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Vol. 1.——No. 24.
MARCH 4th, 1933.
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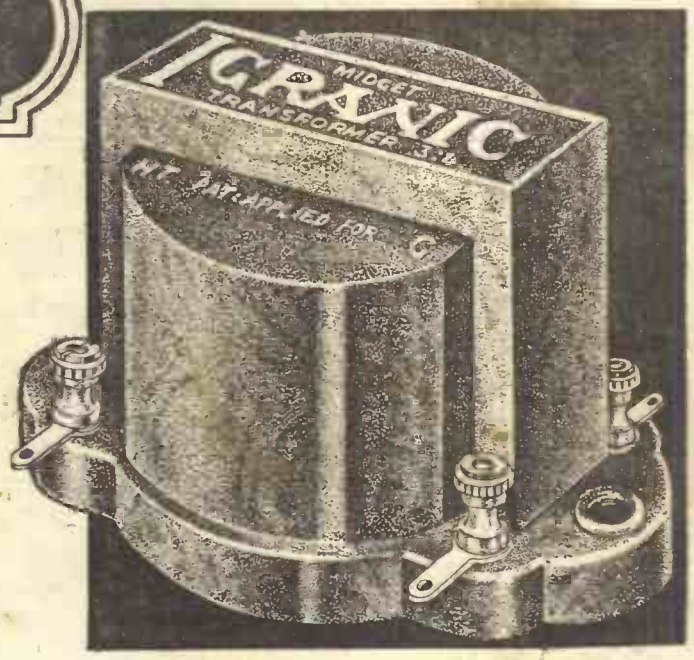

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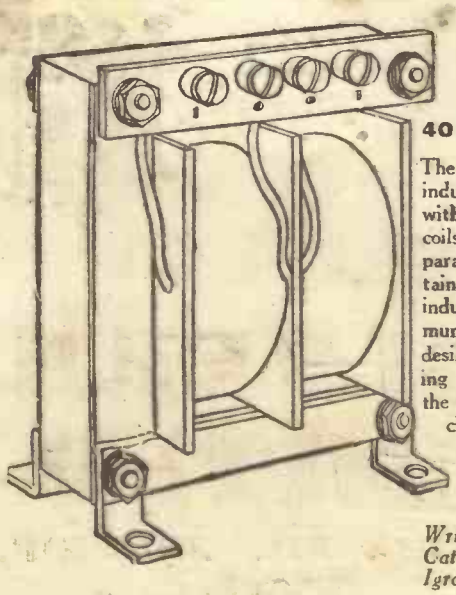

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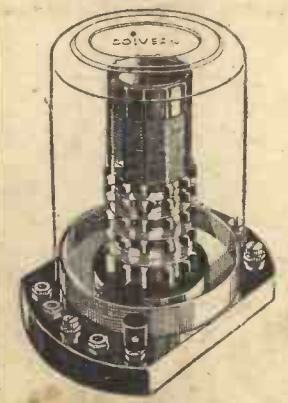

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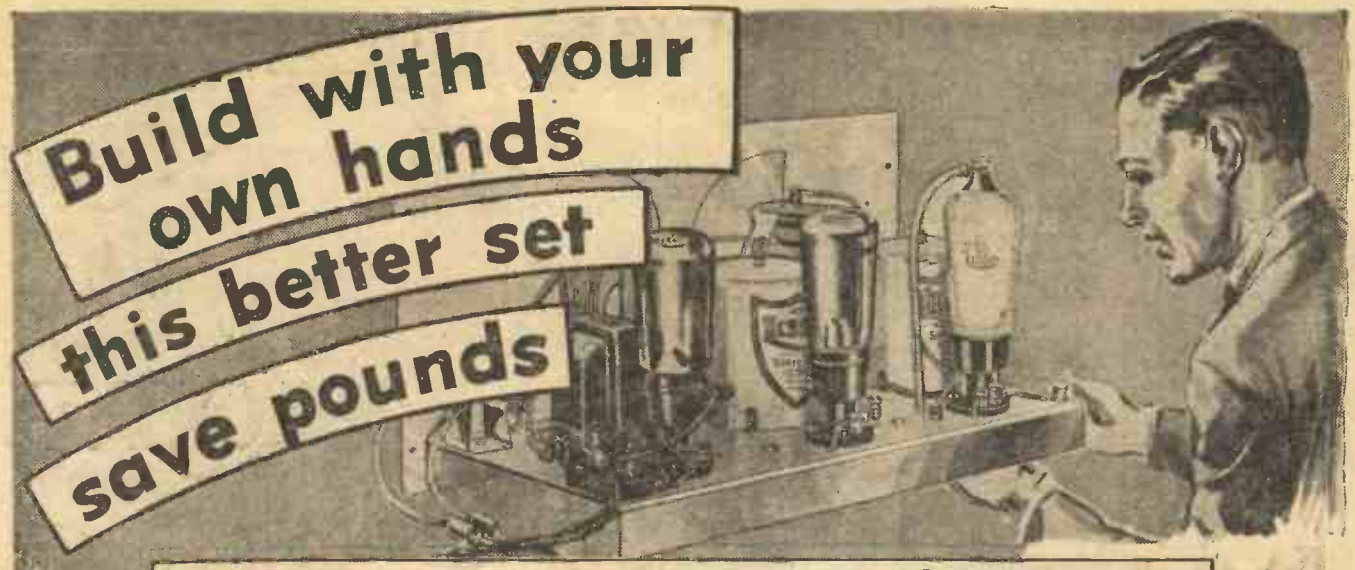

success a certainty!

GET YOUR FREE COPY OF MOST SUCCESSFUL CHART EVER PUBLISHED enabling you to build MOST SUCCESSFUL SET EVER BUILT!

NEVER before was there such a set within the reach of the home constructor. Never before such power from a battery set. Never before so many enthusiastic letters from constructors or so much talk about any radio set as this Lissen "Skyscraper" Kit has elicited. 50—60—70 loud-speaker stations—everybody who builds a "Skyscraper" gets results like that! Lissen have published a 1/- Constructional Chart, giving the most detailed instructions ever printed for the building of a wireless set. You can't go wrong—every part, every wire, every terminal is identified by photographs. Everybody, without any technical knowledge or skill, can safely and with COMPLETE CERTAINTY OF SUCCESS undertake to build this most modern of radio receivers from the instructions given and the parts Lissen have supplied.

This new Lissen "SKYSCRAPER" Kit Set is the only one on the market that you can build yourself employing a Metallised Screened Grid Valve, High Mu Detector and Economy Power Pentode. Around these three valves Lissen have designed a home constructor's kit the equal of which there has never been before. Why be satisfied with whispering foreign stations when you can BUILD WITH YOUR OWN HANDS this Lissen "SKYSCRAPER" that will bring in loudly and clearly distant stations in a profusion that will add largely to your enjoyment of radio?

YOU ARE TOLD EXACTLY WHAT TO DO WITH EVERY SINGLE NUT & SCREW

YOURS FOR ONLY 8/6 DOWN

COMPLETE IN CABINET WITH LOUDSPEAKER £6·5s
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THE ONLY KIT YOU CAN BUILD YOURSELF EMPLOYING METALLISED S.G HIGH MU DETECTOR & ECONOMY POWER PENTODE VALVES

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To Lissen, Ltd., Publicity Dept., P.R.39, Worple Road, Isleworth, Middlesex.

Please send me FREE copy of your 1/- Skyscraper Chart.

Name .....

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SPECIAL PUSH-PULL NUMBER!

ROUND *the* WORLD *of* WIRELESS

Broadcasts from Japan

A SHORT-WAVE transmitter is being erected in the neighbourhood of Tokio; it will operate on a short wavelength and will be used solely for broadcasts destined to Europe. It is expected that the station will start testing in the course of the next six weeks, and the initial transmissions may be relayed by Zeesen (Germany).

Another High-power Station for China

THE central committee of the Kuomin-Tang, the present governing party in China, has decided to erect a high-power transmitter at Shanghai, which will be used mainly for military purposes.

Poland Loses 18,000 Listeners

IN the course of two years, notwithstanding the installation of the Warsaw super-power station, the Polish broadcasting system has lost 18,000 listeners, the total number of licences in December, 1932, reaching only 296,255 for the entire country.

Radio Telephony for Belgian Police

SINCE the beginning of the year, experiments have been carried out with pocket wireless receiving apparatus, with which it is hoped to equip many members of the Brussels Police Force. The receiver weighs roughly two pounds and can be conveniently carried in the coat pocket. The experiments are being made in conjunction with a 200-watt transmitter installed at the Central Police Headquarters; its energy is considered sufficient to cover a radius of some sixteen miles.

Further Development of American Relay System

BOTH the National Broadcasting Company of America and the Columbia Corporation have recently relayed transmissions from Bangkok, Tokio, Manila and the Philippine Isles. With a view to giving their listeners further samples of the world's radio programmes, attempts will be made to take entertainments from the Dutch East Indies, and to rebroadcast them through the American network.

Experimental Relay Station for Roumania

TO improve the broadcasting service a new relay station has been temporarily installed at Blaj; its wavelength is 1,930 metres (156 kc/s), and power 750 watts (aerial). The station rebroadcasts the Bucharest programmes.

Summer Time

THE date fixed for the annual change-over from Winter to Summer time does not, unfortunately, coincide in the various countries adopting this principle. British Summer Time this year is fixed for April 9th, and from that date our clocks will correspond with those of such countries as Scandinavia and other countries working to Central European Time and in which no alteration is made throughout the year. For some reason, France proposes to effect the change-over at an earlier date, and will advance one hour, in the night of March 25th-26th. This must be taken into consideration by British listeners to French programmes. Belgium, it is stated, will make her change simultaneously with the United Kingdom. On the other hand, Holland, which, in the usual way is twenty minutes *ahead* of G.M.T., may alter at a later date and, consequently, for the period between that of our alteration and hers, *British Summer Time will be ahead of Amsterdam by forty minutes.* It is a pity that these various countries cannot come to an agreement to start Summer Time on the same day, as these differences in dates are a source of puzzle to listeners.

Specials in This Issue!

Alternative Programmes for Milan

FOLLOWING the inauguration of the 50-kilowatt station at Milan, the E.I.A.R., with a view to giving local listeners alternative programmes, propose to utilize the old Vigentino transmitter (7 kW.) for the relay of entertainments from Rome and Naples. Tests are to be carried out on about 421 metres.

Short-wave Link Between Belgium and the Congo

A GREATER number of short-wave transmitters are being daily used for the relay of wireless programmes from European countries to their respective colonies. The Brussels broadcasts are to be relayed for the benefit of white residents in the Belgian Congo; they will be transmitted on 30 metres through the Ruysselede (Bruges) station. For some months this station has been carrying out experimental tests with Elizabethville, Leopoldville, Roma, and other towns in Central Africa, with the result that it will now be possible to establish a regular service.

A Pleasure Cruise

UNDER the title of *Fourteen Days' Sunshine*, the B.B.C. will broadcast "Nationally," on March 20th, and "Regionally" on the following day, another John Watt production, revolving around the people who meet on board a liner on one of these much advertised cruises. But no advertising will be allowed! On a recent occasion, when a well-known Vaudeville artist broadcast a skit, he told of his projected attempt to swim the channel at its widest point, stating that he would do so at the end of a tow-line hitched to the . . . . and he mentioned the name of a well-known trans-Atlantic liner. Within a few hours the B.B.C. received a request from another shipping company for a similar advertisement of one of their boats!

Weather Forecasts for the Masses

NOTWITHSTANDING the fact that German studios broadcast weather reports and forecasts at least four times daily it would appear that the inhabitants of some cities are so interested in climatic changes that special services may be estab-

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

lished to supply their wants. At Frankfurt-am-Main, a company has been started to supply printed weather forecasts for delivery through slot-machines. In exchange for 10 pfennigs (at par, one penny) the inhabitants of that city will be able to obtain a printed slip giving a forecast for the ensuing twenty-four hours. Although it is thought that the novelty of the service may appeal to the public, it is doubtful whether the charge will be warranted, as in no case will the company hold itself responsible for the accuracy of its reports.

Development of Broadcasting in U.S.A.

ACCORDING to a recently-published report, during 1932 the National Broadcasting Company of America increased its network to a total of eighty-seven transmitters. The cable used to link up these stations now reaches over 20,500 miles. In the course of twelve months, the letters received by the company's studios amounted to 4,800,000 and the gross income derived from publicity was represented by twenty-nine million dollars. One year's working compelled the organization of 51,900 network programmes or over 500,000 appearances of announcers and artists before the microphone. It is expected that 1933 will show an increase on these figures.

New American Super-power Station

WITHOUT doubt this winter has proved peculiarly favourable to the reception of trans-Atlantic transmissions and listeners on the medium wavelengths have nightly captured broadcasts from stations of as low a power as 250 watts. Within a year's time, logging U.S.A. may be a matter of nightly occurrence as the power of the transmitters on the other side is being steadily increased. WLW. Cincinnati, as an example, which has already been heard on 700 kc/s (428.3 m). on many occasions, is now erecting a 500 *kilowatt* transmitter, which is to serve as a practical laboratory for experiments in the feed of super-power broadcasts. Up to the present, the highest power allowed to any station in the United States by the Federal Radio Commission has been 50 kilowatts. With a few more stations of that calibre on the air, signals from the New World should prove as easy to capture as those emanating from the nearer Continentals.

Contradictory Views!

IN Germany, with a view to improving the technical education of the unemployed, they are granted free listening licences and are encouraged to construct wireless receivers; in Holland, several municipalities have decreed that persons receiving the dole may not be in possession of a wireless set! On the other hand, the Belgian Government has assured the Workmen's Unions that members who are totally unemployed will not be required to pay the radio tax levied from listeners during 1933.

Radio Diffusion in Belgium

NOTWITHSTANDING the fact that this small country possesses two powerful broadcasting transmitters, a law recently passed by the Belgian Chamber of Deputies encourages the installation of wired wireless distributors. The first one to be opened is that of Deurne, near Antwerp; others are to follow in Flanders, and the province of Hainaut and Liége. The charge made is exceedingly low, having been fixed at one franc per day; the subscriber is given a choice of four programmes.

Dutch Colonial Transmitter

THE 40 kilowatt short-wave station PHOHI, which has been carrying out tests of broadcasts destined to Java, Sumatra, etc., resumed its broadcasts on February 21st. It has been decided to adopt two wavelengths, namely, 25.57 m. (11,730 kc/s) during the winter and 16.88 m. (17,770 kc/s) during the summer months.

A Princely Announcer

IT is reported from Sweden that Prince Lennart Bernadotte, a grandson of the King of Sweden, has been appointed announcer to the Stockholm studio.

Short-wave Transmissions from the Polar Regions

A SERIES of broadcasts is being carried out daily by a scientific expedition directed by Professor Mercanton, of the University of Lausanne (Switzerland). These transmissions are made through a 50-watt station (TF3B) situated at Snaefellsjockul (Iceland) on the 40-metre amateur band between 4.0 and 7.0 p.m. G.M.T.

Under the call-sign LMZ and on 21.40 metres transmissions are also being made on Sundays between 7.0 and 8.0 a.m. and again from 7.0 to 8.0 p.m. G.M.T. by the Norwegian Rijser-Larsen expedition to the Antarctic circle. The power is 80 watts (aerial). Should experimental amateurs pick up any of these signals, in the case of Iceland they are asked to report to *Le Reseau des Emetteurs Français*, 17, rue Mayet, Paris (6e), and in respect to the Antarctic messages, to the Norwegian Radio Relay League, Post Box 2253, Oslo (Norway).

Another Frequency for Radio Algiers

IN view of the fact that French listeners are complaining that the broadcasts from Radio Alger (Algiers), on most evenings are swamped by the Mühlacker transmissions the Government General of Algeria proposes to effect a change in the wavelength of the station and at the same time to increase its power.

"When We Come to the End of the Dance"

LISTENERS who have heard Henry Hall and his B.B.C. dance orchestra broadcasting the new waltz "When We Come to the End of the Dance," may be interested to know that this was composed by a woman, Mrs. Marjorie Crocombe, who, although trained as a "high-brow" musician in Milan and Brussels, had never previously thought of writing a popular tune. The chance remark of a friend, to the effect that women rarely succeed as composers of dance music, set her thinking. Just to prove him wrong she composed this lilting waltz, which looks like being the most popular "last dance" of the season.

INTERESTING and TOPICAL PARAGRAPHS

SWEDEN'S MOST NORTHERN WIRELESS STATION

This little building at Kiruna, Lapland, represents Sweden's most northern wireless station.

SOLVE THIS!

Problem No. 24.

Jackson has a four valve A.C. Mains receiver, employing a high-efficiency S.G. valve in the first stage. This was provided with bias in the ordinary manner by a resistance in the cathode lead, and worked admirably. Owing to an accident, the valve got broken, and he decided to replace it with a better valve, but of the metallized type. This was carried out, but the receiver was unstable, and thinking that the screening may not have been efficient, he twisted some bare wire round the bulb and joined this direct to earth. The set was even more unstable with this arrangement, and he found that the anode current of the complete receiver was higher. Why? 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, London, W.C.2, to reach us not later than March 6th, 1933. Mark your envelope Problem No. 24, and do not enclose any other correspondence with your solution.

SOLUTION TO PROBLEM No. 23.

The current of 18 milliamps, passing through the 2,000 ohm winding of the loud-speaker, resulted in a voltage drop of 36 volts. Consequently, as only a 120 volt H.T. battery was in use, the output valve was overloaded and working in a very inefficient manner on 84 volts.

The following three readers received books in connection with Problem No. 22:

Mr. A. Freeman, 43, Netherfield Road, Everton, Liverpool 5; Mr. J. Pickard, 24, Birklea Street, Bradford, Yorks; Mr. R. Waghorn, 33, Westcliffe Parade, Westcliff-on-Sea.

WHAT IS WRONG?—3

In His Third Article of the Series, the Author Continues His Remarks on Anode Voltage and Current Tests.

By FRANK PRESTON, F.R.A.

Anode Current Indications

As was explained at an earlier stage, the values of anode current give a very good idea as to how the valves are performing, but before we can make use of this information we must understand what the readings indicate. We will consider these under different headings, bearing in mind that "high" and "low" readings are purely comparative terms, and are given in respect to the normal currents specified by the valve manufacturers and shown on the characteristic curves.

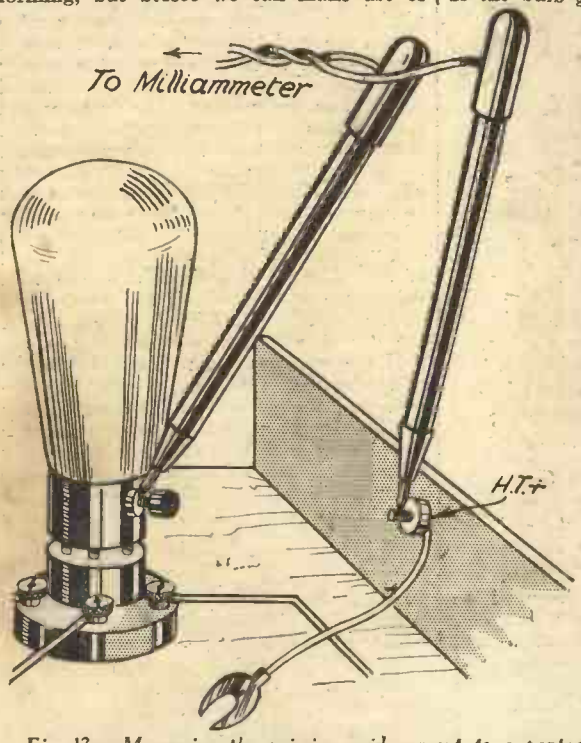


Fig. 13.—Measuring the priming grid current to a pentode.

(1) *No current indicated:* This points to a faulty valve, a break in the anode circuit or a broken connection in the low tension circuit. A method of testing valves will be given later, but the anode circuit components can be tested by short circuiting each in turn as shown in Fig. 14. If a current reading is obtained when any component is short-circuited it will be obvious that that component is faulty, and should be replaced. There is just one possible complication which might arise in respect to this particular test and which would be caused by a "leaky" by-pass or coupling condenser. If the condenser were joined from a point in the anode circuit to earth or to G.B.— it would pass a certain amount of current if any leakage occurred across it, and in consequence it would "rob" the valve of its anode current. If there is reason to suspect a fault of this kind the wire going to one terminal of the condenser should be disconnected whilst making the tests; the wire concerned is indicated in Fig. 14.

Should the latter test fail to disclose the fault it will be clear that the trouble lies either with the valve, valve holder or low tension circuit, so the next thing to do is to test the valve filament by means of the "Filament Tester" referred to last week. If the bulb glows (the light will be quite dim due to the resistance of the valve filament) the L.T. circuit and valve holder will be exonerated from blame, but failure of the bulb to light can point to any of the faults enumerated above. The valve can be eliminated by substituting another one, and if the bulb then shows a light the previous valve was faulty or making bad contact with the holder. The question of contact can be verified by cleaning the valve pins with fine emery cloth and carefully opening them out with a sharp knife, if they are of the split type. When there is no indication of filament current whatever valve is tried in the holder, it will be known that the holder itself, or the L.T. wiring, is at fault. Check the wiring by applying a voltmeter across the filament terminals of the valve holder. "No voltage" shows a break in the L.T. circuit and so the wires must carefully be traced back to their source. The on-off switch might be wrong, but if so there will be no L.T. current (and consequently no anode current) to any of the valves. When a voltage reading is obtained at the filament terminals the fault is obviously concerned with the valve holder, which should be replaced or removed for examination. In the case of a mains receiver, or one fed from a high tension eliminator, it can safely be assumed that the power supply or its connections are defective if the latter tests fail to reveal a fault, and yet there is no sign of anode current. This point will be dealt with when we discuss mains receivers.

(2) *Too low a current indicated:* Shows that the valve is wrong, the grid bias voltage too high, the grid is disconnected, the valve is oscillating, some component in the anode circuit is of too high a resistance, or that there is a resistance in the L.T. circuit. The tests mentioned in respect to (1) should be applied, especially that of measuring the voltage across the filament terminals of the valve holder. If it is suspected that an anode circuit component has developed a high resistance, the component may be replaced by a similar one, if available, or by a variable resistance. By adjusting the resistance until the anode current is the same as before a good indication of the resistance of the suspected component can be gathered—the effective value of the variable resistance can be estimated by the position of the slider. To test for oscillation in any type of valve the anode terminal should be touched with a moistened finger; a change in anode current will take place if the valve is oscillating. Do not forget that, in the case of an S.G. or pentode valve, the screening grid voltage will have a pronounced effect on anode current.

(3) *Too high a value of anode current:* This might point to too little G.B. voltage, grid disconnected, valve oscillating, leaky grid or coupling condenser, short circuit through a component in anode circuit. Apply tests as in (2) and if a leaky grid condenser is suspected the wire from it to the anode circuit of the previous valve should be disconnected as shown in Fig. 15.

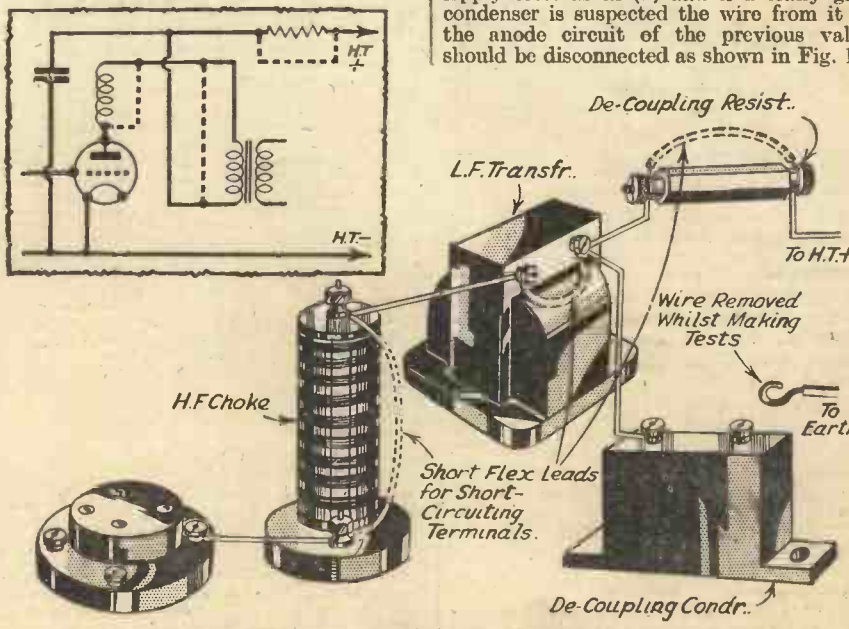


Fig. 14.—Showing how various components in a typical anode circuit should be short-circuited in turn to find which is faulty.

