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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.

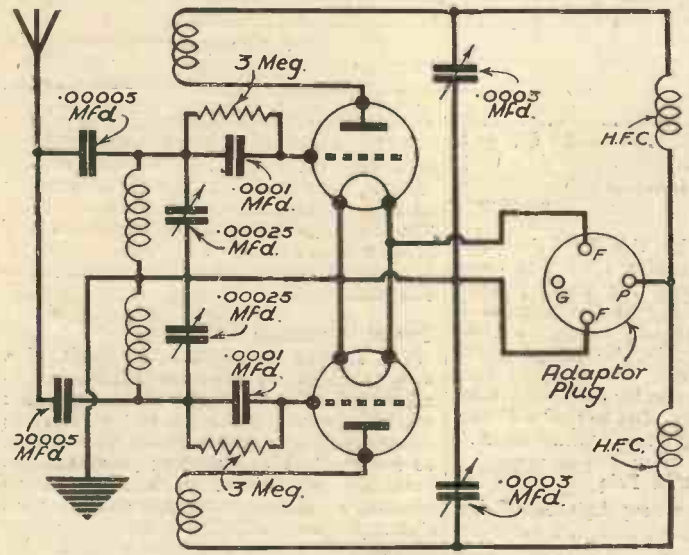


Fig. 2.—The theoretical circuit of the two-detector receiver.

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

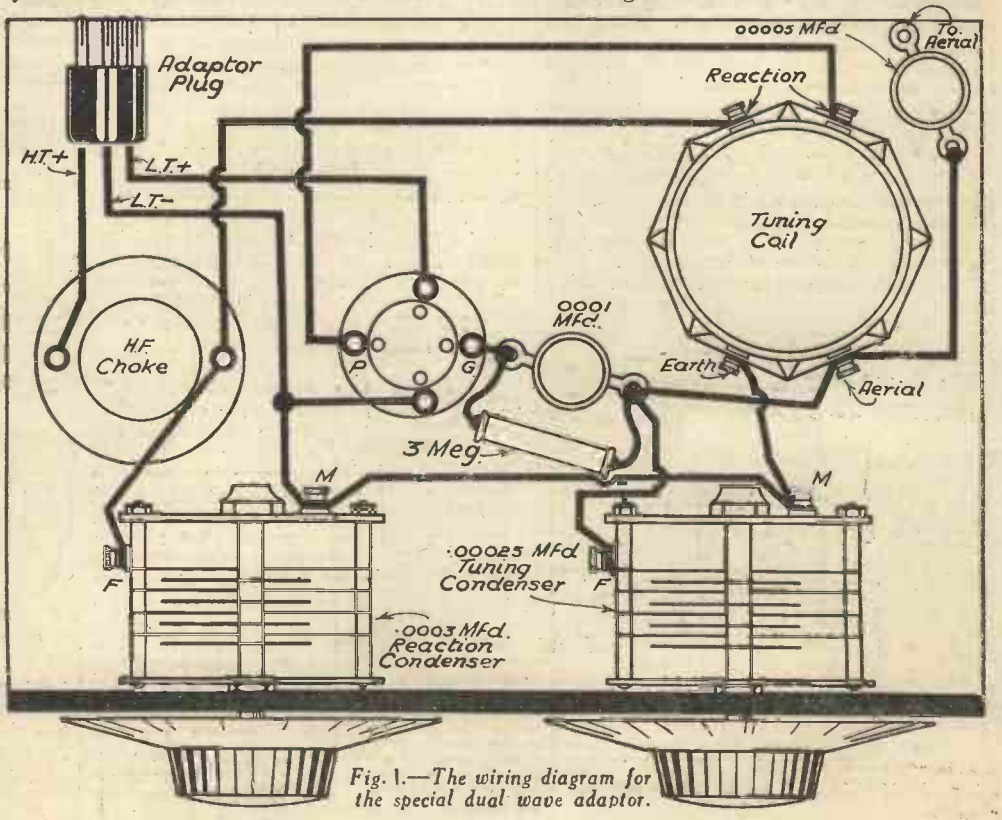


Fig. 1.—The wiring diagram for the special dual wave adaptor.

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.

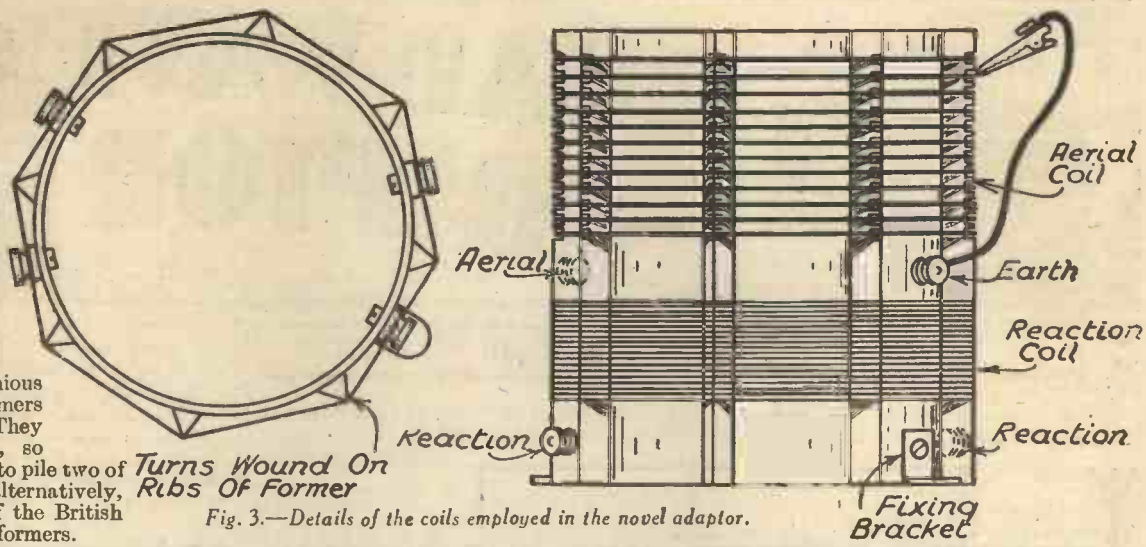


Fig. 3.—Details of the coils employed in the novel adaptor.

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).

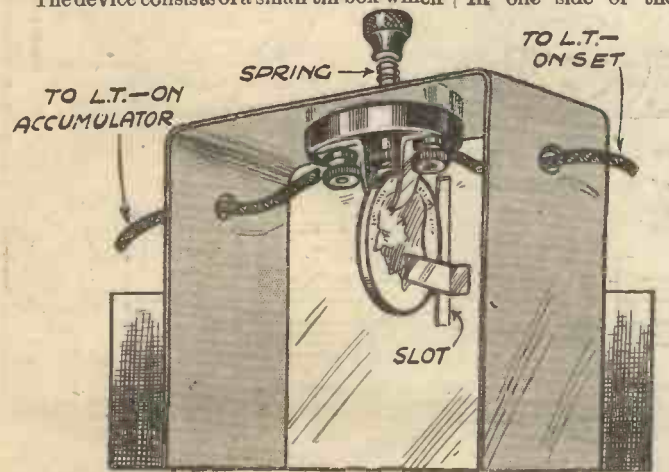


Fig. 1.—A simple coin-operated radio switch showing how a penny completes the circuit.

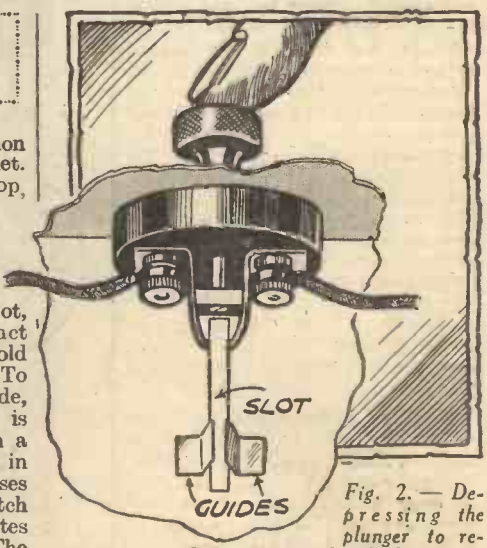


Fig. 2.—Depressing the plunger to release coin and break the circuit.

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.

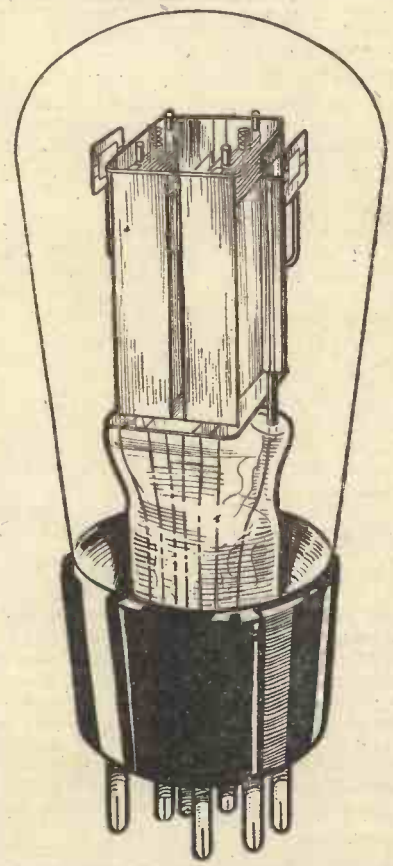


Fig. 3.—The new Cossor 240 B valve with 7-pin base for Class B amplification.

