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Yes! SHORT waves make it possible to get AMERICA *direct!*

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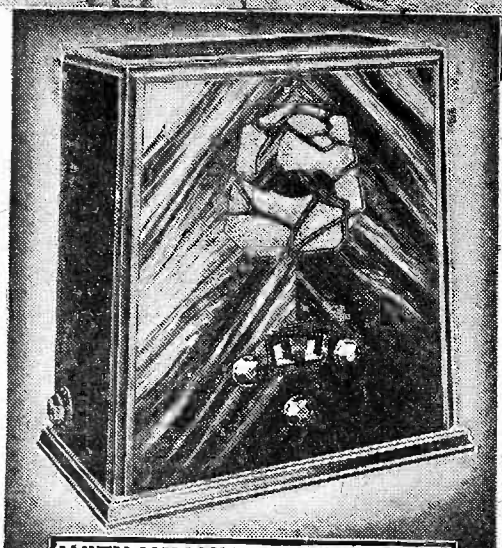

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ENGLAND-EUROPE-AMERICA-AUSTRALIA-ALL NOW ON MOVING COIL SPEAKER!

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World Skyscraper 4 tunes from 12 to 2,100 metres. It gives you all the ordinary British and Continental programmes you can desire, and in addition stations all over the world which broadcast news and views and entertainment on the Short and Ultra Short wavelengths. These Short Wave stations are receivable on this Lissen All-Wave All-World Skyscraper at truly amazing ranges—Melbourne, Australia, at almost 12,000 miles, Johannesburg at 6,000 miles, Sydney, Australia, at 12,000, Pittsburg, Massachusetts, at 4,000 miles—these and many more of which the ordinary listener cannot hear even a whisper.

And remember you get these stations through Double Balanced Pentode Output giving brilliant reproduction on a Moving Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.

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Lissen have made this All-Wave All-World radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia direct on a set you have built yourself; it makes you an enthusiast to realise what a wonderful thing you have created!

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To LISSEN, LTD., Publicity Dept., ISLEWORTH.
Please send me FREE copy of All-Wave All-World "Skyscraper" Chart.
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Address .....
.....
P.R.1934

POST COUPON

The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!

LISSEN

"SKYSCRAPER" 4

SEE "PRACTICAL TELEVISION" IN THIS ISSUE!

ROUND *the* WORLD *of* WIRELESS

"Practical Television" Free This Week!

THE remarkable strides made recently in the development of television have lifted it from the realm in which it was but a qualified success to a stage where satisfactory transmissions are possible and probable. With the object of keeping our readers acquainted with the movements and the developments of this new industry we are presenting free in the centre of this week's issue a four-page supplement, entitled "PRACTICAL TELEVISION." This will be given free once a month and it will appear with its own issue and volume number, so that those readers particularly interested in television may lift out this separate little journal and have it bound up separately. As television develops, PRACTICAL TELEVISION will develop in size with it, but the position at present is such that four pages a month are adequate to cover practical developments and to keep the reader's knowledge up to date.

Manila on 50 Kilowatts

THERE would now appear to be a chance of hearing broadcasts from the Philippine Islands, as KZRM, Manila, has now developed into a 50 kilowatter. Its wavelength is 485 metres (618.5 kc/s). Programmes are transmitted daily from 06.30 local time, the main evening entertainment lasting from 17.00 till midnight or 1 a.m. Translated into G.M.T., this spells a careful search between 22.30—00.00, or, again, between 09.00 and 16.00, as local time in the Philippines is eight hours *ahead* of ours.

B.B.C. Stations and Lucerne Plan

ON January 15, the B.B.C. transmitters will change over to their allotted frequencies as under: Daventry National, 200 kc/s (1,500 m.); North Regional, 668 kc/s (449.1 m.); Midland Regional, 767 kc/s (391.1 m.); Scottish Regional, 804 kc/s (373.1 m.); London Regional, 877 kc/s (342.1 m.); West Regional, 977 kc/s (307.1 m.); North National, 1,013 kc/s (296.2 m.); Scottish National, 1,050 kc/s (285.7 m.); Belfast, 1,122 kc/s (267.4 m.); London and West National, 1,149 kc/s (261.1 m.); Aberdeen, 1,348 kc/s (222.6 m.); Newcastle, 1,429 kc/s (209.9 m.); and Plymouth and Bournemouth on a common wavelength of 203.5 metres (1,474 kc/s). Aberdeen may, however, be provided with another channel. It is noticeable that with the exception of Bournemouth the alterations in the wavelengths of the British stations are small, and, in consequence, cannot cause much inconvenience to listeners; they do not in any way complicate the tuning of modern wireless receivers.

Famous Casino Burnt Down

THE *Palais de la Mediterranee*, opened at Nice some two years ago, has been partly destroyed by fire. It is from this Casino that a number of concerts and other broadcasts were relayed to the Nice-Cannes-Juan-les-Pins transmitter. It is reported that, pending its reconstruction, the studio will endeavour to link up with Cannes or Monte Carlo.

More Interference for Kootwijk

ACCORDING to a report from Romania, the 20-kilowatt transmitter now under construction at Brasov will shortly carry out its initial tests on 1,875 metres (160 kc/s), the channel now used by the Dutch Kootwijk station. This wavelength was allotted to Romania by the Lucerne Wave Plan, much to the disappointment of the Dutch Broadcasting Authorities, who have used it for several years.

Christmas Relay from Bethlehem

ARRANGEMENTS are being made by the B.B.C. to give listeners on Christmas Day a relay of a sacred service held at the Church of the Nativity, Bethlehem. In previous years the idea was mooted by the United States and steps had already been taken in 1932 to carry out the project, but, unfortunately, fell through. If permission can be obtained from the Patriarch of the Greek Orthodox Church to effect this unique transmission, the National Broadcasting Company of America will take it from England and distribute it throughout its vast network.

Berlin and Hamburg

THE construction of these two high-power stations is rapidly nearing completion, but although the Berlin 100-kilowatt transmitter will not be ready as early as anticipated, it is now fully expected that its tests will be made during the Christmas holidays. In these circumstances both Berlin and Hamburg will launch their new stations on the other in January next. No alterations in the wave-lengths of Berlin, Mühlacker, and Stuttgart, contrary to previous statements to that effect, will take place before January 15, 1934.

Eiffel Tower to Remain

AS apparently only that part of the Lucerne Plan dealing with the medium-wave band will be brought into operation on January 15th, Eiffel Tower will retain its channel for the time being. Broadcasts will therefore continue from this station until further notice. As regards the long-wave band, in view of the fact that no agreement could be reached at the recent Amsterdam Conference, there is every possibility that until some practical solution may be found, stations working on wavelengths between 100 and 2,000 metres will retain their present positions.

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

A New German Station

IN the beautiful forest of Tagel, in Germany, a new broadcasting station has been built which incorporates the latest improvements in design. Instead of the usual masts of steel, huge wooden towers are being erected with the aerial running vertically through the centre. The illustration on this page shows one of these towers which has progressed to a height of 100 metres. When completed, it will be 160 metres in height.

Fate of Belgian Private Transmitters

THE number of small privately owned broadcasting stations erected in Belgium during the past three years is such that the Government finds itself compelled to suspend licences in order to prevent mutual interference. They are scattered over the country, and include such towns as Antwerp, Binche, Charleroi, Liége, and have also even invaded the capital. In Liége alone five are operating daily. As their power is very small, it has been suggested that they should be grouped, and that a limited number be required to work on one of two common wavelengths.

Municipal Elimination of Interference

BADEN-BADEN in Germany is anxious to become a model radio city. In order to secure perfect reception of wireless programmes, the inhabitants have induced the council to install free of charge over 9,000 interference suppressors on electric motors which have been judged guilty of marring the radio entertainments.

Radio Version of *The Three Musketeers*

ALEXANDRE DUMAS' famous masterpiece has been specially adapted for broadcast, and will be heard in two parts, the first from the National stations on December 20th and the second in the Regional programme billed for December 21st.

Telephony on Cross-Channel Steamers

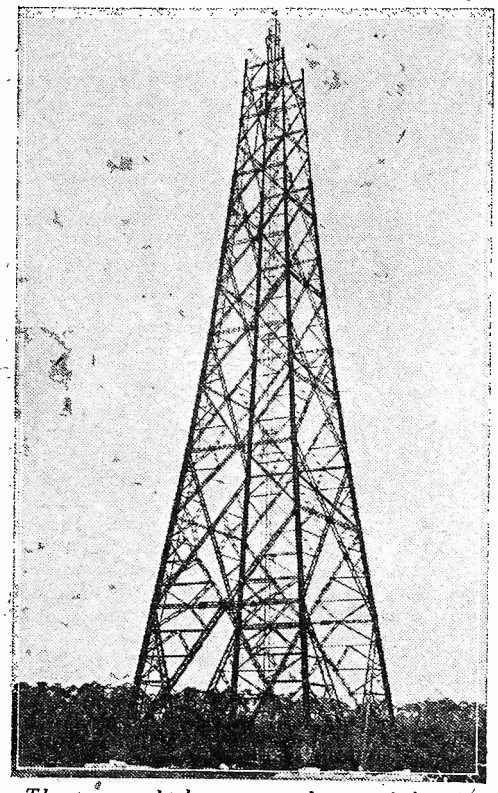
INTERESTING experiments have been carried out in two-way wireless telephony transmissions between the Dover-Ostend mail steamers, and the Belgian and English coasts. The s.s. *Princesse Astrid*, one of the new boats, has already been equipped for the service, and passengers travelling on this sea route will shortly be able to communicate by telephone with any subscriber in any city or town in Belgium. The Ostend radio station picks up these messages, and passes them through the ordinary telephone network.

Europe's Model Stations

MOST European transmitters in the course of their broadcasts are found to deviate in varying degrees from their allotted frequencies. Some, in this respect, are good, others bad, and yet others very bad. If the reports of the U.I.R. through the Brussels checking station are studied, the average deviation in cycles for one working month may be noted. Should prizes be awarded, however, it would appear that the two most conscientious transmitters are Scottish National (Falkirk) and Vienna, on respectively 1,040 and 580 kilocycles. Plus or minus deviation in cycles from their standard frequency has been shown as 0 in recent charts. If only all European stations could attain this excellent result!

INTERESTING and TOPICAL PARAGRAPHS

A VERTICAL AERIAL



The tower which contains the aerial for the new German station in the forest of Tagel.

New 10 kW U.S.A. Short Waver

THE Crosley Radio Corporation has resumed broadcasts with its new 10 kilowatt transmitter W8XAL at Cincinnati (Ohio). The station sends out a daily programme between G.M.T. 11.00-15.30, 18.30-20.30, and from 23.00-06.30 on 49.5 metres (6,060 kilocycles). The radio entertainments are relayed from the WLW, Cincinnati, studios of the N.B.C. network, working on 428.3 metres (700 kilocycles),

SOLVE THIS!

Problem No. 64.

Smith found that he had most of the parts required for the A.C. Quadpak, and he decided to try this out. He made up a rough chassis from plywood and carried out the construction as described in the Christmas number of PRACTICAL WIRELESS, but when finished, all that he could get was most pronounced hum. Why was this? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 64, and should be posted to reach here not later than December 11th.

SOLUTION TO PROBLEM No. 63.

Jackson had made the coils so efficiently that on the long waves the detector valve broke into parasitic oscillation. A simple resistance included in the reaction circuit cured the trouble. The following three readers gave correct solutions to Problem No. 62, and books have, therefore, been forwarded to them: E. Gray, Trinity Cottage, Costessey, Norwich. C. R. Willis, 53, Salisbury Road, Everton, Liverpool, 5. L. I. Butler, The Vicarage, Annerley Woodhouse, Notts.

Budapest's Ether Giant

THE super-power transmitter under construction near the Hungarian capital is nearing completion, and the famous aerial tower, vying in height with the Eiffel Tower, is nearly finished. It is reported that Budapest will carry out its initial tests this month. The station at present in use will adopt another wavelength, and will be utilized for the transmission of an alternative programme.

Piano Tuition by Loud-speaker

IN the United States, pianoforte lessons are broadcast through the microphone. Listeners are requested to place a printed chart on the keyboard and to carefully follow instructions given out by the music teacher. Each corresponding printed note bears a number which, according to the melody, is called out in rotation, with the result, no doubt, that the murdered composition resounds throughout the streets of innumerable cities.

Radio Rennes P.T.T.

FOLLOWING a temporary close-down for reconstruction of the plant, the Rennes P.T.T. transmitter is again on the air on 271.4 metres. It will be found that the signals are now heard at better strength in view of increased power in the broadcast. Rennes is only roughly 250 miles from London, and consequently provides a favourable alternative channel for the Paris *Ecôle Supérieure* concerts.

Ship-shore Telephony in Mediterranean

A SERVICE of wireless telephony is being established between the s.s. *Djenné* and Casablanca (Morocco) and Marseilles (France). The wavelengths adopted for the purpose are 92 metres for the steamer, and 68 and 74 metres respectively for the land stations at Rabat and Tangiers. Further developments will shortly permit similar service on the Casablanca-Bordeaux route.

An Ethereal Harp

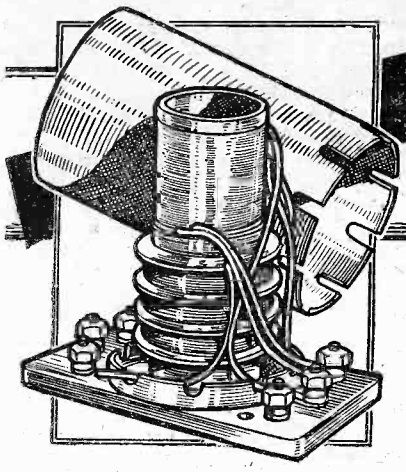
PRAGUE, similar to its neighbours, has finally chosen a characteristic signal to identify itself to its listeners. It has taken the harp motive from the Czech composer Smetana's poem *Wyschehrad*, and, having recorded it, broadcasts a few bars during all intervals of more than one minute duration. A melodious signal, which will be quickly recognised after you have once heard it.

Radio and Bootleggers

THE smuggling of alcoholic liquor during the past few months in the Baltic countries, and in particular Finland, has been assisted, according to a Swedish newspaper, by a pirate wireless station which the Finnish Customs officials are endeavouring to locate. Swedish amateur experimenters report having picked up morse messages destined to the smuggling ships, the search for which is proving an exciting pastime.

A Crop of Small Spanish Broadcasters

PENDING the reorganisation of the Spanish broadcasting system, permits have been granted for the installation of a number of small privately-owned stations. Following the opening of a transmitter at Bilbao and at Huesca, Radio Murcia (EAJ17), Gandia (EAJ23), and Onteniente (EAJ30) have been launched on the ether. These stations are stated to be working on 203 metres and their power does not exceed 200 watts.



MAKING YOUR OWN Screened Coils

This is the First of a Short Series of Articles in which the Construction of Different Types of Highly Efficient Screened Tuning Coils will be Described.