If automatic grid bias is obtained through a voltage dropping resistance, replace the resistance by the variable one and adjust it until a normal reading is obtained. Should this be impossible it will be clear that the bias resistance was not at fault or that its by-pass condenser is broken-down and causing a "short"; disconnect and repeat the tests.

(4) *Anode current fluctuating:* A continual variation in anode current when the set is not tuned to any signal will generally prove to be due to a bad connection which might be either in the grid, filament or anode circuit. First examine carefully all the wiring, see that the valve is firmly in its holder and short-circuit the on-off switch with a short length of wire. Short-circuit each component in the anode circuit as shown in Fig. 14 and apply all the tests mentioned under heading (1). If the fault still persists disconnect the wire going to the grid terminal of the valve holder, if the valve concerned is an S.G. or detector. This should *not be done* in the case of an L.F. valve because the removal of the grid bias voltage might result in damage to the valve. Instead, the grid should be connected directly to the grid bias battery as shown in Fig. 16. If the current becomes steady on applying the latter test it will be obvious that the component(s) in the grid circuit (tuning coil or condenser, transformer, secondary or grid leak) is at fault. In the case of an S.G. or V.-M. valve where a potentiometer is used for volume control, this component should be replaced if a spare is available. Otherwise the connection to the slider should be removed and replaced by a wire going direct to the high tension or grid bias battery. When the current fluctuation occurs only when a signal is tuned-in, there is probably a bad contact in the aerial-earth or tuning system, or in the grid circuit of the valve concerned is an S.G. or detector. To locate the fault, all connections should first be checked and, when possible, other tuning coils substituted. Where the fluctuation is in respect to an L.F. valve it might, or might not, indicate a fault. A certain amount of variation in anode current is inevitable, and it will vary in degree with the delicacy of the meter. But where the current change is so much that the needle "kicks" violently it is likely that the valve is faulty, is receiving incorrect H.T. and G.B. voltages, or is being overloaded. The former points can be checked by trying other voltages and the latter by reducing volume. In any case, if there is anything seriously wrong the fault will previously have made itself conspicuous in the form of distortion.

(5) *Anode current normal to every valve:* When every valve is found to pass the correct amount of H.T. current and yet the set fails to operate in the desired manner, a different series of tests must be applied and these will be dealt with in the next article of this series.

After taking the anode current measurements, as explained above, you will have located most of the likely sources of trouble that exist in your set, but you might still be baffled by some peculiarity which has not yet been brought to light. I will, therefore, explain a few further experiments which should enable you to clear up the difficulty. You will remember that we classified the probable faults under five headings, which I repeat below in order to refresh your memory. They are:—

1. Entire absence of signals.
2. Weak reception.
3. Reception accompanied by noises or crackling.
4. Distortion, or poor "quality."
5. Instability.

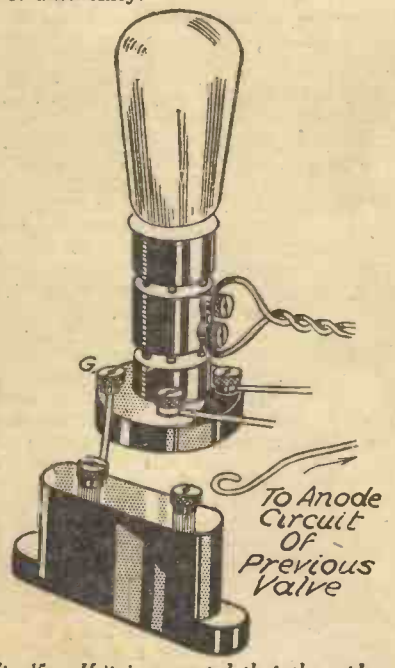


Fig. 15.—If it is suspected that the grid condenser is leaking, it should be disconnected whilst taking anode measurements.

The previous tests were intended to apply chiefly to faults (1) to (3), but they will have helped in the location of (4) and (5) also. In our previous tests we were principally concerned with isolation of the grid, filament, and anode circuits, but now I am going to suggest that we split up the valve stages and check each in turn. There are three ways in which we can do this; one is to start at the loud-speaker "end" of the circuit and work backwards; another is to commence with the tuning circuits and proceed towards the low-frequency amplifier, whilst the third is to start at the detector-valve and work outwards towards the aerial and loud-speaker "ends." Each method has its application to different types of set, and since these remarks must be of a general character, and applicable to any kind of instrument, I shall try to combine the three methods and show how, by following a logical sequence, any set or any fault can be tackled.

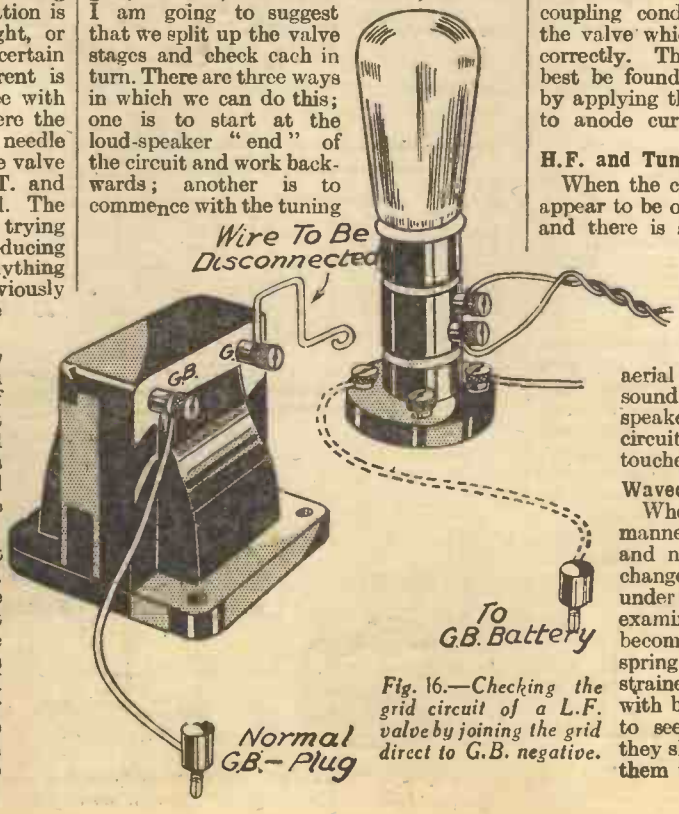


Fig. 16.—Checking the grid circuit of a L.F. valve by joining the grid direct to G.B. negative.

When the set appears to be quite "dead," and signals are absolutely non-existent, it is best to commence work on the most vital part of the receiver—the detector-valve Touch the grid terminal with a moistened finger, either direct or through the agency of a short length of wire; a sound should be heard in the speaker if the detector and L.F. stages are operating correctly. I cannot say what kind of a sound should be heard, because it will vary with every set, but it should be fairly loud. It might be merely a "plop," it might take the form of a terrifying "howl," or it might be a dull "groan." But if there is a loud sound of any kind it will show that the L.F. valves are at least doing something, and so the fault is probably at some point of the circuit preceding the detector.

If the set does not respond, touch the grid terminal of the valve following the detector; if there is still no sound, try the next valve after that. Of course, the sound will be weaker as the last valve is approached because of the lesser degree of amplification before the speaker. When a point is first arrived at where a sound is heard, it will be obvious that the fault is in the stage immediately preceding, and tests can therefore be applied to the anode circuit of that valve. It will probably be found that the coupling component is either short-circuited, open-circuited, or disconnected, but it might be that a similar fault occurs in respect to the transformer secondary, grid-leak, or coupling condenser in the grid-circuit of the valve which appears to be functioning correctly. The defective component can best be found by testing each in turn, or by applying the tests mentioned in respect to anode current measurements.

H.F. and Tuning Circuits

When the circuits following the detector appear to be operating in a normal manner, and there is still no trace of signals, the fault must be confined to the H.F. amplifying and tuning circuits. A preliminary test will consist of touching the grid terminal of each high-frequency valve and then the aerial terminal. In each case a sound should be heard from the speaker; if not, the fault is in the circuit of the valve whose grid is touched.

Wavechange Switches

When the set behaves in a normal manner on one wavelength range and not on the other, the wave-change switches will first come under suspicion. They should be examined to see that no wires have become detached and that the spring contacts are not dirty or strained. If, in the case of tuners with built-in switches, it is difficult to see the switch contact springs, they should be operated by pushing them with the end of a pencil.

(To be Continued.)

The DESIGN of LOUD-SPEAKERS

Some Points about Sound Reproduction, and how the Loud-speaker may Make or Mar the Fidelity of the Received Signals

By W. J. DELANEY

BEFORE we can discuss the question of the design of loud-speakers it is necessary to have a clear idea of just what a sound wave is. For the purpose of this article, I am going to deal with the reproduction of a note produced by a large bass drum, and the following description should be read in conjunction with Fig. 1. The figure at the left of this illustration represents a drum head at rest, and the thin wavy lines at the left are representative of the air in front of the vellum (or skin) of the drum. When the drum is struck the vellum is driven inwards, the actual distance of its travel being governed by the taughtness of the vellum. When it has travelled its maximum distance inwards, the air, which will obviously have followed it, will be rarefied, and there will consequently be a movement of the air in the direction of the drum. As soon as the momentum of the vellum has been overcome it will tend to spring back to its normal position, but due to the force of the original blow and the springiness of the vellum it will overshoot the mark and bulge outwards slightly, as shown in the next illustration. On its outward travel it will push the air in front of it, and owing to the rapidity of its travel the air will be compressed, as shown diagrammatically in this illustration. The beat of the drum may, therefore, be considered as a rarefaction and compression of the air, and although this is not scientifically correct, it will serve to enable the non-technical reader to understand the remainder of this explanation.

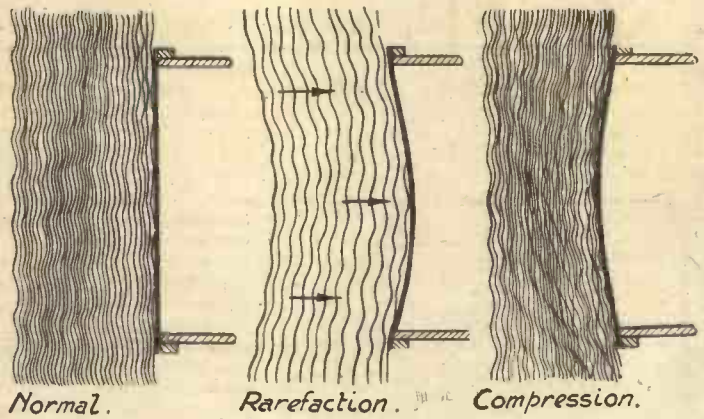


Fig. 1.—A diagrammatic representation of a drum-head, and the condition of the air surrounding it.

Frequency

If you take a piece of elastic 12in. long, and, without stretching it, pluck it slightly, it will give off a musical note. Now reduce the length of the elastic to 6in., and, again without stretching it, pluck it as you did at first. The note will be different. This shows us, then, that the note, which is actually the speed of vibration, is governed by the size, and the drum, which we are using as our illustration, we will imagine to be of such a size that the note produced by it is a 50-cycle note. This means that the vellum of the drum will, if struck, vibrate backwards and forwards fifty times in a second. (Actually, of course, it only does this for a fraction of a second as it quickly comes to rest.) The large bass drum used in some dance bands does, in fact, have, roughly, this note, and this point should be borne in mind. To sum up what has already been said, therefore, a drum with a 50-cycle note will have a vellum which will vibrate backwards and forwards fifty times in a second, and the air will consequently be alternately rarefied and compressed in the same proportion. We can now study the method of reproducing sounds by means of a loud-speaker, and see how difficult it is to actually reproduce some musical frequencies.

Moving-iron Loud-speakers

Loud-speakers are divided, roughly, into two classes—moving-iron and moving-coil. The names are really self-explanatory, and mean that in one type a piece of iron moves to produce the sound and in the other type a coil of some sort is caused to move. Although the iron and the coil are not the actual producers of the sound, they are the means to the end, and must, therefore, be considered, for the moment at least, independently from the cone, trumpet or other apparatus with which they are used. The simplest type of loud-speaker, which is, incidentally, obsolete to-day, but is employed in principle in the headphones, consists of a flat disc of metal clamped round the edge, and fixed just in front of an electro-magnet. It has already been explained in these pages how the sound is converted into electrical impulses, and how these are passed through the magnet windings of the loud-speaker, so we will not discuss this part of the problem here. Fig. 2 shows this type of movement, and it is obvious, if you remember the difference between the two lengths of elastic, that this disc cannot vibrate at the slow rate of the large bass drum. Not only is it too small to do so, but it is so thick, comparatively, that even if the magnet drew it inwards at the correct rate, the tension of the diaphragm would pull it back to normal so quickly, that the frequency would be very much higher than 50 cycles. We can, therefore, dismiss this type of reproducing unit, and it is as well to remember that loud-speaker manufacturers do not now make this movement.

Reed Type Reproducers

We have just noted that the *tension* of the disc, or diaphragm, was the cause of the inability to reproduce the slow vibration, and it will be obvious, therefore, that to obtain this 50-cycle note we have got to do away with tension. The reed-type of loud-speaker is, therefore, the next movement to consider. In Fig. 3 is shown the magnet with a thin *strip* of iron in place of the disc of Fig. 2, and, in addition, this strip is attached only at one end. This strip of iron, or, as it is more correctly called, the reed, will obviously have less restoring force than the disc which is clamped all round its edge, and we may consequently expect it to answer more easily to the 50-cycle note. As, however, the end of the reed *must* be firmly attached to something, there is some restoring force, and this will naturally prevent a faithful following of the slow vibration. In addition, the attachment of the cone or other means of setting the air in vibration will have an effect on

(Continued on page 1141.)

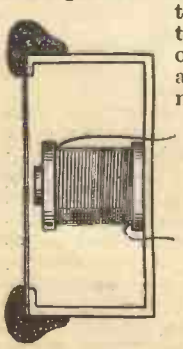


Fig. 2.—A simple diaphragm movement.

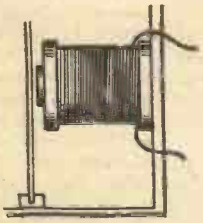


Fig. 3.—A simple reed type movement.

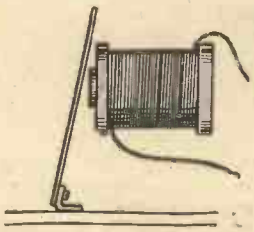


Fig. 4.—A patented reed arrangement.

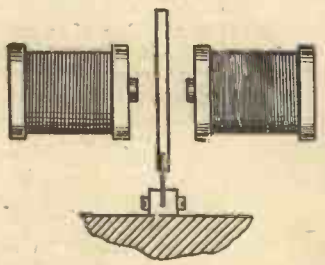


Fig. 5.—A balanced armature arrangement.

ARM-CHAIR VOLUME CONTROL

By "ELECTRODE"

METHODS of volume control are many and varied, and some sort of volume control is an essential part of any set. Typically, a three-valve set of, say, a year or two ago had its volume control in some form of reaction or something practically equivalent to it, and this still represents quite a good method for a three-valve set. In particular, it has the advantage of leaving the set, when at the lowest gain, in the best condition for quality, and increases the gain of the detector stage, giving the requisite improvement on normal sensitivity even with a slight deterioration of quality.

Within the last year or so the variable-mu valve has made its appearance, providing an excellent method of volume control which has notable advantages—in particular that, in the control of gain, it also gives some control of selectivity. It has not, however, been much used in the H.F. stages of three-valve sets, but has been more employed in sets using two H.F. stages, where there is much less need for pushing the gain of the detector stage by reaction. It is also, of course, being much used in the super-heterodynes for the same reason.

Cutting Down the Local Stations

In a good modern set, however, apart from one using variable-mu valves, it is often difficult to get a volume-control that is wide enough in its scope to suit all conditions. Thus with a three-valve mains set quite a small aerial is adequate for relatively local-station reception, but if we want a modicum of foreign reception a moderately good outdoor aerial is necessary. In this case, at a distance of twenty-five or thirty miles from one of the twin-wave B.B.C. stations the outdoor aerial gives a local-station strength which it may not be possible to cut down sufficiently.

Some sets provide an abrupt "local-distant" switch which puts a relatively low resistance across the aerial-earth terminals and reduces the overall level. The "sweetness" of this in practice sometimes—indeed, mostly—leaves a lot to be desired; and a smooth change, instead of the abrupt jump, is much preferable. This can easily be added if the user desires, and, in particular, it can be added externally, as herein described, without making any change whatever to the set.

External Volume Control

Apart, however, from any volume control belonging to the set, it is often a great convenience to have a control accessible from the chair—especially from the fireside arm-chair—without the need for rising to go to the set. Most listeners must have experienced cases when this would have been a very definite advantage. When listening to a serious programme or one demanding continuity, it is mostly undesirable to make changes of volume or otherwise to meddle with the volume. But, on the other hand, certain varied types of programme can often do with varied volume. Personally, I can never get the "crooner" or "syncopated harmonists" reduced to sufficiently low volume, but then, "chacun à son goût." In other cases, also, reduction of volume may be desirable for some point of discussion or conversation. Domestic listeners can readily imagine such a need. In these cases it is a great advantage to be able to control it from the arm-chair. Very few sets provide for a permanent volume control for remote operation, but such a device is neither expensive nor difficult to apply.

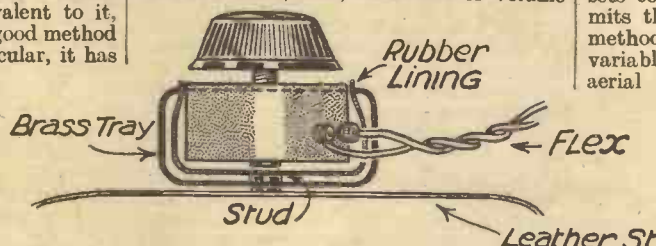


Fig. 1.—Small volume control in arm-chair ash-tray as volume control.

Quite a well-known device is a resistance across the loud-speaker, either as a shunt or as a potentiometer controlling the actual supply to the loud-speaker. At least one commercial set makes provision for additional terminals for the attachment either of an extra loud-speaker or for a shunt volume control of the type just mentioned. Any method, however, which controls the volume on the loud-speaker itself has naturally the disadvantage that all the circuits before the speaker, from input to output terminals, have to be working at the highest signal level. This is, of course, the condition in which distortion is most likely to occur, and, apart from distortion due to the speaker itself, reduction of volume at the speaker is not going to be of any help in reducing distortion already existing in the set.

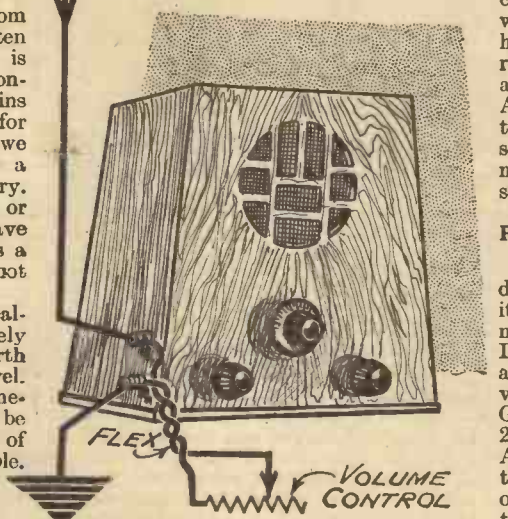


Fig. 2.—Application of remote volume control to set.

Control at the Input

An obviously better method is to do the control right at the beginning of the set, so that at low volumes the signal through the whole receiver is at a low level. Many sets contain a series condenser which permits this to be done, but a very suitable method for external application is to put a variable shunting resistance across the aerial earth terminals of the set. This being external, it can be added without any alteration to the set.

If a small-sized resistance of the typical volume-control variety is used it can be accommodated on the arm of the arm-chair with a flex of suitable length joining it to the set. The accompanying illustrations show one of these resistances used in this manner. The resistance is housed in one of those arm-chair ash-trays, in which a small brass cup is fastened by a stud on to a band of suede leather, with end weights which keep it taut over the arm of the chair. Many people—I will not exclude myself—have found these a delusion and a snare as ash-trays, waiting till they get comfortably full of ash, stubs, and matches to get knocked over on to the floor. As arm-chair volume controls, however, I find them delightful. The first illustration, Fig. 1, shows the general housing. The resistance is one of the small bakelite variety; the terminals had to be cut short to get it into the ash-tray, but this was easy. Rubber lining—cut from an old hot-water bag—keeps all the metal of the resistance off the metal of the tray, as well as providing a means of tight packing. A small hole drilled through one side of the tray permits entry of the flex. The second illustration, Fig. 2, shows diagrammatically the method of applying this to the set.

Resistance Value

The best value of the resistance will depend on a number of things—for example, it will depend on the particular arrangement of the aerial circuit of the set itself. It will also depend on the efficiency of the aerial, and of the set itself, as well as the variation of volume-control that is desired. Generally, however, a resistance of about 25,000 ohms will be found fairly suitable. A test for the best resistance is to ensure that, with the resistance all in, the presence or the absence of the resistance across the set terminals makes no detectable difference. It can then be inferred that the resistance when at its maximum value is causing no loss of efficiency, while it will, of course, serve as a regulator of volume as the value of resistance is cut down.

Apart from being an inherently good method as regards keeping down distortion, this arrangement is also particularly useful in sets with built-in speakers, where access to the speaker itself is often not easily obtained. The writer has used this arrangement with complete success on several different sets, *e.g.*, a 3-valve battery set (detector, L.F., power), a commercial 3-valve A.C. set (H.F., detector, power-pentode), and also on an eight-valve super-heterodyne.

PUSH-PULL DETECTION

An Important, Informative and Interesting Article dealing with Push-Pull in the Detector Stage

By S. J. GARRATT

READERS will be more or less familiar with push-pull amplifiers, these having been the subject of various articles in PRACTICAL WIRELESS, but the push-pull system may also be applied to the detector circuit in a comparatively simple manner. The present article is intended for those who wish to understand something of the "why and wherefore," but for the severely practical readers whose demand is "something to make," the specification and construction of a three-valve push-pull detector set is described elsewhere in this issue.

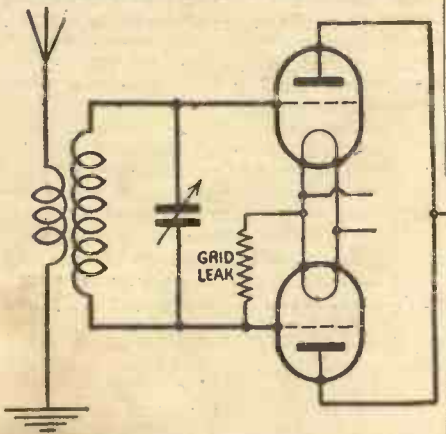


Fig. 1.—The essential connections of a push-pull detector circuit.

The essentials of the circuit are shown in Fig. 1. The tuning arrangement consists of an aperiodic aerial coil closely coupled to a tuned grid coil. In the ordinary way the lower end of the grid coil would be earthed, but in the present case this end is connected to the grid of another detector valve. The grid system is thus entirely isolated except for the grid leak.

The high-frequency currents which flow through the aerial coil are reproduced by induction in the grid coil which is, of course, tuned to the required wavelength in the usual manner by means of a variable condenser. When the top end of the coil is negative the bottom end is positive, and *vice versa*, and as each end is connected to a grid, each valve is always half a cycle out of step with its companion. Let us look into this rather more closely.

Cycle of Voltage

Fig. 2 shows diagrammatically a single complete cycle of voltage as it would arrive on the grids of the two valves; this is the radio-frequency wave which is repeated about one million times per second. The top diagram shows the grid voltage rising to a positive value in the top valve at the same time that the voltage is falling to a negative value, as shown in the bottom diagram, in the bottom valve. (The dotted vertical lines represent the same instant of time in both diagrams.)