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

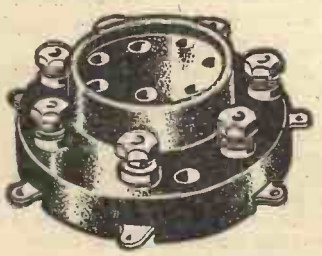
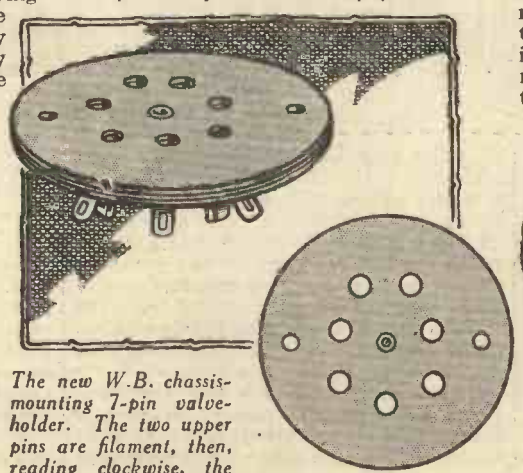


Fig. 4.—The W.B. baseboard mounting 7-pin valve-holder.



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.

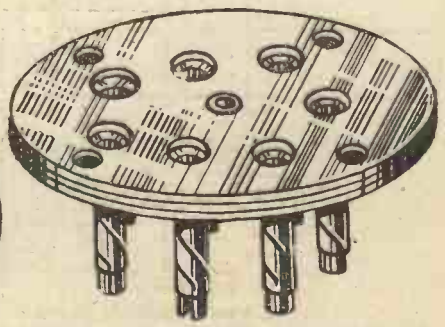
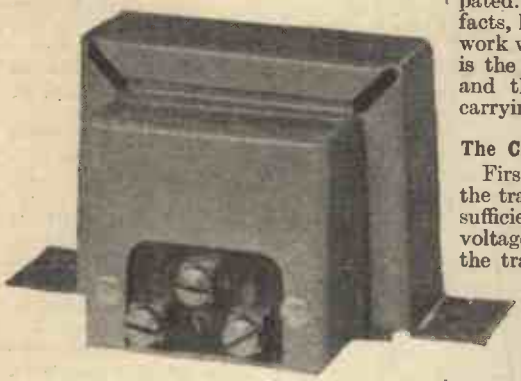


Fig. 5.—The Clix chassis-mounting 7-pin valve-holder.

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.

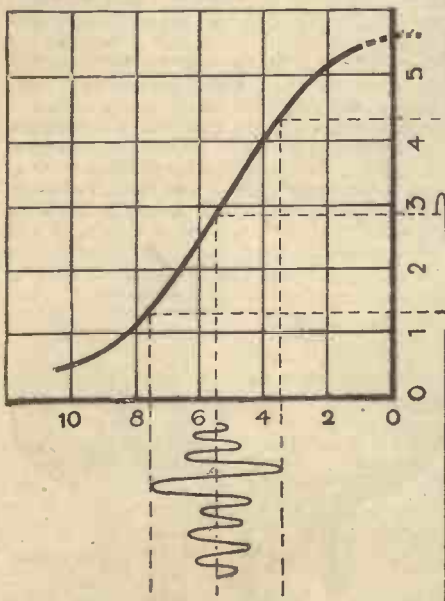


Fig. 1—The curve of a valve biased to give even amplification. The lower line gives grid volts, and the right-hand line gives anode current.

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.

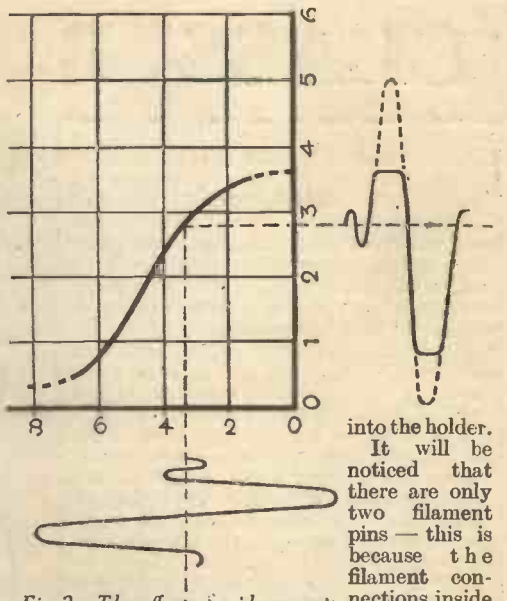
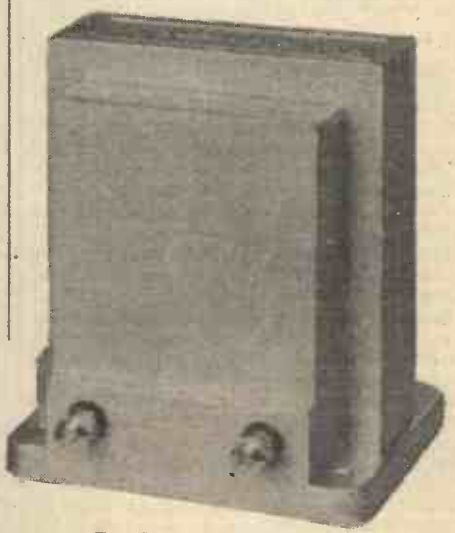


Fig. 2—The effect of grid current shown in diagrammatic form.

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.

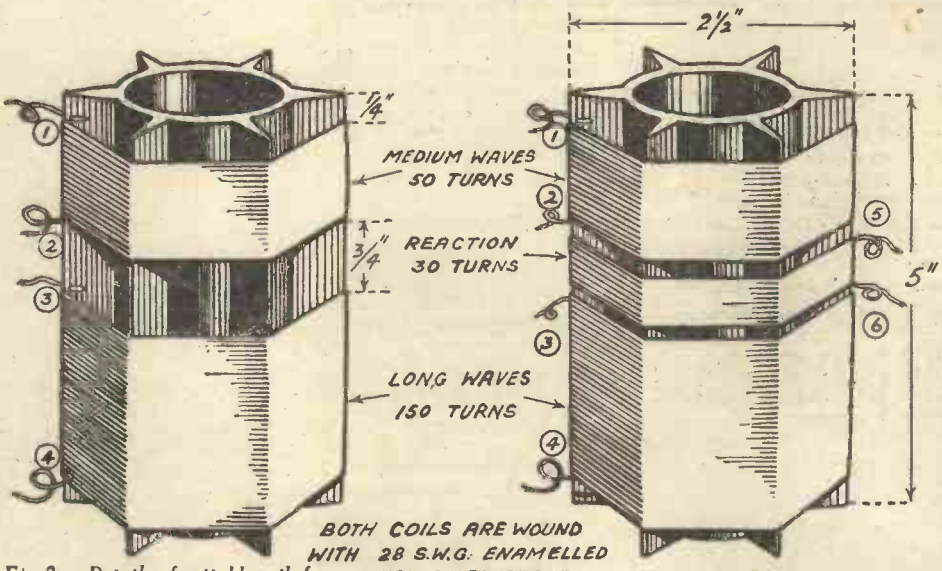


Fig. 3.—Details of suitable coils for a home-made band-pass tuner.

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.

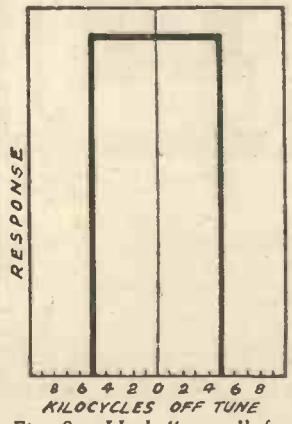


Fig. 2.—Ideal "curve" for a band-pass tuner.

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.

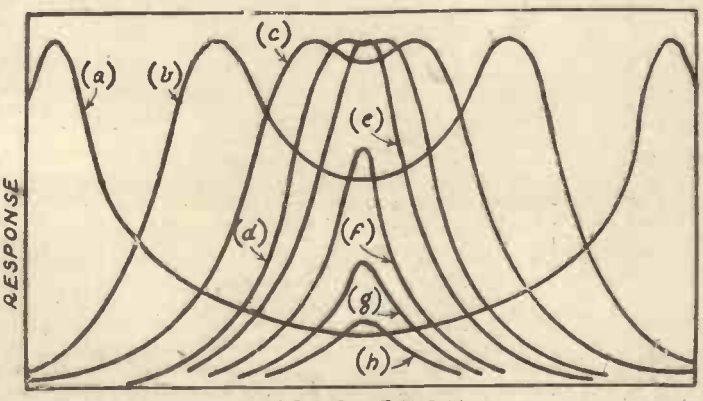


Fig. 1.—Resonance curves of a coupled circuit with various degrees of coupling.

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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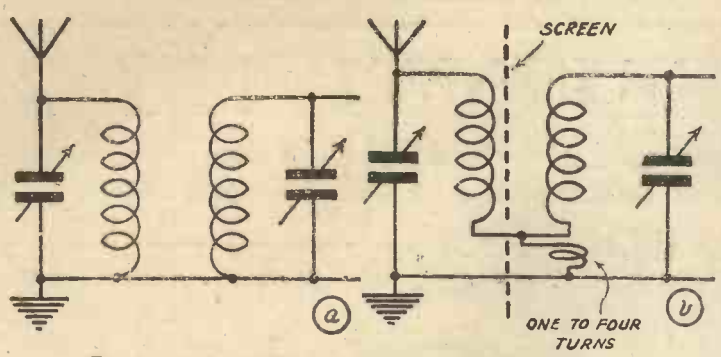

Fig. 4.—Two methods of inductively coupling two circuits.