By FRANK PRESTON

DESPITE the extremely low prices at which efficient tuning coils can now be bought, there is an insistent demand from readers of PRACTICAL WIRELESS for some really practical information regarding the design and construction of tuners which can be made at home. As a matter of fact, a good deal of information in respect to coil construction has been given in these pages before, but all the coils described have, of necessity, been of the unscreened type. The reason for that is very simple, and is that the constructor has been unable to buy screening cans in ready-made form. To make these cheaply at home is well-nigh impossible unless the amateur has a fairly well-equipped workroom, but the difficulty has now entirely been overcome by the introduction (by Messrs. Peto-Scott, Ltd.) of well-made screening cans, which are supplied in conjunction with a paxolin former and the necessary dividing washers. By making use of these sets of coil materials, units of extreme efficiency and compactness can be made by using no other tool than a small drill. Additionally, a screened air-core coil of excellent design and high efficiency can be produced for a little over half a crown.

It is hoped in the course of a few articles to deal with the construction of tuning units of all the types which are required for a modern wireless set, but this particular article will refer only to one type which can be used satisfactorily in any normal receiver of the Det.-L.F. or S.G.-Det. types.

A good idea of what the finished component looks like can be gained from the photograph at Fig. 1, whilst all the necessary materials are shown grouped together in Fig. 5. The overall size of the complete tuner, including the baseplate and terminals, is only 3in. by 2in. by 3¼in. high, so it can easily be accommodated in any kind of receiver.

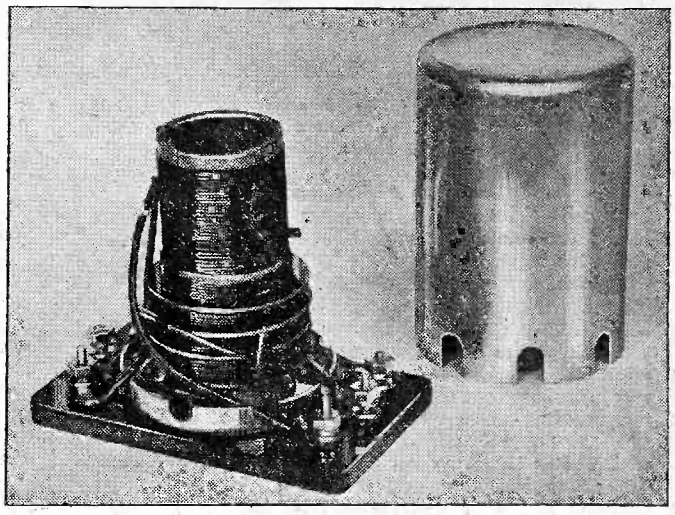


Fig. 1.—This photograph shows the finished coil and screen.

The Materials Required

The set of parts supplied by Messrs. Peto-Scott includes a cylindrical screening can, a "lid" for the can, a 1in. diameter paxolin tube, a number of paxolin dividing washers, and a "U"-shaped metal bracket for mounting purposes. The only additional materials required are six 6 B.A. terminals, an ounce of 34 gauge single-cotton-covered wire, a piece of 3-16in. ebonite measuring 3in. by 2in., an odd piece of insulating tape, and a short length of systoflex sleeving. Most of the latter will be found in the constructor's junk box, but if not they can be bought for less than eighteenpence.

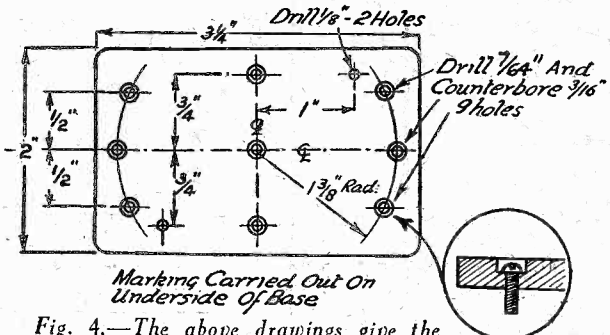


Fig. 4.—The above drawings give the necessary dimensions for making and drilling the ebonite base-plate

Fig. 2 shows the theoretical and practical arrangement of the windings for the coil I am going to describe first of all, and it will be seen that this is a rather unusual one. I can assure you, however, that it is one which I have proved to be extremely good, most especially in receivers of the Det.-L.F. type, where the maximum degree of selectivity is required from a single tuned circuit. The medium-wave winding

(Continued on next page)

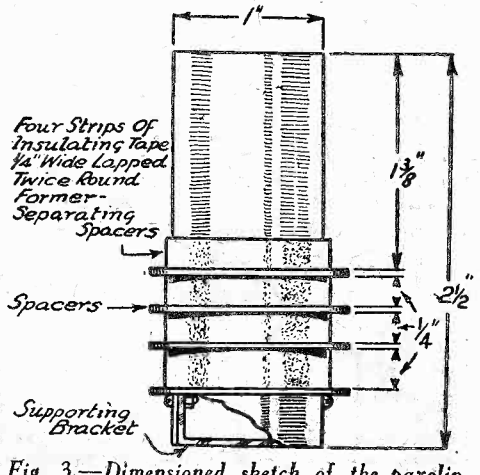


Fig. 3.—Dimensioned sketch of the paxolin former, showing how the washers are spaced by means of insulating tape.

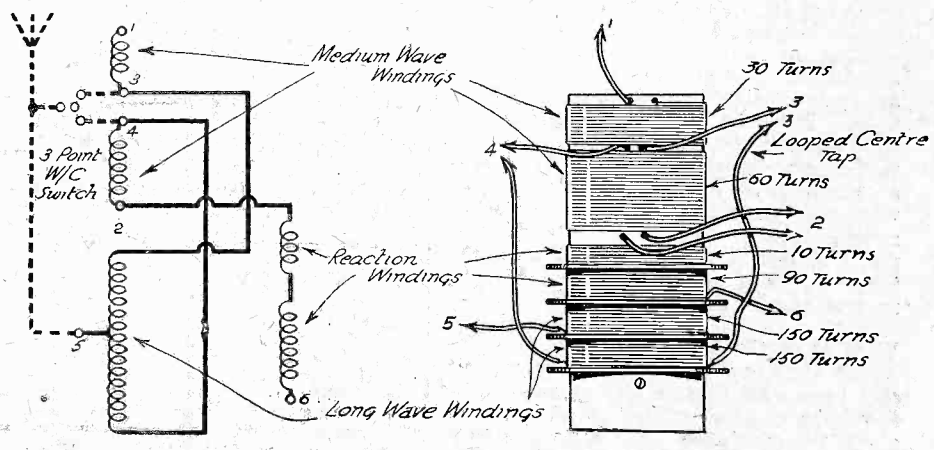


Fig. 2.—This sketch shows the theoretical and practical arrangement of the windings for the tuner described. Connections for the 3-point wavechange switch are indicated by broken lines.

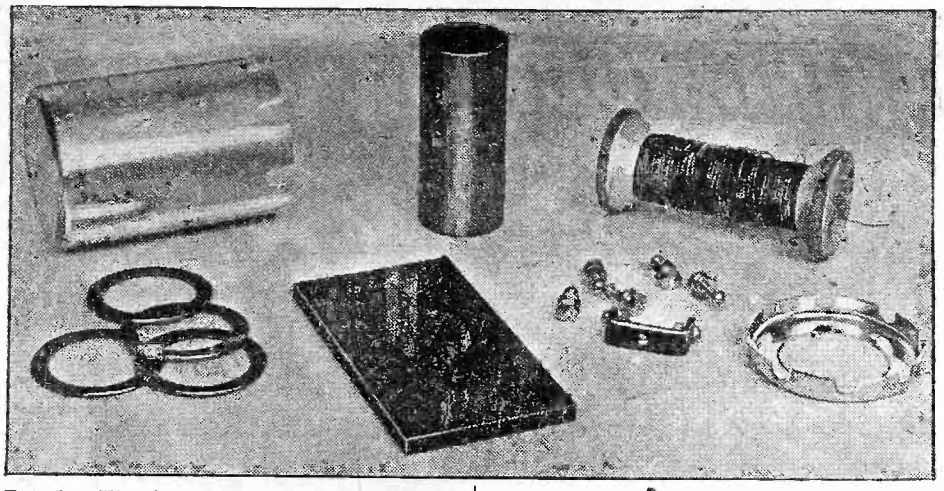


Fig. 5.—The few and simple parts required for making the complete screened coil are illustrated above.

(*Continued from previous page*)

is "split" into two sections, and the long-wave one is connected between them. A centre tapping is provided on the long-wave winding and the aerial is normally joined to this, but when the knob of the three-point wave-change switch is pulled out the long-wave section is short-circuited and the aerial is connected to the junction between the two sections of the medium-wave winding. By dividing the latter winding into two parts, one of which has half as many turns as the other, sufficient selectivity is obtained without reducing the sensitivity to any marked extent. Experiment has proved that best results are obtainable on long waves by taking the aerial tapping from the exact centre of the winding.

A reaction winding is also provided, and the size and position of this have been so determined that it provides an almost uniform effect over the whole of both wave-bands. This result has been secured by winding ten turns side by side near to the medium-wave windings, and placing the remaining ninety on a bobbin next to the long-wave windings.

Preparing the Former

Before commencing to wind on the wire, the paxolin former must be prepared by fitting the mounting bracket and paxolin-spacing washers. The bracket is fitted into one end of the tube by making two 7/32in. holes and passing the small bolts provided through them. Next slip one washer over the tube and push it down until it is against the heads of the bracket-fixing bolts. Now cut a strip of insulating tape ¼in. wide and wind this round the tube close to the washer for about a couple of turns. The second washer can then be fitted on the tube and pushed tightly against the insulating tape. Put on a second strip of tape and then another washer, repeating the operation once again and finishing off by winding a fourth strip of tape outside the last washer to keep it in place. The spacers should then be quite securely held in position, but if any doubt is felt on this score, a coat of shellac varnish or thin glue may be applied as a check.

Winding on the Wire

The winding is easy enough to carry out, and before starting, a pair of small holes should be made about 3-16in. from the end of the tube with the point of a compass or a thin pricker. Pass the end of the wire through one hole and back again through the other, leaving a length of about 5in. projecting for making a later connection to a terminal. Carefully wind on thirty turns of the wire, keeping a steady tension on the wire the whole time and arranging the turns neatly side by side. After that, make two more small holes in the tube in line with the end of the winding and anchor the wire in these, again leaving a length of 5in. projecting. So that this connection can easily be identified at a later stage a piece of stamp edging should be stuck on to it and marked with the terminal number (3). The second portion of the medium-wave winding can now be put on, and the end of the wire should be anchored in the two holes already made. Wind on sixty turns and make quite sure that they go in the same direction as the previous ones. Make a third pair of holes and anchor the wire, labelling the end with a figure 2.

The reaction winding comes next, and the end of the wire is secured by passing it through the pair of holes just made. Leave a gap of ⅛in. and then wind on ten turns, again in the same direction, pass on to the first slot and complete the remaining ninety turns. Cut off the wire and secure the end with a dab of sealing-wax or by looping it under the previous turn where it passes from the tube to the slot. Label this end of the wire with a figure 6.

Lastly we come to the long-wave winding, which consists of a total of 300 turns, half of which are placed in the two lower slots. The beginning of the winding need not be anchored, since it will be held in place by the following turns. Again, make quite sure that the turns are wound in the same

(*Continued on page 668*)

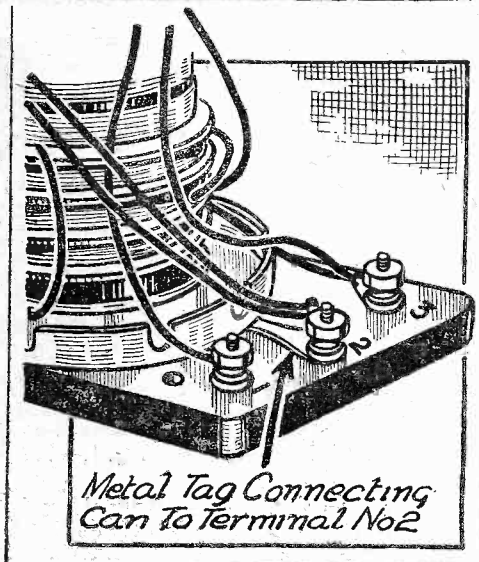


Fig. 6.—(Left) This sketch shows how the screening can is earthed by being connected to terminal 2 by means of a soldering tag.

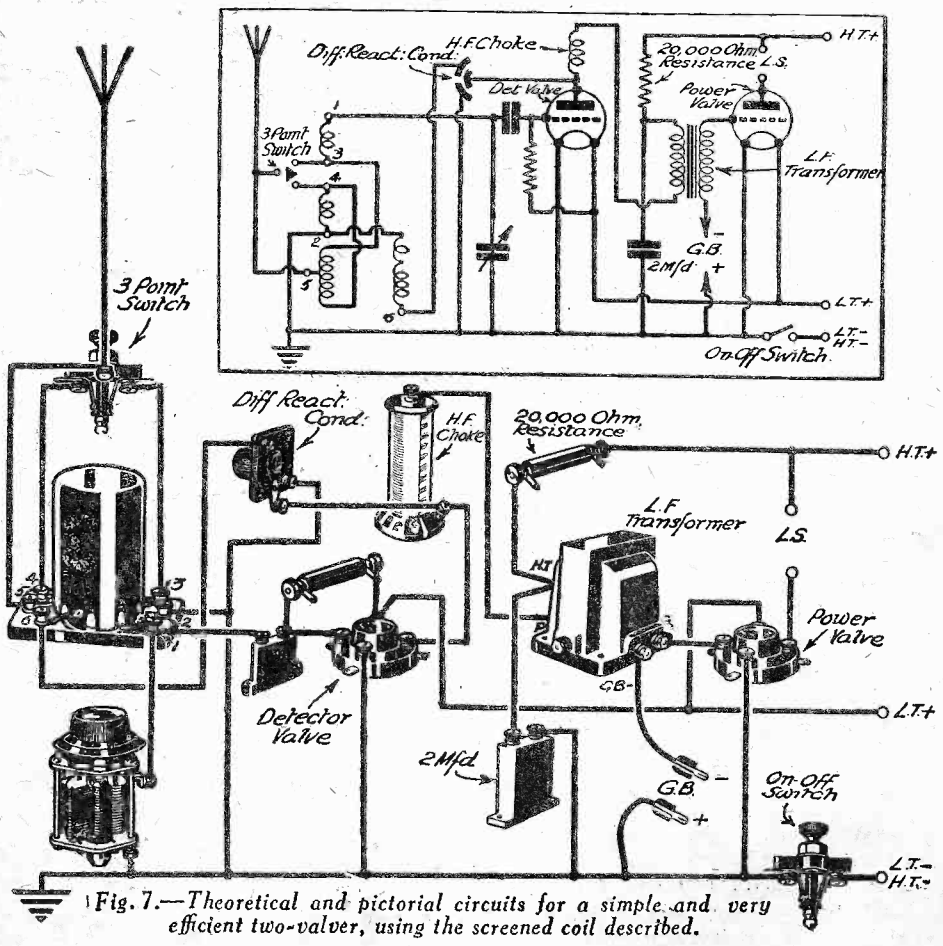
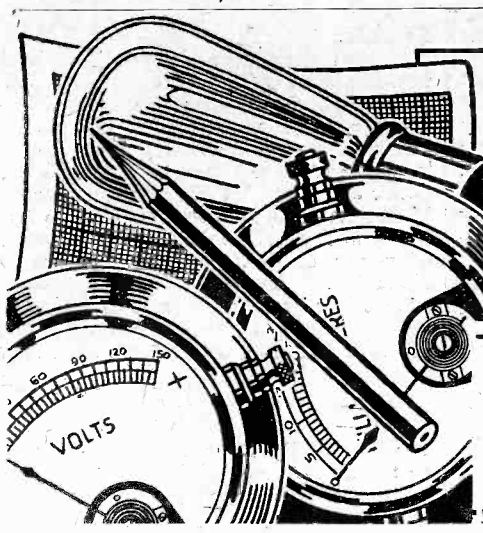


Fig. 7.—Theoretical and pictorial circuits for a simple and very efficient two-valver, using the screened coil described.