For the sake of simplicity, we will disregard the detector action for the present and consider what happens in the anode circuit. Each valve will, of course, reproduce the grid voltage fluctuations in its own anode circuit, though the anode current will not be an alternating one (*i.e.*, the anode current increases or decreases with change of grid voltage, but always flows in one direction). Now the anodes of both valves are connected to a common output connection, so the total output will, of course, be the sum of the two individual outputs. This is shown diagrammatically in Fig. 3, where the full line represents the output from one valve and the dotted line that of the other valve. It will be seen that at any instant the output of one valve is always as much above a straight line drawn through the middle as the other output is below it, or, in other words, the combined output is constant in value and the high frequency fluctuations have entirely disappeared. This is a most important point, for it means that no decoupling is required provided the valves are well matched.

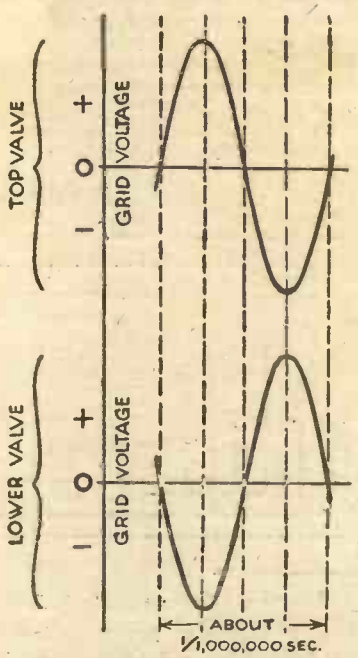


Fig. 2.—The signal variations of the two valves.

Now let us see what happens to the audio-frequency component when a broadcast wave is received. The full lines in Fig. 4 show, in the usual diagrammatic form, the main characteristics of such a signal wave as it arrives at the grid of one valve, while the dotted lines show what is happening simultaneously in the other valve, the two valves being, as already explained, exactly half a cycle out of step.

In Fig. 4, both valves must be considered to have the high-tension battery disconnected for the moment, when it will be seen that the mean grid voltage remains constant at zero; or, to put it another way, the radio-frequency currents surge to and fro through the tuned grid coil (shown in Fig. 1), from one grid to the other and back again, but the total charge on the whole of the isolated grid circuit remains unaltered at zero.

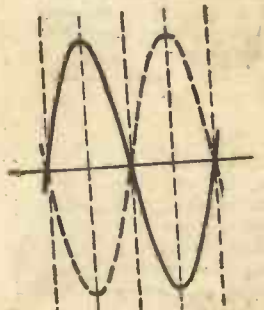


Fig. 3.—The anode components of the two valves.

Grid Current

When the high-tension battery is connected up, the diagram, Fig. 4, becomes altered very considerably owing to the effect of grid current. Grid current, as most readers will know, arises out of the stream of electrons flowing inside the valve from the filament to the anode, some few of the electrons being attracted to the grid instead of the anode, *but only when the grid is positively charged*. This grid current charges up the whole of the isolated grid system of Fig. 1 negatively. Now the greater the amplitude in Fig. 4, the greater becomes the grid current and the greater the corresponding negative charge on the grid system, with the result that the positive half of Fig. 4 is depressed as shown in

(Continued on page 1163.)

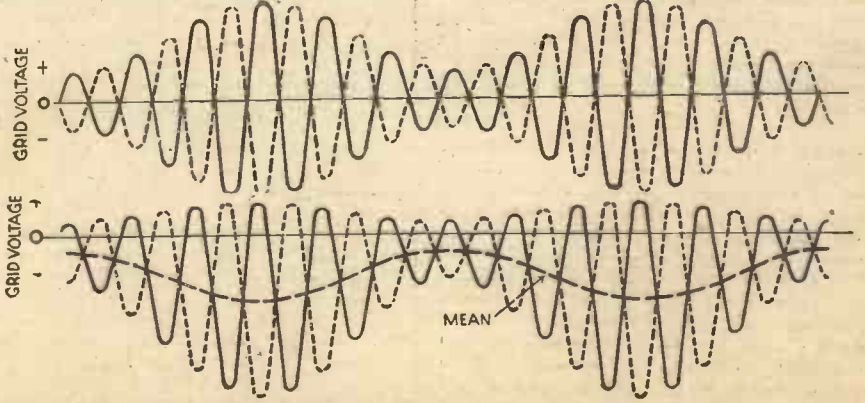


Fig. 4 (above)—the two oscillations of the push-pull detectors, and Fig. 5 (below)—the result of the rectification of the dual oscillations.

Rear view of the Q.P.-P. Three-Four, showing the slide-in frame and the R. and A. moving-coil speaker.

BUILDING THE Q.P.-P.

Constructional Details of the Latest Receiver Employing Two

PRELIMINARY details were given last week concerning the latest receiver to be produced by us, employing the now popular Quiescent Push-pull principle. Photographs were given last week showing that the receiver was of the self-contained type, having the receiver situated on a shelf in the upper portion of the cabinet, and the loud-speaker being screwed into the lower portion. The batteries may also be incorporated in this part of the cabinet. Sufficient has already been said in our pages to enable our readers to understand the benefits of this form of L.F. coupling, and it will be found that this particular receiver will deliver an output usually only obtained with a mains-operated receiver employing the very largest of output valves.

Constructional Details

The actual constructional work will be found extremely simple, and should occupy only a few hours. The cabinet will be found to contain an inner section, which is fitted with a removable baseboard. This is held in place by small nails, and should be removed for the constructional part of the work. Mount the components as shown in the various illustrations, leaving the under-baseboard components until part of the wiring has been completed on the upper surface of the baseboard. Wire those parts which you have now fixed, carrying out the wiring with Glazite. There are no difficulties to be met with in this receiver, so that there is very little that can be said about the actual wiring. Next drill the panel from the details given in Fig. 2, and attach the condensers, switches and tone control. Be careful when handling this latter component that the fine wire winding is not broken by coming into contact with the screwdriver, etc. Now attach the panel, and carry out any further wiring that is possible and then mount the condensers and output choke on the undersurface of the baseboard. It will now be found that the baseboard with the panel attached may be stood on the table or work-bench on its side, and there will be no risk of damage to the wiring or components which would be occasioned if the baseboard was handled without the panel attached. The Ohmite resistances are held in position by the wiring, and their position is clearly shown in the wiring diagrams. Next screw the loud-speaker to the back of the lower section of the cabinet, using either wood screws driven in from the rear, or bolts passed through from the front of this part of the cabinet and nuts employed to hold the speaker rim in position. It must be borne in mind that the speaker must be very rigidly held, otherwise with the volume which is produced by this receiver the cabinet will set up most distressing rattles. A further point which may be of interest here is the fact that the volume of the lower notes in the musical scale may be reduced in intensity by attaching the speaker so that the felt rings surrounding the framework do not press against the front of the baffle. This may be carried out by using small distance pieces, such as strips of wood, between the baffle and the speaker. The distance pieces should only be about 1in. long, so that there is an air space between the baffle and the speaker of about ¼in. However, this is a point which must be left to individual taste. The grid-bias battery is accommodated at the rear of the upper part of the cabinet, and it may be stood behind the valves, or if preferred, a Bulgin grid-bias clip may be attached in the centre of this part of the baseboard and the battery held firmly in this. The remaining batteries, namely, the H.T. and L.T., are stood in the lower compartment behind the loud-speaker, and it will be found that the back of the cabinet may then be screwed in place making the whole receiver self-contained.

COMPONENTS FOR THE Q.P.-P. THREE-FOUR.

1 Colvern T.D. Coil.
1 J.B. .0005 Slow Motion Condenser, Type D.
1 J.B. .0003 Differential Condenser.
4 T.C.C. Fixed Condensers.
.0001 mfd. (Type S) .05 mfd. (Type 50).
.01 mfd. (Type S), .1 mfd. (Type 50).
6 Graham Farish Ohmite Resistances.
2-1 megohm, 2-100,000 ohms.
1-5,000 ohms, 1-30,000 ohms.
1 Watmel 20,000 ohm Variable Resistance.
1 R.I. Q Type Transformer.
1 Varley Transchoke D.P. 39.
2 Clix 4-pin Valve-holders.
2 Clix 5-pin Valve-holders.
3 Clix Wander Plugs, G.B.+, G.B.1, G.B.2.
1 Belling-Lee 6-way Battery Cord.
1 Becol Panel, 12in. by 7in.
Speaker.—R. & A. Bantam.
Cabinet.—Clarion Q.P.-P.
Valves.—Mazda, L.2, H210 and 2 Pen. 220A.
Batteries. Drydex Special Q.P.-P. H.T. Battery.
Drydex 16 volt G.B. Battery.
Accumulator. 2 volt Block Battery.

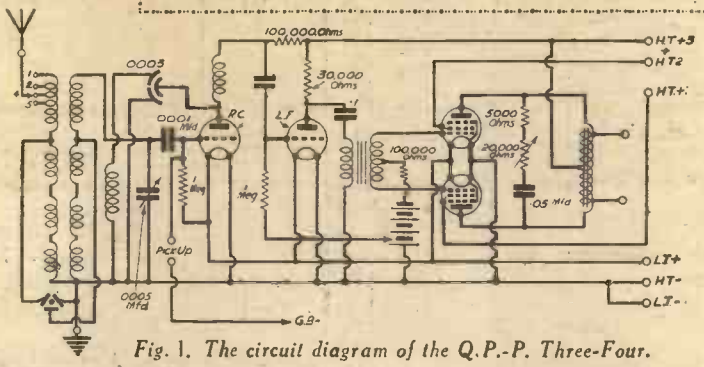


Fig. 1. The circuit diagram of the Q.P.-P. Three-Four.

The Cabinet Back

It will be noted that the terminals for this receiver project a short distance to the rear of the baseboard and cabinet back, and it will be necessary, therefore, to cut away part of the fretted back. It will not be found difficult to carry out this part of the work, and the utility of the cabinet is in no way destroyed by this small alteration, and the appearance is maintained by the two oval holes being run in to the fretted pattern. The battery

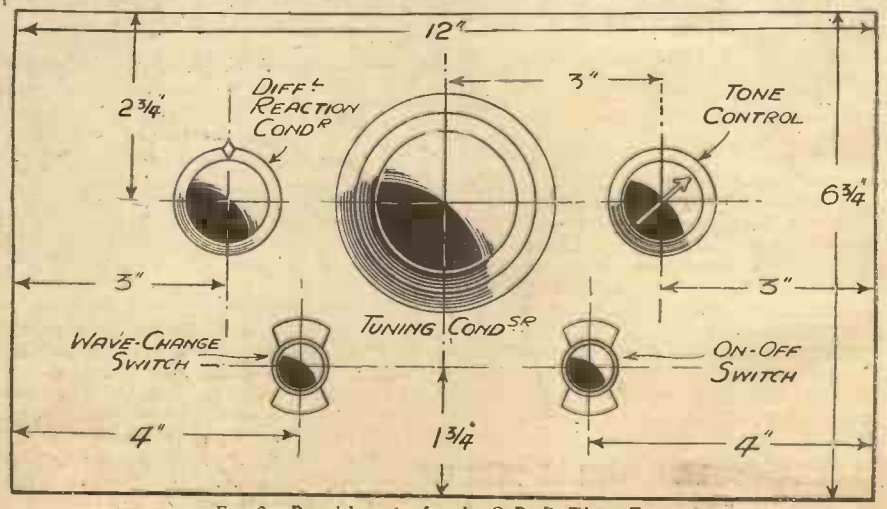


Fig. 2. Panel lay-out for the Q.P.-P. Three-Four.

THREE-FOUR

Output Valves Working on the Quiescent Push-Pull Principle

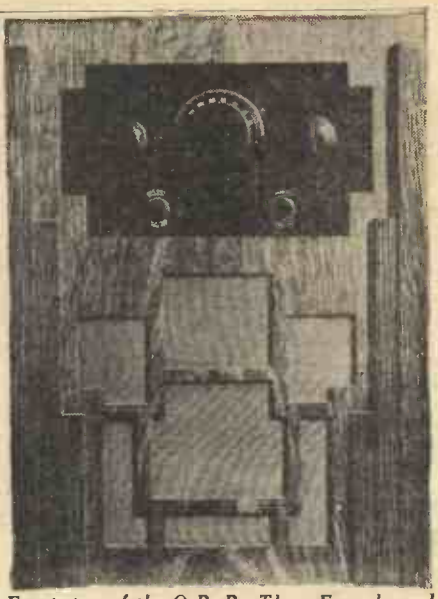
leads are attached direct to the valve sockets, the filament switch, and the other respective components, and to prevent them being pulled away by accident, a small bracket or other device should be attached to the undersurface of the baseboard to firmly clamp the multi-cord in its position. The grid-bias lead for the first L.F. valve is passed through a hole in the baseboard, after tying a knot in it. This prevents the lead from being pulled through and so breaking the connection to the grid of the first L.F. valve. There are no other points upon which we can dwell so far as the actual construction is concerned, and we may therefore pass to the actual testing.

Testing

Plug the valves into the sockets, so that the two pentode valves are at the extreme left, and the L.2 valve next to them. The grid-bias positive lead should be inserted in the positive socket of the 16.5 volt battery, and G.B. 1 plugged into the 4.5 volt socket. The remaining grid-bias plug is inserted in the 15-volt socket. H.T.3 is inserted in the 120-volt socket of the H.T. battery, and H.T.1 and H.T.2 should be inserted in sockets slightly lower than this. If you have a milliammeter you can experiment by trying different sockets for these two plugs. Without altering the value of grid-bias applied to the two output valves you will find that the variation of the high tension applied to the priming grids of the pentodes will vary the amount of current which is taken from the high tension battery, and as one of the chief features of the Q.P.P. system is economy, the anode current should naturally be kept as low as possible. The total current taken by the four valves in this receiver will be found to be just under 6 milliamps when no signal is being received. The output, when the valves are biased to give this figure, will be found quite sufficient for the normal home. If economy is not such an important feature, the grid-bias value may be lowered, and in this way it is possible to experiment and obtain a value which gives the volume and consumption to suit the individual requirements. Actual figures obtained with the experimental receiver which is illustrated, and which employs the components and valves shown in the list of components attached to this article is as follows:

Standing anode current of the complete

(Continued on page 1152.)



Front view of the Q.P.-P. Three-Four housed in its attractive Clarion cabinet.

THE WIRING DIAGRAM OF THE Q.P.-P. THREE-FOUR IS GIVEN OVERLEAF

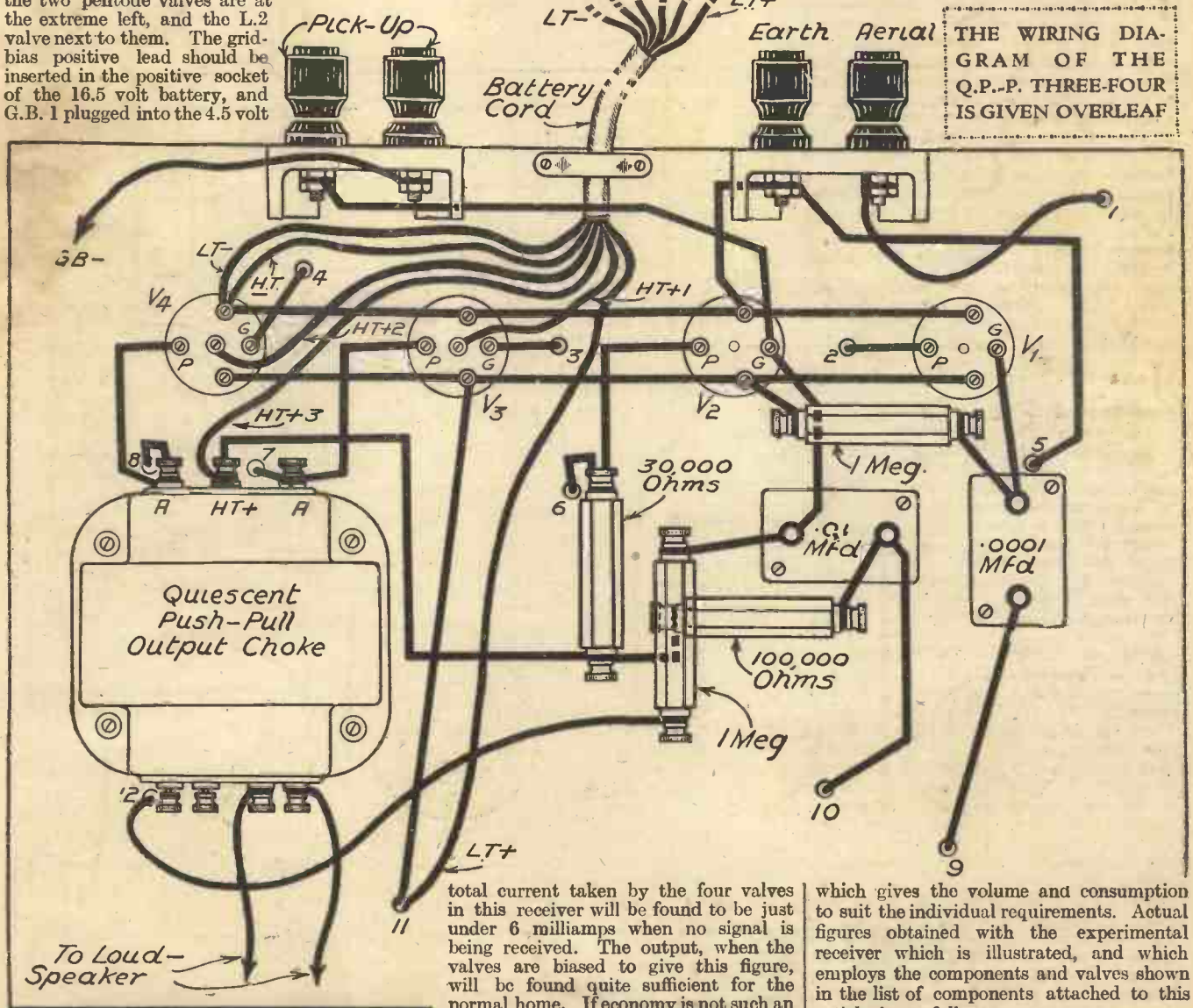


Fig. 3.—Sub-baseboard wiring diagram of the Q.P.-P Three-Four.

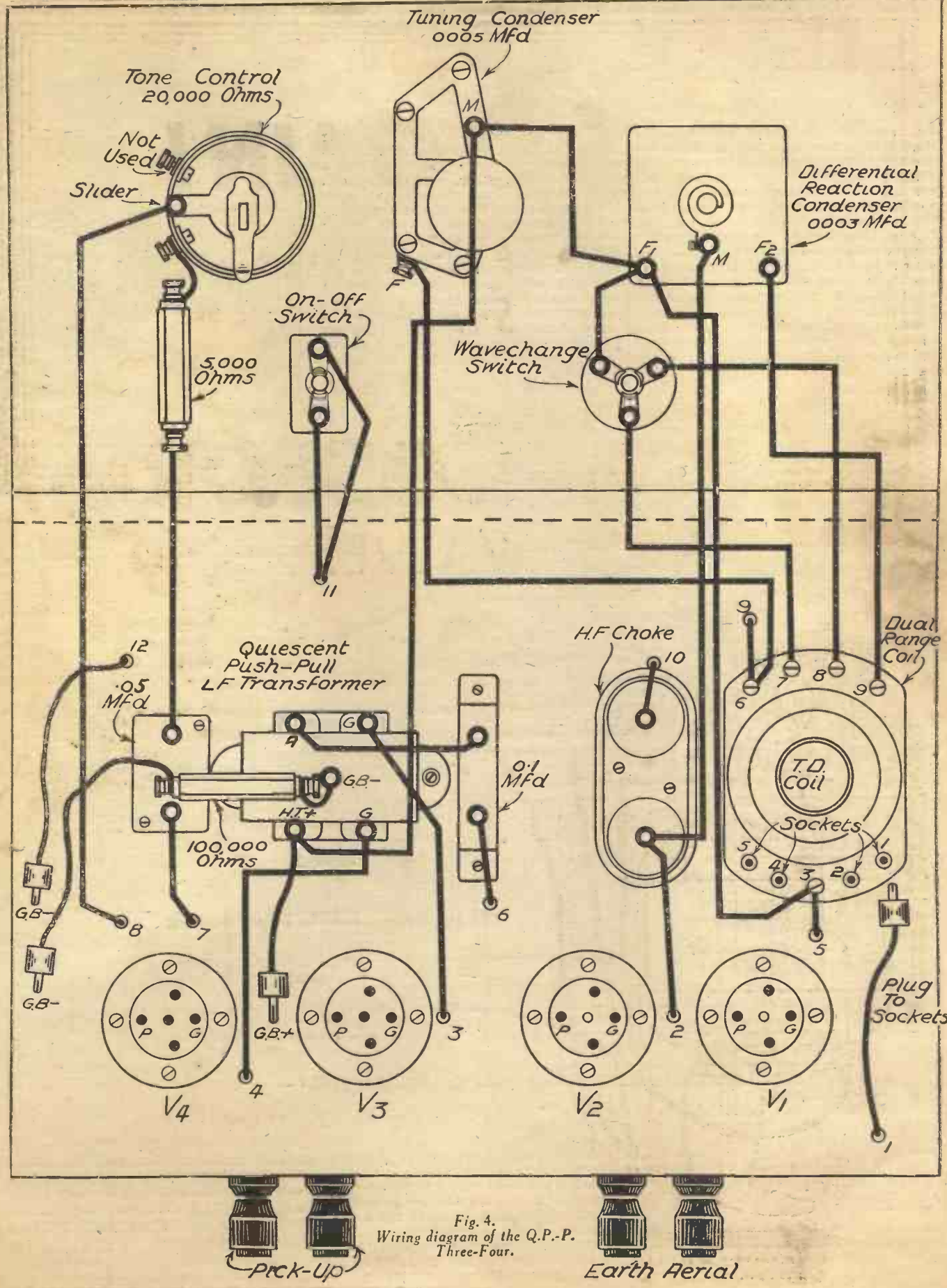


Fig. 4.
Wiring diagram of the Q.P.-P. Three-Four.