(*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

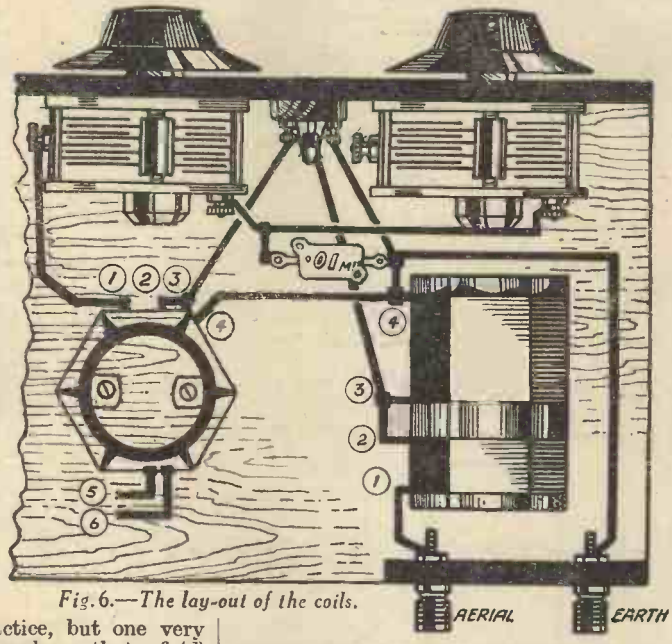

Fig. 6.—The lay-out of the coils.

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.

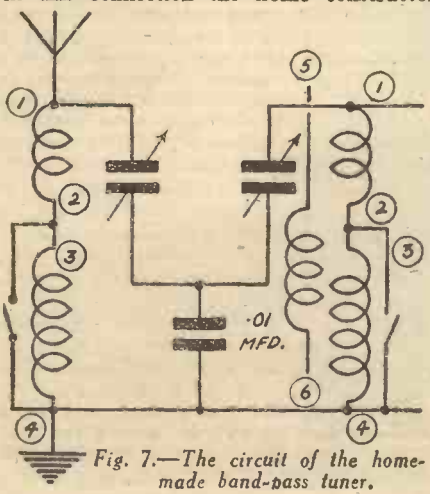

Fig. 7.—The circuit of the home-made band-pass tuner.

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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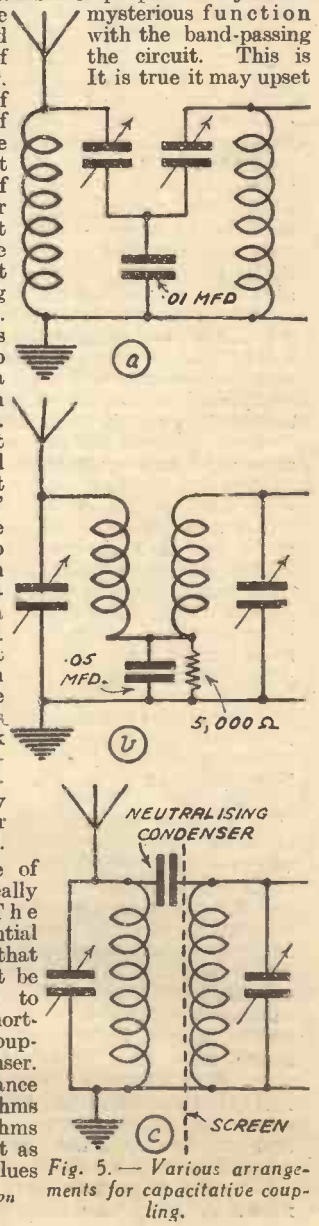

Fig. 5.—Various arrangements for capacitative coupling.

CIRCUIT DIAGRAMS SIMPLIFIED *for the* BEGINNER

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

By FRANK PRESTON, F.R.A.

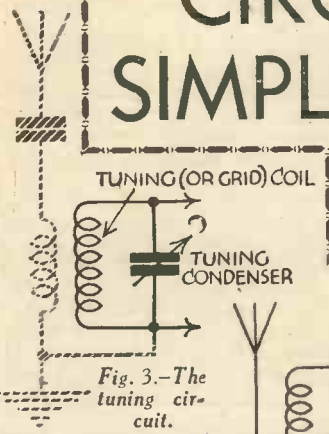

Fig. 3.—The tuning circuit.

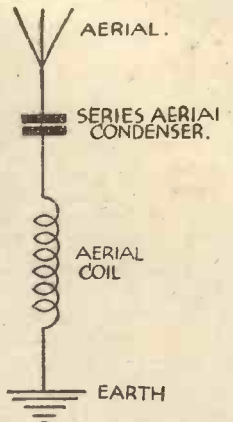

Fig. 2.—The aerial-earth circuit.

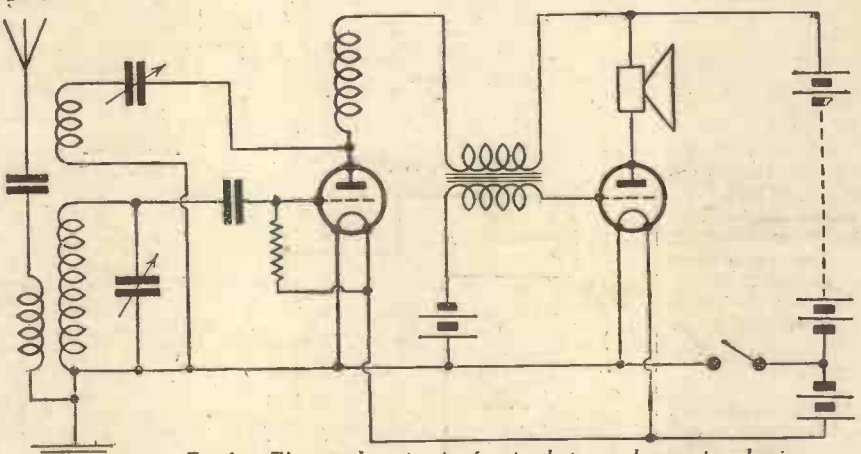

Fig. 1.—The complete circuit of a simple two-valve receiver having detector and low-frequency valves.

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.

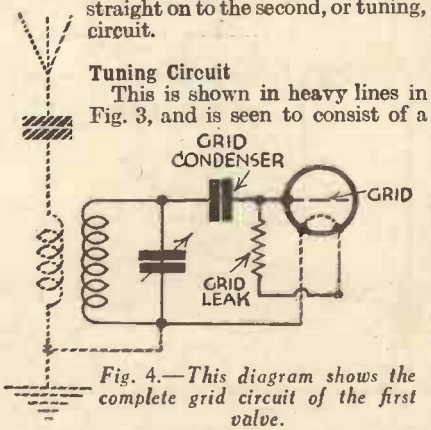

Fig. 4.—This diagram shows the complete grid circuit of the first valve.

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.

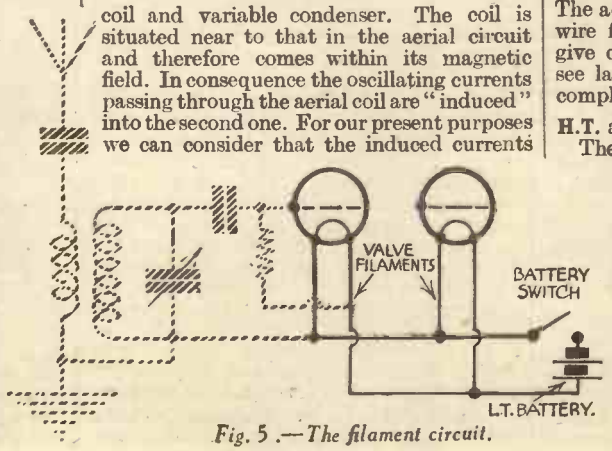

Fig. 5.—The filament circuit.

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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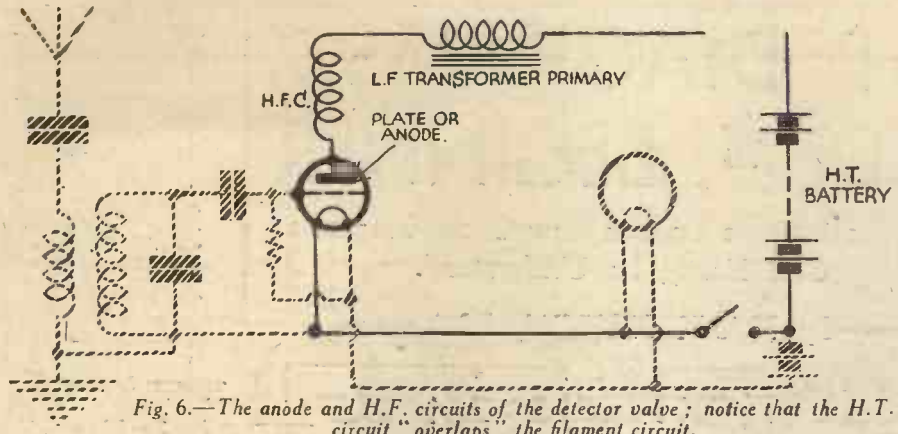


Fig. 6.—The anode and H.F. circuits of the detector valve; notice that the H.T. circuit "overlaps" the filament circuit.

(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.

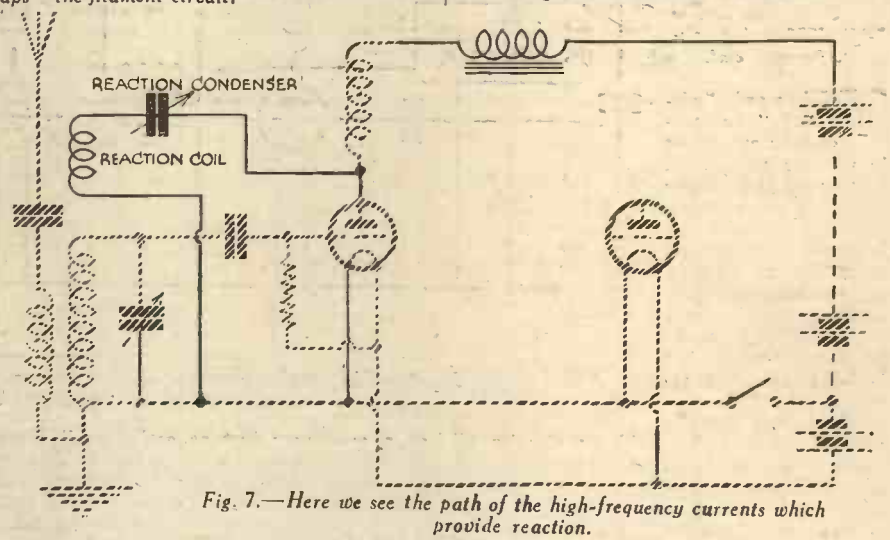


Fig. 7.—Here we see the path of the high-frequency currents which provide reaction.