Power Output

In This Article the Author Discusses Output Valves, and the Methods Employed to Ascertain the Power Output of the Last Valve in a Receiver

By "LAMBDA"

THERE are four important units of measurement with which every wireless enthusiast is familiar. He knows to what they refer, and they are always cropping up in everyday conversation between radio enthusiasts. They are volts, ohms, amperes, and watts. For the present, however, we are interested in the last unit—watts, with particular reference to output valves. How often have you heard a friend say his power output was two, five, or even twenty-five watts? Now be very careful. There is a distinct difference between anode dissipation in watts and power output in watts, so you must be sure that you are both talking about the same thing. We will discuss anode dissipation in connection with power output later, for sometimes, when dealing with the latter, anode dissipation has to be taken into consideration.

Now, what is this power output, and how is it calculated? Is it just one of those common, everyday calculations such as amperes × volts equals watts, or is it something a little more complicated? Yes, it is! But if you follow this explanation carefully you will have at your finger-tips a method of approximately calculating the power output of a valve, and, therefore, be enabled to select the most suitable valve for your particular purpose. For instance, if you wish to operate a mains receiver at reasonable volume in a medium-sized room, about 2 to 2½ watts output is quite ample. This, of course, is the writer's own opinion, others may not agree. If you want something still nearer realism, and have no neighbours who would object, employ a 5-watt output valve. After all, many constructors like that extra reserve of power even if not constantly employed. If you are interested in public address work, then you can go higher still and use an output valve giving 10 or 25 watts, or even greater power output. However, our chief interest at the moment lies in ascertaining how this power output is calculated.

Necessary Factors

In order to make the necessary calculations, all that is necessary is the anode volts-anode current curves of the output valve, together with the load impedance in ohms. These curves are obtainable for the majority of output valves, and are supplied by the valve manufacturers in their catalogues.

The writer happened to have a spare 2-volt power valve, so decided to take the necessary curves himself, and calculate the power output in order that readers might have an opportunity of following through the whole process from a concrete example. Take a glance at the circuit shown in Fig. 1. This will show you the circuit of the hook-up required in order to obtain the necessary data.

You will notice that this is quite a simple arrangement, and for ease in operating it was assembled on a small baseboard. All that was necessary was a valve-holder and a few terminals, and every wireless

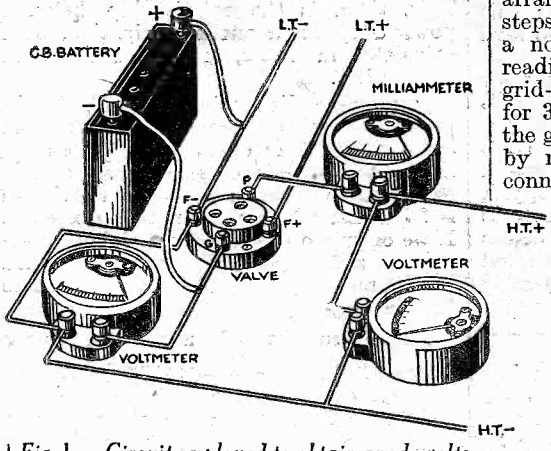


Fig. 1.—Circuit employed to obtain anode volts-anode current curves of an output valve.

man usually has these at hand. The necessary connections can then be made to the batteries and meters. The voltmeter should be capable of reading up to 250 volts, and for accurate results should be of the high-resistance type. Actually, the voltmeter employed had a resistance of 1,000 ohms per volt, while the milliammeter was a first-grade instrument. If the milliammeter only reads up to 10 milliamps it will be necessary to extend the range, and this can be carried out quite easily by following the instructions given in earlier articles on increasing the range of meters.

GRID VOLTAGE ZERO.	
Anode voltage.	Anode current milliamps.
20	0.4
40	2.3
60	5.6
80	9.6
100	14.0
125	21.0
150	26.0

GRID VOLTAGE 3 VOLTS NEGATIVE.	
Anode voltage.	Anode current milliamps.
20	0
40	0
60	0.6
80	2.3
100	5.6
125	10.5
150	16.5

Taking a Reading

Having fixed your valve in the holder and connected up your batteries and meters, arrange the first set of readings with zero grid-bias. This can be done by connecting the grid and filament together, or, preferably, by disconnecting the grid-bias battery, and connecting a piece of wire across the battery terminals. Now arrange to adjust your anode voltage in steps of 20 volts or thereabouts, and make a note each time of the anode current readings obtained. Next connect your grid-bias battery in circuit, and arrange for 3 volts negative bias to be applied to the grid of the valve (this can be checked by means of the low reading voltmeter connected in parallel with it). Repeat the process outlined above and again jot down the readings; this will give you data somewhat similar to that in the table of meter readings. Of course, different types of valves will give different readings. Continue increasing the grid-bias potential until you have applied approximately twice that recommended by the valve manufacturers.

The writer completed the series of readings up to 14 volts negative grid-bias, but only two sets of the readings are shown in the table mentioned.

Our next step is to plot these readings on squared paper, and the graph reproduced in Fig. 2 shows the resultant anode current and voltage curves, which is what we require.

The Load Line

We now have the anode volts-anode current curves, and our third requirement is the load line. It is well known that in order to obtain any amplification a valve must be operated with a load in its anode circuit. In the case of an output valve, the most suitable load is recommended by the manufacturers, and in this particular instance was 7,000 ohms. Knowing the optimum load, it is fairly easy to arrange our load line. First of all assume the 7,000 ohms resistance be placed in series with the anode of the valve. Then, if the grid voltage recommended by the manufacturers be 7 volts at a maximum anode voltage of 150, and the anode current be 6 milliamps, there will be a voltage drop across the load of 42 volts; add this voltage to the maximum anode voltage, making the total 192 volts. This will compensate

(*Continued overleaf*)

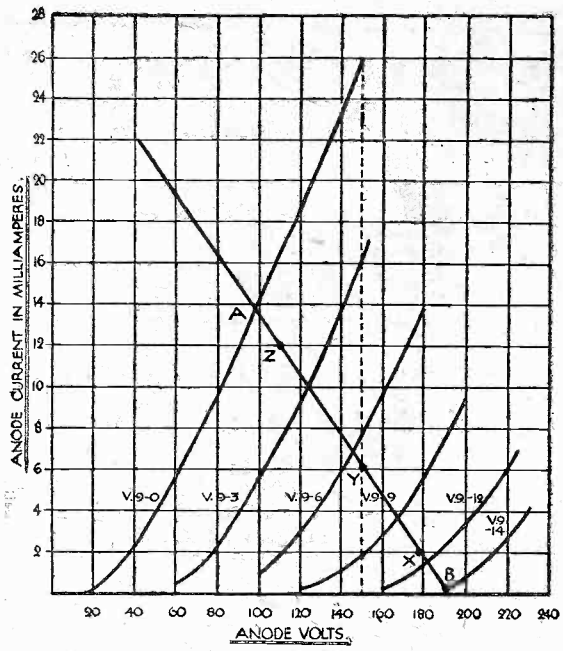


Fig. 2.—Anode volts-anode current curves of 2-volt power valve.

(Continued from previous page)

for the drop in voltage across the load resistance. Now, any change in anode voltage will be accompanied by a corresponding change in anode current; this would not be the case if there was no load in the anode circuit of the valve.

Next calculate the various voltages for variations in anode current. At 2 milliamperes 14 volts will be dropped, which, subtracted from 192 volts, will leave 178 volts. Mark this point on the graph. At 6 milliamperes 42 volts will be dropped, leaving 150 volts, and at 12 milliamperes 84 volts, leaving 108 volts. These points should be marked on the graph as indicated by the letters x, y, z. Draw a line passing through these points, and this will represent our load line, when the optimum load is 7,000 ohms.

The next thing is to assume a signal of 14 volts peak value being applied to the grid of the valve when it is biased, say, 7 volts negative. The grid will then swing backwards and forwards from zero to 14 volts negative, between the points A—B, which are marked on the load line where it cuts the grid-bias curves at zero and 14 volts respectively. At these points ascertain the anode current and voltage, which in this case will be: At zero grid volts 13.6 milliamps 98 volts, and at 14 volts grid-bias 0.4 milliamps 188 volts. Subtract the smaller figures from the larger and this will give us 13 milliamps and 90 volts.

Our next step is to multiply these together and divide by 8, and the result will give us the power output in milliwatts.

$$\frac{13.2 \times 90}{8} = 148.5 \text{ milliwatts.}$$

Therefore the undistorted output of this particular valve is roughly 150 milliwatts, not very great, but quite suitable for use as an output valve in a portable receiver.

"Yes, all very simple," you exclaim; "but where do you get the figure 8 from, and why should we divide by this particular number?" Let us see!

It has to be borne in mind that the values of anode current and voltage with which we have been dealing are maximum values, and what we require is the R.M.S. values. To obtain these we divide both current and voltage by $\sqrt{2}$. Now $2\sqrt{2}$ multiplied by itself will give us 8, which is, of course, so much simpler to employ and gives precisely the same results.

Anode Dissipation

In order to appreciate the importance of anode dissipation and how it differs from power output, although both are expressed in watts, we will examine the curves of a large output valve with an undistorted output of about 4 or 5 watts. This is shown in Fig. 3. You will notice the curved dotted line which at one point touches the load line, but never crosses it. If the slope of the load line were such that it cut the dotted line, greater power output might be obtained, but the life of the valve would be endangered, as the anode dissipation limit fixed by the valve manufacturers would be exceeded. Therefore a compromise has often to be made in order to keep below the anode dissipation line. This, then, is the relationship between power output and anode dissipation, both calculated in watts, mentioned earlier in this article.

The anode dissipation in watts is the product of anode voltage and anode current at any particular operating point on the anode volts-anode current curve, and in the example given in Fig. 3 the maximum is 25 watts, which must not be exceeded. If we calculate this at the maximum anode voltage and anode current recommended by the manufacturers our result will be as follows:—

Anode current 63 milliamps, anode voltage 400 volts—$\frac{63}{1{,}000} \times \frac{400}{1} = 25$ w.

At the point O, therefore, the maximum anode dissipation in watts is reached. In determining the position of the load line in Fig. 3 the maximum anode dissipation had to be considered.

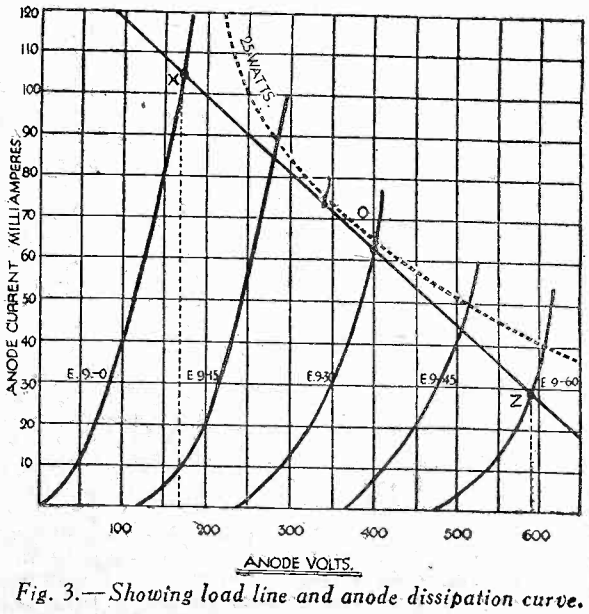


Fig. 3.—Showing load line and anode dissipation curve.

Distortion

If load lines were drawn through the working point O (Fig. 3) at different slopes, assuming for a moment no limit due to maximum anode dissipation, OX and OZ would become more nearly equal as the load line become nearly vertical, but the power output would fall off rather rapidly. If, however, the load line were made more nearly horizontal there would be an increase of power output, resulting in increased distortion. Theoretically, distortionless output is only obtainable when OX equals OZ, but in actual practice a certain amount of distortion can be tolerated, as it is not aurally appreciable. In deciding the best position for the load line, not only has the maximum undistorted output to be obtained, but the load line must not cut the anode dissipation curve. In calculating the amount of distortion which is permissible it is laid down that the distance between OX and OZ should not exceed the ratio of 11 to 9. If the ratio should exceed this amount the quality of reproduction will suffer. The valve manufacturer, therefore, fixed the load line so that the above conditions are complied with.

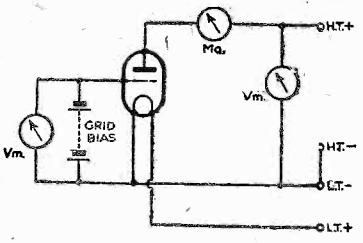


Fig. 4.—The theoretical circuit of the arrangement shown in Fig. 1.

Now take a family of curves of an output valve, and calculate the undistorted output for yourself. It is extremely interesting, and you will gain a lot of useful information on the operation of your output valve.

Books Received

B.B.C. YEAR BOOK FOR 1934. 480 pages, 2s. Published by The British Broadcasting Corporation, Broadcasting House, London.

THIS is a remarkably interesting volume, crammed with facts, figures, and biographies, details and data about everything and everybody connected with British Broadcasting. Special sections deal with Programmes, The Regions, Empire and Foreign Sections, Technical Matters, etc. The new wavelength plan is explained in detail, and the keen listener should purchase a copy at the earliest moment. There is something of real interest on every page, and the illustrations considerably add to the value of the work. It is on sale at all newsagents.

CHRISTOPHER STONE SPEAKING, 6s., 250 pages. Published by Ivor Nicholson and Watson, Ltd.