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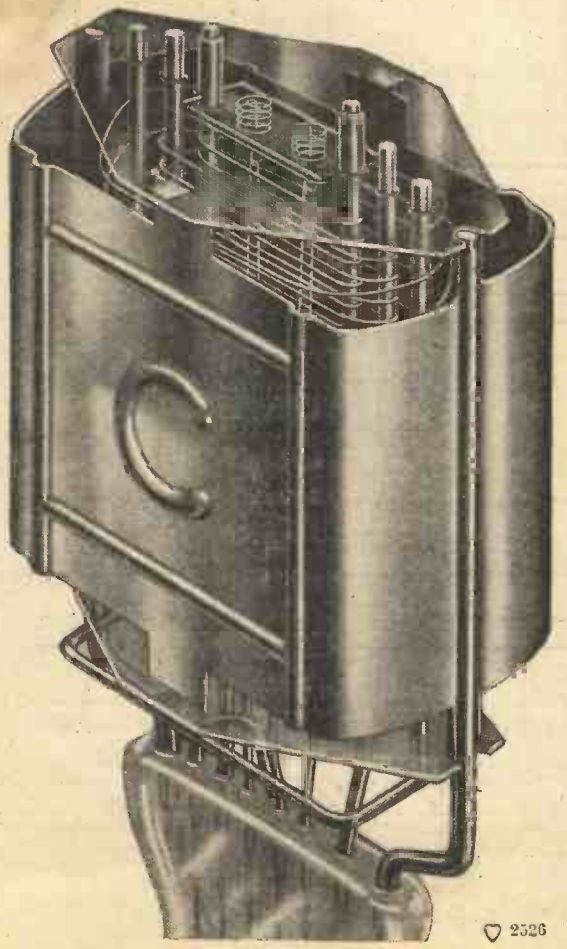

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Capacity Mfd.	Type M. Moulded-in with Soldering Tags.		Type 34. Upright with Terminals.		S.P. Type (Series-Parallel)	
	New	Old	New	Old	New	Old
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
.00005	0 8	1 0	1 3	1 6	—	—
.0001/3	0 8	1 0	1 3	1 6	2 0	2 4
.0004/5	0 9	1 0	1 3	1 6	2 0	2 4
.001/4	1 0	1 4	1 6	1 10	2 6	2 10
.005/6	1 6	1 9	2 0	2 6	3 0	3 6
.01	2 0	2 3	3 0	3 0	—	—

PAPER CONDENSERS. TERMINAL TYPES

Capacity Mfd.	Type 50/61 200 V. D.C. Working		Type 80/81 400 V. D.C. Working		Type 101 800 V. D.C. Working		Type 121 1,500 V. D.C. Working	
	New	Old	New	Old	New	Old	New	Old
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
0.1	—	—	2 0	2 3	—	—	—	—
0.25	—	—	2 3	2 9	—	—	—	—
0.5	2 4	2 7	2 6	3 0	5 0	6 3	7 0	8 0
1	2 6	2 10	3 0	3 9	6 0	7 6	8 6	10 0
2	3 6	3 10	4 0	5 0	9 0	10 0	13 6	15 2
3	5 0	5 3	6 0	7 6	—	—	—	—
4	5 6	6 3	7 0	8 6	17 6	19 4	25 0	28 6
5	7 3	8 0	9 0	10 6	22 0	24 6	31 0	35 0
6	8 6	9 0	10 6	12 0	25 0	28 6	37 6	42 0
8	11 0	11 9	14 0	15 0	—	—	—	—
10	14 0	14 6	17 6	18 0	—	—	—	—

PAPER CONDENSERS. SOLDERING TAG TYPES

Capacity Mfd.	Type 65 500 V. D.C. Test 250 V. D.C. Working		Type 84 750 V. D.C. Test 350 V. D.C. Working		Type 87 1,500 V. D.C. Test 450 V. D.C. Working	
	New	Old	New	Old	New	Old
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
0.1	1 8	1 9	2 0	2 0	2 2	2 3
0.25	1 10	1 11	2 2	2 4	2 4	2 6
0.5	1 11	2 0	2 4	2 8	2 6	2 10
1	2 0	2 3	2 9	3 3	3 0	3 8
2	2 8	3 0	3 9	4 6	4 0	4 9
3	—	—	—	—	—	—
4	5 0	5 0	6 9	7 6	7 3	8 0
5	—	—	—	—	—	—
6	7 0	7 9	10 0	10 9	—	—
8	9 0	9 6	13 0	14 0	—	—
10	11 6	12 6	16 0	16 6	—	—

ELECTROLYTIC CONDENSERS

Capacity Mfd.	Type 802. Aqueous 440 V. D.C. Working		Type 801. Aqueous 460 V. D.C. Working		Type 902. Dry 500 V D.C. Working	
	New	Old	New	Old	New	Old
8	6 0	9 0	—	—	6 6	9 0
4	5 0	8 0	—	—	—	—
7	—	—	6 0	9 0	—	—

THE PRICES OF ALL OTHER TYPES AND CAPACITIES NOT MENTIONED ABOVE REMAIN UNALTERED

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2458

THE PROBLEMS OF FAITHFUL REPRODUCTION

Interesting Notes—

—By P. E. BARNES, B.Sc.

THE object of this article is to set out the important points on which faithful reproduction of broadcasting is dependent, and to indicate to the radio amateur general principles on which he may profitably work in an attempt to improve the standard of his set, and which can be modified in accordance with his particular needs.

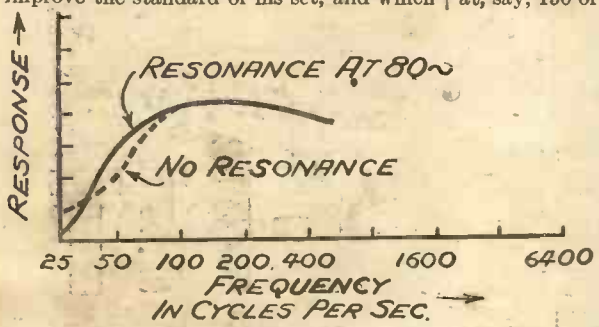


Fig. 1—A response curve showing resonance effects.

Given a reasonably good loud-speaker which is free from any objectionable resonances, there are really three problems which we must consider:—

(1) to retain sufficient bass to give the body to the reproduction.

(2) to retain sufficient of the upper frequencies to give to each orchestral instrument its own characteristic tone.

(3) to eliminate, or at any rate to reduce as far as possible such undesired additions to the output as heterodyne whistles, needle scratch, and so on

Such questions as the elimination of "man-made static," mains hum and similar problems are really outside the province of this article, and in fact would need several articles each for their consideration.

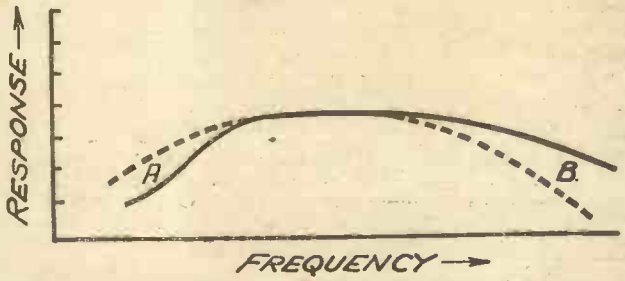


Fig. 2.—Lower frequencies reduced, and upper frequencies strengthened.

Bass Reproduction

Let us now consider these problems in order, and begin with the difficulties in the way of satisfactory bass reproduction. A transformer must be of larger size to deal adequately with lower frequencies, while the movement of the loud-speaker diaphragm, while being slower will be larger—these are the two fundamental difficulties with which we have to deal.

The inconvenience of large transformers has led recently to the introduction of special alloy steel cores, which will give the same properties as the larger soft iron cores only if they are so connected that none of the steady anode current is allowed to pass through the windings. If these are connected correctly, then results will be quite as good as, if not better than, with the old arrangement. Do not be led away, however, by the presence on the market of small transformers with the ordinary soft iron cores, usually of cheap foreign make. If the core is to have certain properties, then it must either be of large size or consist of special alloy.

The problem of the greater movement of the loud-speaker diaphragm for low notes is only serious with the balanced armature or similar types of moving-iron speakers, where the moving parts have to travel across a very small air gap. Here it is necessary to allow the response to die away gradually in the extreme bass, beginning at, say, 150 or 200 cycles. Fortunately the human ear is a very adaptable organ, and if the reproduction is well maintained down to the point where the cut off really begins, it will reconstruct many of the lower frequencies from the harmonics which are not reduced in intensity, and there will be very little falling off in quality. Of course, we must make the best use of the reduced bass notes by the use of a large baffle, either of the box type, now the custom, or flat. In either case the wood should not be less than half an inch thick if the full benefit is to be obtained.

Inductor and Moving-coil Speakers

The inductor dynamic and moving-coil speakers have the moving portions travelling in a direction which is parallel to the face of the magnet, and consequently these types can handle very large volumes with the bass at its correct value without difficulty. Hence with them it is usual to compensate for the usual loss of bottom notes in the amplifier by a resonance of some kind, either electrical or mechanical. Provided that this resonance is not too pronounced, it is almost indistinguishable from the "real thing," but it must be remembered that transient noises such as pistol shots will tend to set the speaker resonating always at this frequency, and so produce an objectionable booming.

The effect of such a resonance on the response curve can be seen in the diagram (Fig. 1). The bass output is maintained at its true value further down the scale, and a sharp cut off follows. Fortunately the ever-accommodating human ear comes to our assistance again, for it will scarcely miss the extremely low notes, which were never very loud anyway, while it will appreciate the increased output in the region of 80 cycles or so which is provided.

The mechanical resonance is usually obtained from the diaphragm surround, and is generally arranged by the makers to be quite unobjectionable. If it occurs at too high a frequency for the particular set, the surround must be slackened off to a suitable degree. The electrical resonance to be obtained by altering the value of the coupling condenser in a parallel-fed L.F. amplifier to such a value that it will produce a resonant circuit with the primary of the transformer is a very interesting field for experiment. The most suitable value can be calculated if the exact characteristics of the transformer are known, but if values around 0.05 mfd. are tried it will generally be quite easy to notice the effect on the output.

By-passing the Higher Frequencies

The common custom of shunting the primary of a transformer or the output terminals with a condenser to by-pass the higher frequencies is often abused in this connection, and the idea employed to give a "tone-lowering" effect under the impression that a lack of bass will be counteracted thereby. Fig. 2 shows the result, instead of providing the bass which is lacking at A, the upper frequencies and harmonics are reduced at B, with the result that violins sound like flutes and the other instruments similarly lose their character.

This is shirking the real issue, and it is the cause of the characterless reproduction so often described as "mellow." Henry Wood and Henry Hall, Berlin and Beethoven are the standards at which we should aim, and we shall not attain them by pretending to prefer something which we have to admit is far below. If we have succeeded in providing the bass response which we require, we find in general that the upper frequencies are lacking, rather than in excess.

A receiver which has two or more sharply tuned circuits will cut off a considerable amount of our high notes as compared with a band-pass filter, due to the cutting off of the outer sidebands of the transmission, while if we have a condenser of more than about .0005 mfd. as part of a H.F. filter in the detector valve anode circuit, we have another possible source of high-note loss. The effect is shown in Fig. 3.

(To be continued.)

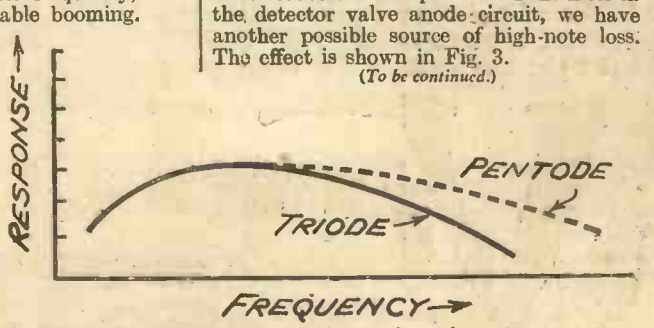
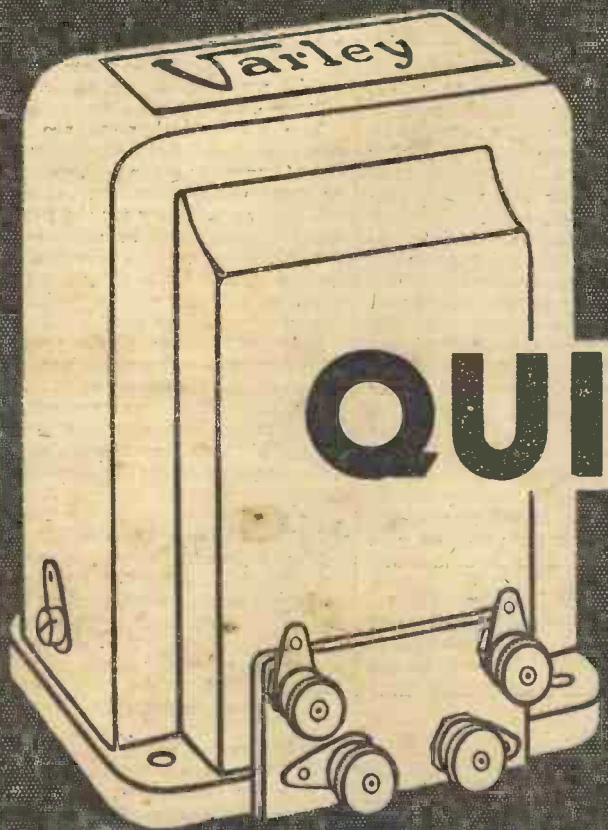


Fig. 3.—Response curves of pentode and triode valves.

Specified in the Q.P.P. 3-4



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You are building the Practical Wireless "Q.P.P. 3-4"? Or adapting your existing battery set to Q.P.P.? ***In either case can you do better than choose Varley?***

Varley Quiescent Push-Pull Components are made in a wide range to suit your every need . . . an Input Transformer, ratio 9-1, and three different Output Transchokes to give you accurate matching. Each Varley Output Transchoke is suitable for either high or low impedance speakers, thus avoiding the losses of an additional matching transformer and its expense—a double economy.

For Q.P.P. everything depends upon the exact characteristics of the transformers. For your "Q.P.P.3-4" use the correct transformers—Varley DP 36 and DP 38—and you will get the results the designers got!

DP36. QUIESCENT PUSH-PULL INPUT TRANSFORMER

Ratio 9/1
Primary D.C. Resistance . . . . . 825 ohms.
Total Sec. D.C. Resistance . . . . . 9300 ohms.
Prim. Inductance . . . . . 30 henries with no D.C.
. . . . . 27 „ „ 2 M.A.
. . . . . 22 „ „ 4 M.A.
PRICE, *including Royalty* **17/6**

DP38. QUIESCENT PUSH-PULL OUTPUT TRANSCHOKE

Ratios . . . . . 3/1 and 50/1
Primary D.C. Resistance . . . . . 400 ohms.
Sec. D.C. Resistance (3/1) . . . . . 130 ohms.
Sec. D.C. Resistance (50/1) . . . . . 9 ohms.
Primary Inductance . . . . . (each half)
8 henries with D.C. current of 26 M.A.
PRICE, *including Royalty* **16/6**

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5 New FERRANTI Transformers for QUIESCENT PUSH-PULL

1 **Type AF11c.** Ratio 1/10. Inductance 50/25 hys. 0/10 m/A. Good amplification curve, giving approximately double the amplification at 50 cycles hitherto obtainable. Price **34/-**

2 **Type AF12c.** Ratio 1/9. Inductance 30/15 hys. 0/6 m/A. A lower priced transformer which yet has a good performance and a higher step-up than others in this price class. Price **15/-**

3 **Type OPM11c.** P.P. Output Transformer. Ratio 35, 56 and 100/1. Specially suitable for use with AF11c, will carry a current, if necessary, up to a maximum of 100 m/A in Q.P.P. (200 m/A in ordinary P.P.). For operating low resistance M.C. Speakers. Primary Res. approx. 230 ohms. Price **26/6**

4 **Type OPM12c.** Ratios 1.7 and 40/1. To correspond in quality with the AF12c. Carries D.C. Primary Current up to 75 m/A in Q.P.P. (150 m/A in ordinary P.P.). For use with high resistance Speakers or low resistance M.C. types with or without built-in Transformers. Primary Res. approx. 210 ohms. Price **15/-**

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ALL PRICES INCLUDE PUSH-PULL ROYALTY

NOTE.—Either of these Quiescent Push-Pull A.F. Transformers may be used with any of the three Output Transformers mentioned above. Both the AF11c and AF12c types may be used in ordinary Push-Pull circuits, or as straight A.F. Transformers.

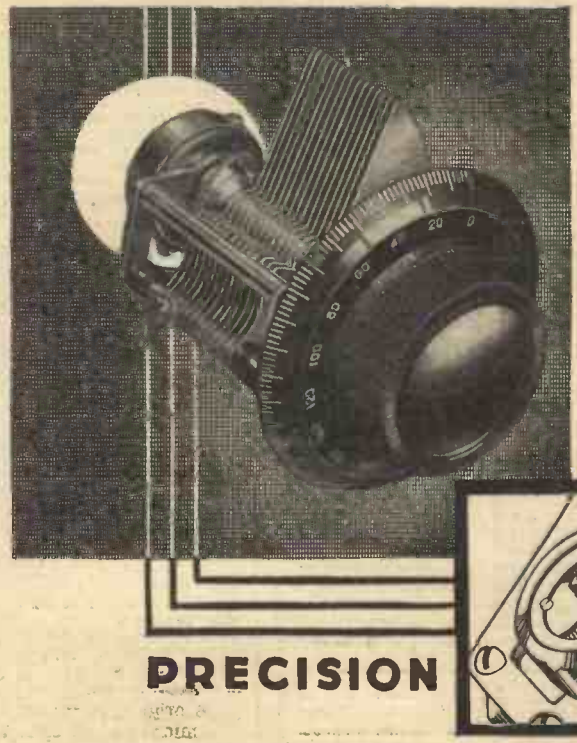
This system enables much greater power to be obtained from Battery Operated Receivers and Amplifiers for a given expenditure of High Tension Current than has hitherto been possible. In fact, by its use, Power Output and Volume comparable to that given by the average Mains set are obtainable, even when employing the small H.T. Batteries in common use.

Ferranti Ltd. have produced these five Transformers to enable the experimenter to obtain the best possible results from Quiescent Push-Pull at reasonable cost. It will be noted that the inductances and ratios of these new Ferranti Transformers are unusually high.

FERRANTI TRANSFORMERS

FERRANTI Ltd., Hollinwood, Lancs. London: Bush House, Aldwych, W.C.2

SPECIFIED in the Q.P.P. 3-4



When you are buying the components for your "Q.P.P. 3-4" remember this:— the condensers used by "Practical Wireless" for the original model were the J.B. Popular Log (Slow motion type) and the J.B. Differential.

Build your "Q.P.P. 3-4" exactly as the original—then you are certain of fullest success. Follow the specification and use J.B.

J.B. POPULAR LOG CONDENSER
(as illustrated)

Slow-motion type (35/1). Capacity .0005. Complete with 3 in. dial, 8/6. Extra heavy gauge brass vanes. Rigid nickel-plated frame. High-grade ebonite insulation.

J.B. DIFFERENTIAL REACTION

.0003, 4/6. Insulated centre spindle. Bakelite dielectric between vanes.

Also Specified.

In this illustration the end cap of the J.B. Popular Log has been cut away to show the Epicyclic Friction Drive, which is smooth and sure in action and absolutely silent.

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Official Demonstration of the FURY FOUR *by special arrangement with Mr. CAMM, Editor of* PRACTICAL WIRELESS *at 159, Boro' High St.*

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	s.	d.
SIEMENS 120-volt H.T. battery, standard capacity ..	13	6
OLDHAM type 0.50 L.T. accumulators	9	0
SIEMENS 9-volt G.B. battery	1	0
BLOCK L.T. accumulators, 80 ampere hours capacity	11	6
OLDHAM 120-volt wet H.T. accumulators. (Or 12 monthly payments of 7/6)	4	1	0
ATLAS A.C.244 H.T. eliminators	2	19	6
ATLAS D.C. 15/25 H.T. eliminators for D.C. mains ..	1	19	6
ATLAS A.K. 260 H.T. eliminators, with trickle charger. (Or 12 monthly payments of 8/6)	4	10	0
CELESTION PPM Soundex permanent magnet moving-coil speaker, with input transformer	1	7	6
W.B. PM4 permanent magnet moving-coil speaker, with input transformer.. ..	2	2	0
COLLARO double spring gramo motor, automatic stop..	1	13	0

THE "Q.P.P." THREE-FOUR

SPECIFICATION

	£	s.	d.
1 Colvern TD. Coil		8	6
1 J.B. .0005 Slow Motion Variable Condenser, Type "P"		14	0
1 Ready Radio .0003 mfd. Differential condenser ..		3	0
1 T.C.C. fixed condenser type "S" .0001 mfd.		1	3
1 T.C.C. fixed condenser type "S" .01 mfd.		2	6
1 T.C.C. fixed condenser type 40 .05 mfd...		1	9
1 T.C.C. fixed condenser type 50 .1 mfd.		1	10
2 Erie resistances 1 megohm		2	0
2 Erie resistances 100,000 ohms		2	0
1 Erie resistance 30,000 ohms		1	0
1 Erie resistance 5,000 ohms		1	0
1 Watmel 20,000 ohm wire wound Volume Control ..		5	6
1 R.I. type "Q" transformer		16	6
1 Varley Transchoke type D.P.39		16	6
2 4-pin valveholders.. ..		1	0
2 5-pin valveholders.. ..		1	6
1 Permcol panel 12 x 7 drilled to specification ..		4	6
3 Belling Lee wander Plugs G.B.+, G.B.—1, G.B.—2			6
1 Belling Lee 6-way battery cord		2	6
Screws, Flex-wire, connecting wire, etc.		1	2
4 Valves to specification ..	1	18	0
1 Direct Radio "159" Type Cabinet in Walnut.. ..		18	6
	£7	5	0

KIT Model 1
As per detailed specification but without valves or cabinet **£4 : 8 : 6**
or twelve monthly payments of 8/3.

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As above but with valves without cabinet .. .. **£6 : 6 : 6**
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As above but with valves, "159" type consolette cabinet and W.B. PM.4 Permanent Magnet Moving Coil Loudspeaker .. .. **£10 : 2 : 6**
or twelve monthly payments of 19/-

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SPECIFICATION:

	£	s.	d.
1 Lissen Three-gang Coil Unit type LN5162	1	6	0
1 Erie 2-megohm Grid Leak with wire-ends	0	1	0
1 J.B. Unitune two-gang screened condenser .0005 mfd., with disc drive	0	18	6
1 J.B. Nugang Single screened condenser with disc drive ..	0	9	6
1 Ready-Radio .0003-mfd. Differential Reaction Condenser ..	0	3	0
1 Varley Pentode Nichoke.. ..	0	12	6
1 Erie 100,000 ohms resistance ..	0	1	0
2 Erie 30,000 ohm resistances ..	0	2	0
1 Erie 5,000 ohms resistance ..	0	1	0
4 Erie 1,000 ohms resistances ..	0	4	0
1 Set of 8 Erie Resistor coupling links	0	1	0
1 pair Panel Brackets	0	0	6
1 Ready Radio fuse holder and fuse	0	1	0
1 Wearite screened H.F. Choke Type HFPA	0	4	0
1 Ready Radio 3-pt. switch ..	0	1	6
1 Ready Radio S.G. H.F. Choke..	0	5	6
1 Kinva standard screened H.F. Choke	0	2	9
2 Dubilier .1-mfd. C.T. Condenser type B.E.31	0	6	0
Carried Forward	£5	0	9

	£	s.	d.
Brought Forward	5	0	9
3 Dubilier 1-mfd. Condenser type B.S.	0	6	0
2 Dubilier .0003-mfd. Condensers type 665	0	1	0
1 Dubilier .0002-mfd. Condenser type 665	0	0	6
1 Lewcos 50,000 ohm Potentiometer	0	3	0
1 Sovereign .0003-mfd. Preset condenser	0	1	3
1 Ready Radio 3-1 ratio L.F. Transformer	0	8	6
2 Belling Lee Wander plugs G.B. +, G.B.—	0	0	4
3 Clix sub-baseboard valve holders, 4-pin	0	2	0
1 Clix sub-baseboard valve holder, 5-pin	0	0	9
1 Belling Lee 4-way Battery Cord	0	1	9
3 Belling Lee terminal mounts ..	0	1	6
6 Belling Lee terminals A.E.P.U., L.S.+., L.S.—	0	1	3
1 Permcol Panel 16" x 8" drilled to specification	0	5	6
1 Drilled and foil covered baseboard 16" x 10" x ⅜", and 2 side strips 10" x 2"	0	4	0
Connecting Wire, Screws, Flex, etc.	0	0	8
	£6	19	3

FURY FOUR A.C. MAINS RADIOGRAM

Additional components required to those specified for battery kit.

SPECIFICATION:

	£	s.	d.
Brought Forward as above	6	19	3
1 Heayberd Fury Four Mains Transformer .. .. (Please state voltage and frequency of Mains supply.)	1	4	0
1 Westinghouse H.T.8 Metal Rectifier	0	18	6
1 Igranic type C.H.2 Smoothing Choke	0	9	6
2 T.C.C. 4-mfd. condensers 400-volt working	0	14	0
2 T.C.C. 2-mfd. condensers 400-volt working	0	8	0
Carried Forward	£10	13	3

	£	s.	d.
Brought Forward	10	13	3
1 Erie Pentode Bias Resistor 350-ohms	0	1	0
1 Erie Bias Resistor 1,000-ohms	0	1	0
1 Becker Mains on-off switch type 460	0	1	11
1 Ready Radio Radiogram Switch	0	2	9
1 Goltone complete Mains Lead with socket, plug and plug adaptor	0	3	0
Twin mains flex, extra wire, screws, etc.	0	1	4
	£11	4	3

"FURY FOUR" BATTERY KITS

KIT Model 1
As detailed specification, less Valves and Cabinet.
£6 : 19 : 3
or twelve monthly payments of 12/9.

KIT Model 2
As detailed specification (with 4 Battery Valves less Cabinet)
£9 : 16 : 9
or twelve monthly payments of 18/3

KIT Model 3
As detailed specification (with Valves and Cabinet)
£10 : 17 : 9
or twelve monthly payments of 20/-.