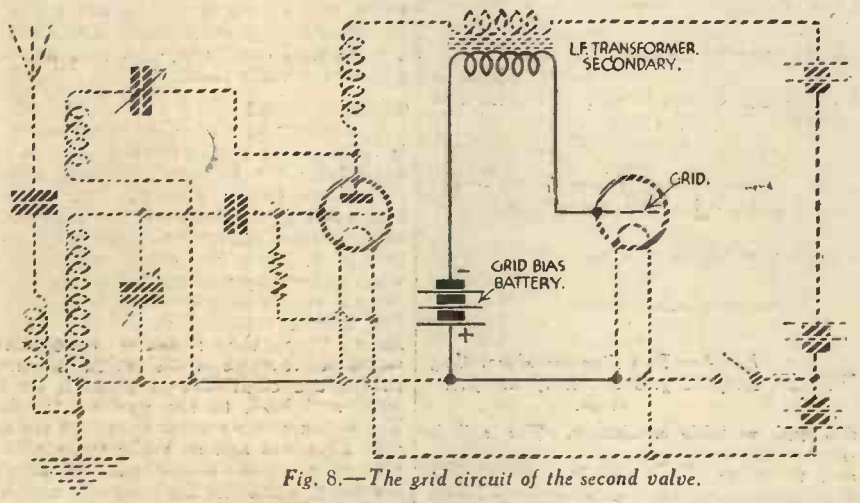


Fig. 8.—The grid circuit of the second valve.

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.

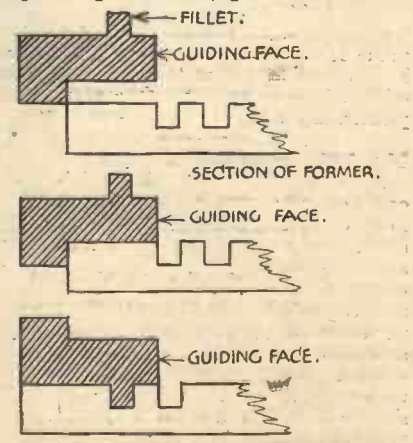
Output Circuit

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

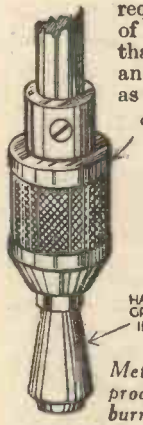
1 2-gang .0005 mfd. Variable Condenser with escutcheon. (Polar.)
2 .0003 mfd. Precision Condensers. (Lissen.)
1 .01 mfd. Fixed Condenser. (T.C.C. Type S.)
1 1 mfd. Condenser. (T.C.C. Type 50.)
1 2 mfd. Condenser. (T.C.C. Type 50.)
1 .02 mfd. Condenser. (T.C.C. Type M.)
1 1,000 ohms 1 watt resistance. (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.

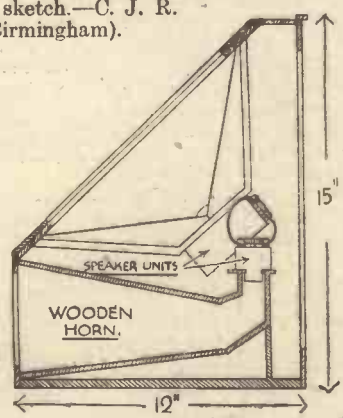


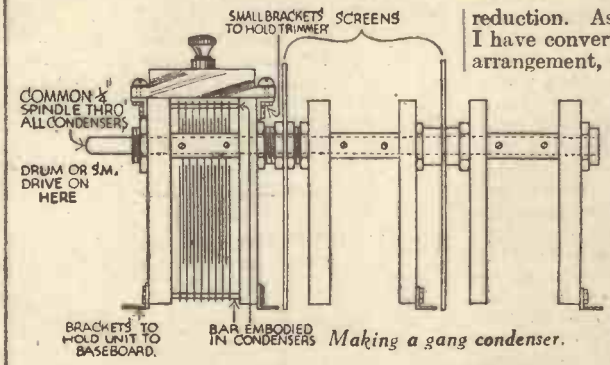
Fig. 2.—Sectional view of speaker.

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

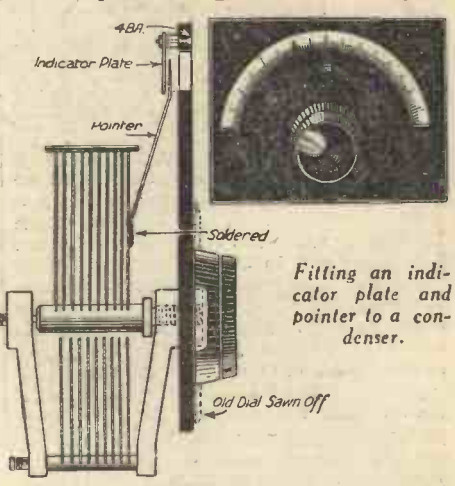
HERE is a cheap but efficient way to make your own gang condensers. There is a condenser on the market in which the rotor spindle is removable without upsetting the rotor. This spindle is held by two grub screws in the hollow centre piece to which the moving vanes are fixed. Thus, by removing the spindle 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.

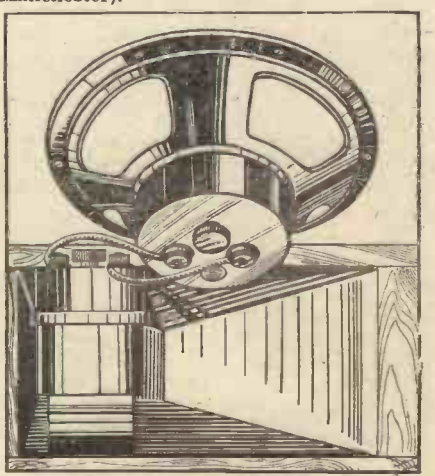
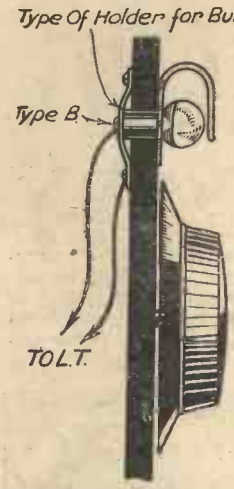
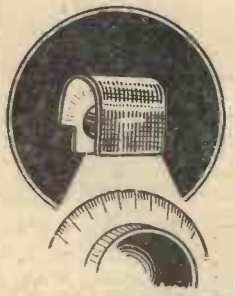


Fig. 3.—Rear view with back of casing removed.





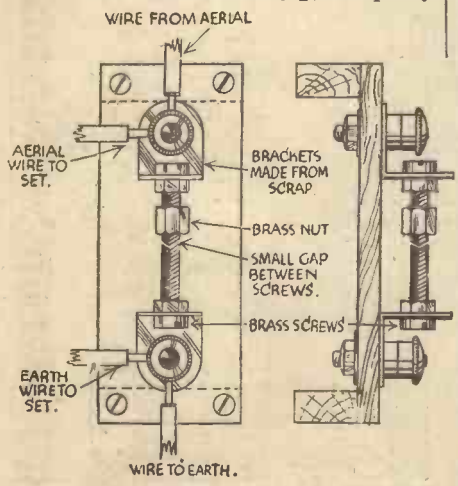
A novel method of fitting a dial light.

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.

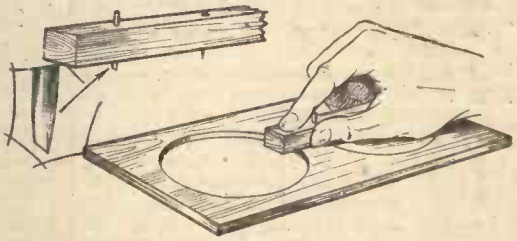
Cutting Device for Circular Holes

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.

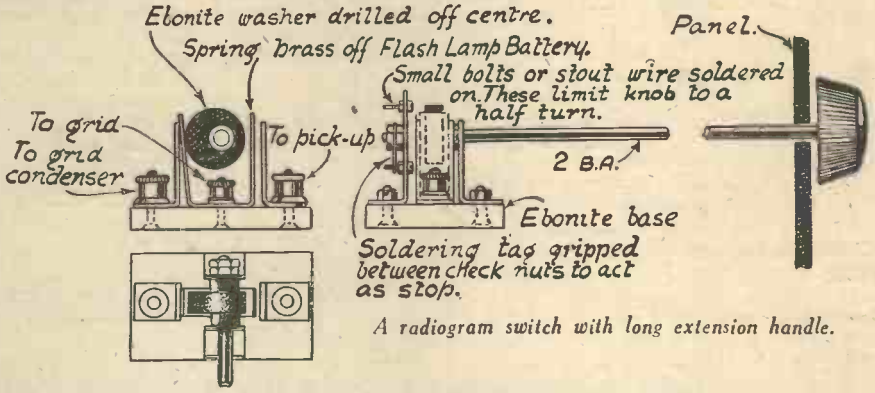
Fig. 2 shows another form in which the compression spring is replaced by two of the expansion type.—J. P. SAVAGE (Liverpool).