I HAVE never worshipped at the shrine of gramophone record announcers. To me it has always seemed that the mere playing and announcing of gramophone records is hardly a task in which one could leave footprints in the sands of broadcasting history. To me the interest, or lack of it, is in the record itself, and not in the announcer. But I am prepared to concede that I am among the minority and probably wrong. In this volume, somewhat egregiously and at the same time, self-deprecatingly written by Christopher Stone himself, he manages to fill 250 pages in an interesting style, by suitably enlarging upon small incidents. And I must admit that the book *is* interesting, and will appeal enormously to Mr. Stone's large following. He explains the technique of record announcing in great detail.

DICTIONARY OF WIRELESS TERMS, by Ralph Stranger, 2s. 6d. 160 pages. Published by Geo. Newnes, Ltd.

A HANDY volume of definitions of the technical terms used in wireless. F.J.C.

DISTORTION FROM A NEW VIEWPOINT

In This Concluding Article the Author Deals with Lack of "Attack," Decoupling, Microphonic Tendencies, and Leaking Condensers. The First Article Appeared on Page 537 of Our Issue Dated November 25th.

By W. B. RICHARDSON

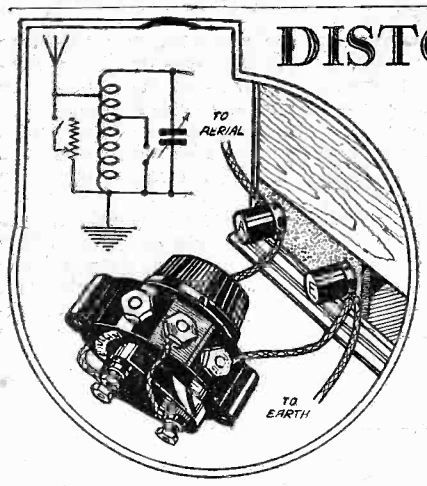


Fig. 1.—A resistance connected across the aerial circuit to obviate overloading of the detector, thus preventing distortion.

Selectivity and Tone

THE opposite effect of resonation, namely, a falling-off in the response to some frequencies, may be due to a variety of causes. When it is the high notes which are lacking, the most obvious cause is that the tuning is too selective. It is well known that to sharpen the tuning beyond a certain degree means a loss of the higher notes. The popular *band-pass* tuning arrangement was introduced for the express purpose of overcoming this defect.

The transmission from a broadcasting station, although stated as being radiated at one definite frequency, say 1,000 kilocycles (300 metres), actually occupies a band of frequency extending over about nine or ten kilocycles, so that to get proper reception the receiver must not tune too sharply or some of the side bands will not be received. On the other hand, if the tuning is too flat, there will be interference from other stations. A band-pass tuner gives a more or less even response over a band of frequencies of about nine kilocycles, while on either side the response drops off sharply. In this way the demands of both quality and selectivity are satisfied.

Compensating for Loss of High Notes

If your set is not provided with band-pass tuning, and the tuning is very selective, then some means should be provided to compensate for the cutting off of the higher notes which will naturally result. One method is to use an L.F. transformer which has a rising characteristic, that is to say, one which provides greater amplification of the high notes than the medium and low ones.

An even better arrangement is to use a tone control transformer, such as the "Multitone." Most careful designers will specify something of this sort in a set with ordinary tuning, but if your receiver is not so provided or if it is lacking in high-note response for some other reason, then a simple tone control, consisting of a fixed condenser with a variable resistance across it, should be connected in series with one of the speaker leads, as has been shown before. The effect of this will be to reduce the response to the low notes and so level matters somewhat. Naturally it is not an ideal arrangement, since for one thing it robs the set of a certain amount of power by cutting down the fully amplified frequencies to the level of the weak ones.

A point worth mentioning in connection with high-note cut-off is that reaction can introduce noticeable distortion. As the reaction control is advanced, so the tuning becomes more selective. Reaction should never be used to any great extent with band-pass tuning, as it immediately alters the shape of the response curve from a flat topped one to a pointed one, and so defeats the whole object of the system.

If a receiver suffering from poor upper frequency response is fitted with a triode as the output valve, then its substitution with a pentode will, in a large measure, restore the brilliance of the original transmission. Matching of the impedances of the speaker and the new valve is usually necessary. If a multi-ratio speaker is used, then the adjustment can easily be carried out. Failing this an output choke with suitable tappings for a pentode should be used.

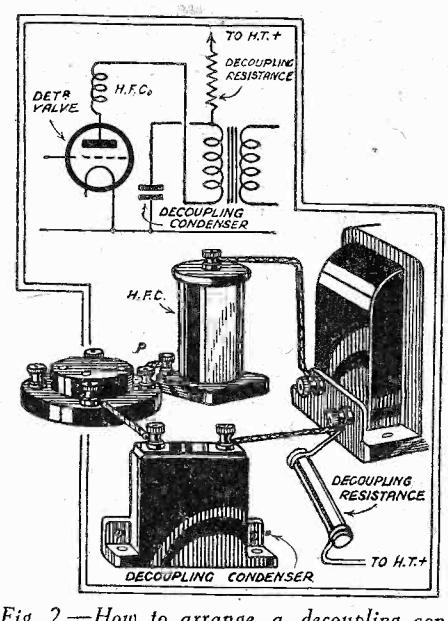


Fig. 2.—How to arrange a decoupling condenser and resistance to prevent distortion.

We have already dealt with distortion due to resonating effects, and also that due to the falling off in the response to certain frequencies. We now come to what is known as lack of "attack." This, as I have already explained, is a slurring of reception caused by the inability of the moving elements of the speaker to follow the rapid fluctuations of the speech current. It is due, of course, to the inertia of the reed or the moving coil (as the case may be) together with that of the cone. This may sound rather technical, but it simply means that the moving parts are too heavy and do not "jump to it" as they should do.

Unfortunately, if a speaker suffers from this defect to any marked degree the only course open is to substitute another one. Naturally nothing can be done to the receiver itself since the cause of the trouble lies entirely with the speaker. Obviously it is unwise to try to lighten the reed (moving iron) or the moving coil, as this will probably do more harm than good. The use of a lighter cone may help matters, but here again care must be taken that rigidity is not sacrificed for the sake of lightness. Incidentally, with good-class moving-coil speakers the weight of the moving coil is kept very low by the use of the lightest materials including aluminium wire for the coil, so that if the reproduction from your present speaker lacks sparkle, try the effect of substituting another of modern design.

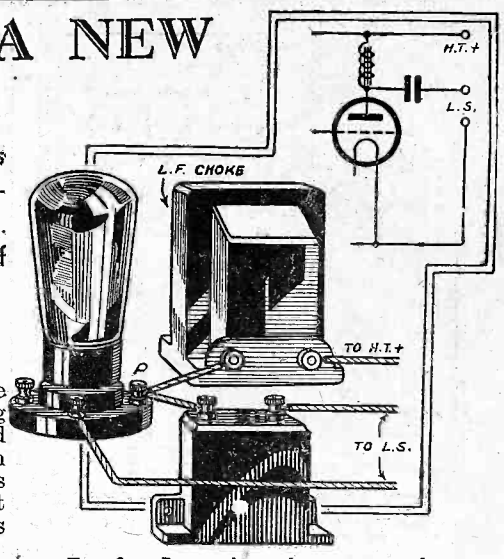


Fig. 3.—Decoupling the output valve.

Wave-Form Distortion

In the first part of this article I indicated how various forms of distortion might be recognized, and in the following pages I have endeavoured to show how some of the causes might be diagnosed and the necessary remedies applied. Now in the case of distortion resulting from deformation of the wave-form, there are so many different causes giving much the same effect that it is almost impossible to say, by listening to a receiver suffering from this form of distortion, to what particular cause it is due. We know the results are characterized by blurred, muffled, or rough reproduction, but it must be left to the reader to find out, by the process of elimination, the actual cause or causes. I am giving here some of the most likely ones, together with hints on suitable remedies. Distortion of this type is most frequently associated with the incorrect use of valves, such as under and over-biasing, overloading, etc.

Let us take an elementary case of incorrect bias causing distortion in a battery set. Suppose the H.T. battery has been in use for some time and its voltage has dropped considerably. Distortion sets in. This may be partly due to the increased internal resistance of the battery resulting in a certain amount of back coupling, but it may also be very largely attributable to too much bias. Naturally when the battery was new the bias would be set to the maximum figure for undistorted reproduction, but it must not be forgotten that as the H.T. voltage drops so the grid bias needs lowering, since the amount of bias necessary depends on the anode voltage supplied to the valve. The higher the anode voltage the higher the grid bias required, and *vice versa*.

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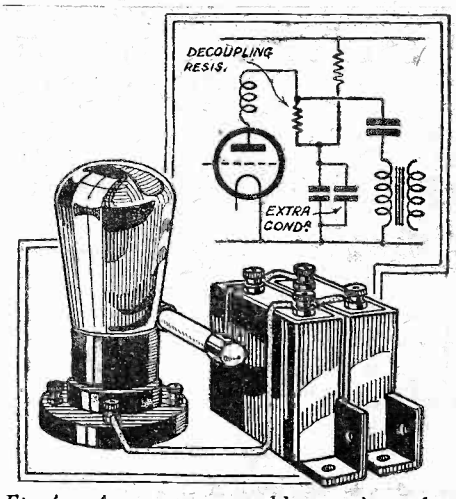


Fig. 4.—An easy way to add extra decoupling. Join another condenser in parallel with the existing decoupling condenser.

DISTORTION FROM A NEW VIEWPOINT

(*Continued from previous page*)

Therefore, if the setting of the grid bias was left unaltered it would be too high after the H.T. battery had been in use for some time. In such a case reducing the setting of the bias tappings will usually improve matters considerably and so give the H.T. battery a new lease of life.

Overloading the Detector

Overloading a valve is quite a common cause of distortion. With modern receivers employing high-magnification valves in the H.F. stages it is very often the detector which causes the trouble. Detector overload is not always easy to diagnose, as the resulting distortion is not of a very blatant nature. However, if it is present it will spoil the reproduction, although in a somewhat intangible manner. The symptoms to look for are over-emphasis of the high notes and a marked double-hump effect in the tuning of loud transmissions, the maximum signal strength being obtained just slightly on either side of the true wavelength. Another feature is that the reaction control or any predetector volume control will appear insensitive on powerful transmissions, quite a large movement of the control making but little difference in the volume. A screen-grid valve used as a detector is particularly liable to overloading.

To increase the power-handling properties of the detector it is always worth while trying an increase in anode voltage, at the same time using a grid leak and condenser of suitable values. The leak should be about ½ megohm to 1 megohm and the condenser .0001 mfd. For short-wave work the leak may be increased to 3 megohms. If overloading still occurs then some form of predetector volume control must be fitted and brought into operation on the strong transmissions. The ideal form of control is provided by the use of variable-mu valves in the H.F. stages. Another good scheme for reducing the input to the detector, in the case of a straight tuned circuit, is the connection of a variable resistance between the aerial and earth terminals of the set. The resistance should either have a definite "off" position or else be fitted with a switch to cut it out of circuit when maximum sensitivity is required. A suitable value for the resistance is 50,000 ohms. One of the combined volume controls and switches now on the market can be recommended for this purpose. (See Fig. 1.)

Distortion Due to Back Coupling

I mentioned just now distortion caused by high internal resistance of the H.T. battery. The reason for distortion in this case is two-fold. Firstly, there is the obvious reason that the anode current of the various valves is lowered below the optimum figure, and, secondly, there is the question of back coupling. Obviously, since the anode circuit of all the valves is completed through the high-tension battery, the internal resistance of this is common to each anode circuit, and thus forms a coupling between one valve and another. In this way fluctuations in the current passing through the later valves will cause corresponding fluctuations in that passing through the earlier ones. These fluctuations, owing to the time taken for the currents to travel through the succeeding stages, will be out of step, or out of phase as it is called, with the fluctuations of the original current. This will produce a howl. Sometimes, instead of a howl, the noise produced is of so low a pitch that each separate beat can be distinguished. It is then called "motor-boating."

The way to cure L.F. howls and motor-boating is to get rid of the undesirable coupling by *decoupling*. First of all, a resistance and condenser connected in the plate circuit of the detector valves, as shown in Fig. 2, should be provided. If

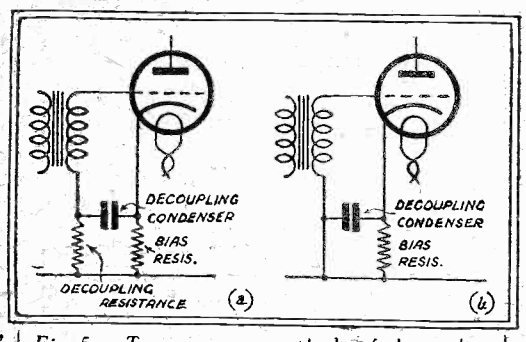


Fig. 5.—Two common methods of decoupling the grid circuits when using automatic bias.

this fails, then further decoupling of a similar nature should be employed in the intermediate L.F. stages (if any) and the last valve should be decoupled by using choke output, if it is not already fitted, as in Fig. 3. A very old dodge for curing motor-boating consists of changing over one pair of leads to the L.F. transformer. Either the wires to the terminals marked "H.T.+" and "P" are changed round or else those to terminals "G" and "G.B."

Of course L.F. howling and motor-boating are of so blatant a nature as to hardly come under the heading of distortion at all. On the other hand, there may be just sufficient back coupling in the L.F. stages of a receiver to introduce distortion without actually causing a definite howl. The reproduction will be characterized by a certain roughness. Where it is due to a run-down H.T. battery there is also loss of volume. The use of a pocket voltmeter will soon determine if the battery is getting low. If so the remedy is obvious. Of course, the use of adequate decoupling, and the readjustment of grid bias, as already explained, will help to increase the useful life of the high-tension battery.

Adding Extra Decoupling

It is quite possible to get distortion, due to L.F. back coupling, in a receiver in which the H.T. battery is quite O.K., or in a mains receiver even although decoupling arrangements are provided. In this case the existing decoupling should be supplemented. The best way to do this is to either fit larger decoupling condensers (say 2 mfd. in place of existing 1 mfd. components) or else to connect extra ones in parallel with the present ones, as in Fig. 4.

In an all-mains set, where grid bias is obtained by utilizing the drop in voltage across a resistance, decoupling of the associated grid circuits is necessary and this is usually carried out by using a resistance and condenser as in Fig. 5 (*a*). In some receivers, however, the resistance is omitted, the condenser only being used as in Fig. 5 (*b*). In the latter case, a resistance may often be included with advantage.

Microphonic Tendencies

A frequent cause of distortion which is sometimes overlooked is that produced by microphonic feed-back. The sound waves from the speaker travelling through the air, and also, in the case of a combined receiver and speaker, through the cabinet and chassis, set up vibrations in the valves and vanes of the variable condensers, etc. In extreme cases a loud, sonorous howl will build up, which drowns everything. However, this condition is not often met with, but a receiver will frequently be found to be working in a state where a microphonic howl almost manifests itself on loud passages, the result being a rough jarring kind of reproduction.