KIT Model 4
As detailed specification, with Valves and "159" Fury Four Walnut Consolette Cabinet and Celestion PPM Soundex Permanent Magnet Moving Coil Speaker **£13 : 0 : 0**
or twelve monthly payments of 24/6.

"FURY FOUR" A.C. MAINS KITS

KIT Model A.C.1
As per detailed specifications **£11 : 4 : 3**
or twelve monthly payments of 21/-.

KIT Model A.C.2
As above, including 4 A.C. Mains Valves **£14:15:9**
or twelve monthly payments of 27/6.

KIT Model A.C.3
As above, including "159" type Consolette Cabinet and Celestion Soundex Permanent Magnet Moving Coil Speaker **£18 : 0 : 0**
or twelve monthly payments of 33/-.

KIT Model A.C.4
Complete A.C. Mains Radiogram Equipment as per detailed specification including Valves and "159" type "Fury Four" Radiogram Cabinet, Celestion Soundex Speaker, Collaro A.C. Gramophone Motor, Bowyer Lowe A.E.D. Pickup with Volume Control **£24 : 0 : 0**
or twelve monthly payments of 45/-.

Direct Radio

CASH, C.O.D., and EASY PAYMENT ORDER FORM

To DIRECT RADIO, LTD., 159, Boro' High Street, London Bridge, S.E.1.
'Phone: Hop. 3000. 'Grams: "Dirrad, Sedist, London."

Please dispatch to me at once the following goods.....
(a) I enclose
or which (b) I will pay on delivery
(c) I enclose first payment of
{Cross out line not applicable}

NAME .....
ADDRESS ..... Practical Wireless, 4-3-33.

ACCESSORIES FOR THE "FURY FOUR"

A.C. MAIN VERSIONS

	£	s.	d.
COLLARO A.C. Induction Gramo Motor	2	10	0
COLLARO Complete A.C. Gramo Motor Plain Unit, including Motor Pick-up and volume control. (Or 12 monthly payments of 7/6)	4	0	0
BOWYER LOWE A.E.D. Pick-Up with self-contained volume control	1	15	0
B.T.H. Minor Pick-up with self-contained volume control	1	5	0
W.B. P.M.2 Permanent magnet moving coil speaker. (Or 12 monthly payments of 8/-)	4	5	0
EPOCH A.2 permanent magnet moving coil speaker. (Or 10 monthly payments of 7/-).. ..	3	3	0
IGRANIC D.9 permanent magnet moving coil speaker	1	12	6
Direct Radio "159" "Fury Four" Radiogram Cabinet	3	15	0

"Q.P.P." AMPLIFIER

SPECIFICATION.

	£	s.	d.
1 R.I. "Q" Transformer ..		16	6
1 Ferranti Type O.P.M. 12C tapped output transformer		15	0
1 T.C.C. Type "S" .01 mfd. fixed condenser		2	6
1 T.C.C. Type 40 .05 mfd. fixed condenser		1	9
1 Ready Radio On/Off switch			10
1 Erie resistance 15,000 ohms		1	0
1 Erie resistance 10,000 ohms		1	0
1 Permcol Ebonite Panel drilled to specification 10 x 7		4	0
1 baseboard 10 x 8		1	6
1 Coil connecting wire ..			4
5 Belling Lee wander plugs			10
6 Belling Lee Terminals		1	3
2 5-pin valveholders.. ..		1	6
Screws, Flex-wire, etc. ..		1	6
2 Pentode Valves, low consumption type	1	15	0
	£4	4	6

KIT Model 1
As per detailed specification without valves .. .. **£2 : 9 : 6**
or six monthly payments of 9/6.

KIT Model 2
As above but including valves **£4 : 4 : 6**
or ten monthly payments of 9/6.

Three Valve PUSH-PULL DETECTOR

SPECIFICATION.

	£	s.	d.
1 Panel drilled 8in. x 7in...		3	3
1 Strip drilled 8in. x 1½in...		1	3
1 Baseboard 8in. x 7in. ..			9
2 Panel Brackets			6
1 Ready Radio Micalog Tuning Condenser 0005 mfd..		3	6
1 Ready Radio Moulded Slow Motion dial..		2	6
1 Set of Wire, Formers, Terminals, etc., for special coil		5	6
1 RI Hypermite L.F. Transformer		12	6
3 4-pin valveholders.. ..		1	6
1 2 meg. Grid Leak wire ends			10
1 Ready Radio On/Off switch			10
8 Belling Lee terminals ..		1	8
Screws, flex, connecting wire,		1	2
3 Valves to specification ..	1	2	9
1 Direct Radio "159" type Walnut Cabinet		15	6
	£3	14	0

Note. The Coil can be supplied ready wound and tested. Price 8/6.

KIT Model 1
As per detailed specification without valves or cabinet .. **£1 : 16 : 3**

KIT Model 2
As above but including valves **£2 : 19 : 0**

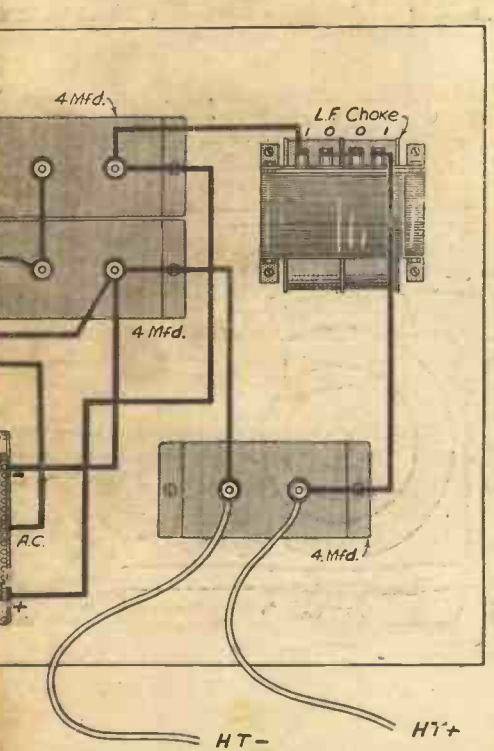
KIT Model 3
As above and including valves and cabinet .. .. **£3 : 14 : 0**
or ten monthly payments of 8/3.

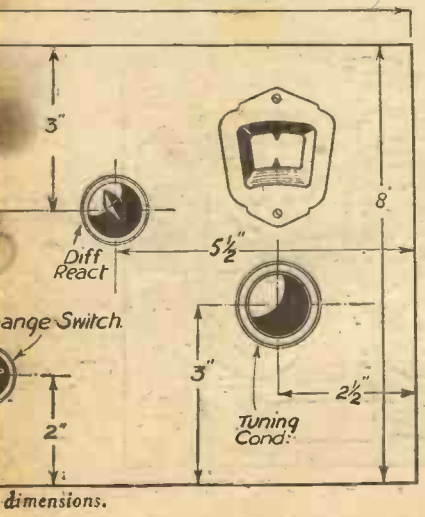
A.C. VERSION OF—

...y Four

...CAMM

...ALLY GUARANTEED





dimensions.

on to a piece of plywood of convenient size. It will only take about half-an-hour to wire up this, and the various connections should be made to the set. Note very carefully the arrangement of the flex for the heater leads of the mains valves. To join the unit to the set long leads are necessary, and in the illustration these are shown simply dropping down the back, but twisted to reduce the field. They may, if the reader so desires, be run along the baseboard and down the side of the cabinet for the sake of neatness. Also, if thought desirable, the reader may use valve-holders and valve bases, or some similar plug-in arrangement such as those sold by Bulgins for making the connections from the mains unit to the set. The actual connections are as follows: A lead is taken from the 2 mfd. fixed condenser to one of the loud-speaker terminals. Note that H.T. positive and H.T. negative leads are joined to the terminals on the 4 mfd. condenser on the mains unit; the loud-speaker lead remaining is connected to the centre terminal of the heater terminal on the mains transformer.

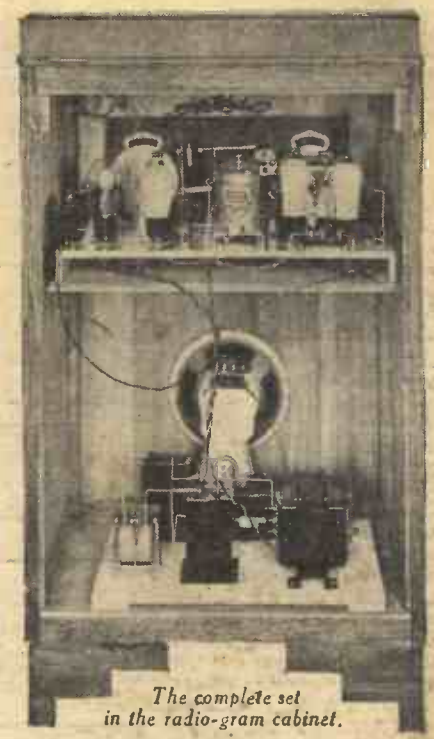
I think you will agree that the A.C. "Fury Four" has particularly attractive lines, and by means of the complete diagrams given here no difficulty in construction should be experienced. If, however, any little point is not made clear by these notes, please address a letter to me personally, and helpful advice will be yours by return of post.

There is no need for me to repeat the operating instructions, as they are virtually the same as for the battery model. I would repeat that my guarantee of free personal advice also holds for the A.C. "Fury Four."

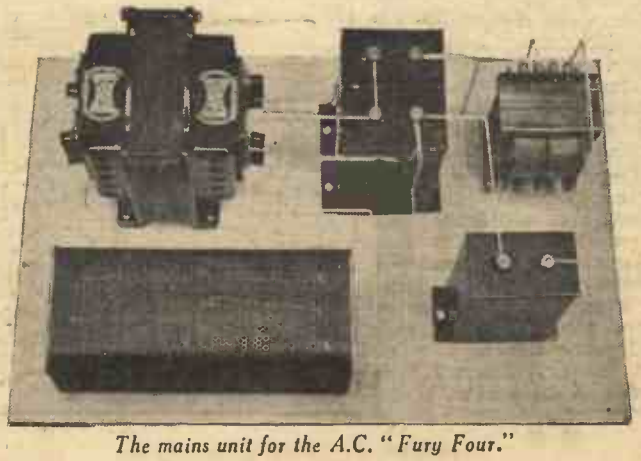
A small point concerning the Heayberd Mains Transformer. You will note that the tappings provided by the makers are for 200 volts, 230 volts and 250 volts. It is desirable in order to obtain best results to use a tapping higher than the voltage of which the set is to be operated should that voltage not coincide with one of the three tappings provided by the makers. For example, if your mains voltage is 220, use the 230 volt tapping, and if 240 volts, use the 250 volts tapping. A small point, and yet an important one is this; do not use a screw driver, pair of pliers or any tool whatsoever to make adjustments inside the set while it is on. Always switch off and thus avoid short circuits

THE A.C. FURY FOUR RADIO-GRAM

One Three-gang Coil Assembly. Lissen LN. 5162.
One Lotus Two-gang Condenser Type P.C.2.
One Lotus .0005 Condenser Type P.C.1.
One Sovereign Compression Type Condenser, Type J.
One Wearite S.G. Choke, Type H.F.P.A.
One Bulgin S.G. Choke, Type H.F.4.
One Peto-Scott Screened H.F. Choke.
One L.F. Transformer, Ratio 3 to 1. Igranic Midget.
One Telsen Pentode Output Choke, Type W.72.
Six Dubilier 1 mfd. Fixed Condensers, Type BB.
Two Dubilier .0003 mfd. Fixed Condensers, Type 665.
One Dubilier .0002 mfd. Fixed Condenser, Type 665.
Three 4 mfd. Dubilier Fixed Condensers, Type BS.
Two 2 mfd. Dubilier Fixed Condensers, Type BS.
Four Clix 5-pin Chassis mounting valve-holders.
Four 1,000 ohm Erie Resistors, 1 watt type.
Two 30,000 ohm Erie Resistors, 1 watt type.
One 100,000 ohm Erie Resistor, 1 watt type.
One 5,000 ohm Erie Resistor, 1 watt type.
Two 350 ohm Erie Resistors, 1 watt type.
One Lissen 2 meg. Grid Leak with wire ends.
One Lewcos 50,000 ohm Potentiometer.
One Telsen .0003 mfd. Differential Reaction Condenser.
One Ebonite Panel 16ins. by 8ins. Becol.
One Heayberd Fury Four Mains Transformer.
One Westinghouse H.T.8 Metal Rectifier.
One Igranic C.H.2 Smoothing Choke.
One Becker Mains On-Off Switch.
One Bulgin Radio-Gram switch, Type S.85.
One Simpson's Electric Turntable.
One Amplion Pick-up with Volume Control.
One W.B. Loud-speaker, Type P.M.4.
One Adaptagram Radio-Gram Cabinet.
Two Cossor MSG-LA Valves (metallized).
One Cossor MHL Valve (metallized).
One Cossor PT.41 Valve.
One yard Goltone Flexible Metallic Screening Tubing.
Glazite, Flex, Screws, etc.
One sheet Konductite Metallic Paper for covering baseboard.
One Baseboard, 19in. by 12in.
One Belling-Lee Terminal Block.
Two Belling-Lee Terminals, Type B, Aerial and Earth.



The complete set in the radio-gram cabinet.



The mains unit for the A.C. "Fury Four."

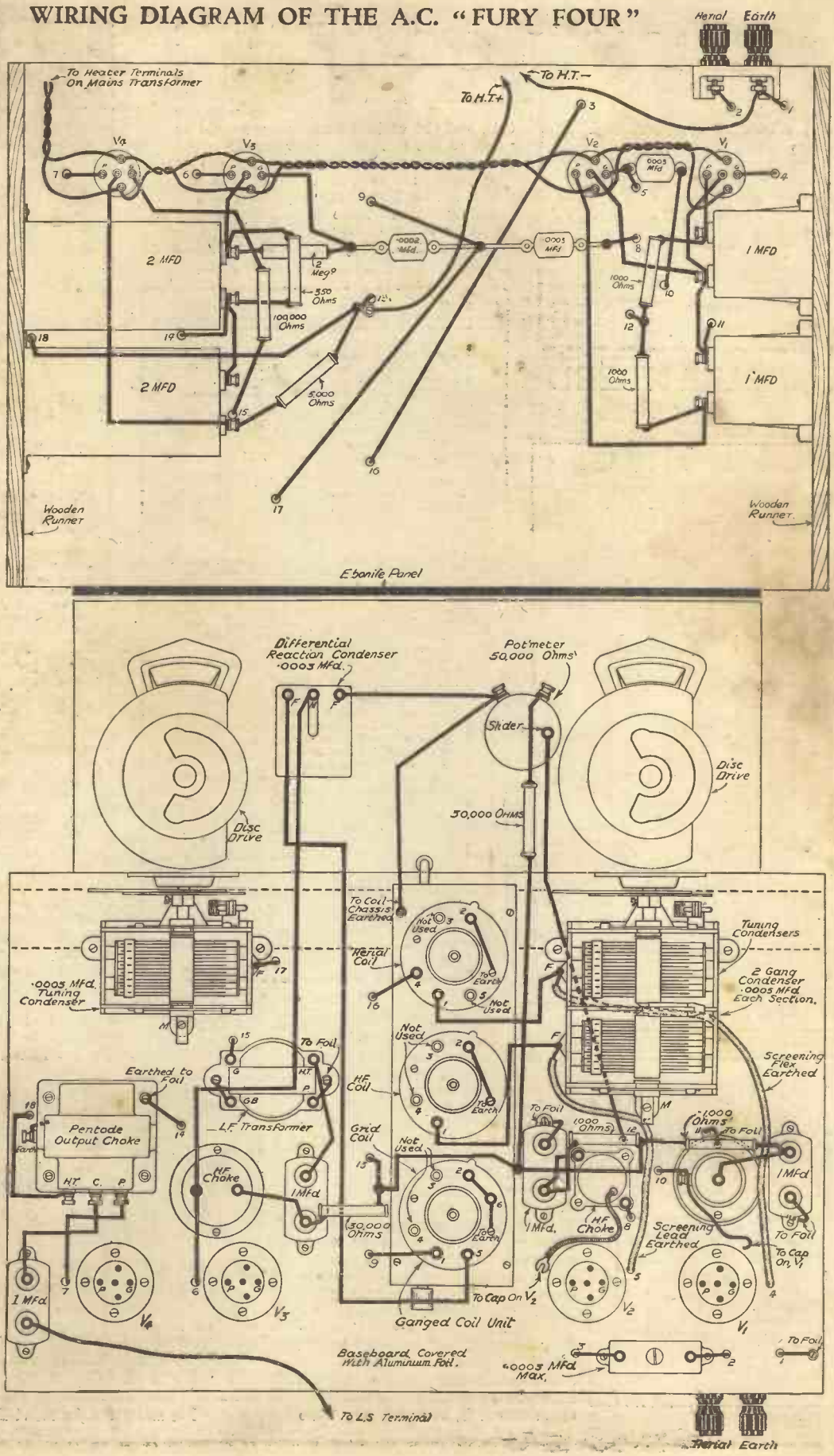
and shocks. Unlike battery sets, which immediately jump to life when switched on, it will take a few moments for the filament of the "A.C. Fury Four" to reach emission temperature. This is, of course, common to all valves using indirectly heated filaments.

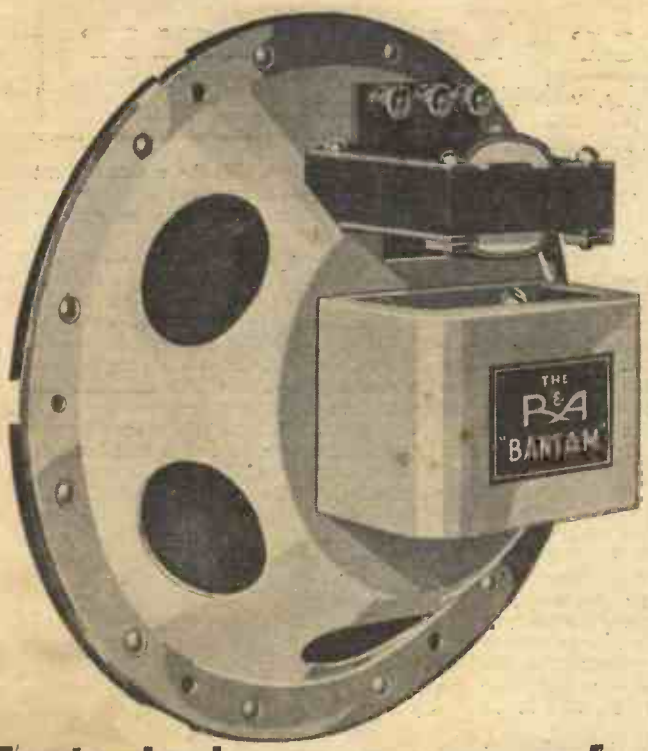
There is naturally much greater punch with the "A.C. Fury" than with the battery model, although the latter exceeds by many decibels that obtainable from the normal four valve wireless set.

And now concerning the many hundreds of letters I have received from readers who have already built the battery model of the "Fury Four." I have just space to deal with a few of the points raised by my correspondents. Firstly, my experiments with the D.C. version have now reached such a stage that I can say that I shall shortly deal with a D.C. version of it. That brief statement answers at one fell swoop some dozens of letters to which I have, of course, also replied personally. Regarding adapting the "Fury Four" so that it will also receive the short waves, I am experimenting with that end in view, but I must say that, whilst such an adaptation is quite possible, I have been quite unsuccessful in getting more than three or four short wave stations, and then only at weak volume and even then not consistently. I have come to the conclusion that it can only be done satisfactorily by means of an adaptor, but I shall write more about this later; for whilst I realise that there is a great amount of interest in receiving short waves, I am yet to be convinced that the majority of listeners require to do so. The present state of short wave reception is not such that it is possible easily to tune in short wave stations with certainty and consistency. At present short wave reception is for the skilled experimenter only, but we are continuing our experiments and investigations and will pass on the results as soon as they have been collected into tangible form.

Some readers have written asking me to vary the design to suit local conditions. These I am bearing in mind and will give them considered treatment in greater issue. I have not been able to alter the design to suit individual readers' lists of components. I have struck a careful balance with the components I specify, and my guarantee relates specifically to "Fury Fours" built with those components.

WIRING DIAGRAM OF THE A.C. "FURY FOUR"





Exclusively specified for the 'Q.P.P. Three-Four'

27/6 including 3-ratio Ferranti Transformer

described in this issue

The R. & A. "Bantam" has been specially chosen by the designer for use with the "Q.P.P. Three-Four" because it reproduces speech and music with such remarkable fidelity and purity, and handles a generous input without overload.

Indeed, the quality of reproduction is not equalled by many similar instruments of much higher price, and none is so well adapted to the requirements of the "Q.P.P. Three-Four," hence the designer's exclusive choice of the "Bantam." Your dealer can supply.

Purchase a 'BANTAM' the reproducer specified by the designer of the 'Q.P.P. THREE-FOUR'

The R&A "BANTAM"

PERMANENT MAGNET MOVING COIL REPRODUCER

REPRODUCERS & AMPLIFIERS, LTD., WOLVERHAMPTON.

"GOLTONE"

SCREENED DUAL-RANGE COILS ON METAL CHASSIS

For modern receiver designs, these "Goltone" matched Dual-Range units will meet all requirements.
Type GGR—Tuned grid with separate reaction and aerial tap.
Type GGO—Tuned grid with reaction and alternative aerial taps.
Type GGC—Special aerial coil with three tappings. No reaction.
Type GBA—Band-pass aerial coil with coupling winding.
Type GBS—Band-pass secondary coil with separate coupling winding.
Obtainable from all First-Class Radio Stores. Refuse Substitutes—if any difficulty, write direct.,

Price for ALL TYPES **5/9** EACH.

FREE Send for large Radio Catalogue and three four-page folders, with 1933 circuits and description of the various Goltone Screened Coils.

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FREE Ask for the ETA "Comparative Table" No. 13 showing which ETA valves to use in place of your old ones. Technical advice gladly given. Write to

THE ELECTRICAL TRADING ASSOCIATION, Aldwych House, Aldwych, W.C.2.

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THE INTERNATIONAL VALVE

As low in price as a really good valve can be

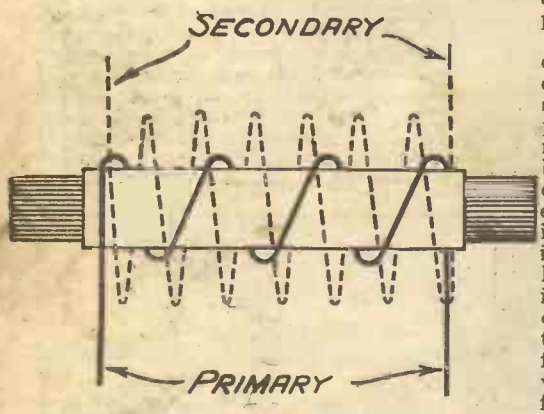
The A.C. Eliminator Transformer

An Explanation of its Underlying Principles, with Notes on its Use

By G. H. WRAY, F.C.S.

IT is beyond dispute that practice is generally found to be more interesting than theory, but however practical one desires to be, it is impossible to travel very far in any scientific pursuit without realizing that practice and theory go hand in hand, and that lack of some theoretical knowledge of the subject is a severe handicap.

The transformer is probably the most simple of all alternating current devices. It has no mechanically moving parts, its action depending upon what is known as electro-magnetic induction. Faraday discovered that by winding two insulated wires on an iron ring, and passing a current through one of the wires, a current was produced in the second wire every time he started or interrupted the current flowing in the first wire. This is the fundamental principle of the transformation of current, and although, of course, great strides have been made in the design of transformers since the time of Faraday's discovery, the actual principle remains unaltered.



A diagram showing the construction of a transformer.

Essential Parts

A transformer consists in its essential parts of two insulated coils of wire wound cylindrically outside one another on a straight iron core, as shown in the accompanying illustration. One winding, usually that nearest to the iron core, is termed the primary winding, and the other winding the secondary. In operation, an alternating current (that is, one changing in direction a number of times per second) in the primary winding, produces an alternating magnetic field in the iron core, and this produces an alternating current in the secondary winding.