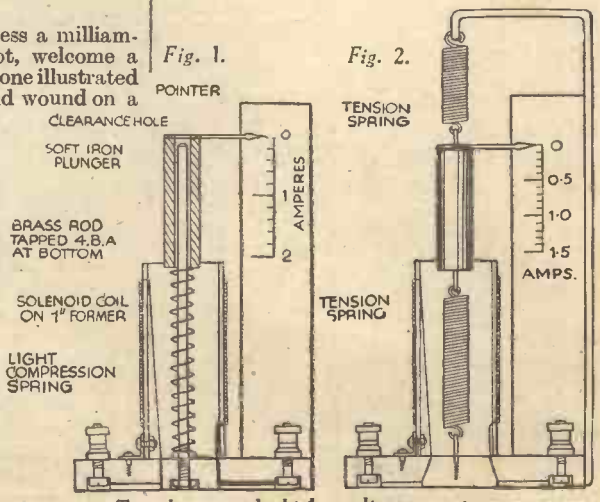
Cutting large circular holes in a baffle board.

A Radiogram Switch

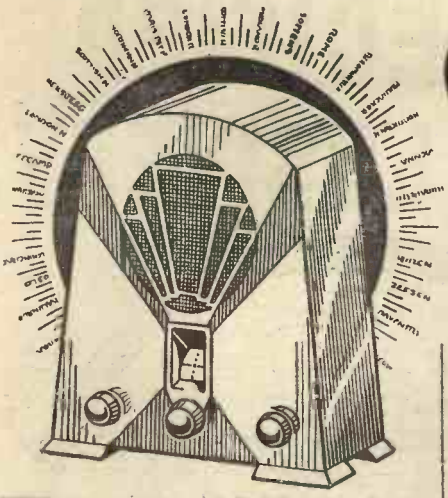
TO obviate the use of long grid leads, which are necessary with ordinary radiogram switches, I made the switch shown in the accompanying sketches. With this switch short leads can be used, as it can be screwed down to the baseboard close to the grid terminal of the valve-holder. There is no hand-capacity 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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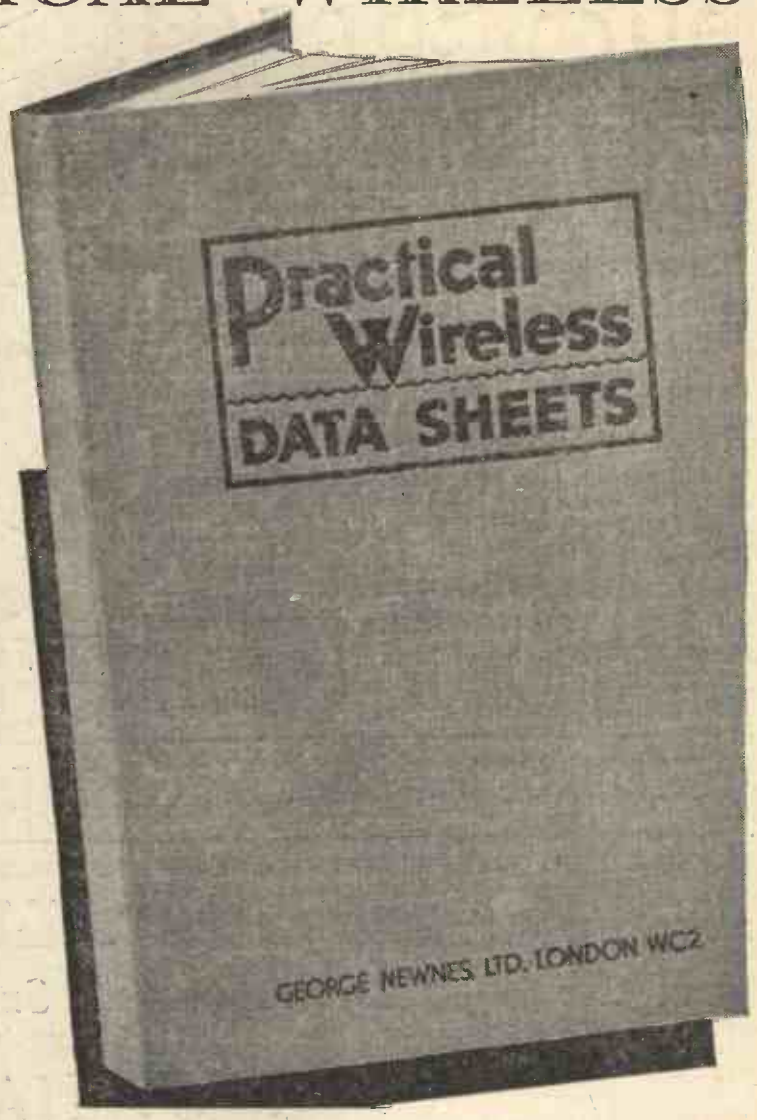

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The loose-leaf binders for preserving in permanently consultable form the Data Sheets which are given in PRACTICAL WIRELESS are expressly made for the purpose.

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.

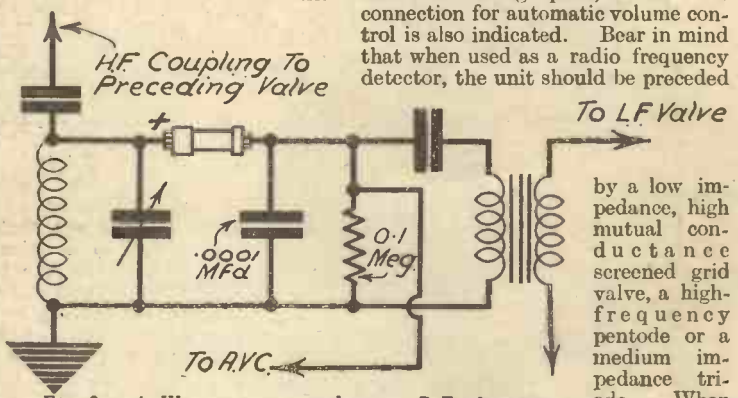


Fig. 2.—A Westector arranged as an R.F. detector.

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.)

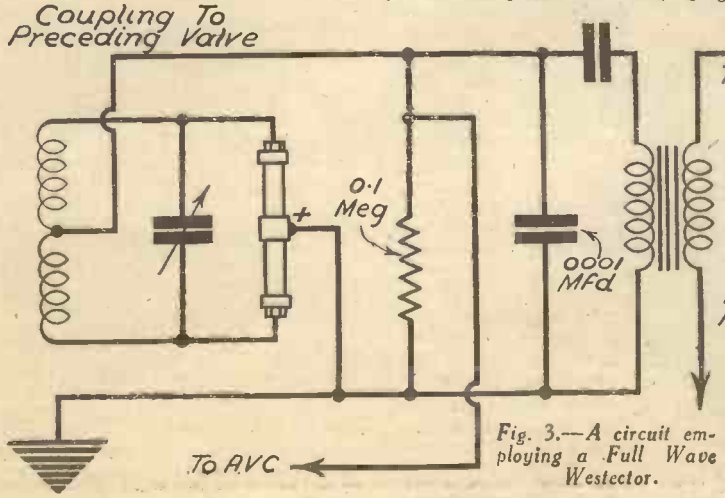


Fig. 3.—A circuit employing a Full Wave Westector.

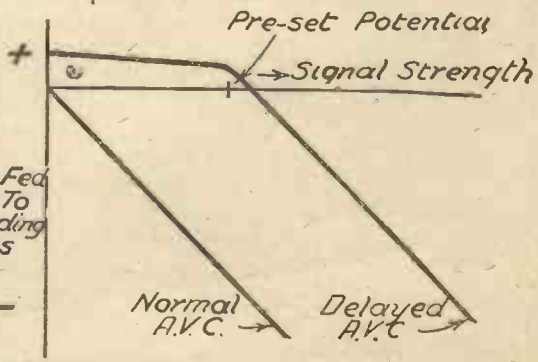
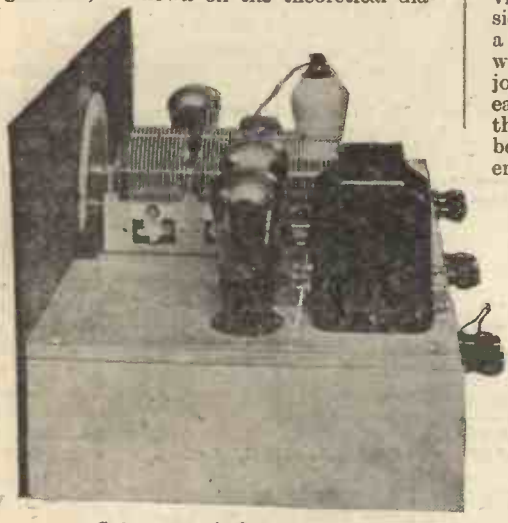


Fig. 5.—How the delayed automatic volume control differs from normal A.V.C.

The Fer Hi-M

CONSTRUCTIONAL DETAILS OF THE NEW SUPER-SEL

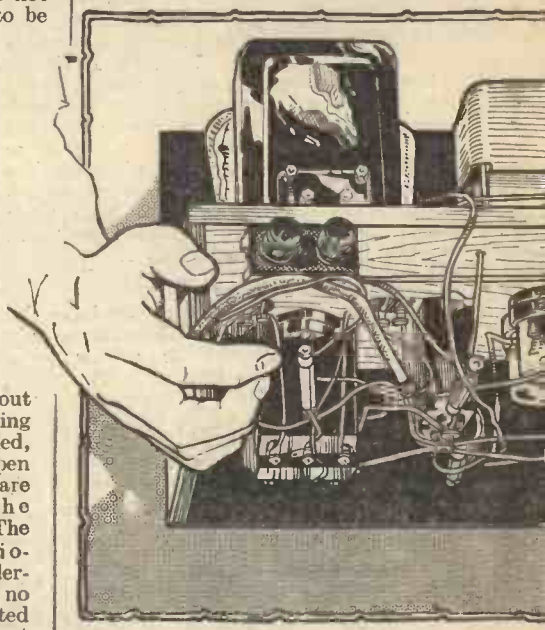
IN last week's issue of PRACTICAL WIRELESS the preliminary notes of this receiver were given, and the complete instructions for wiring up and operating were given in brief form for those who wished to go ahead with the complete receiver. In order, however, that those who cannot wire a receiver from a 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.