The most usual cause of the trouble lies with the detector valve, this valve being particularly susceptible to any vibrations transmitted to it through the holder or through the air. The use of an anti-microphonic valve-holder, and the enclosure of the valve in a cardboard tube lined with cotton wool, as in Fig. 6, are two recommended devices for curing this trouble.

Condenser-Vane Vibration

The vanes of variable condensers, especially if they are thin and unsupported at the tips, are liable to start vibrating when sound waves from the speaker impinge on them, or are transmitted to them through the chassis. The remedy here consists of mounting the condensers on rubber buffers. This is easily done with ganged condensers as a soft rubber washer can be placed under each foot of the condenser. With panel-mounted condensers of the one-hole-fixing variety it is rather more difficult, but the mounting of the panel or even the whole chassis on pieces of sponge rubber will prevent the direct transmission of the vibrations through the cabinet and panel to the condensers.

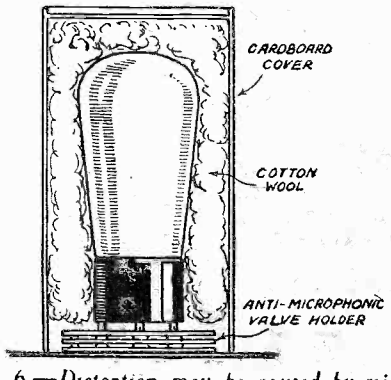


Fig. 6.—Distortion may be caused by microphonic feed-back. Protecting the detector valve as shown here may effect a cure.

The LANCHESTER-JONES "Class B" CIRCUIT

How It Diminishes the Current Consumption of the Driver Valve.

By F. W. LANCHESTER

IN conjunction with Mr. A. H. Jones, the writer has developed a modification of a "Class B" circuit directed to secure a still greater economy in the aggregate plate current than is obtainable in the "Class B" amplifier as hitherto known. The object of the improved circuit is to diminish the demand of the driver valve, and so increase the life of the H.T. battery.

It is perfectly well known that the great advantage of adopting "Class B" amplification is that the demand on the H.T. battery, more especially under static conditions, or small signal loads, is reduced, and the advent of "Class B" has had the effect of giving a new lease of life to the battery-driven set. The bugbear hitherto has been that the driver valve is too greedy, and either it has to be biased down to a point at which a certain amount of distortion comes in under heavy load, or, alternatively, the plate current is excessive, and takes away much of the advantage secured by the "Class B" output valve. The reason for this is that the driver valve and its transformer, having to take charge of the grid current, necessitates the drive circuit being treated as a power circuit in a small way of business. In the improved circuit the driver valve is normally biased down to a point at which it only takes a very small current, say half to one milliamp, but when the heavy signal comes through the bias is automatically diminished so that the necessary A.C. signal can be passed without distortion.

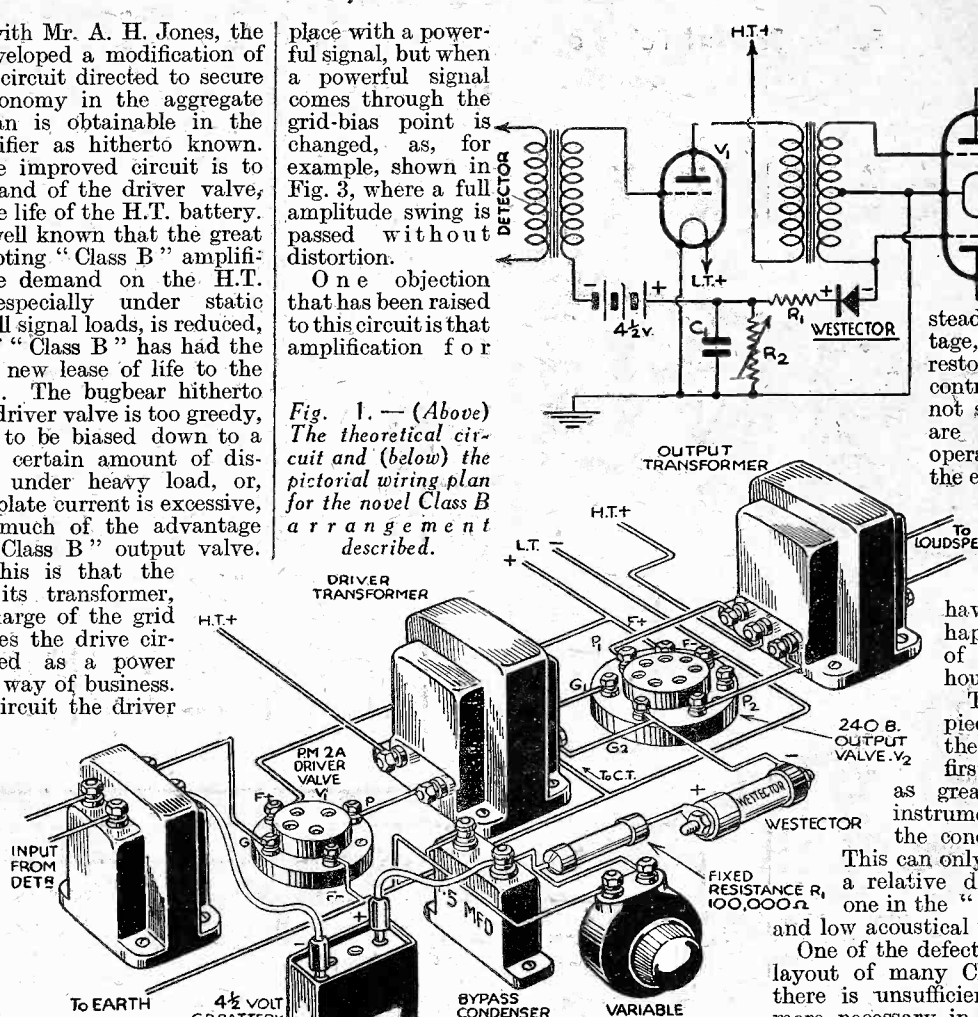


Fig. 1.—(Above) The theoretical circuit and (below) the pictorial wiring plan for the novel Class B arrangement described.

The diagram of the circuit is as given in Fig. 1, where it will be seen that when there is a heavy signal the voltage from the power circuit is fed back to the grid-bias battery of the driver valve after undergoing rectification, for which latter purpose a metal or other rectifier, such as a Westector, is used. The action of this system is illustrated by the valve diagrams shown in Figs. 2 and 3. Under static conditions, or when the signal is quite small, the drive valve is biased right down on to its anode bend, where, under normal conditions, considerable distortion would take place with a powerful signal, but when a powerful signal comes through the grid-bias point is changed, as, for example, shown in Fig. 3, where a full amplitude swing is passed without distortion.

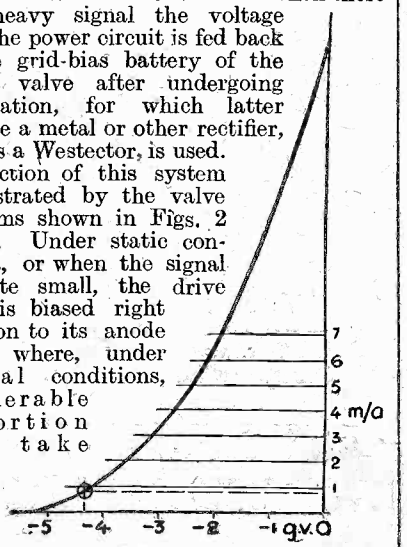


Fig. 2.—Showing how the driver valve is biased right down to the "bottom bend" of its characteristic when signals are not being received.

One objection that has been raised to this circuit is that amplification for small signals would be very much less than for heavy signals, and consequently there will be an exaggerated contrast between pianissimo and fortissimo passages. But this apparent disadvantage is really an advantage, because in recording, as in studio transmission, it is common that the singer or instrumentalist is instructed to diminish the contrast. In the case of a gramophone record this is to avoid the pianissimo being drowned by the mechanical noise; moreover, extreme pianissimos tend to get lost in the recording, so that really the new "Class B" circuit, instead of being a disadvantage, in many cases acts to restore the desired degree of contrast. Even were this not so, as when broadcasts are being made from the opera house or concert hall, the extent of the exaggerated contrast is not noticeable to the ordinary listener.

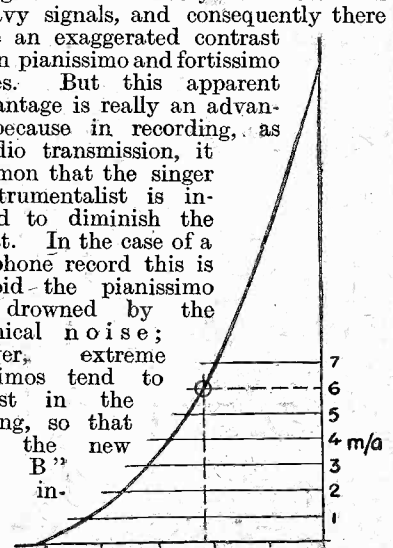


Fig. 3.—The bias on the driver is reduced to its normal figure when signal voltages are applied to it.

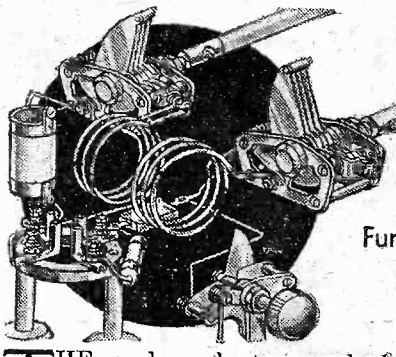
In proof of this statement we have only to consider what happens in the auditorium of a concert hall or opera house.

There are positions occupied by listeners in which the distance from the (say) first violins is three times as great as from the bass instruments, and others where the conditions are the reverse. This can only result in a difference, a relative difference, of eighty to one in the "reception" of the high and low acoustical frequencies.

One of the defects most prevalent in the layout of many Class B circuits is that there is unsufficient decoupling. This is more necessary in the case of an H.T. dry battery being employed than where an accumulator battery is used owing to the higher resistance of the former. The distortion due to inadequate decoupling comes into prominence when the tone volume increases; for low-signal values the absence of decoupling (unless there is motor-boating) is little noticed.

We have much to learn in the practical working of the Class B circuit, and it is of great value to provide milliammeters, both on the power valve and on the driver valve, as indicators of what is taking place. It is most entertaining to hear nearly perfect reproduction with the milliammeter needles dancing all over the place, when he has become accustomed in his previous experience to regard needle flick as taboo.

[*We are requested to announce that the patentees have no intention of asking for royalties from bona fide amateurs (readers of* PRACTICAL WIRELESS*) putting up sets according to the description given in the present article. To avoid uncertainty, any amateur wishing to make use of this concession is requested to send in his name and address to Messrs. Lanchester's Laboratories, Ltd., Spring Road, Tyseley, Birmingham, marking the envelope "free licence," and enclosing postage or a stamped envelope, when he will receive a formal authorization.*—ED.]



Short Wave Section

Further Practical Points on the Technical Side

THE modern short-wave dual range coil provides a very efficient answer to the problem of arranging short-wave tuning on comparatively efficient lines without having to use plug-in coils. However, problems commence when one or more H.F. stages have to be used. Certainly we can use various forms of ganged switching, but the efficiency of these arrangements on short waves is doubtful. The simplest method of controlling two dual-range circuits with one switch is shown in Fig. 1, where we have a more or less conventional screened-grid high-frequency amplifier and detector of the type suitable for short-wave operation. The switch S is of the three-point type, with the centre point earthed and the remaining two contacts connected to the appropriate coil taps. If the two stages are screened by means of a single metal screen, the more efficient arrangement is to cut away a portion of the screen where it comes up against the front panel, and mount the switch in the middle of this portion so that one half of the switch is on either side of the screen where it will be possible to take wires direct from the coils without either wire having to enter the wrong side of the screen. The other alternative to this arrangement is to use two separate switches for each coil. It is also possible to use two mechanically ganged switches so that each switch is on the correct side of the screen.

Adding a Superhet Stage

Actually, if one wishes to add amplification to a short-wave receiver, apart from that provided by the detector and the low-frequency stages, the very most efficient method of doing this is to use the superheterodyne arrangement. We can add as many stages of amplification at intermediate frequency as we wish, and still retain a single switch to do all our wave-changing. The diagram of such an arrangement is shown in Fig. 2, where, although we have a stage of powerful screened-grid amplification (V_2), the only tuning control is that of the oscillator-detector condenser C_1, supplemented by the wave-change switch S. Compare these two diagrams and note the differences between the two systems.

A point which many amateurs apparently do not appreciate is that a superheterodyne receiver which is to be used for short-wave reception *only* can be a very much simpler affair compared with the normal type of superheterodyne receiver used on the medium and longer waves. I am not saying that a receiver of this type even is a very complicated affair, but the short-wave version is much simpler because of the fact that, providing the intermediate frequency is kept sufficiently low, one tuned circuit can do the work which is normally done by two, three, or even more circuits in the longer wave receivers. Admittedly, in the superheterodyne arrangement we have to use two detector valves (V_1, V_3), but the final degree of amplification will be very considerably greater than that provided by the other arrangement and the receiver will also be very much easier to tune. One has actually to tune a short-wave superheterodyne receiver before it is possible to realize the very great advantages of having a reaction control which is constant all over the dial (the reaction in this case is at intermediate frequency, of course). The reaction control can be set just below the point of oscillation and left there from one end of the dial to the other, and the degree of reaction coupling will remain constant.

A Question of Tuning

The tuning of a short-wave receiver of this type, therefore, becomes very similar to that of one of the modern large superheterodyne medium and long-wave receivers with which one can travel from one end of the dial to the other with stations coming in at good strength without so much as even bothering about a reaction control. Of course, for the reception of weaker stations, it is sometimes necessary to "spill over" the reaction control to the actual oscillating point, and this is also necessary in order to receive code stations, although unfortunately so many code stations suffer either from hum-modulation or key-clicks that some so-called C.W. stations can be heard without the second detector valve being near the point of oscillation.

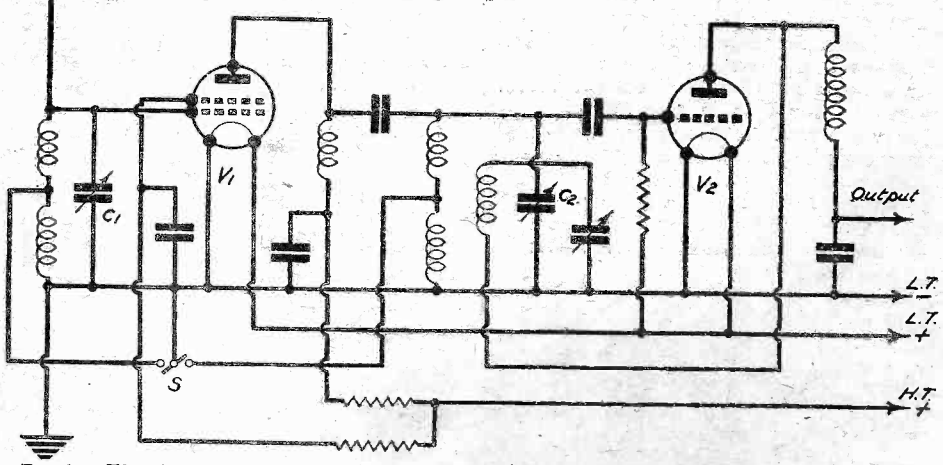


Fig. 1.—This diagram shows how the two dual-range short-wave coils may be operated from one switch where a single screened grid H.F. stage is used.