A close analogy exists between a transformer and the gear box of, say, a motor-car, and a transformer may really be regarded as an electrical gear box. By the use of a transformer we can transform a strong alternating current to a weaker one, but of higher voltage, or vice versa, we can convert a weak current at high voltage into a strong current at lower voltage.

In the same way, a motor-car gear box is used either to transmit more power to the driving shaft, at a decreased number of revolutions per minute, or vice versa, an increased number of revolutions at a lower power. The proportion in which power is increased at the expense of speed, or speed at the expense of power, depends upon the number of teeth in the different gear wheels. Exactly the same thing applies in the case of a transformer, which may be either a step up, an equal ratio, or a step down transformer, according to whether the voltage induced in the secondary winding is greater, equal to, or less than that which is flowing in the primary winding. This depends upon the ratio between the windings, or in other words, the number of turns of wire of which each winding consists.

E.M.F. and Coil Windings

In all transformers, the electromotive force, or voltage, generated in the secondary winding, is compared to that applied to the primary winding, nearly in the same proportion as the relative number of turns on the two windings. That is to say, if the primary coil consists of 2,000 turns, and the secondary of 6,000 turns, the voltage generated in the secondary coil will be nearly three times as great as that used in the primary.

It is, of course, impossible to obtain from the secondary winding of a transformer more power than is supplied to the primary. The power put in and that taken out will be nearly equal. The output can never be quite equal to the input, because of certain inevitable losses of energy which occur in the transformer itself. These losses are due to the internal resistance of the windings, hysteresis and eddy currents in the iron core, and to the magnetizing current which flows continuously through the primary while the transformer is connected in circuit, whether current is being drawn from the secondary winding or not. The losses due to the resistance of the windings vary according to the load or output of the transformer, but the other losses remain practically constant irrespective of the load. In a well-designed transformer, the losses are reduced to a minimum, otherwise the over-all efficiency of the transformer would be impaired.

If a transformer were connected to a D.C. mains supply, the result would be a dead short circuit of the mains and serious damage to the primary winding, and it is interesting to examine why this does not happen when the transformer is connected to A.C. mains. Suppose that our mains supply is 230 volts alternating at 50 cycles per second, and that the primary of a transformer is connected to this supply, the secondary being on open circuit, that is, no current is being taken from it.

"No Load" Current

A small current known as the "no load," or magnetizing, current will flow through the primary circuit, the iron core of the transformer will be magnetized, the magnetic flux being alternating in character like the current which produces it and alternating at the same frequency as that current, in this case, 50 cycles per second. The transformer simply acts as a choke coil, a current being self induced in the primary circuit in a direction opposite to that in which the mains current is flowing through the primary.

This induced back pressure or counter voltage in the primary is almost equal to the impressed voltage or mains current, and it therefore impedes the flow of mains current through the winding. The current in the primary, while the secondary is on open circuit, is consequently automatically controlled by the reactive current set up, and its magnitude is just sufficient to maintain the magnetization of the iron core.

If the secondary circuit of the transformer be now closed upon a load such as a lamp of suitable voltage, current will be drawn from the secondary, and although no direct connection exists between the secondary winding and the mains supply, an increased current will flow through the primary to compensate for the current drawn from the secondary.

The reason for this is that the ampere turns of the secondary winding will be approximately opposed to those of the primary and will tend to reduce the density of the magnetic field in the iron core. This in turn tends to reduce the back pressure or opposing voltage, self-induced in the primary winding, and therefore allows an increased current to pass from the supply mains through the primary, to balance the power drawn from the secondary. In this way, readjustment of the primary current automatically follows any variation in the current taken from the secondary, and the action of a transformer is therefore practically self-regulating.

Where more than one transformer is connected to the supply mains, the primary circuits are connected in parallel. It might appear that it would be more economical to connect them in series in order to utilize the same primary current in each primary winding, in the same manner as installing a number of water wheels in the same stream, but this is impracticable, owing to the fact that any change in the current taken from one transformer affects the electromotive force set up in the secondary circuits of the other transformers.

Q.P.-P. THREE-FOUR

(Continued from page 1131.)

receiver: 6 mA.

Maximum current on full volume with dance band: 12 mA.

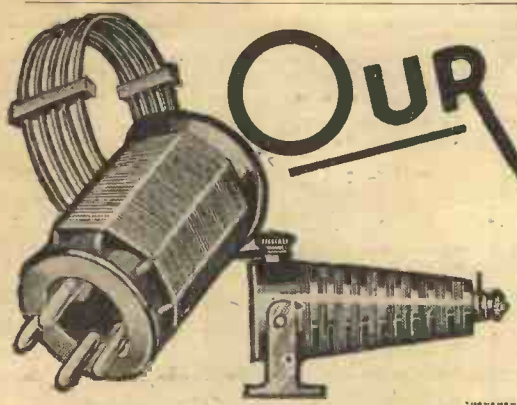
Mean current consumption at maximum volume over one hour's reception: 9 mA.

Maximum current on volume which would satisfy most listeners: 9 mA.

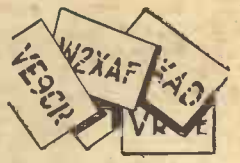
Mean current consumption under the above conditions: 7.5 mA.

Range of Reception

Obviously, as this receiver only employs a detector stage followed by low frequency amplifiers, the range is not enormous. The use of reaction does, however, enable a number of stations to be tuned in, although the full advantage of the Q.P.-P. feature is not felt on all of these stations. A really good input to the detector is required, and therefore the receiver should be looked upon as a local station set designed to give a high quality, good volume output comparable with a mains-operated receiver, but at only a trifle of the cost, and with the very minimum of cost in upkeep.



OUR SHORT-WAVE SECTION



GETTING THE BEST FROM A SHORT-WAVER

By FRANK PRESTON, F.R.A.

In this article a few methods of improving the performance of short-wave receivers are explained.

A SHORT-WAVE receiver is, basically, an extremely simple instrument having a minimum number of components arranged in a straightforward manner. Despite this, and although simplicity generally leads to high efficiency, there are a number of little refinements and modifications which often provide a surprising improvement in reception. Operating conditions are generally so critical that even the mere changing of the detector valve for another of similar type, but having very slightly different characteristics, might result in the set becoming much "livelier" and bringing in fifty per cent. more stations. Similarly, exchanging the grid leak for one of higher value often makes quite a surprising difference.

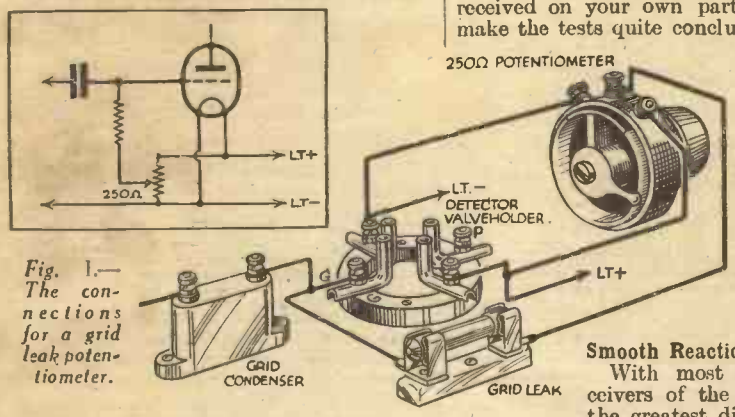
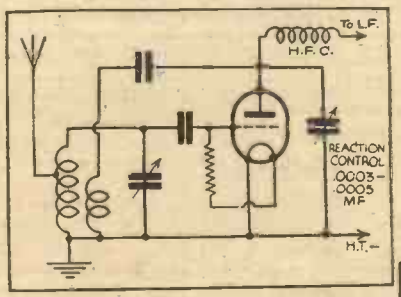


Fig. 1.—The connections for a grid leak potentiometer.

By way of making a start in "hotting-up" a short-waver it is therefore well worth while to try the effect of different detector valves and grid leaks which happen to be on hand. The next step should be to replace the fixed detector grid condenser by a pre-set one of about .0003 mfd. maximum capacity; there will probably be a particular setting of this at which the receiver's performance will be appreciably better than at all others. It is impossible to observe the effect of a gradual adjustment since the inevitable hand-capacity present during the operation will have more effect than the slight variation of condenser capacity, so the best method of procedure is as follows:—Connect up the pre-set condenser and adjust it to a capacity mid-way between maximum and minimum; tune in a "steady" and reliable station such as Zeesen, on 31.38 metres, or Vatican City, on 19.84 metres, and slack off reaction until signals are only just nicely audible; next slightly vary the grid condenser setting, first to a higher, and then to a lower, capacity and carefully note the effect on signal strength. It should be observed that these experiments will be of no value if the signal is subject to "slow-fading," and you should therefore choose the station that is best received on your own particular set. To make the tests quite conclusive the tuning condenser should be adjusted between each alteration to grid condenser capacity in order to cover the possibility of tuning being affected by the other adjustments.

Smooth Reaction Control

With most short-wave receivers of the Det.-L.F. type the greatest difficulty is that of obtaining a smooth control of reaction over the entire tuning range. It frequently happens that when the reaction condenser is being finally adjusted to bring a signal up to full strength the set suddenly bursts into oscillation with a "plop." This makes it necessary to slack off reaction and start all over again—a most annoying procedure. I believe that this kind of trouble is so frequent that many amateurs consider it to be insurmountable, but it can most emphatically be overcome by careful attention to details. Observation of those points referred to above, namely, proper choice of detector valve, grid leak and condenser will go a long way towards simplifying reaction control, but further improvements can be made by varying the high tension voltage and experimenting with different values for the series aerial condenser. The latter should not generally have a greater capacity than .0001 mfd., whilst one-tenth of this (.00001 mfd.) might be noticeably better if the aerial is long or if it runs close to a roof. A good, low-resistance earth connection has a pronounced "stabilizing" effect on reaction control and can make a big difference. As with an ordinary broadcast receiver, the earth lead should be of well insulated (heavily rubber-covered) multi-strand wire.



Sometimes perfectly smooth reaction cannot be attained even by paying attention to the details referred to, and in that case still further modifications must be made. If the reaction condenser is of greater capacity than is necessary, that is if it never requires to be set to its "full in" position, it cannot be adjusted with sufficient delicacy, and thus a component of smaller capacity would be better. Instead of scrapping the condenser its capacity can be reduced by connecting a fixed one in series; the latter should be of such a size that oscillation can be obtained at any part of the tuning range by adjusting the variable reaction condenser to a point just short of maximum capacity. Incidentally it should be noted that the fitting of a good slow-motion dial to the reaction condenser is often well repaid by the better control thus made possible.

The use of a potentiometer to vary the detector grid potential is often advocated, but the value of this component is less frequently recognized by the constructor. A potentiometer can transform an unworkable set into one which it is a pleasure to handle—and at very small cost. Even though the information has been given scores of times before, I make no excuse for showing again the connections for a grid leak potentiometer in Fig. 1. The two "outside" terminals are connected to the filament terminals of the detector valve holder whilst the

(Continued on page 1157.)

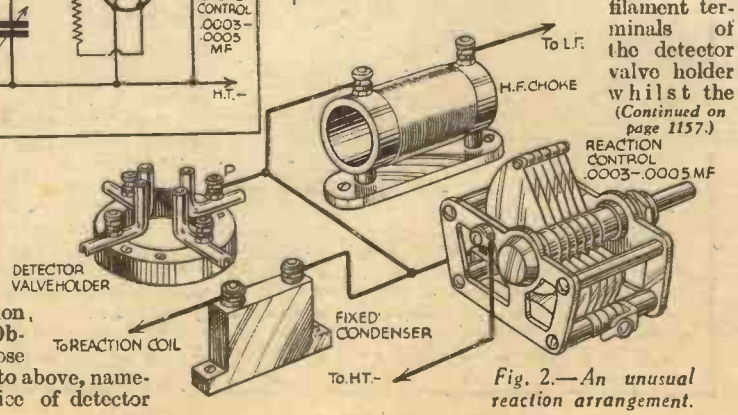


Fig. 2.—An unusual reaction arrangement.

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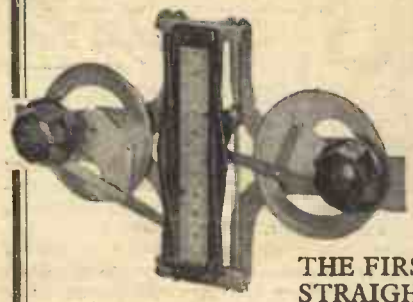

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(*Continued from page 1155.*)

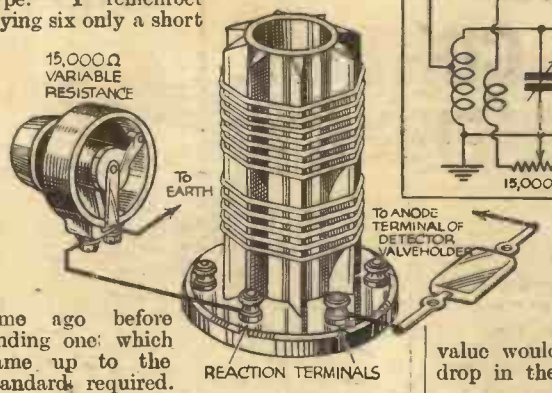
centre terminal is connected to the grid leak. A .002 mfd. fixed condenser is shown as being joined between the grid leak and H.T. negative, for whilst this is not always essential it provides an easy by-pass for high frequency currents and so prevents any danger of instability. A value of some 400 ohms is generally recommended for the potentiometer but, personally, I find 250 ohms slightly better under some circumstances.

Other Methods of Reaction Control

Although it has become standard practice to obtain reaction control by connecting a variable condenser in series with the reaction winding, there are other systems which are worthy of consideration and trial. One of these is illustrated in Fig. 2, from which it will be seen that the usual variable reaction condenser is replaced by a fixed one of similar value, whilst a variable condenser is connected between the anode of the detector valve and H.T. negative. This variable condenser, which should have a maximum capacity between .0003 mfd. and .0005 mfd., serves as reaction control, but works in the opposite manner to the normal reaction condenser. In other words, its object is to *check* reaction, and in consequence, increasing its capacity reduces the degree of feed-back, by allowing more H.F. current to leak away to earth. The only difficulty with this form of control is that it is liable to introduce a certain amount of hand-capacity unless the condenser is operated through an extension spindle. Even then it is best to use an aluminium panel for screening purposes, or at least to employ a screened operating dial. In any event the moving vanes should be connected to H.T. negative and fixed vanes to the anode, or else hand-capacity will be incurable.

Resistance-controlled Reaction

Another form of reaction control, and one of which I am particularly fond, is that shown in Fig. 3, where adjustments are made by means of a 15,000 ohm variable resistance connected in series with the reaction winding; here again, the variable reaction condenser is replaced by a fixed one of equal capacity. If the terminal making contact with the resistance slider is earth connected, there is practically no hand-capacity and the system works with beautiful smoothness. It is imperative that the variable resistance should be dead silent in operation, for otherwise it will cause crackles loud enough completely to drown all reception. For this reason the method would have been impracticable a year or so ago, but there are now two or three really silent variable resistances on the market. A resistance of the "carbon-track" variety is generally to be preferred, but it is rather difficult to obtain a silent one of this type. I remember trying six only a short time ago before finding one which came up to the standard required. For use on wavelengths above about 20 metres I have found the new Lewcos wire-wound component extremely good, but even this gives rise to a little noise on the lowest wavelengths.



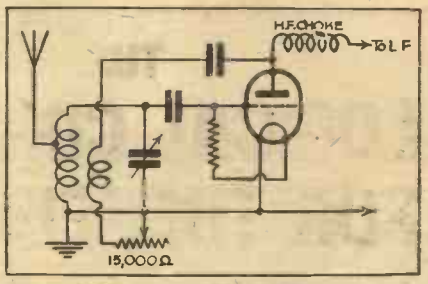
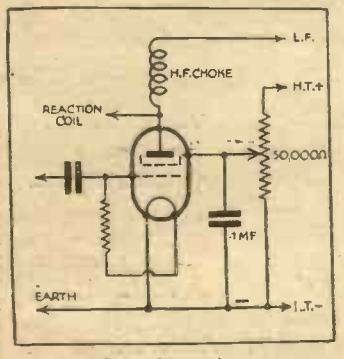


Fig. 3. — Showing how reaction may be controlled by a variable resistance.

Screened Grid Detector

To anyone who is out for absolutely maximum efficiency from a short-waver, I can strongly recommend the use of a screened-grid valve for detector. It is a little more expensive, and requires a 50,000 ohm potentiometer, and .1 mfd. non-inductive condenser to provide its screening-grid potential, but is easily worth the extra cost. The connections for an S.G. detector are shown in Fig. 4, from which it will be seen that they are quite conventional except for the additional ones required for the potentiometer and condenser. In changing over from a three-electrode valve it is, of course, necessary to transfer the connections from the "anode" terminal of the valve-holder to the terminal mounted on the glass bulb.

The potentiometer provides a very smooth control of reaction, and is used in addition to the existing variable condenser, etc., for making final adjustments. There is one important point to watch in connection with the use of an S.G. valve for detector, which is that the L.F. transformer following it must have a high primary inductance to match the high impedance of the valve. As an alternative, the transformer can be resistance-fed by using a 100,000 ohm coupling resistance, and the usual .01 mfd. to 1 mfd. coupling condenser. Even 100,000 ohms is insufficient to give accurate matching, but a higher value would cause too great a voltage drop in the high-tension supply.



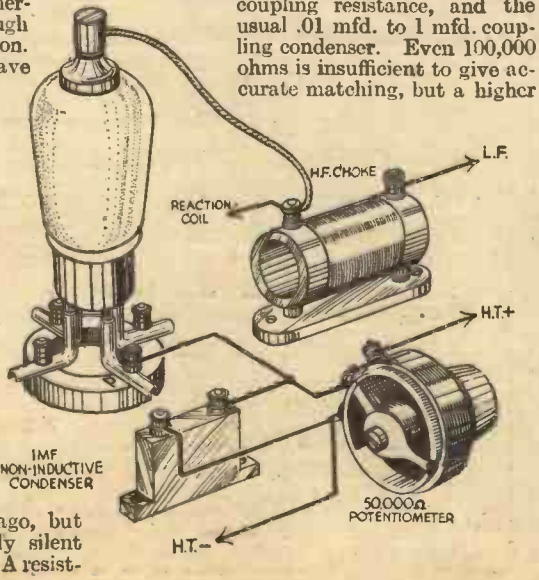


Fig. 4.—The additional connections required when using an S.G. valve as detector.

Preventing Hand-capacity

Next to that of obtaining a smooth control of reaction, the difficulties of entirely obviating hand-capacity effects and minor forms of instability are of greatest importance in S.W. work. It is particularly trying to attempt long-distance reception on a set which goes out of tune immediately the hand is taken off the condenser dial, or which howls and shrieks when some other knob is touched, and yet I have seen a number of sets which do behave in this way. A golden rule to remember in wiring up is that all moving parts of condensers, variable resistances and so on which are mounted on the panel should be at earth potential, and if this is followed there are not likely to be many great difficulties in the way of hand-capacities. Screening is distinctly useful if arranged with care, but is best avoided by the less expert constructor, because it can be the cause of many unsuspected losses. There is certainly no harm in using an aluminium panel so long as tuning coils are not placed less than 3ins. from it, and if this is effectively earth connected it will prove very useful as a screen. Do not, however, overlook the fact that it *is* earthed when mounting a reaction condenser connected on the "anode" side of the reaction coil, or the H.T. battery will be short-circuited; the condenser bush must be insulated by means of ebonite washers. The same thing applies in regard to potentiometers connected either in the high-tension or low-tension circuits, because if their bushes are not insulated a short-circuit is bound to occur.

H.F. Leakage

When hand-capacity is noticed, even though the latter precautions have been taken, it is fairly safe to assume that there is a leakage of high-frequency currents into the amplifier or 'phone leads if only a single valve is used. A cure can often be effected by the simple expedient of thoroughly de-coupling the detector anode by means of a 50,000 ohm resistance and 2 mfd. condenser. This should be done even in the case of a single-valve receiver, the resistance being connected between the high-frequency choke and the 'phone terminal as shown in Fig. 5. When L.F. amplification is employed, it is a good plan to insert a 100,000 ohm resistance between the secondary winding of the first L.F. transformer and the grid of the second valve; the resistance "stops" H.F. currents but offers no impedance to the L.F. ones. Another good way of preventing hand-

(*Continued on page 1158.*)

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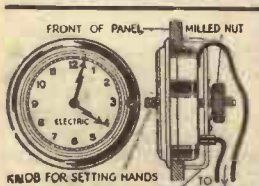

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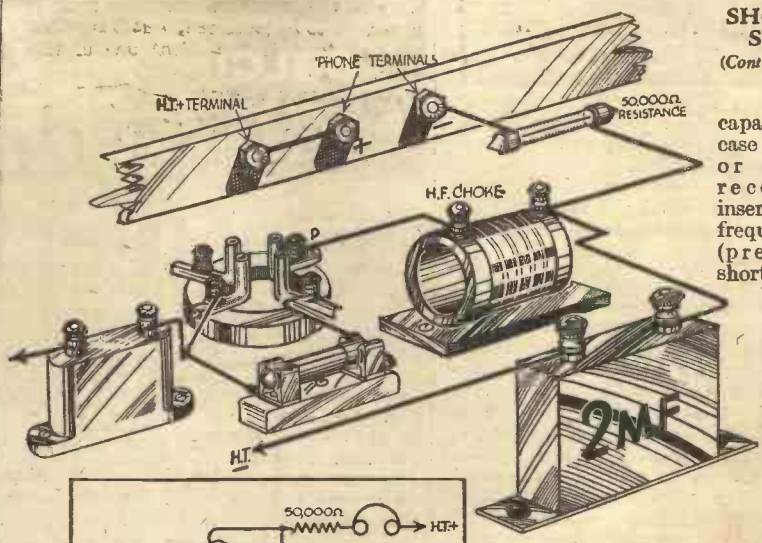

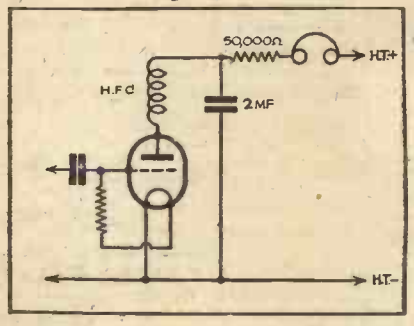

Fig. 5.—The method of decoupling a single valve short-wave receiver.

capacity in the case of a two or three-valve receiver is to insert a high-frequency choke (preferably a short-wave one) between the anode of the last valve and the loud-speaker terminal (see Fig. 6). The choke prevents the passage of H.F. currents, and it can be made still more effective by joining a .002 mfd. fixed by-pass condenser between the anode terminal and earth; this is also shown in Fig. 6. Constructional details of a suitable short-wave choke appeared in PRACTICAL WIRELESS, dated December 17th, 1932.

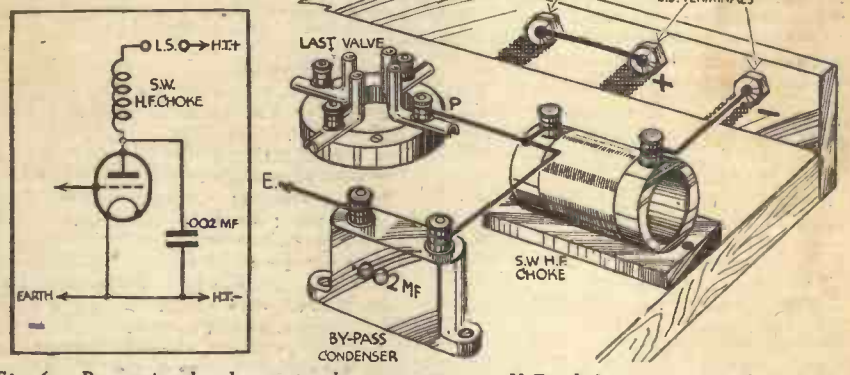

Fig. 6.—Preventing hand-capacity by connecting an H.F. choke in series with a loud-speaker lead.

A Q.P.-P. Amplifier

(*Continued from page 1143*).