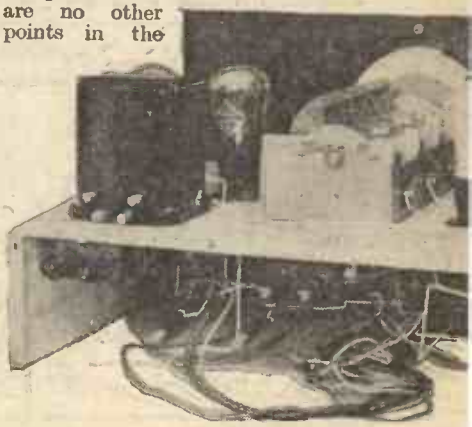
Soldered Joints

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.

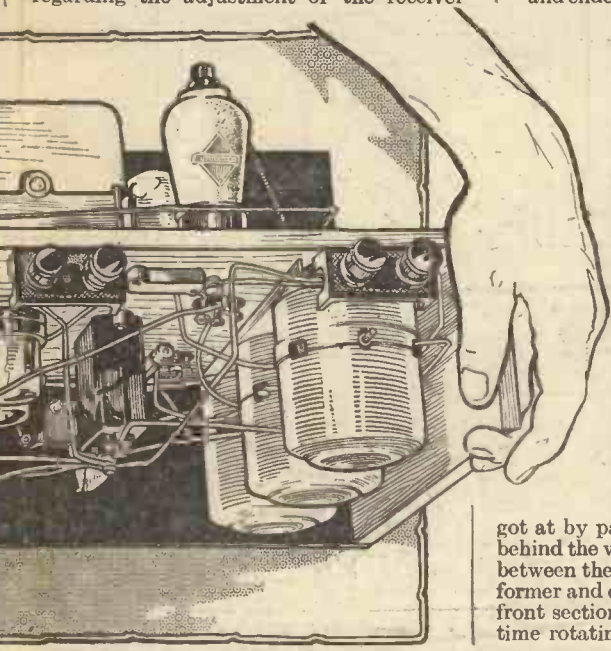


Rear view of the new "Practical Wireless" recei Ferrocart coils.

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.



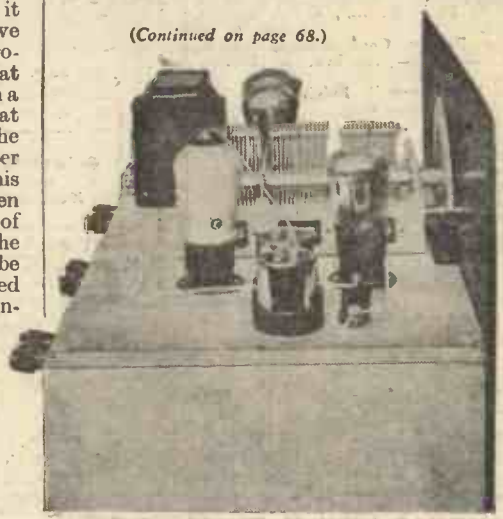
COMPONENTS DIAGRAMS e 68.

ver, employing

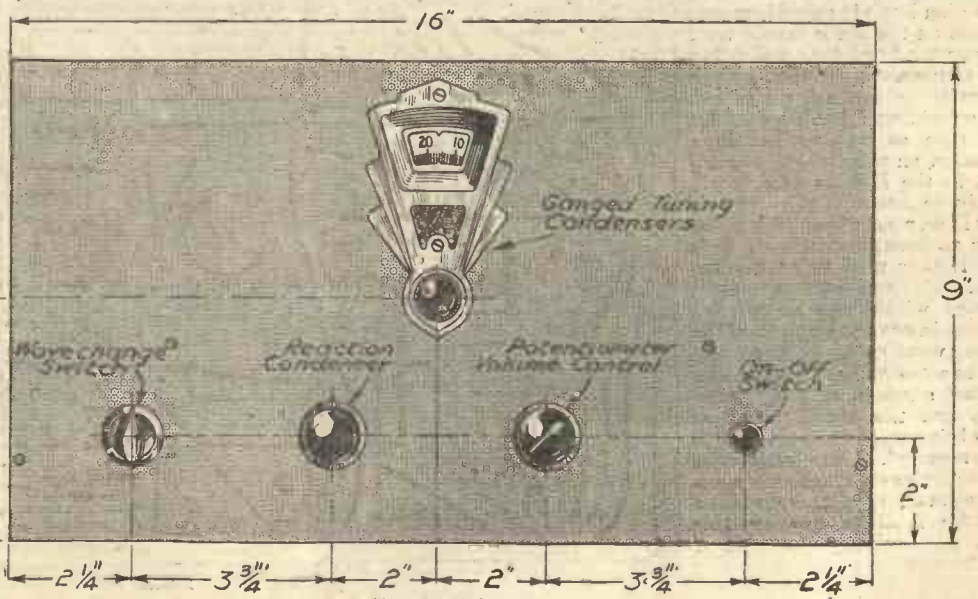
Trimming

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.

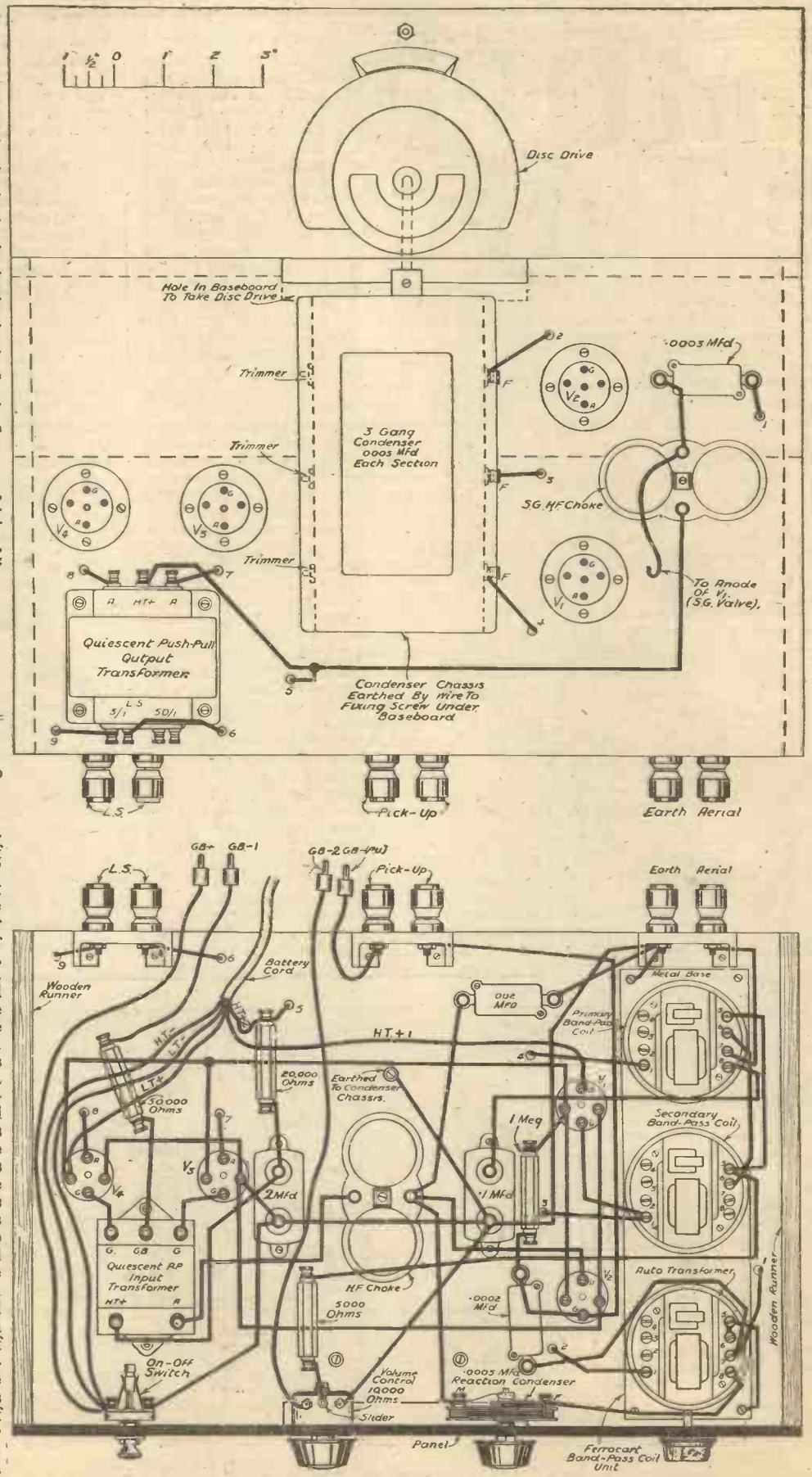
1 Set Ferrocart Coils. Colvern.
1 Three-Gang Condenser Assembly. Brit. Radiophone.
4 4-Pin Valveholders. Clix.
2 L.M.S. screened H.F. Chokes. Graham Farish.
1 Q.P.-P. Input Transformer, Type D.P. 36. Varley.
1 Q.P.-P. Transchoke, Type D.P.38. Varley.
1 .0002 fixed condenser, Type 670. Dubilier.
1 .1 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.

