the all-purpose meters, but as you say you cannot afford a lot, the most accurate results will be obtained by getting a really good low-reading milliammeter, and buying the necessary shunts, etc., as funds permit. You could, in this way, build up a highly efficient instrument, and if you obtain guaranteed resistances the percentage of error will be very small indeed. A similar arrangement was recently described in our pages under the title, "The Practical Wireless Multi-Meter."

FAULTY EARTH

"My receiver has developed most annoying crackling and sizzling noises, and I have hunted all round for the cause. The only thing that will stop it is to take off the earth lead, but as this is not supposed to be good for the set I do not know what to do. Can you help me, please?"—(G. B., Edgware).

The fault obviously rests with your earth connection, which you will no doubt find has rotted away. Trace through the lead and the actual connection, and undoubtedly you will find that the lead is broken somewhere, or the actual connection to the buried plate or water-pipe (whichever type you have used), is either partially or completely broken.

STROBOSCOPE

"Can you give me the formula for working out the number of lines and spaces for a stroboscope. I want it for ordinary gramophone records, and my mains supply is 200 volts. I only want it for 78 r.p.m., and I think the formula is quite simple to work out, but I cannot find it anywhere."—(R. F., Brighton).

The voltage of your mains will not affect the design of the stroboscope, and the only figures you require are the number of revolutions per minute and the frequency of the mains supply. The latter is multiplied by 120, and the answer divided by the speed required. The formula, therefore, is

$$\frac{120 \times F}{R}$$

F being the frequency in cycles per second, and R being the speed required in revolutions per minute.

FREE ADVICE BUREAU COUPON

This coupon is available until May 6th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 29/4/33.

CATALOGUES RECEIVED

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

ALL ABOUT CLASS "B"

EVERYTHING in connection with class "B" amplification and its associated equipment is fully dealt with in a twelve-page folder we have received from Radio Instruments Ltd. Diagrams, tables and technical data are given for the application of the class "B" system of amplification to battery sets, and to enable constructors to easily select the right valves and appropriate Drivermu transformers and output chokes. Prices of these components are also included in the folder. The address is Purley Way, Croydon, Surrey.

BAKER'S LOUD-SPEAKERS

SEVERAL new models of Baker's moving coil speakers are given in the latest list issued by Baker's Selhurst Radio. There is a super-power model for either battery or mains operation; a more powerful speaker for A.C. mains, and two permanent magnet-moving coil instruments. One of these is a new model having a cobalt steel magnet of the cross type and a universal output transformer. It is priced at £3 15s. The list also includes particulars of A.C. rectifier units, a variable tone control and needle-scratch filter, and various high-resistance and other coils. The address is 75 and 77, Sussex Road, Croydon, Surrey.

MULLARD LOOSE LEAF CATALOGUE

A NEW catalogue leaflet, No. VR127, is just to hand giving particulars of the new Mullard 2-volt screened-grid valve, PM 12A. A copy of this leaflet can be obtained from the Mullard Wireless Service Company, Mullard House, Charing Cross Road, London, W.C.2.

BAKELITE ACCESSORIES

PARTICULARS of a useful range of small components in moulded Bakelite are given in a folder recently issued by Ward and Goldstone, Ltd. Plug attachments, lampholders, bell pushes, connectors and switch plates are amongst the fittings illustrated in the folder, a copy of which can be had on application to the firm at Pendleton, Manchester.

DUBILIER COMPONENTS

TWO booklets of special interest to home constructors were recently issued by the Dubilier Condenser Company. One deals with condensers and resistances and gives particulars of mica condensers, paper condensers, block condensers for use with mains receivers and battery eliminators, and high voltage electrolytic condensers. Resistance capacity coupling units and anti-interference filters are amongst the other components listed. The other booklet deals with Dubilier metallized resistances, designed especially for use in mains-operated receivers for voltage dropping and decoupling purposes. Useful tables giving maximum currents and voltages, and graphs showing the voltage and current ratings at a glance, are also included in the booklet. Interested readers should write for copies of these booklets to Dubilier Condenser Co., Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.

PIX—PRICE CORRECTION.

Owing to a printer's error, we wrongly gave the price of Pix on page 207 of our April 22nd issue as 2/9. The correct price with clip is 2/6. Will readers please note this.

ODDS and ENDS

Microphones for Medical Men

IN Germany, to prevent doctors being brought out of their beds unnecessarily at night, some surgeries have been specially equipped with microphones and loud-speakers. The two instruments, with the necessary amplifiers, are installed in a weatherproof casing at the front door of the house, with duplex apparatus in the practitioner's bedroom. In this manner the doctor may speak to the outside caller in comfort and ascertain the urgency of his business before admitting him to the surgery.

Radio Luxembourg

THE programmes broadcast from this new high-power station are still in the "skeleton" stage, but as a rule they will be found to consist of the following items: B.S.T., 7.0 p.m., light music (records); 7.45, news, symphony concert (records); 8.30, talk in foreign language; 8.40, records; 9.0, news bulletin (French); 9.15, light music; 9.45, news bulletin (German); 10.0, dance music (records). At intervals between items the studio transmits stock exchange quotations and sporting results.

New American Broadcasting Chain

THE Amalgamated Broadcasting System is the name of a new network which has been created in the United States to compete with the C.B.S. and N.B.C. It will mainly consist of the link-up of nine important stations in Michigan, but when completed the new organisation may number one hundred transmitters. Most of the programmes will emanate from the studios of WOL, Washington (228.9 m.), 1,310 kc/s, which will act as the key station of the network.

Replies to Broadcast Queries

L. A. MERCHANT, Midway: Apparently wavelength is wrong; too vague to trace. LENIN (Southport): G5KO, not advertised in list; write to Radio Society of Great Britain, 53, Victoria Street, S.W.1; G6OW is the call sign of James Tennant, 65, Hillhead St., Glasgow. D. ROBERTSON (Midlothian): G6YL, Miss Barbara Dunn, Aston House, Felton, Morpeth (Northumberland); cannot trace XZN2B. E. S. W. (Ilford): G5AR, E. D. Ostermeyer, 59, Gordon Rd., Woodford, London, E.13; G2XC, G2AZ, cannot trace; write to Radio Society of Great Britain, 53, Victoria Street, S.W.1; G2LZ, F. A. Mayer, "Stilemans" Wickford (Essex); G5TZ, W. G. Sherratt, 11, Bath Rd., Cowes (Isle of Wight); G6FN, S. A. French, "Valetta," Alnwickhill Rd., Liberton, Midlothian; G6FY, R. A. Fereday, 37, Wallwood Rd., Leytonstone, E.11. G6NV, J. J. A. Allnutt, M.P.S., 193, Brixton Rd., London, S.W.9.; G5NC, H. Osborne, 77, Barrett Rd., Walthamstow, London, E.17; G5GZ, G. L. Grisdale, 39, Ranelagh Gardens, Ilford, Essex; G5JZ, C. W. K. Sands, "Springfield," Heathfield (Sussex); G5SK, W. H. Maycock, 33, Camden St., Stoke, Coventry: ON4NC, C. J. Nolf, Chateau de Rameignies, Thumaide, Hainaut (Belgium); PNOBL, PNOSR, PNOKA, PNORM, cannot trace in published lists; are you sure these call signs did not begin with initial letters PA0 (Holland)?; F8JS, Maurice Philippe, Schaar, Solignac (Haute Vienne), France; F8KJ, R. Sonlie, 27, rue Toussaint Louverture, Bordeaux (France); F8MK, Georges Beck, c/o C. F. M., rue de la Republique, Rabat (Morocco). F8RM, regret, cannot trace.

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