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- 1 Ferranti Type O.P.M. 12c. Output Transformer.
- 1 T.C.C. Type S. .01 mfd. Fixed Condenser.
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- 1 Bulgin Type S.25 On-off Switch.
- 1 Graham Farish (Ohmite) Fixed Resistance 15,000 ohms.
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- 2 H.P.T.—Q.P.-P. Valves. Cossor.
- 1 Becol Panel, 10ins. by 7ins.
- 1 Plywood Baseboard 10ins. by 8ins.
- 1 Clarion Cabinet.
- 1 Coil Glazite.
- 5 Wander Plugs, marked G.B.+, G.B.+, H.T.1, H.T.2. H.T.3, (Eelex.)
- 6 Belling-Lee Terminals marked Input—, Input+, L.T.,—L.T.+, and 2 marked Output.
- 2 Valve-holders, 5-pin Type (Benjamin).

MOTORBOARD MUSINGS

(Continued from page 1090, Feb. 25th issue.)

Preventing Feed-Back

Upon first connecting a pick-up to a receiver, it often happens that an unpleasant whistle sets up in the loud-speaker which can usually be traced to "feed-back" occurring in the amplifier, which in turn is frequently due to long pick-up leads. In some cases it is possible to overcome this trouble by using "screened" wire for the pick-up leads, taking care that both the screening element of the wire and the pick-up arm are efficiently earthed. Where these leads are exceptionally long and cannot be shortened, it may be found necessary to connect the pick-up to the set through a transformer, the pick-up being connected to the primary and the amplifier to the secondary. This isolating transformer must be positioned at the amplifier end of the circuit, *i.e.*, the connections between the pick-up and the primary may be long, but the secondary connections to the amplifier must be as short as possible. Normally, the ratio of such a transformer should be 1 : 1, but it is possible to step-up the voltage from the pick-up if so desired by using a ratio of, say, 3 : 1, the larger number of turns being, of course, on the secondary winding connected to the amplifier. With such a transformer in circuit, the potentiometer control should be connected as shown last week.

Where a pick-up is connected to a receiver having a fully-ganged tuning arrangement, it is sometimes found that the slight additional capacity across the grid circuit caused by the pick-up switch, terminals and wiring is sufficient to upset the ganging to some extent causing a slight reduction in sensitivity and selectivity (it will, of course, be borne in mind that this additional capacity still exists even when no pick-up is connected to the pick-up terminals). Such an effect is not likely to be noticeable with an ordinary triode detector, but where a S.G. valve is used as detector, this additional stray capacity may have a very decided effect, as the "damping" imposed on the preceding circuit is much less in the case of a S.G. valve than in the ordinary triode valve. Consequently after adding a pick-up circuit to an existing (ganged) receiver it is always advisable to try a slight adjustment of the trimmer across the tuning coil.

Eliminating Needle-Scratch

Needle-scratch is another source of annoyance which frequently crops up, but this can be overcome to a considerable degree in quite a simple manner. The frequency of needle-scratch is always fairly high, somewhere above 4,000 cycles, and therefore if matters are so arranged that all response from the pick-up at this frequency is by-passed and not allowed to enter the grid circuit of the amplifier, these higher frequencies will be missing from the reproduction and with them the needle-scratch. We require, therefore, a variable impedance to the pick-up energy, and the simplest method of obtaining this is by connecting a variable resistance and a small condenser in series across the pick-up as shown in Fig. 6. In most cases, the resistance should have a maximum value of 50,000 ohms, but the capacity of the condenser is a matter to be determined by experiment. A good value to commence with is .01, which can be gradually increased until the most suitable value is found.

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RADIO RAMBLINGS

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APROPOS my remarks about short-wave working and silent backgrounds, I think this is the one way in which modern radio conditions have definitely deteriorated, for our silent backgrounds are no more. In the early days, with a straight two or three valver, an accumulator for filament current, and a really good H.T. battery, one could put on the headphones, and with luck hear absolutely nothing. Unless you put your tuning dials hopelessly out of step, or reduce your filament voltage until the set is to all purposes "dead," you will rarely attach headphones to a set and hear nothing nowadays. High power stations crowded together over the wave-bands have left hardly any part of the ether free from signals of some sort, to say nothing of the innumerable Morse and other stations using radio as a means of communication. In this way, radio more than any other invention, has made the world a very small place, and I don't suppose there is any spot on the globe, apart from those places where geological peculiarities make wireless reception impossible, where a good set would be unable to pick up signals of some sort. It is little wonder that advanced radio scientists are again toying with the idea of inter-planetary communications, for having sent wireless signals all over and around the earth it is but a step forward to send them to our nearest neighbours in space. The Heaviside layer is the only drawback, and for all intents and purposes the world might be encased in a steel sphere so far as the transmission of radio signals goes. Still, somebody somewhere may hit upon a solution of the difficulty and show that infinitely short or infinitely long wavelengths will penetrate this inconvenient layer. When this comes about what a fine excuse the radio "fan" will have for making another new set!

Radio and Mount Everest Expedition

THE vital link between the explorers of the Mount Everest expedition and their base camp will be a radio set designed by two London amateur transmitters. This radio link will be used to relay to the base by radio any message from the advance party. The organizers of the expedition applied to the Radio Society of Great Britain when they decided to use radio as a means of communication, and the Society found volunteers in two young amateurs known by the call signs of their respective stations as G6RU and G6US, who are partners in a radio concern in Earl's Court Road, W.8. The transmitter is a portable one which can easily be carried by one man and comprises a re-designed and re-built ex-War Department trench set operating on a wavelength of between 60 and 120 metres. High tension current is supplied by a rotary hand generator giving 600 volts at 30 milliamps and low tension is supplied from inert cells. Two valves are used in the set and six spare valves are carried. The transmitter is fitted with folding legs and measures when closed only 9in. by 9in. by 11in., and the set is lined with felt to withstand shock and low temperatures.

JOTTINGS FROM MY NOTEBOOK
By "DETECTOR"

Shelf Life of Dry Batteries

THE Institute of Patentees, as its name implies, does good work in assisting inventors and has just issued a booklet of 895 inventions needed called "What's Wanted." The number of inventions badly needed are surprising, while some of them are slightly fantastic. Some of them are for very lazy people indeed—the kind of people who use selenium-cell operated doors and automatic record-changing devices—and in this class is the electric toaster that switches itself off when the toast is made to the desired crisp brown. More serviceable inventions required are a dry cell that will not discharge itself on open circuit and will give a more "straight line" discharge, and a much lighter system of accumulator construction. Dry cell shelf life, as it is called, has been much improved upon in later years thanks to radio, and six months is a fair time to keep a battery in stock. After this the voltage of the very best batteries begins to drop and the internal resistance commences to rise, both undesirable in an H.T. battery designed for radio work. Of course, in a busy radio shop an H.T. battery may not be on the shelf six days, but in a village stores such a quick turn-over would be impossible and the need for a long shelf life is important for radio batteries. Batteries used for telephone work and for emergency alarm systems are often required to stand for years without attention and these, too, often fail through a battery running down which has not delivered a scrap of current in the circuit in which it is employed. Those of you who have carried accumulators for miles to be charged will need no comment of mine as to the desirability of a light-weight system of "juice" storage!

Wonders of the New Mond Laboratory

I WONDER if you have read about the wonders of the new Royal Society Mond Laboratory that has been erected at Cambridge in order that Prof. Kapitza might continue his research work in regard to electrical investigations. He will endeavour to discover the properties of matter when placed in intense magnetic fields and will also carry out investigations on the resistance of metals and conductors at the lowest attainable temperatures. You may remember my account of the lead ring immersed in liquid helium in which a current continued for days without a boost from a battery or any other source of electrical energy, showing that at very low temperatures the resistance of conductors to electrical energy is practically nil. Well, a special helium and hydrogen liquefying plant is installed at the Laboratory for studying this supra-conductivity of metals, as it is called, and temperatures as low as about 450 degrees Fahr. below zero will be obtained. At -450° F. anything might happen, and

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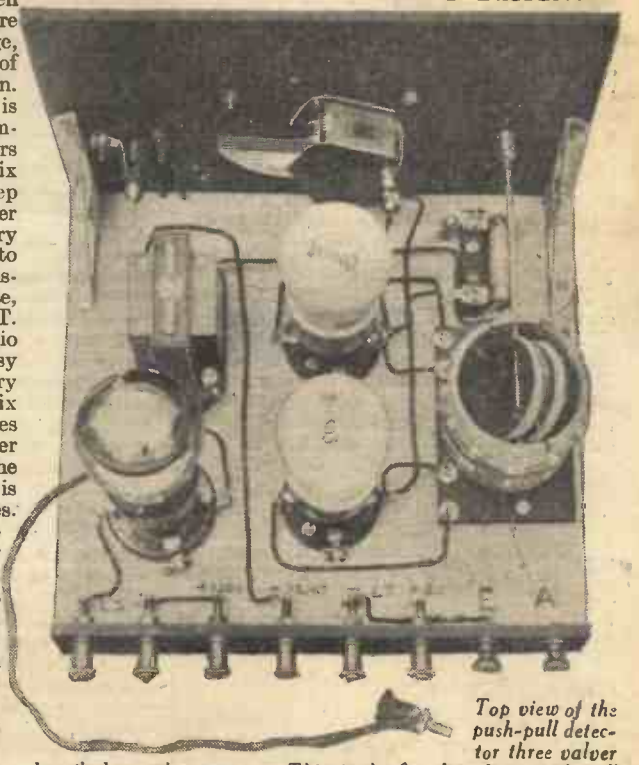

Top view of the push-pull detector three valver described on other pages. This is the first broadcast push-pull detector set ever described.

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because I know what the constructor wants—reliability and efficiency. When I design a component I make up my mind to provide the best, no matter the cost. Then, and only then, can I be sure that the constructor is going to be satisfied. Whatever else may go wrong with his set, it will not be a Graham Farish Component. They're not built that way. They're built to last.

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RADIO RAMBLINGS

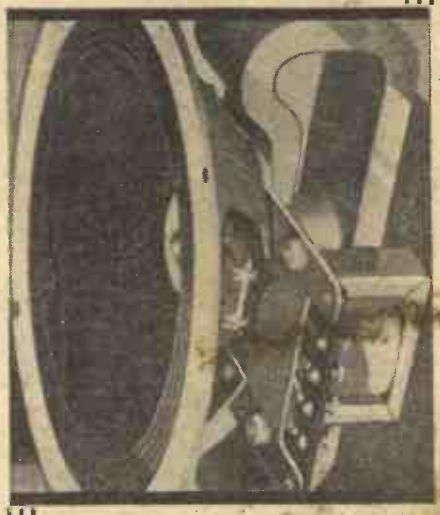
(*Continued from page 1160.*)

metal without resistance has an attractive flavour of perpetual motion about it. In addition, different kinds of matter behave in a peculiar manner when placed in intense magnetic fields, and the field strengths used make those we employ in our moving coils look very puny indeed. Faraday's discovery of the electro magnet and its power was the foundation on which electricity and radio was built, but at the same time we know comparatively little of intense field strengths. One of the greatest problems, in fact, has been the production of these fields, and it is not possible to obtain an intense field of more than about 60,000 gauss without resorting to a magnet of impossible dimensions and cost. (Incidentally, a gauss is the unit given to the field strength of one line of force of a magnet per square centimetre.) A new method of obtaining intense fields had, therefore, to be evolved, and quite high field strengths have been reached by the use of a solenoid through which heavy currents are passed. The difficulty with this method, however, is the great heat that is generated in the coil and which is sufficient to destroy the material of the coil. This has been overcome by limiting the time of the experiments to fractions of a second, thus enabling the heat generated to dissipate before repeating the flow of current. Some years ago 125,000 gauss was produced in a solenoid for 1/100th of a second from accumulators, but in the new laboratory a special alternator is to be used capable of supplying 40,000 kW. to a coil for short periods. A special switch has been designed which allows the current to flow through the solenoid for the duration of one half period only, and field strengths of 320,000 gauss have been reached. With the use of powers of these magnitudes, mechanical stresses in the material of the coils are set up to the extent of from twenty to thirty tons per square inch so that it has been found to encircle the solenoids with bands of steel in the same way as the barrels of guns are reinforced against the internal pressure. It is expected that fields of a strength of half a million gauss will be attained when desired.

Look to Your Aerial

I WONDER how many readers have suffered the misfortune of having their aerials broken with the recent heavy falls of snow; I counted three broken wires on my way to the office the other morning. In most cases of damage of this kind the owner is to blame, either because the aerial was carelessly erected or had received no attention for several years. In these days far too little attention is paid to the aerial in many instances, and any kind of cheap wire is used. It is a sound investment to obtain really good aerial wire of the "7/22 hard drawn copper" variety, for it only costs a shilling or so more than the cheap stuff and lasts infinitely longer. Enamelled wire is much better than bare copper, especially for use in town areas, because it is better able to withstand the effect of smoke and chemical-laden fumes. Bare wire soon becomes corroded and gradually gets brittle, due to crystallization. If your aerial has been up for more than three years or so, I can strongly recommend you to examine it and, if there are any signs of brittleness or corrosion, to replace it by a new wire before the season of "March winds" comes along.

The reason why!



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Practical Letters from Readers.

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Congratulations

SIR,—As a reader of PRACTICAL WIRELESS since No. 1, I did not expect to receive such a magnificent book as the Encyclopædia most certainly is, and I am agreeably surprised. As a wireless enthusiast I must say your paper has been a great help to me. I have been most interested in Mr. Barton Chapple's articles on "Television," also the short-wave section. I see that at the head of the first page are the words "The predominant wireless weekly," and I hope that you will always continue to be predominant.—F. W. ALLOTT (Rotherham).

All Mains "Fury Four"

SIR,—Having bought your book every week since its inception, may I congratulate you on the wealth of information you are imparting each week for the benefit of your readers. I myself having gained considerably more knowledge as a result of its publication have naturally advertised it to others who have become regular readers. My object in writing chiefly is to ask if you will provide me with, either direct or through the medium of your paper, a circuit of the Fury Four for all mains purposes. I may say I am building my own power unit, thanks to information supplied in your journal, which will give a rectified voltage of 200, at 28 m/a. I can see your Fury Four is going to be a fine set, and I have no doubt that many enthusiasts, not only of the battery class, but all mains as well, will wish to build it.—S. TAYLOR (Bury).

Standards of Quality

SIR,—You have asked for criticism and suggestion. In general composition I do not think PRACTICAL WIRELESS could be improved on. The admirable illustrations must help the veriest tyro in following the context. Now for my suggestion. I take a weekly interest in your "Receivers and their Records," and you generally say in plain unequivocal language what its selectivity is, also sensitivity, etc., but when it comes to what for many of your readers is an essential, viz., quality of output, we get vague terms, such as good "quality production," "up to standard of similar type sets," and so on. In order, sir, that your readers may know what you mean by these expressions, I suggest you should set a standard of your own, such as A, B and C. These standards would not introduce invidious distinctions between different makes of sets; but would indicate to the buyer which set would meet his requirement: for instance, pleasing reproduction for an ordinary living-room might be better than a true or nearly true reproduction of the original. Hence, your A, B and C could represent something like the following:—

A. Straight line reproduction from say 30 to 8,000 cycles.

B. 50 to 5,000 (The cut off being for selectivity or to obviate needle scratch with records.)

C. Moving iron quality, *i.e.*, nothing below, say, 150.

This or even an extended category would, I think, be helpful if you were to standardize it for use in your columns about either your own or other sets. Thanking you for an interesting paper.—J. C. BRINTON (Sutton).

A Reader's Thanks

SIR,—I have to thank you for my copy of the "Wireless Constructor's Encyclopædia," received on Tuesday last. I have found it a most interesting and useful book, containing everything the amateur is likely to want to know. Also, please allow me to contratulate you on the excellence of PRACTICAL WIRELESS, which I have taken from No. 1. I consider it to be the most practical radio journal to date.—READER (West Croydon).

More Thanks

SIR,—Permit me to thank you for the splendid Encyclopædia, just received. It certainly is well worth the trouble of saving the coupons and small fee charged.

It is a worthy companion to PRACTICAL WIRELESS, which is practical, insomuch that it caters for every stage of constructor, whether professional or amateur.—E. W. ANDERSON (Norwich).

A Splendid Book

SIR,—Kindly accept my best thanks for "The Wireless Encyclopædia," safely to hand. It is a splendid book and I must congratulate you on compiling such a valuable work which should be in the hands of every wireless fan. I conclude by wishing every success to the journal, which has long been needed by the wireless constructor.—A. H. KEYSE (Birmingham).

Mains Valve Set Wanted

SIR,—I suppose I really owe you an apology for addressing you so often, but you have only yourself to blame. If PRACTICAL WIRELESS did not grip our interest any more than the radio journals of old did, we amateurs would not write you so often. I see that other correspondents are seconding my call for a really up-to-date, selective Det. 2 L.F. set to be published, and I presume when your Technical Department get breathing space they will tackle this problem, and give us an unganged, unscreened band-pass circuit to rebuild our old unselective Det. 2 LF. sets to, using up old parts, apart perhaps from a new coil or two. However, the purpose of the present letter is to remind you that in the last paragraph but one on page 196 of No. 4 of your journal, "Pentamp" promised us a three-valve circuit utilizing the Ostar-Ganz all-mains valves. Now, these valves are to be had in Det. and L.F. only so far, so the promised circuit could not include an S.G. stage, and will needs be a Det. 2 LF. again, and this will suit thousands of old set owners, providing the circuit be right bang up to date in other respects, and will get 9 kc/s separation, etc. Never mind whether it will get dozens of foreigners or not, who cannot be held until we get a big set with automatic volume control. I run my sets with an eliminator off the A.C. mains and would like to go on all-mains—providing the set can be made selective at the same time. I also wish to acknowledge receipt of my volume of the "Wireless Constructor's Encyclopædia," which I find a mine

CUT THIS OUT EACH WEEK.

DO YOU KNOW?

—THAT instability may be introduced in a receiver employing a multi-ganged condenser assembly, due to coupling between the various sections of the condenser.

—THAT a moving-coil loud-speaker with an energized field winding may be used in place of a resistance for biasing purposes.

—THAT when choosing a fuse for a mains eliminator, it is important to consider the surge voltage which may take place, and not consider only the normal current rating.

—THAT to maintain a balance, the grid-bias battery in a Q.P.-P. amplifier should be periodically adjusted or discharged at the same rate as the H.T. battery.

—THAT all metal parts of a receiver (condenser cases, etc.), should be connected to earth in the interests of stability.

—THAT it makes no difference whether the grid leak is joined across the grid condenser, or to L.T. positive in a normal grid-detector circuit.

—THAT the weight of the gramophone pick-up has a great bearing on the quality of reproduction, as well as the life of the record.

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.*

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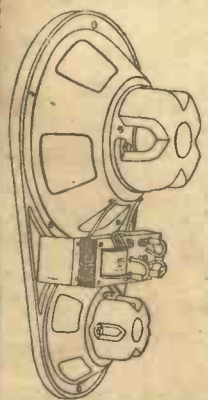

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PRACTICAL LETTERS

(*Continued from page 1162.*)

of information, and really a gift to the regular subscribers. Many thanks. The Data Sheets now appearing each week are also a wonderfully helpful idea. This week's, No. 5, is the very thing I have been hunting for. I am an engineer (but not of the electrical variety), and while my text-books give all data of wire gauges, I had no access to any source of information on resistance and current-carrying capacity I require for an experiment. Trusting to see an up-to-date Det. 2 LF. circuit in PRACTICAL WIRELESS before long embodying the Ostar all-mains valves—F. M. BECK (London, W.C.).

"Full of Good Things"

SIR,—I beg to acknowledge receipt of your Presentation Volume—"Newnes' Wireless Constructor's Encyclopædia"; thanks for same. I find it is like PRACTICAL WIRELESS, full of good things, plain and understandable to the lay mind and is invaluable to the beginner as well as the more advanced wireless fan. With best wishes for an ever increasing prosperity to PRACTICAL WIRELESS. It is a real titbit. —W. S. CROSBY (Horton).

Plug-in Coils *v.* Dual Coils

SIR,—To every advantage, there is the snag!—the disadvantage. Every debit must have a credit, so we are told. Here is an interesting topic for one of your experts to deal with in an article for PRACTICAL WIRELESS. The writer has reason to believe that in the Services, plug-in coils are preferred to any other. I can imagine the difficulty is in the matching of the coils, medium and long waves. To change a coil is no more than changing a gramo-record. Anyhow, may I suggest an article in the immediate future, giving the pros and cons.—A. J. (Cardiff).

PUSH-PULL DETECTION

(*Continued from page 1129.*)

Fig. 5. The amplitude, however, is not reduced, so that at the same time that the top half is pushed down the bottom half goes down also, or, in other words, the positive half is reduced considerably and the negative half increased.

It will be seen from Fig. 5 that the mean grid voltage is no longer steady at zero, but becomes negative in value and fluctuates at audible frequency. The fluctuations of each grid are reproduced in its own anode circuit and these two anode circuits being connected together as shown in Fig. 1, the two radio frequency components cancel themselves out as already explained, leaving a purely audio frequency current in the output. This output is double that which would be obtained from a single detector valve. The grid leak, of course, allows the negative charge on the isolated grid circuit to leak away gradually so that the grids have a definite tendency to return to zero potential when the grid current falls off. The location of the grid leak in Fig. 1 might seem open to criticism, the proper place to connect it being to a centre tapping on the grid coil. This point, however, is a "nicety"; in practice it makes no difference and it is much simpler to connect it as shown.

One advantage of this circuit has already been mentioned; another is that having eliminated the damping effect of the ordinary grid condenser and leak we should expect tuning to be sharper and the set therefore more selective and more sensitive. Experiments indicate that there is definite improvement in these points and distortion is more easily avoided.

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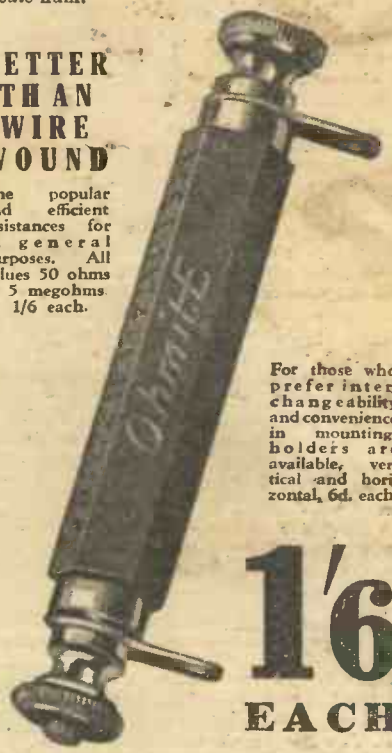

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RADIO CLUBS & SOCIETIES

NEW CLUB FOR CLACTON-ON-SEA

A number of local wireless enthusiasts have decided to establish a radio club for Clacton-on-Sea and District. A meeting was held recently at Dixon's Café, Station Road, Clacton-on-Sea, to which all interested in wireless matters were invited to attend. Particulars regarding future meetings can be obtained from Mr. Rodney Loader, "Aubretia," Southcliffe Park, Clacton-on-Sea."

A SOUTH LONDON RADIO CLUB

A South London Branch of the Anglo-American Radio and Television Society is being organized by Mr. W. Cope, of 7, St. Alphonsus Road, Clapham, London, S.W.4. In the proposed programme of this branch are tours of radio factories in and around London and a tour of the Brookmans Park transmitters will, if permission can be obtained, be made. Meetings will be held as soon as sufficient members are obtained. Those interested should communicate with Mr. Cope at the above address. South London members of the A.-A.R.and T.S. may obtain their copies of "Radio" from the South London Branch (members of other localities should apply direct to the headquarters of the society, 11, Hawthorn Drive, Willowbank, Uxbridge).

THE SOUTHALL RADIO SOCIETY

On Tuesday, February 7th, the above society was visited by Mr. Carter, who gave a talk entitled "Jottings from My Technical Notebook," a well-chosen title, as it allowed him to cover a range of subjects from automatic volume control to the side-band theory in his inimitable way which is so popular with the members of the society. Full particulars of the society can be obtained from H. L. Rayner, 114, North Road, Southall, Middx.