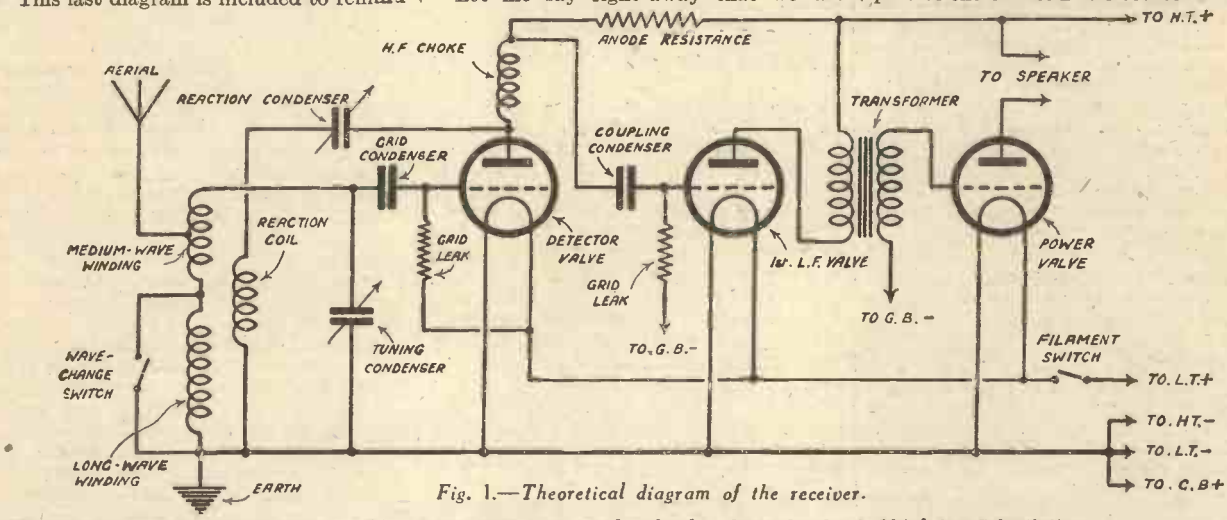


Fig. 1.—Theoretical diagram of the receiver.

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

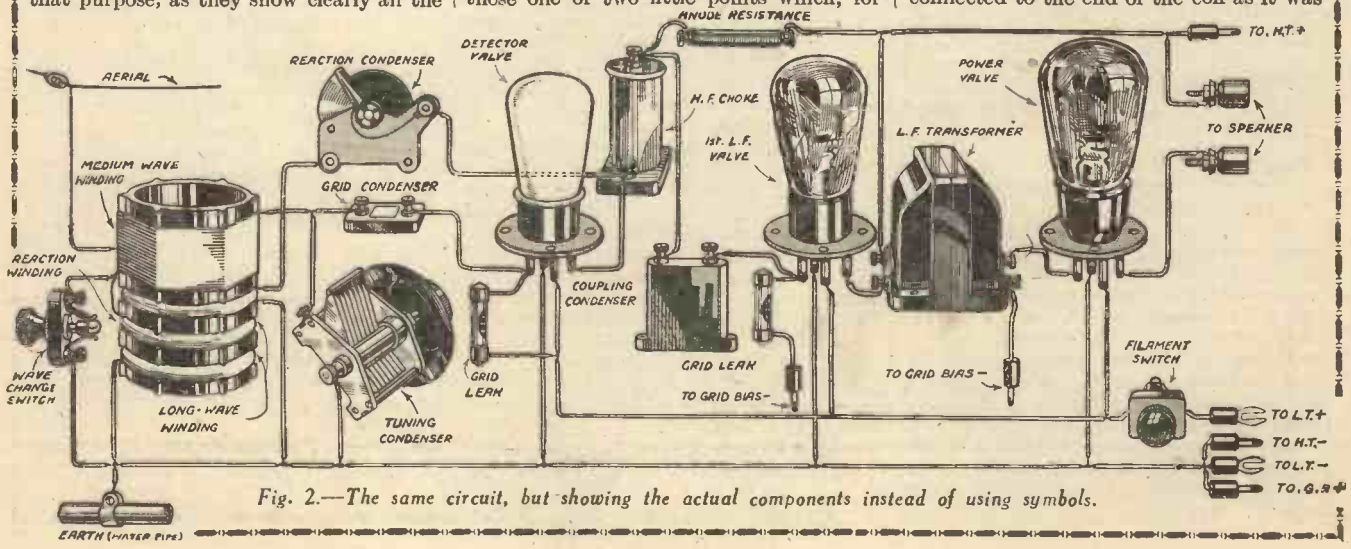


Fig. 2.—The same circuit, but showing the actual components instead of using symbols.

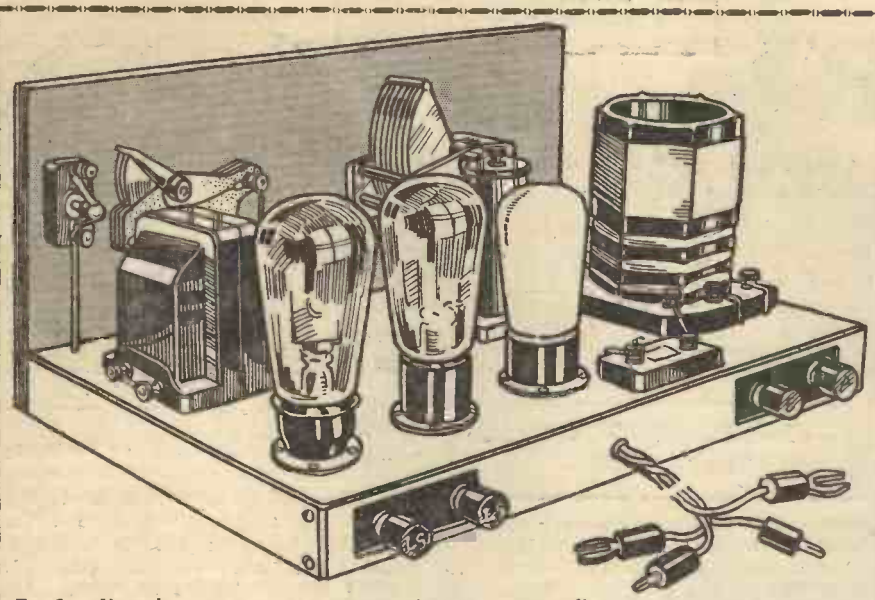


Fig. 3.—How the various parts are mounted on the "chassis" to form the complete receiver.

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

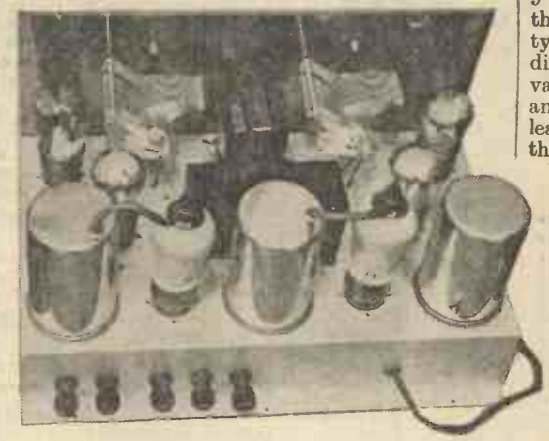
OUR FIRST SUPER-HET

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.



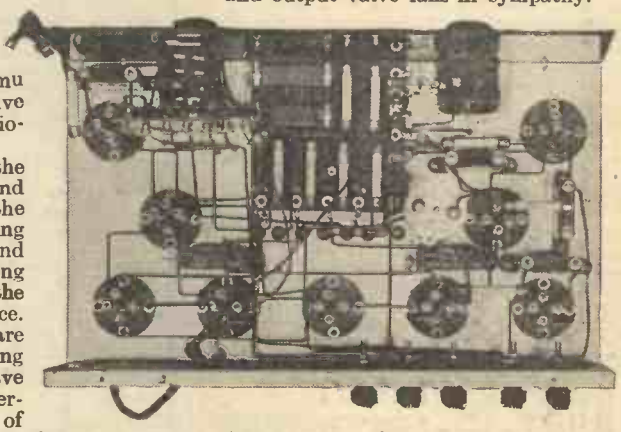
Another view of the Supersonic Six.

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.

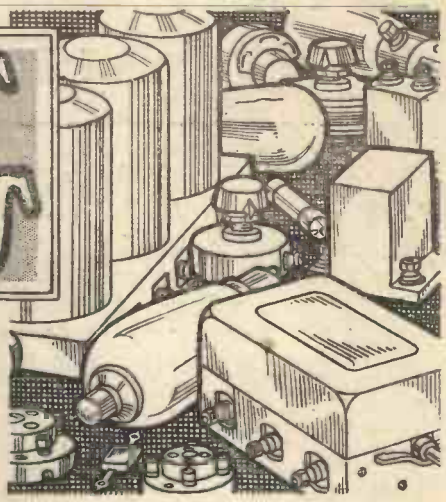


Sub-baseboard view of the Supersonic Six. Note the clean lay-out.

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

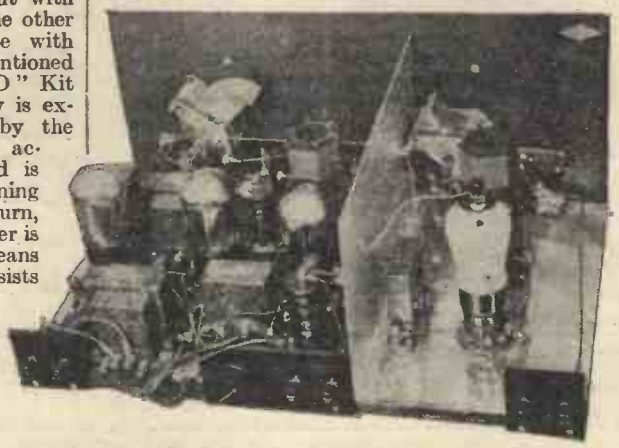


THE Peto-Scott Company have just submitted to us one of their new kits bearing the above title. As this explains, it is a four-valve set employing quiescent push-pull in the output stage, and the claims are: treble output, mains quality and volume with batteries. The kit is most attractively marketed 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.