In the diagram shown (Fig. 2), further amplifying stages can be added between valves V_2 and V_3 without complicating the tuning at all, as the condensers C_2 and C_3 are only trimmers, and once set they can be forgotten, and this, of course, applies to all further stages which may be added here. Actually, if the receiver is well designed and well made, a second stage of I.F. amplification will be rarely necessary, the arrangement of Fig. 2, in conjunction with two stages of L.F. amplification, being quite capable of providing great volume when required.

The short-wave superheterodyne is an exceedingly interesting type of receiver, and in a future article it is proposed to deal more closely with the practical construction of receivers of this type. A short-wave superheterodyne need not necessarily be a costly affair, and the results obtainable with a receiver of this type can be truly excellent.

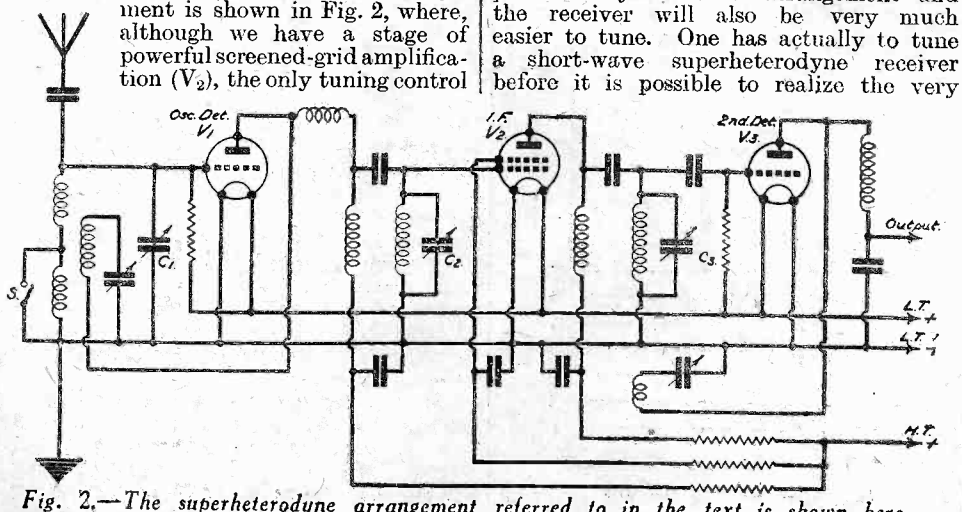


Fig. 2.—The superheterodyne arrangement referred to in the text is shown here. Compare this diagram with the arrangement shown in Fig. 1.

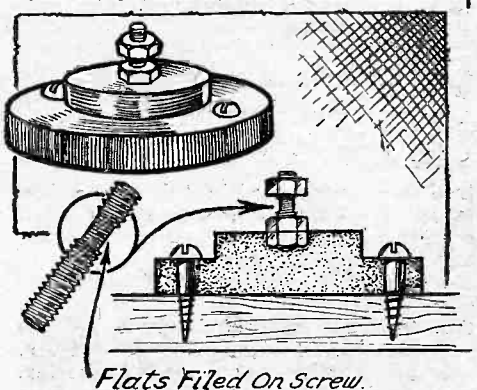
READERS' WRINKLES

THE HALF-GUINEA PAGE

Easily-made Insulating Blocks

INSULATING blocks have a variety of uses, especially in short-wave work, for the mounting of coils, etc., and can easily be made from moulded ebonite knobs which have been dismantled from old components.

The knob is laid flat on its front face and

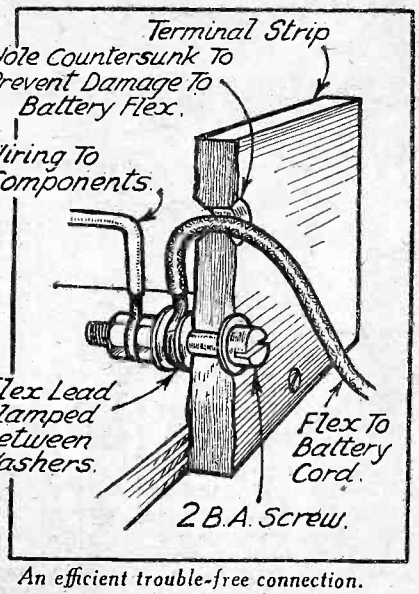


Easily-made insulating blocks made from bakelite knobs.

two ⅛in. holes drilled through the flange and diametrically opposite. Care must be taken when drilling, as too much pressure on the drill may cause the edge of the knob to break away. A piece of screwed rod about ⅝in. long is screwed into the recessed nut in the knob, and a lock-nut screwed on to prevent turning. Two flats are filed on the rod just above the lock-nut, as indicated, to accommodate spade connections, and another nut is screwed on the rod to facilitate gripping connections.—Mr. F. ALLEN (Sunderland).

Trouble-free Connections

MANY times I have experienced those annoying crackles in my set caused by loose connections, and traced them to the connection strip upon the rear of my baseboard. Terminals with screw tops, I find, are apt to work loose, and tags upon battery cords are inclined to become damaged during household cleaning, and other necessary movements of the set. Therefore, I have, as far as possible, discarded the usual terminal and adopted the following method. The diagram will give a good idea of the arrangement; No. 2 or 3 B.A. bolts are used in place of terminals, and the individual leads are passed through the rear panel, looped and bolted directly under the nut and washer upon the rear panel. The rear panel is drilled, and well countersunk on both sides to prevent the rubbing of the cord covering, and it will be obvious that this scheme relieves the connection of the strain that may be caused by the movement of the cord. The connection to the apparatus is locked on the inner side of the panel, and thus a sound and thoroughly efficient termination results, which proves more satisfactory than the usual highly-priced terminal. An important point is that these semi-permanent connections should be made at the correct end of the cords. That is, the end of the cord where there is least possibility of short circuits, etc., which may result in damage to the apparatus—the set end of all battery cords and the speaker cord connections upon the speaker itself.—W. A. HARRISON (Aintree).



An efficient trouble-free connection.

Improving Short-wave Control

TUNING a short-wave receiver for the clear reception of low-power transmissions thousands of miles away can never be truthfully termed "child's play," even when the operator has had years of experience and has an almost perfect receiver. Failure to receive any but the more notable transmissions can usually be traced to lack of patience or slip-shod dialing on the part of the operator. The latter fault is almost always due to the unsuitability of the tuning controls for this essentially precise work.

Many home-constructors use their discarded components in a short-wave receiver, particularly the old-type S.M. dials which, having only small operating knobs, make short-wave tuning accuracy impossible. Dials of this type can always be made more suitable for short-wave work by fitting a large tuning knob, which may be cut from a discarded 4-inch dial with the aid of a fret-saw. Not only is tuning made more accurate, but the large knobs enhance the appearance of the receiver; and of course, the improvements cost nothing.—F. J. GOUGH (Ellesmere).

THAT DODGE OF YOURS!

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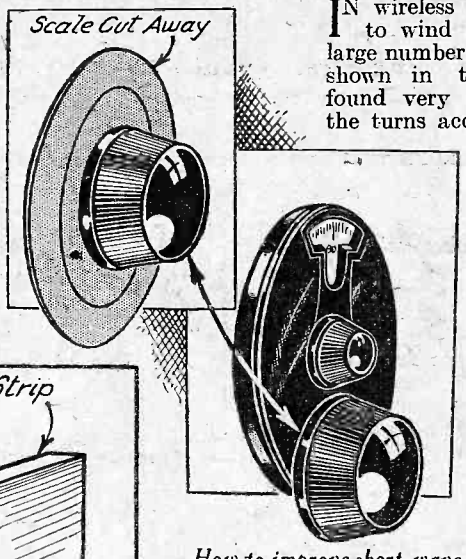
A Simple Revolution Counter

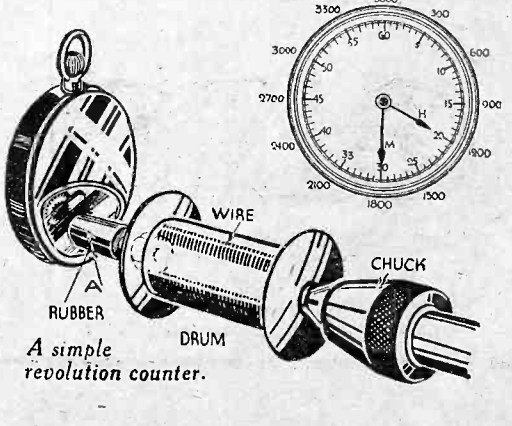
IN wireless work one often has to wind coils which have a large number of turns. The counter shown in the sketch will be found very useful for recording the turns accurately.



How to improve short-wave control.

It can be made from an old watch which has the escapement removed, with the "second" shaft reversed so that its extension protrudes from the back of the watch instead of the dial. A piece of round rubber is pressed on to the shaft end, so as to form a definite drive, and the counter is then held against the chuck of a geared hand drill or lathe centre. A new dial should be made and marked out as shown. Before winding a coil the watch hands should be set at zero, the counter held lightly, so that shaft A is rotated until the required number of turns are recorded on the dial.

Sixty turns of A=1 revolution of hand M. 3,600 turns of A=1 revolution of hand H. Higher values should be recorded by hand H —K. A. VARTY (Alnmouth).

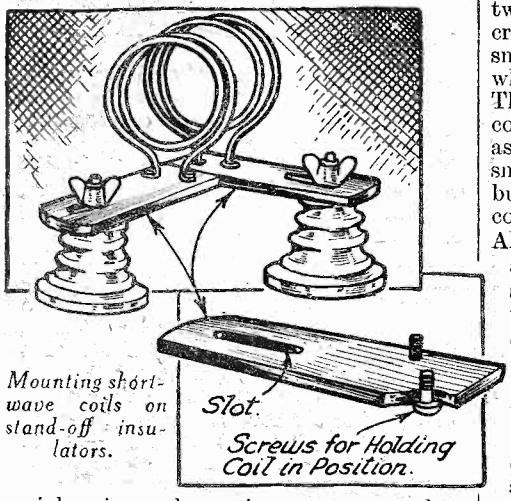


A simple revolution counter.

Mounting Short-wave Coils on Stand-off Insulators

A SIMPLE method of using stand-off insulators for mounting short-wave coils is shown in the accompanying sketch.

A slotted strip of ebonite is fitted with two screws at one end, to which the looped ends of the inductance are secured. For a 3-coil tuner the two end coils, *i.e.* aerial series and reaction, are arranged as shown with the insulator to the left of the coil and the reaction coil in line, but with the insulator to the right of the coil. The tuned-grid coil has the insulator placed on the right-hand side, the coil being mounted the other way round on the end of the strip. Adjustments of spacing between coils is thus easily arranged.—B. PEDDER (Southgate).



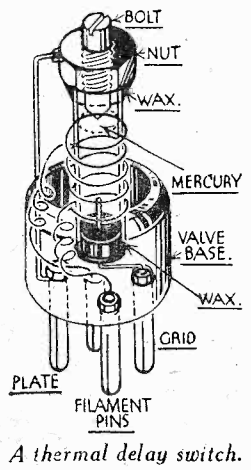
Mounting short-wave coils on stand-off insulators.

A Thermal Delay Switch

A GOOD thermal delay switch can be made from parts taken from the "junk box." The mercury can be obtained from your local chemist.

The parts required are: An old valve base; an inch of glass tubing; about 2d. worth of mercury; a nut and bolt, and some fine wire.

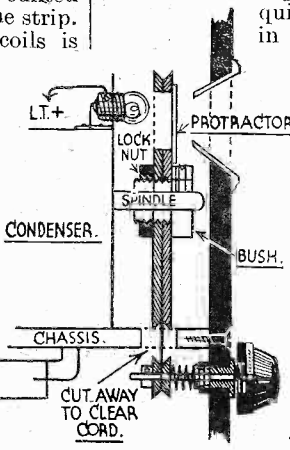
Having connected a piece of the wire to one filament, coil it around the glass tubing several times, and then take it to the other filament pin; then from the grid pin take a wire to the bottom of the glass tubing, pass it a little way inside and then seal with wax. Now fill the tube three-quarters full with mercury, take the nut and bolt and solder a piece of wire to the nut. Seal this to the top of tubing with the wax, then by screwing the bolt up or down you can adjust the switch to suit your requirements. —H. W. NICHOLS (Amersham).

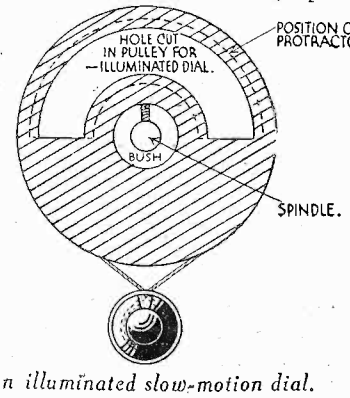


A thermal delay switch.

An Illuminated Slow-motion Dial

THE accompanying illustrations of a home-made illuminated slow-motion dial may be of interest to other readers. The large pulley was made from two thin discs of wood (cut from a cigar box), sandpapered to a bevel of about 45°, and glued together with the bevels inside. A hole was cut, as shown, and a celluloid protractor was seccotined over this, after inking in the graduations with indian ink. A hole was cut to take the bush, and the whole disc mounted on the condenser spindle. The small pulley was mounted on a $\frac{3}{16}$in. spindle, and was held in place by spring washers. The cord is cobblers' twine, lightly rubbed with resin and crossed. Besides keeping the cord on the small pulley this gives an easy tension which considerably facilitates slow tuning. The device can be adapted to suit varying conditions, no measurements being given, as these will vary with the size of the small pulley and the ratio desired. A bulb is mounted on the condenser, or other convenient place, to illuminate the dial. Altogether this makes a very neat arrangement. If desired, the condenser spindle can be mounted to project through the panel to take a knob for a direct drive.—W. LOWENS (Manchester).





An illuminated slow-motion dial.