SLADE RADIO

A lantern lecture entitled "The Navy" was given by Lieut.-Commander Brewster at the meeting of the above society held last week. Commencing with the new recruits, it showed step by step the various items in the training which has to be undergone. A splendid series of slides was shown, and these included seamanship study, boating instruction, wireless, signalling, gun classes, manning the yard, boat sailing, stokers' class, cooks and bakery, electrical lectures, portable wireless, knotting and splicing, torpedo class, gun loading, and also the firing of large guns. The physical training was illustrated by slides of physical jerks, gymnasium, swimming, rowing, and sports side by photos of both soccer, rugger matches, hockey and hurdling. On the lighter side was shown the billiard rooms and also theatricals. The subject proved of great interest, as the slides were so capably explained by the lecturer, and it was keenly followed by all those present. Hon. Sec., 110, Hillarles Road, Gravelly Hill, Birmingham.

SIDCUP AND DISTRICT RADIO CLUB

A very successful inaugural meeting of the above club was held recently at the Regal Cinema, Sidcup. After the Club's officers had been elected, an interesting discussion on "man-made static" took place, and several technical members offered their services in a campaign against local interference. At another meeting a paper on cumulative grid rectification was read by T. W. E. Towers, and was followed by a lecture on "First Principles of Television" by E. G. H. Mobsby. Radio manufacturers who are willing to give lectures, demonstrations, etc., are invited to write to the Secretary. Meeting night, every Wednesday at 8 p.m. in the Regal Cinema, Sidcup. A hearty welcome will be extended to any prospective member who attends.—T. W. E. Towers, Hon. Sec., 22, Crombie Road, Sidcup, Kent.

WOODFORD, WANSTEAD AND DISTRICT RADIO SOCIETY

On Thursday, February 16th, Mr. Nixon gave this society a demonstration and lecture on the Gas-filled Relay, G.T.I., and its parent the Hot Cathode Mercury Vapour Rectifying Valve G.U. It was explained by the lecturer that the former was a direct development of the latter. As scientific products, the photo electric cell and the relay prove of exceeding interest, seeing the many uses to which these can now be put for alarms and checking purposes. Mr. Headland, of this club, had also brought his receiver for demonstration. At the conclusion of the lecture this receiver, capable of giving a 10 Watt output, was worked on a moving-coil energised speaker. Mr. Nixon remarked that he, as an enthusiast, was probably as much interested to hear results as members. The quality was excellent, and the evening was considered the most successful of the season. Mr. H. O. Crisp, 2, Ramsay Road, Forest Gate, E.7, is the Hon. Secretary.

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CHOSEN FOR THE "PUSH-PULL DETECTOR"

Remarkable tonal response and sensitivity, coupled with finest quality workmanship and materials, has proved the supremacy of the Celestion P.P.M. Soundex Speaker, which is priced at only 27/6, including universal transformer. That is why the designers of the "Push-Pull Detector" chose this amazing speaker for their set, and why many hundreds of satisfied users are praising the merits of the Soundex.

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Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

PLASTAPE AERIAL

THE problem of the indoor aerial is continually being attacked, and the latest entry into the field of easily-erected and more or less invisible aerials is the Plastape self-moulding wire manufactured by the Kenden Manufacturing Company. This consists of a plastic tape which is double, and in between the two surfaces is laid multi-strand wire. In the sample submitted ten strands were accommodated, and it is also available with eight strands or four strands. The latter two types are for loud-speaker extensions and earth connections respectively. The construction of the wire is very novel, five strands of bare copper wire (24 gauge) being stitched in a silk material, and the remaining five strands are laid on this, with the adhesive tape surrounding the complete assembly. The total width is half-an-inch, and the thickness under 1/32in. This form of wire may be affixed to the walls of a room, and passed round the jamb of a door, etc., without in any way affecting the closing of the door. As it is available in various colours, it may also be affixed to walls so as to be practically invisible. Joins are extremely easy to make and full instructions accompany the wire. A 30ft. coil of the 10-strand aerial costs 3s. 6d., whilst 20ft. costs 2s. 6d. The earth wire of four strands is sold at 3½d. per yd., and the 8-strand costs 4d. per yd.

WEEDON BOX BAFFLE

WE have already reported on the Weedon method of building a loud-speaker of the cabinet type which avoids box resonance and enables real bass to be obtained. The constructor will find the new Box Baffle Former a simpler method of carrying out the conversion. This incorporates the Weedon method in a ready built unit which simply needs to be inserted into the existing loud-speaker cabinet and avoids the building-up method previously necessary. It is obtainable in a standard size to fit the majority of speaker cabinets at 8s. 6d. A special type is also made for speakers which require a shelf for mounting.

LEWCOS SCREENED COILS

A NEW form of screened coil manufactured by the London Electric Wire Company & Smith's is illustrated on this page. These consist of a deep-ribbed ebonite former having a cylindrical winding at the upper portion, and a sectional winding at the lower end. This is mounted on a moulded ebonite base, and a metal screen fits completely round the coil. The necessary switching gear is incorporated in the moulded base. This coil is made in four types—an Aerial and Tuned Grid coil, a Band Pass Link Filter coil, a Standard Oscillator and a Ganged Oscillator. These cost 8s. 6d. with the exception of the Band Pass coil, which costs 1s. more. All coils are accurately matched for ganging purposes, and each type has identical self-capacity and inductive values. The switching apparatus is designed for ganging, so that any number of these coils may be arranged to operate from one control knob. Very complete instructions for connection to receivers are supplied with the coils.

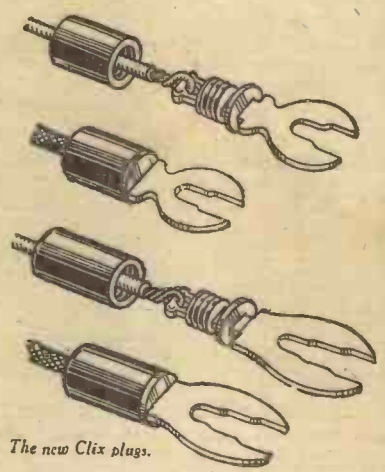
Ganged Lewcos potentiometers.

A further development by this company, which is also illustrated on this page, is the ganged potentiometer. In many receivers it is essential to have two such potentiometers for controlling different parts of the circuit, and in many cases the adjustment of these controls is more or less interdependent. By careful design, therefore, it is possible to arrange these two resistances (or potentiometers) so that only one control knob need appear on the panel. A common use of this form of control would be in an S.G. receiver where a potentiometer is arranged across the aerial coil to control the input signal strength, and a potentiometer is employed for adjusting the screening grid potential.

Lewcos screened coils.

CLIX NON-CORROSIVE SPADE TERMINALS

MANY constructors experience difficulty in making a firm connection to the usual type of spade terminal. Messrs. Lectrolinx have introduced yet another form of spade terminal for the constructor, and in this two new features have been incorporated. Firstly, the spade end is lead-coated, which, of course, makes it ideal for connection to accumulators, etc. In addition, a special collar is provided, and this locks close up to the small ebonite end of the tag, and thus effectively prevents acid creeping to the copper wire. The second feature is the novel method of anchoring wires to these spades. As can be seen, a slot is cut in the flat end of the spade, and the threaded portion is a sliding collar running on this portion of the spade. The wire is passed through the slot, and then when the threaded collar is screwed into the ebonite it draws up and so clamps the wire rigidly. The illustrations should make this arrangement perfectly clear. Two sizes of the terminal are made, the large costing 2d. and the smaller 1½d.



The new Clix plugs.

BULGIN SENATOR TRANSFORMER

L.F. TRANSFORMERS seem to decrease in size every day, and the latest to be reviewed by us is the Senator manufactured by the well-known component manufacturers, Messrs. Bulgin. This is mounted in the now standard metal case, as used for this firm's H.F. chokes, etc. It is extremely small, measuring only two inches by two inches. It is of the nickel alloy core type, and gives remarkable results for such a small component. It may be mounted above, or beneath, a baseboard, fixing holes being provided at top and bottom. The primary inductance is quite high, and best results were obtained by using it on the parallel-fed method. At 6s. 9d. this is a splendid component for the low-frequency side of the receiver.

(Continued on page 1166.)

Tune in on this New Wireless Instruction

The I.C.S. Wireless Courses cover every phase of wireless work, from the requirements of the youth who wishes to make wireless engineering his career to the man who wants to construct a broadcasting set for his home, and, at the same time, to know how and why it operates and how to locate any faults that may develop.

No branch of industry has ever progressed as rapidly as wireless and the rate of progress is increasing. Only by knowing thoroughly the basic principles can pace be kept with it. Our instruction includes American broadcasting as well as British wireless practice. It is a modern education, covering every department of the industry.

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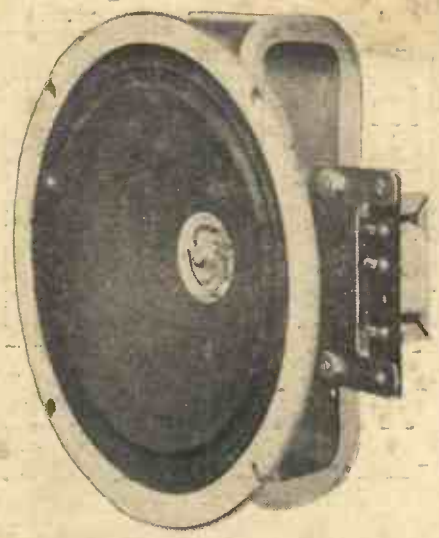
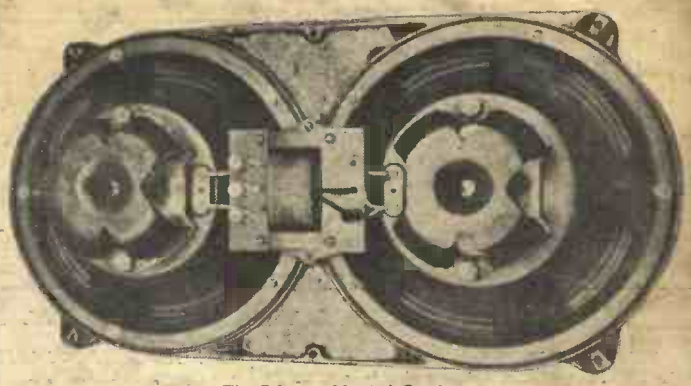


Amplion Q.P.-P. Model.

SINCE the advent of the Quiescent Push-pull arrangement, the component manufacturers have turned their attention to the production of components specially applicable for this form of coupling. It will be obvious from what has been already said in these pages that the intervalve transformer, as well as the output transformer requires certain characteristics if the full benefits of the Q.P.-P. method are to be obtained. In addition to these, however, the low resistance type of moving-coil loud-speaker requires an input transformer which has also been designed for the special purpose. On this page are illustrated a few of the many components which have been submitted to us for test and comment.

INPUT TRANSFORMERS

AMONGST the special L.F. transformers are the Varley, Sound Sales, Ferranti and Radio Instruments. Each of these firms has produced a high-class transformer for coupling the two push-pull valves to the preceding stage, and the ratio is in all cases quite high. The Varley Input Transformer (Type DP.36) has a step-up ratio of 9 to 1, and has a very efficient primary winding which is practically of the constant inductance type. With no D.C. flowing, the inductance is of the order of 30 henries, and with 4 mA this drops to only 22 henries. The D.C. resistance of this winding is 825 ohms. This is, therefore, a really first-class transformer and with its high ratio will ensure that Pen. 220A type valves will be fully loaded with the normal type of detector valve, without having to force the detector signal and so produce distortion. The price is 17s. 6d. Messrs. Ferranti have produced two types of input transformer, the AF. 11c. and the AF. 12c. The former is an expensive component designed especially for those who require only the very best, and although it costs 34s., it represents splendid value for money. The ratio is 10 to 1, and with no D.C. the primary is of the order of 50 henries. The anode current may rise to as much as 10 mA with this particular transformer, and the inductance at this figure is reduced to approximately 25 henries—a very creditable figure. The other model is a cheaper component, costing only 15s. It possesses an inductance of 30 henries with no D.C., and the current which may be passed through the primary is approximately 6 mA. At this figure the inductance is 15 henries. The ratio of this transformer is 9 to 1, and both of these transformers give splendid quality, especially of the bass notes. The Sound Sales component has a ratio of 9 to 1, and the inductance of the primary is 30 henries at 2 mA. The performance of this transformer is also very good. The R.I. input transformer has a ratio of 8 to 1 with a primary winding having a D.C. resistance of 900 ohms. The windings are sectionalised giving a low self-capacity, and the inductance of the primary is 30 henries with no D.C., and this falls to 16 henries at a current of 2 mA. The windings are internally screened, and when attached to a metal or metallised baseboard, the screening is automatically earthed through the metal eyelet holes. This component costs 15s.



The Celestion Matched Speakers.

OUTPUT TRANSFORMERS

FOR combining the output of the two valves, there is a very large range of components available.

Sound Sales Q.P.-P. Transformer and Output Choke.

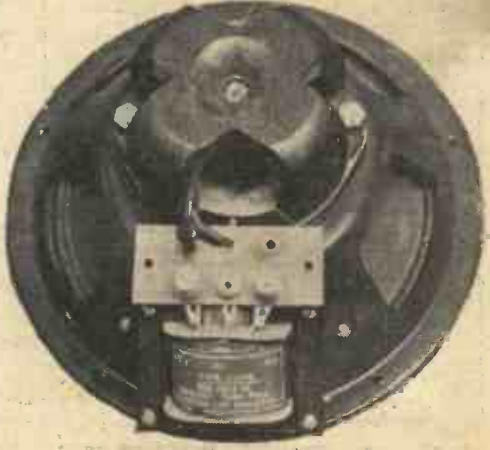
Messrs. Varley have produced three, Messrs. Ferranti also produce three. Radio Instruments and Sound Sales only manufacturing one. The Varley components bear the name "Transchoke," a combination of the words "transformer" and "choke." The DP.37 is a model having two output ratios, 3 to 1 and 42 to 1. The D.C. resistance of the primary is 460 ohms, and each half of the primary has an inductance of 13 henries with a D.C. current of 26 mA. The DP.38 has two ratios, 3 to 1 and 50 to 1. The resistance of the primary of this model is slightly lower, namely, 400 ohms, and consequently the inductance of the primary is not so high. The actual figures are 8 henries at 26 mA., which is, of course, quite a good rating. This model, with the DP.39 to be mentioned next, costs 16s. 6d., as compared with 18s. 6d. for the first-mentioned Transchoke. The DP.39 also has two ratios, the lower being 3 to 1 and the high 75 to 1. The D.C. resistance of the primary is the same as in the case of the DP.38, and the inductance value is the same. It will be seen from the above figures that any model of the Varley Transchoke may be obtained, and the speaker may be of high or low resistance. The performance of the whole range of the Varley transformers is of the high order which one usually expects from the products of this firm. The Radio Instruments Output Choke has four output terminals enabling ratios of 1 to 1, 1.4 to 1, 2 to 1, and 2.8 to 1 to be obtained. The total D.C. resistance of the primary in this model is 400 ohms, and the primary inductance of each half is 70 henries. This output choke costs 12s. 6d.

The Ferranti models range in price from 26s. 6d. to 15s., and are very substantial components. The largest model, the OPM 11c., is provided with three alternative ratios, 35 to 1, 56 to 1 and 100 to 1. It is designed to carry a current as high as 200 mA, and the primary resistance is only 230 ohms. This may, obviously, only be used with low resistance loud-speakers, but the most powerful output valve may be employed in view of the current rating of the primary. The OPM 13c. costs a similar amount, but is designed for low-resistance loud-speakers. The three ratios provided are 1.7 to 1, 2.7 to 1 and 4.5 to 1. The maximum D.C. current rating of the primary is similar to the OPM 11c., with a resistance of approximately 230 ohms. This type of transformer is, of course, suitable for use with loud-speakers which already have an input transformer built into them. The cheaper model, the OPM 12c. is provided with two ratios, for high or low resistance speakers. For high-resistance types the ratio is 1.7 to 1, and for low-resistance speakers it is 40 to 1. The current rating is lower than the other two models, being 150 mA, with a D.C. resistance of 210 ohms. The Sound Sales Output Choke has ratios of 2 to 1 and 3 to 1 and is a substantial component.

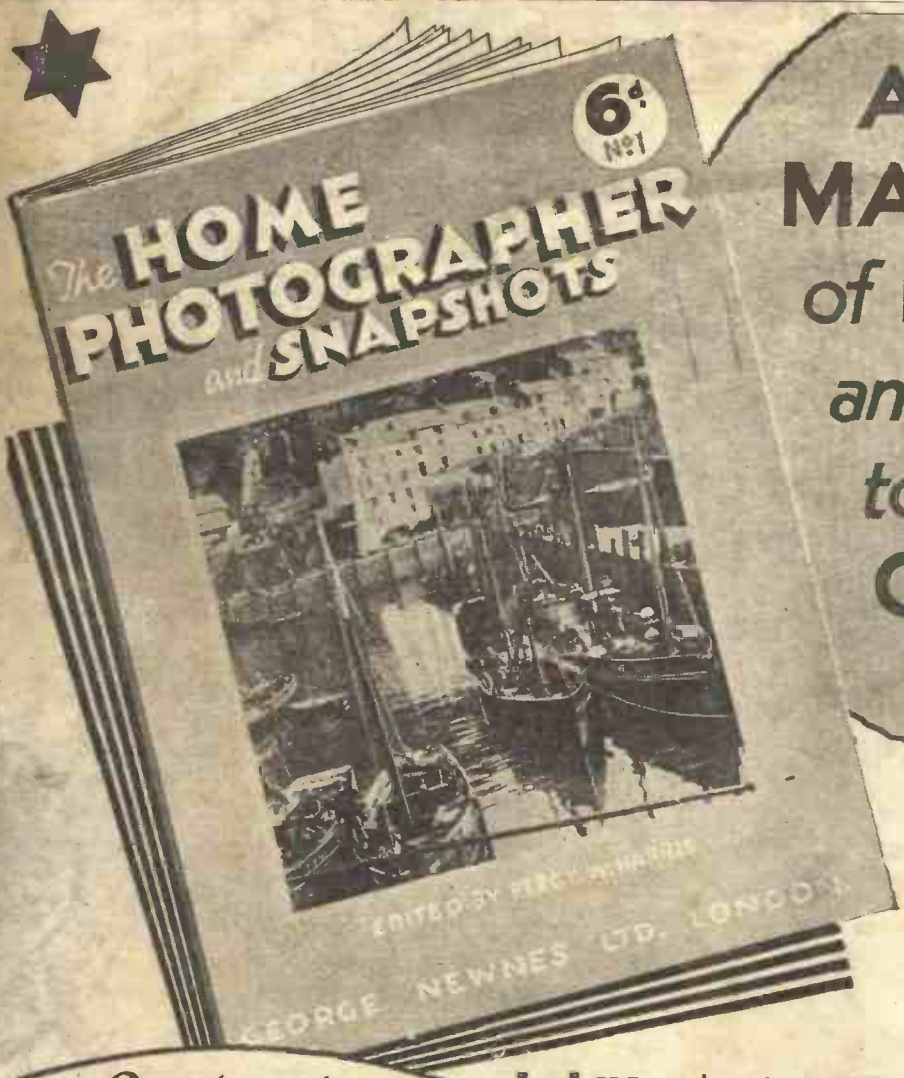
LOUD-SPEAKERS

WHERE a complete new receiver is being built to oper[illegible] this principle, it is neces[illegible] obtain a loud-speaker, and the[illegible] pense of one component may be saved by purchasing a loud-speaker which is fitted with a special Q.P.-P. transformer. Several firms are now producing this type of speaker, among which may be mentioned Amplion, Celestion and W.B. The Amplion model is practically the standard type, except for the matching transformer. This is designed for Pen.220A's, and gave a really splendid performance. The overall performance was, judged aurally, a practically straight line, the falling off at the bass and the upper register being very gradual indeed. The lowest notes seemed to be dealt with as well as the very highest flute notes, and at 39s. 6d. this is a splendid speaker. The Celestion people are making two types of Q.P.-P. Speaker, a single unit, and one of the Reetone type. This comprises two speakers of similar size and appearance, mounted on a metal plate. These two units are so designed that the bass resonances are "staggered," that is to say, they do not each resonate at the same particular frequency. The difference is, however, so arranged that the overall bass response is materially increased over that obtainable with one ordinary M.C. speaker, and the quality of reproduction with this type of speaker is of a very high order. The special matching transformer included on this unit enables any degree of matching to be carried out, and the tone may be varied between fairly wide limits by using a suitable tapping, for which a wander plug is fitted. Other Celestion speakers will be dealt with next week.

Varley Transchoke.



Celestion Q.P.-P. Speaker.



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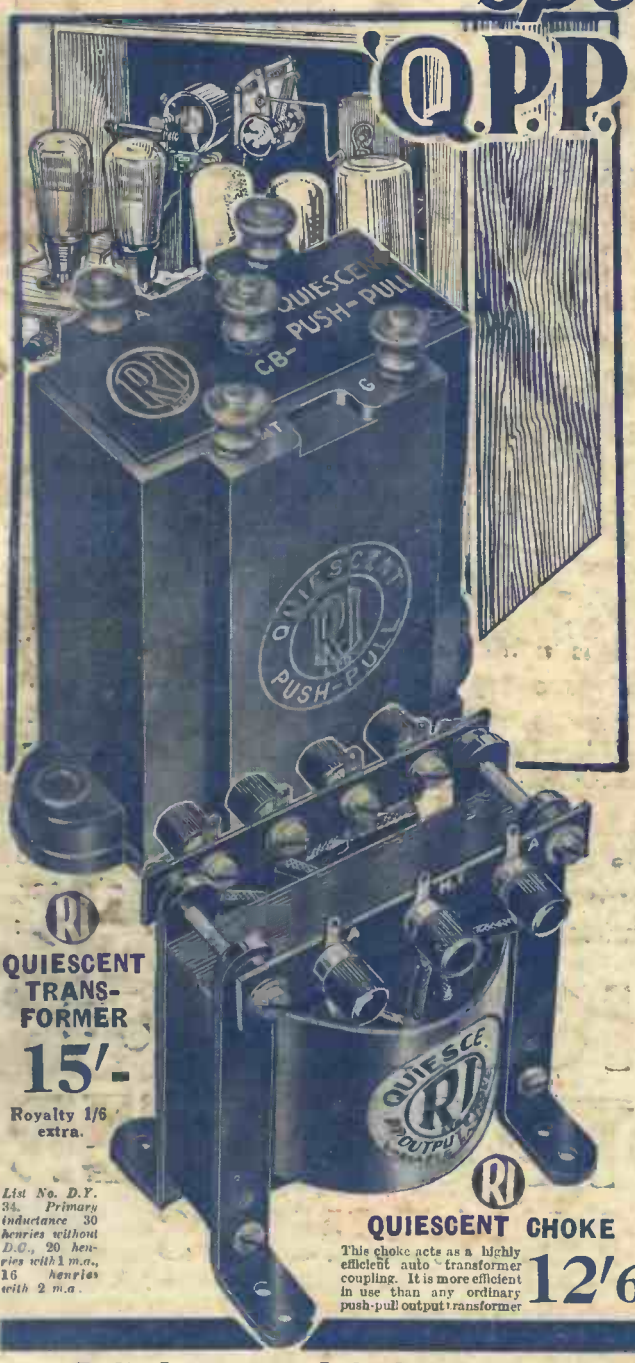

QUIESCENT TRANSFORMER 15/-
Royalty 1/6 extra.

List No. D.Y. 34. Primary inductance 30 henries without D.C., 20 henries with 1 m.a., 16 henries with 2 m.a.

QUIESCENT CHOKE 12/6
This choke acts as a highly efficient auto transformer coupling. It is more efficient in use than any ordinary push-pull output transformer

The enormous response to R.I. announcements concerning the "Quiescent" system and the amazing advantages to be gained by constructing or reconstructing battery sets with R.I. "Quiescent" components, proves the value and rightness of this revolutionary development. Public enthusiasm is shown by the hundreds of letters that continue to pour in from delighted constructors, who have applied the system, with R.I. components, to their sets—one correspondent writes:—

"I have been a keen radio enthusiast for the past 10 years, and have always made a special point of keeping my set up to date, and from previous experience of R.I. Components I had no hesitation in ordering the R.I. 'Quiescent' Input Transformer and Output Choke after reading your brochure on same. These components, working with 2 Pentode valves, Mazda Pen. 220A, do everything you claim for the system. The set gives

FULL MAINS QUALITY AND VOLUME EQUAL TO ANY MAINS SET"

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