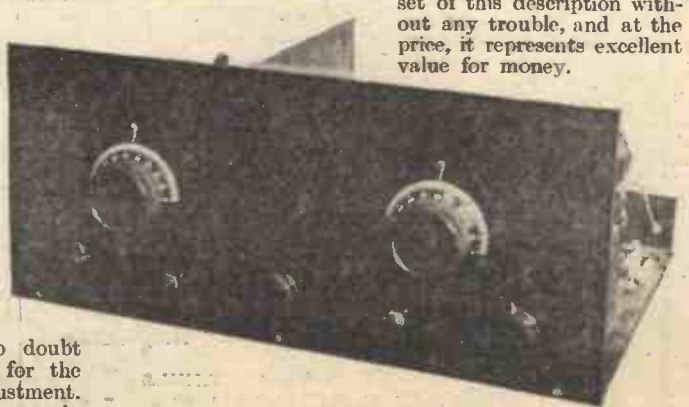
Rear view of the Peto-Scott Guardian 4-Valve Q.P.-P. kit assembled.

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

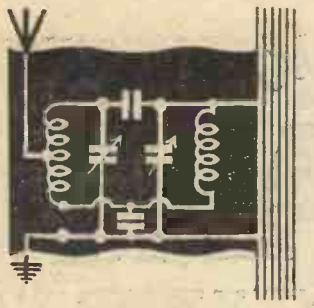
KIT—Pilot Guardian 4-valve Q.P.-P.

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.

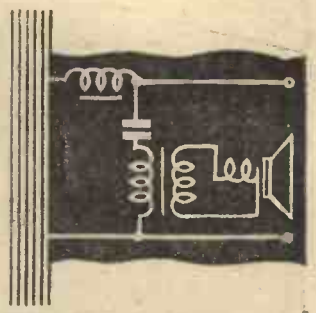
REMARKS—Splendid results at full-room strength from many stations. Quality of reproduction very high. Economical to maintain. The kit may be purchased on hire purchase terms if desired.



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.

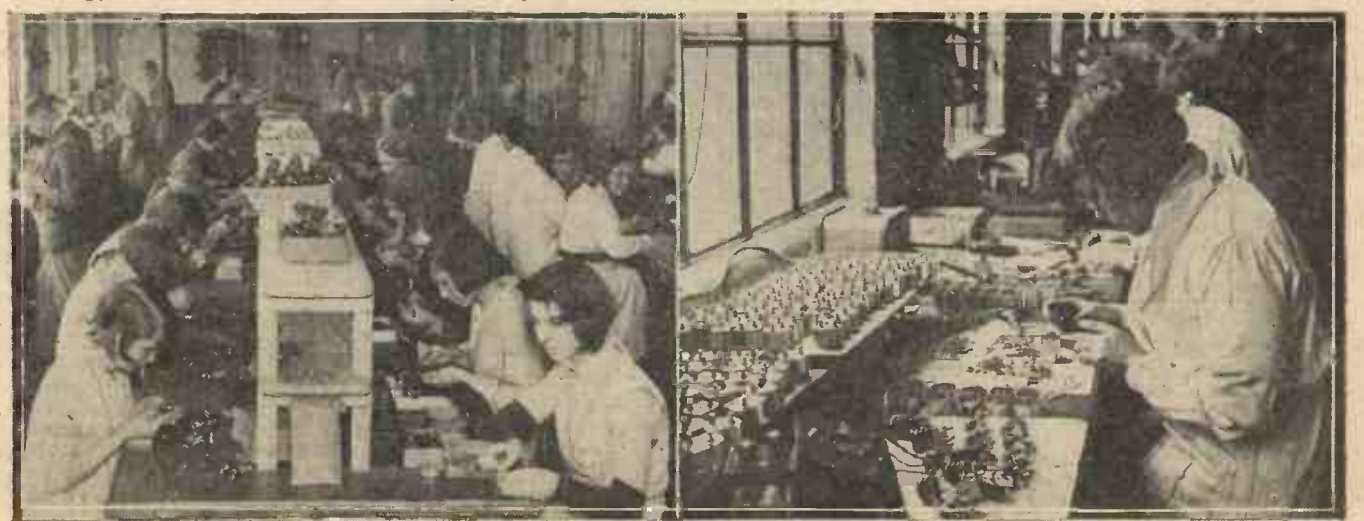
WIRELESS firms come and wireless firms go. Fortunately the basis of a successful industry is not created by the birds of passage who do no pioneering but live, limpet-like, upon the work of others. In almost every case these parasitic appendages to the radio trade (all industries have them) have a short 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.

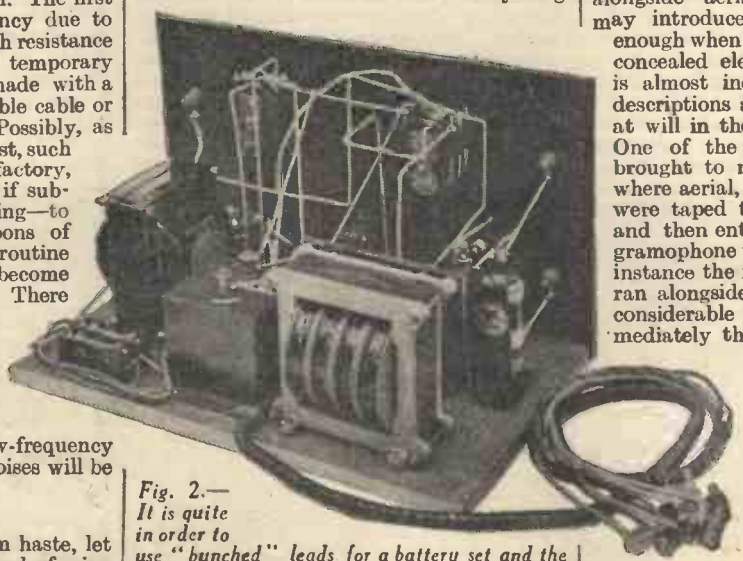


Fig. 2.—It is quite in order to use "bunched" leads for a battery set and the neat effect is shown here.

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.

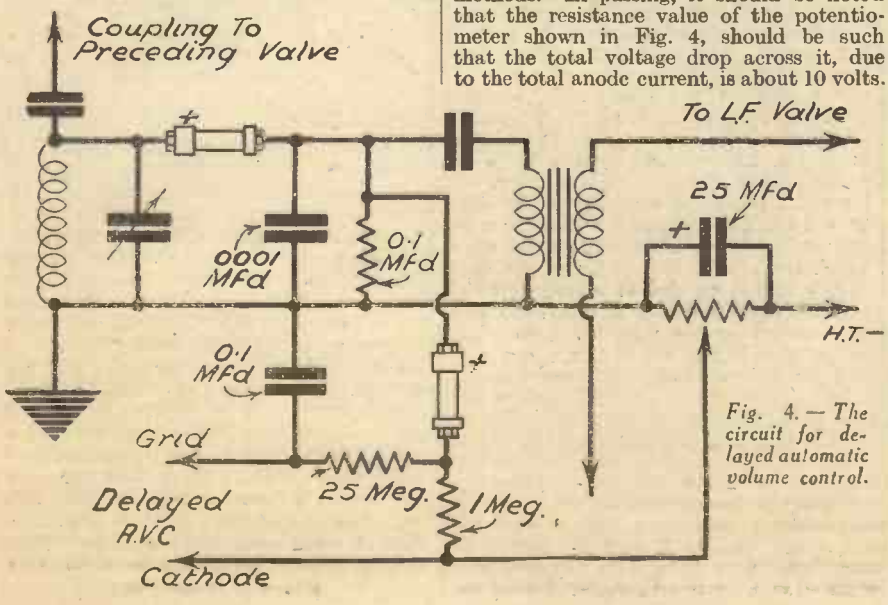


Fig. 4.—The circuit for delayed automatic volume control.

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.

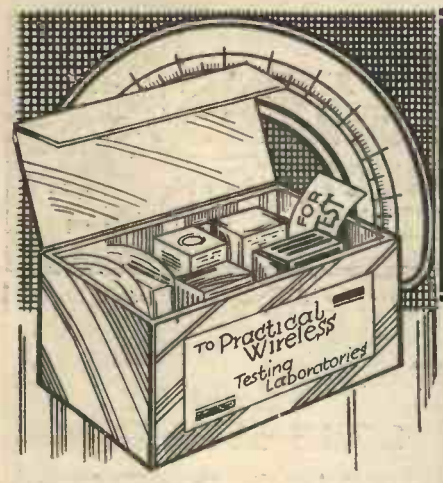
Still another method, which I ought to mention before leaving the subject of couplings, is that in which a resistance is used. It is of the order of 100,000 ohms and is connected between the top end of the two coils in the same way as the condenser in Fig. 5 (c). This arrangement is employed in a certain 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.



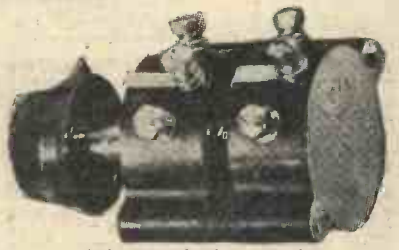
Facts and Figures

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

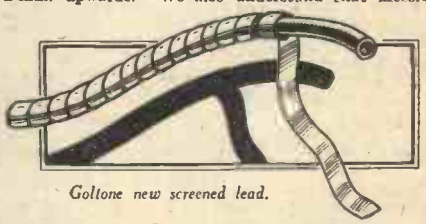
IN the article on a Radio workshop which recently appeared in our pages, one or two ingenious methods of obtaining more than one electric light supply from a single socket were shown. We are now informed that Mr. E. J. Clarke, of 70A, Norton Road, Wembley, Middlesex, has obtained a number of these adaptors 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.

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