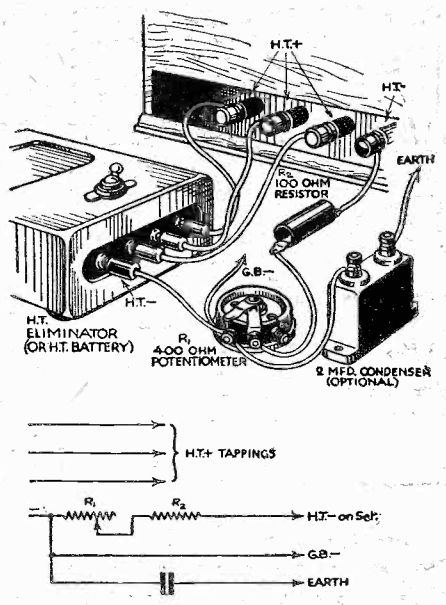
Auto Grid-bias from an H.T. Eliminator

THE accompanying illustration shows a simple and convenient method of obtaining automatic grid-bias when using an H.T. eliminator for power supply purposes.

The +GB connection will normally be effected through L.T.— on set. R_1 is a 350 or 400 ohm grid-leak potentiometer. The value of the series resistance R_2 will depend on the grid-bias required by the output valve in use. Using a Mullard P22A with 4v. G.B. and total current m/a on all valves being 10 m/a, then total resistance $R_1+R_2=400$ ohms, so in that case R_2 should be 100 ohms. Thus the bias on particular stage may be varied to suit conditions. When using a power valve with 6 volts G.B. and the total current consumption of all valves in set is 6 MA (for example),

$$R_1 + R_2 = \frac{6}{.006} = \frac{6{,}000}{6}$$

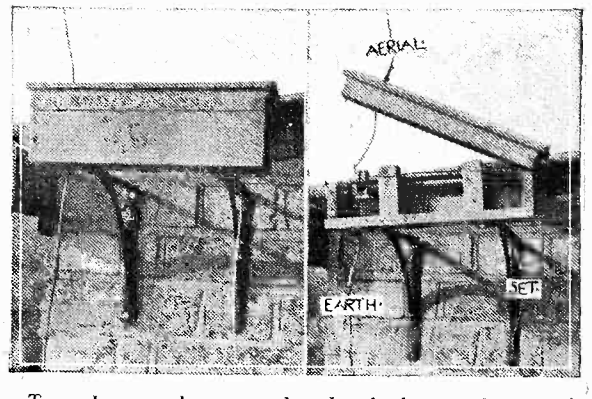
$=1{,}000$ ohms, hence R_2 would be about 750 ohms. When using the connections shown, the G.B. battery can entirely be dispensed with.—J. M. DAVIES (Chingford).



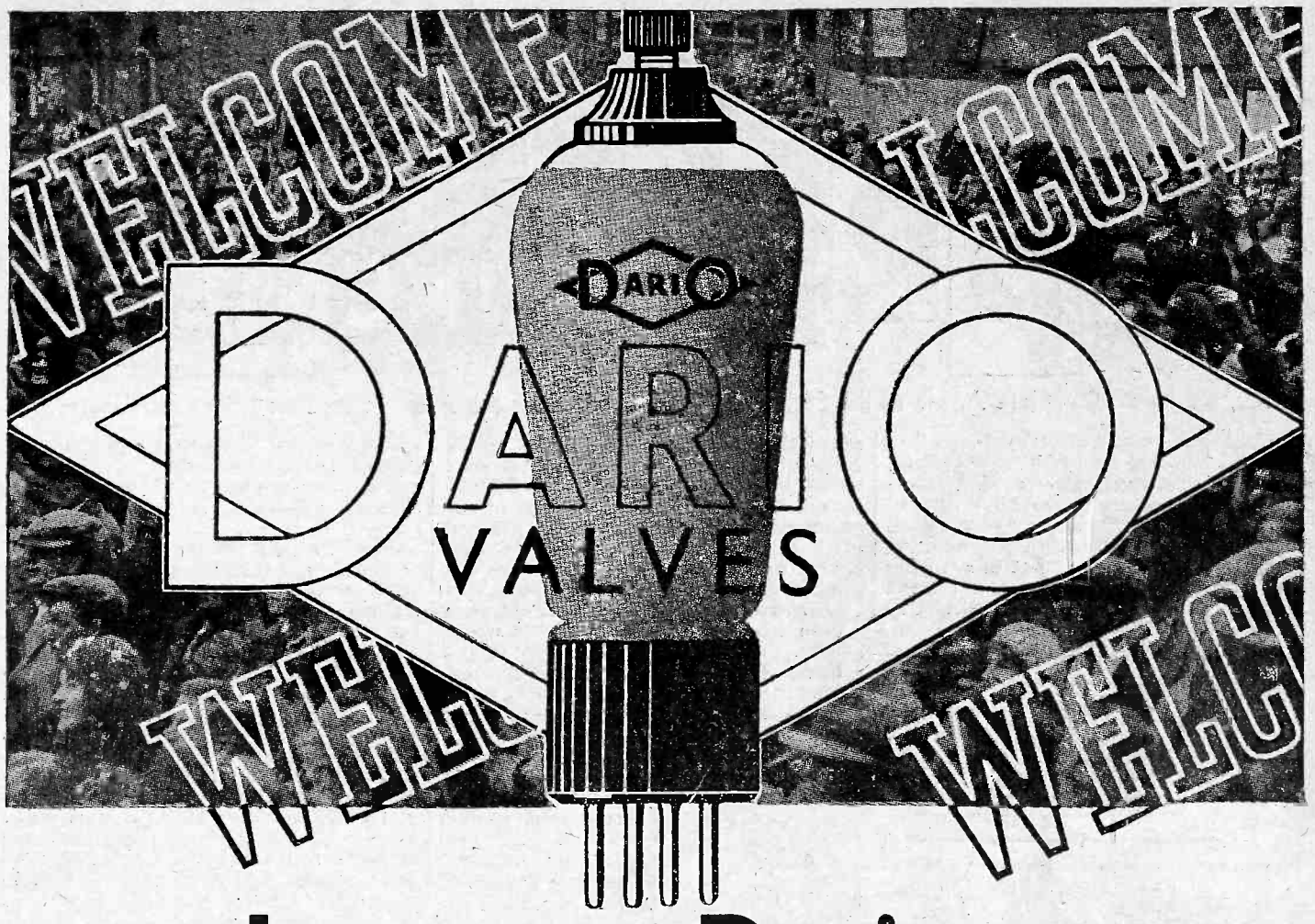
Auto grid-bias from an H.T. eliminator.

A Weather-proof Lead-in

THERE are probably many readers who still suffer from dirty contacts on the aerial-earth switch, or who find it inconvenient to open a window to switch on and off. The trouble can be remedied by fitting a lead-in tube incorporating a lightning arrestor, and suitably housing it outside the house. The accompanying illustration shows a lead-in tube, in a box mounted on brackets, which has been outside a house for over four years, during which time it has required no attention. The contacts are still clean, and it efficiently serves a 40ft. high aerial. The tube is 9in. long and is held in place by two supports $2\frac{3}{4}$in. high, $1\frac{1}{2}$in. wide and 1in. thick, so that it does not touch the casing. A hole was bored $\frac{3}{4}$in. from one end, equal to the diameter of the tube, and the wood was then sawn through the hole, making two halves. The tube is laid in one half and the other is screwed down on top. The supports are in turn screwed to the base from outside. The overall dimensions of the box are 11in. long, $3\frac{1}{2}$in. high, and 3in. wide. The top of the lid is a length of capping $11\frac{1}{2}$in. long and $3\frac{1}{2}$in. wide, all the wood being $\frac{1}{2}$in. thick. The three holes through which the covered wire leads pass were filled in with putty and the whole box was then painted. The lid, of course, is hinged at one end and a suitable clasp is fitted at the other.—R. E. WILLIAMS (Winchmore Hill).



Two photographs giving details of the weather-proof lead-in described.



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In this, the Eighth Complete Article of the Series, the Author Describes the Addition of Class B to the "Progressor."

LAST week we left the "Progressor" as a "de-luxe model" three-valver, having a variable-mu H.F. stage followed by a detector (providing delayed and controlled A.V.C.) and a power output valve. Practically the only useful addition that can now be made is that of a further low-frequency amplifying stage, which will increase the available output volume. One

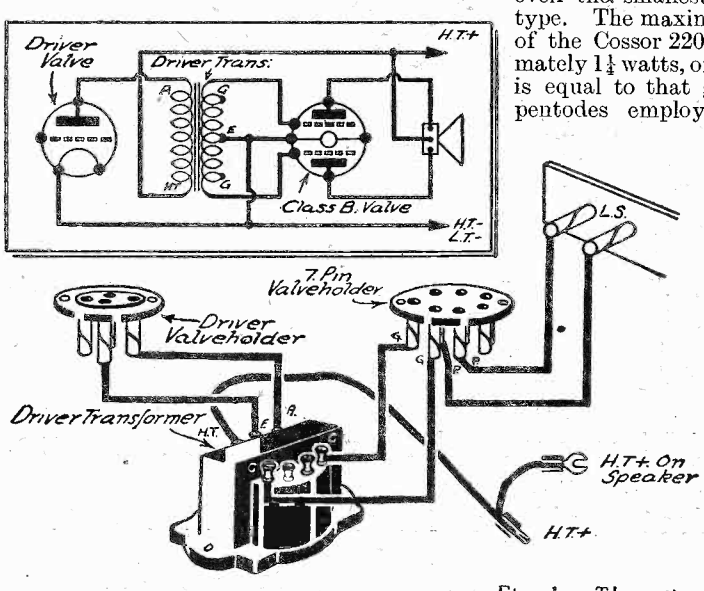


Fig. 1.—Theoretical and pictorial circuit of the Class B amplifier of the "Progressor."

L.F. valve is provided, so the best course to follow is fairly obvious; a Class B output stage must be added.

Class B Advantages

Class B amplification has many advantages over the older and more conventional systems, and for the benefit of new-comers to wireless, and also to refresh the memories of those who by now take Class B for granted, I will briefly summarize those advantages. In the first place a Class B valve provides a considerably greater volume of sound than any other type of battery valve, although it consumes only slightly more current than even the smallest one of the "power" type. The maximum undistorted output of the Cossor 220B specified is approximately 1¼ watts, or 1,250 milliwatts, which is equal to that given by several of the pentodes employed in powerful mains receivers. Even when providing such an output it consumes an average H.T. current of some 6 milliamps, whilst its filament takes only .2 amp. of current from the accumulator. I stated that the "average" current was 6 milliamps, that adjective being used because the actual anode current varies between about 2 milliamps (when the set is not tuned to a signal) to a figure as high as 30 milliamps when dealing with the loudest passages of speech or music from the local station. Between the two limits the current constantly fluctuates in intensity. It will be seen from this that an economy can always be effected by reducing the volume, since the current consumption is proportional to the average output.

The Class B valve really consists of two separate three-electrode valves placed side by side in a single glass bulb, and these two function on the push-pull principle, each dealing with alternate half waves of the signal voltages. Moreover, the valve is so designed that it works without any grid bias, for each of the triodes passes practically zero anode current when its grid is "returned" to H.T. negative. When a signal is tuned in, however, the positive halves of the signal voltages bias the grids positively, and then anode current flows. It should also be explained that the negative half-waves have practically no effect at all, because they merely tend to reduce the anode current still further, so rendering the valve irresponsive to them.

The Driver Transformer

Due to the fact that the Class B valve operates on the positive portions of the signal voltages, it will be seen that, as the grids become positive, current must flow from the filaments to the grids. Were it not for the fact that a special feed transformer were used prior to the Class B valve this would result in hopeless distortion. But the preceding transformer (called the driver transformer) is just the opposite of an L.F. transformer and gives a voltage "step-down" instead of a "step-up" effect. Additionally, the secondary of the transformer has a very low D.C. resistance, so that the varying currents flowing through it do not produce any appreciable voltage

(*Continued on page 650*)

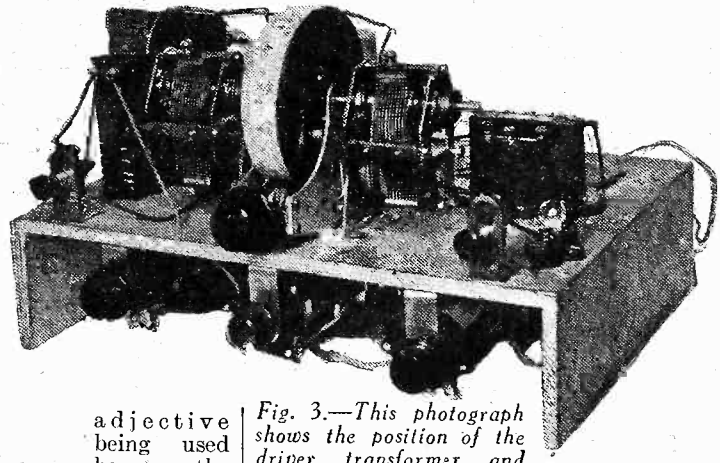


Fig. 3.—This photograph shows the position of the driver transformer and tone-control resistances.

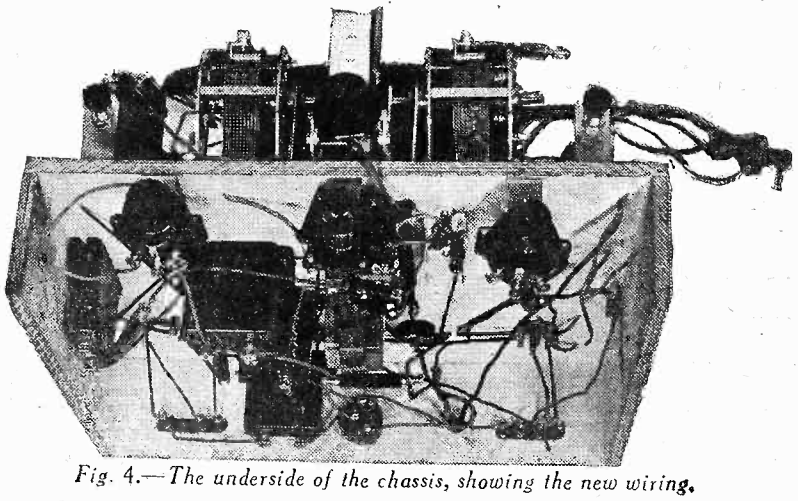


Fig. 4.—The underside of the chassis, showing the new wiring.

THE PROGRESSIVE EXPERIMENTER.

(Continued from page 648).

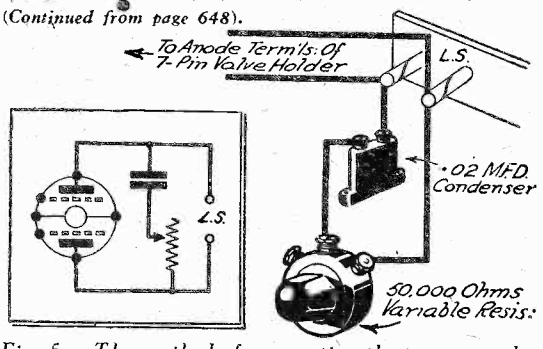


Fig. 5.—The method of connecting the tone control components between the anodes of the Class B valve.

drop across it. The driver transformer really supplies power to the output valve, and in order that it may do this it must be fed from some source or other. The feeding source is the driver valve which must be used between the detector and Class B valves. As a matter of fact, the driver valve is purely and simply a low frequency amplifier connected to the Class B valve by means of the driver transformer just mentioned.

The above explanation will probably be understood more easily by making reference to the pictorial and theoretical circuits, shown in Fig. 1, which depict the arrangement of components in a straightforward Class B amplifier. They also show the arrangement which we shall employ in the "Progressor," of which the new wiring plan is given in Fig. 2. The new components have been shaded for easy reference, whilst the few extra wires are indicated by broken lines to contrast with the previous wires, which are represented by full lines.

Mounting the Class B Components

It is a perfectly simple matter to add the Class B amplifier to the "Progressor," and the first thing is to make a fourth hole in the chassis for the 7-pin valve-holder. This hole is larger than the previous ones, being 1⅛in. instead of 1in. diameter. If a bit of the correct size is not available, you can make a 1in. hole and enlarge it by means of a half-round file. In any case care must be taken to ensure that the valve legs cannot make contact with the metallized surface of the chassis—if they did a short-circuit would be introduced which might "blow" the fuse, or otherwise prevent the set from working. In order to safeguard against the latter possibility it is rather a good plan to slightly chamfer off the edge of the hole with a file.

The position of the driver transformer can easily be determined from Fig. 2, and also by examining the photograph at Fig. 3. No explanation need be given in regard to the new wiring, since this is clearly shown. It might be added, however, that a few slight modifications have to be made to the original connections to the third valve-holder, but these are indicated as new wires to avoid the possibility of your overlooking them. You will notice also that a new flexible lead, with spade terminal attached, is used and passed through the back edge of the chassis near to the loud-speaker terminal-socket strip. This is the third loud-speaker connection and must be connected to the centre (red) terminal on the speaker.

Alternative Ratios

It will be noticed in the wiring plan that the grid connections to the Class B valve are taken to the terminals on the driver transformer marked "G"; these two terminals provide a ratio of 1 : 1, but by transferring the leads to terminals "G.1." a 1.5 : 1 ratio is obtained. When using the 215 P. power valve specified as driver, the former ratio should produce best results, but if you have on hand an ordinary L.F. valve this might be tried as driver, and in that case the higher ratio will prove somewhat better. No matter what valve you are using it will be interesting and instructive to experiment with the two alternative ratios.

Tone Correction

One of the peculiarities of Class B amplification is that it tends to produce an over emphasis of the higher musical frequencies, and in this respect the Class B valve is rather like the ordinary pentode. Because of this, reproduction is liable to be "screechy" and high-pitched unless some form of tone-correction is introduced. With a pentode the usual method of curtailing the higher frequencies is to connect a fixed condenser and fixed resistance in series between the loud-speaker terminals. The same idea can be applied in the case of Class B when the "tone-corrector" components are joined between the two anodes of the valve. It is better, however, to employ a variable resistance in conjunction with the fixed condenser so that a certain amount of control over the tone of reproduction can be obtained. Suitable values for the condenser and resistance respectively are .02 and 50,000 ohms, and these components should be connected, as shown in Fig. 5. In fitting the parts to the set itself the potentiometer specified (it is used as a variable resistance by leaving one of its terminals disconnected) should be mounted on the component bracket in a position which balances with that of the V.M. potentiometer control.

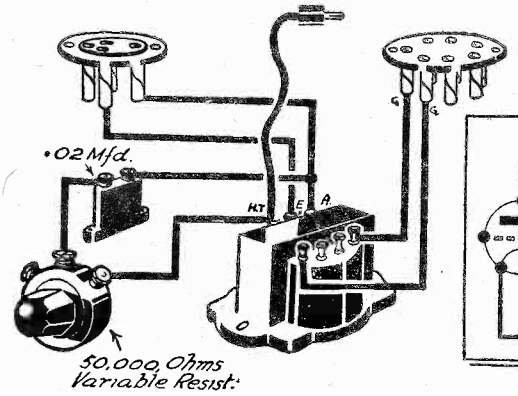
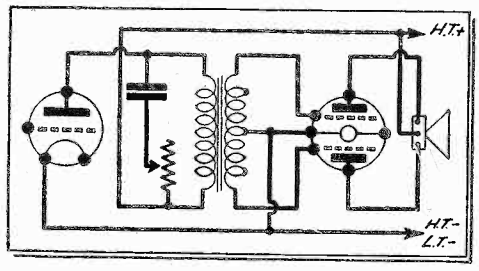


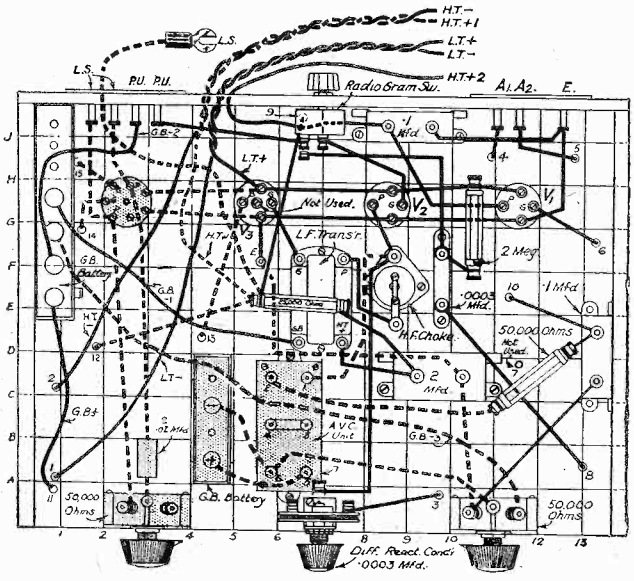
Fig. 6.—A better method of tone control, where the variable resistance and fixed condenser are connected in series across the primary of the driver transformer.



A Better Method

There is an objection to this very simple system of tone control since, by acting on the output circuit, it diminishes the strength of high notes which the Class B valve has amplified. In other words, it is wasteful, and in trying it you will probably notice a reduction in signal strength, especially when the resistance is turned to that position which gives maximum high-note cut-off. The difficulty is most easily overcome by transferring the tone-control components from the positions illustrated in Fig. 5 to the new ones shown in Fig. 6. In the latter case they are wired in parallel with the primary winding of the driver transformer, and so the correction effect is obtained before the signals are finally

(Continued on page 668)



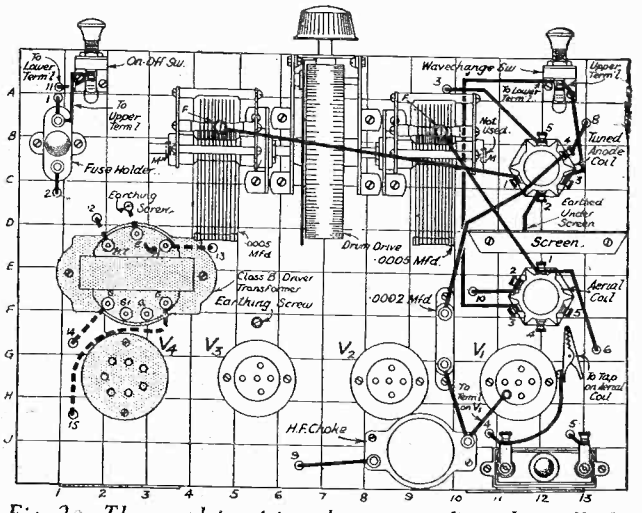


Fig. 2.—The complete wiring plans given above show all the new components (shaded) and new wires (in broken lines) which are added during this week's experiment.

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In the Following Article the Author Deals with the Working of Neon Lamps, and Synchronizing.

By H. J. Barton Chapple,
Wh.Sch., B.Sc., A.M.I.E.E.

IN ordinary radio reception it is common knowledge that the full quality and benefit of a good loud-speaker is never realized unless it is connected correctly to a first-class radio receiver. The same axiom holds good in television reception, and no matter how good your television and radio receivers may be, the full value of the apparatus cannot be appreciated unless the proper link is included between the two sets of equipment. Except under special circumstances, it is not just a case of disconnecting the loud-speaker and replacing it with television apparatus joined across the same terminals, and from past experience I have found that many amateurs have been disappointed when this simple expedient has failed to give the anticipated images.

Cases not Similar

In articles published in PRACTICAL WIRELESS I have described how to build up a simple disc-type television machine using a neon lamp, and have stated that the incoming radio signals broadcast from the television transmitter are passed to the neon lamp in order to modulate or regulate the magnitude of its glow. The signals do not start or stop the glow in a manner similar to a loud-speaker, being made to operate by the varying audio signal. The object of the signals is to modulate an existing neon lamp glow—that is to say make it glow brighter or darker, according to whether high lights or dim shadows are to be portrayed. It is the initial neon glow which has to be given to the lamp that provides so often the stumbling block and leads to subsequent misunderstandings. With our loud-speaker we generally find it a better policy to isolate it from any steady D.C. current that may be passing in the output valve anode circuit, but not so our neon.

According to the type of lamp used in the television apparatus, so it requires a definite voltage across its terminals before it will glow with normal brilliance. For example, the ordinary beehive lamp requires about 110 or 220 volts, according to rating, before it will glow, and then it passes a current of from 5 to 8 milliamperes. On the other hand, a special flat plate neon lamp designed for television purposes requires about 180-200 volts across its electrodes, and then it passes a current of 25 milliamperes.

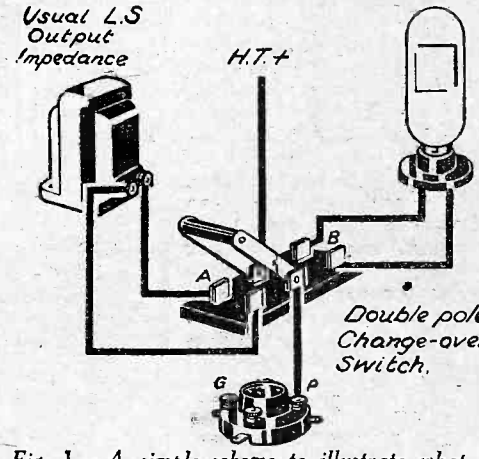


Fig. 1.—A simple scheme to illustrate what happens when the neon lamp replaces the loud-speaker.

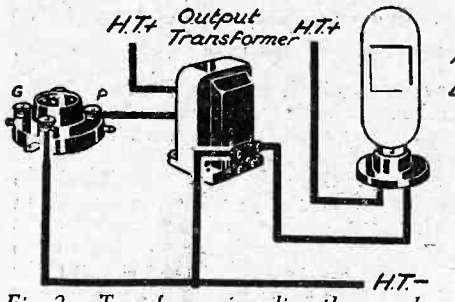


Fig. 2.—Transformer coupling the neon lamp to the output stage.

An Example

To make my meaning clear, let us refer to Fig. 1. Here we have the output valve of a radio receiver which normally has applied to it a voltage of 150. Imagine a double-pole double-throw switch inserted in the manner shown. In position A we have inserted the normal output choke, output transformer primary or loud-speaker itself. There is a drop of voltage of, say, 30 volts across this form of anode impedance, and in consequence the remaining 120 volts is applied to the valve anode. With correct grid bias a current of, say, 10 milliamps flows, and all is well for loud-speaker working.

Changing the switch over to position B, however, and using a small type letter or beehive neon requiring, say, 100 volts for it to strike and glow normally, what happens? If the neon lamp absorbed its required 110 volts, only 40 volts would be applied to the valve anode. The current flowing under these conditions would be very small, and in consequence the scheme would fail. Whereas A position gives a 30-volt impedance drop, B requires 110, so if we still require this B scheme to work, the applied voltage must be increased by the difference between these two figures, that is, 110 minus 30, equals 80 volts, giving a total applied voltage of 230 to restore the balance.

Neon Lamp.

It can be taken as a general rule that if it is desired to work the neon lamp in series with the anode of the output valve, then the applied voltage must be increased by about 100 to 200 volts, according to the type of neon lamp used. The anode current passing through the last valve must then be equal to that required for normal neon glow.

Alternatives

There are many cases where this scheme is inconvenient or will not even work satisfactorily (an exception rather than the rule, however), and to meet this there are several alternatives open to the choice of the individual. The first is shown in Fig. 2. Across the normal "direct" output terminals is placed the primary winding of an output transformer. One side of the secondary winding passes to H.T.— while the other side goes to the neon lamp and thence to H.T.+. In this way a direct current flows through the neon lamp and secondary winding, and by properly adjusting the value of H.T. the correct voltage and current conditions for the "polarized" state of the neon lamp can be obtained. The high-tension feed to the neon lamp can be

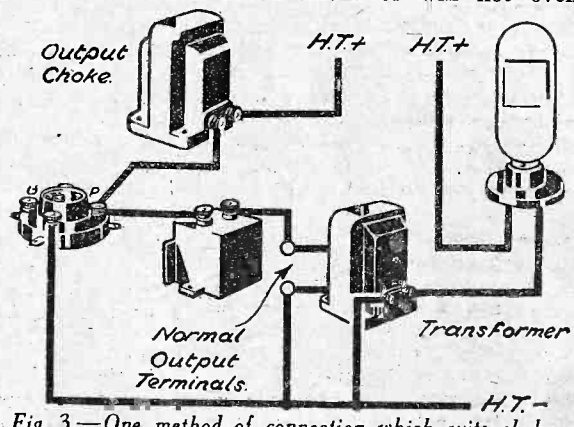


Fig. 3.—One method of connection which suits choke capacity coupled output stages.

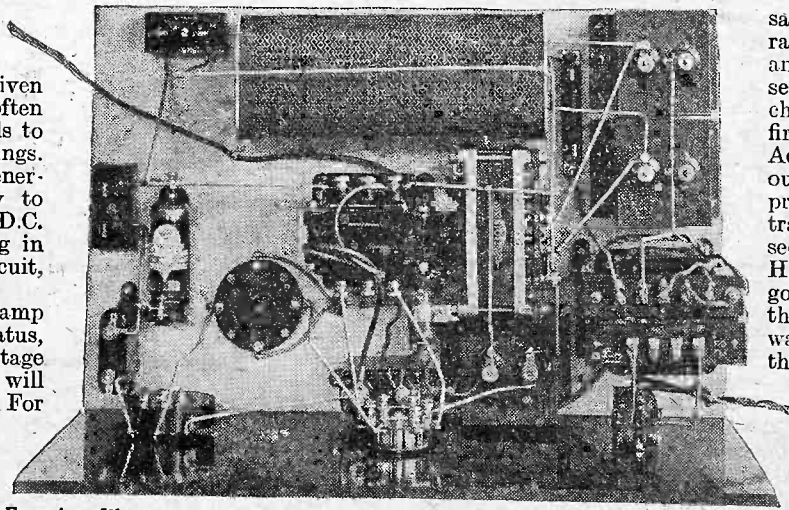


Fig. 4.—Illustrating a combined power output stage and eliminator unit for television working.

taken from the same source as feeds the radio set, provided it can furnish the voltage and additional current required without overloading. If not, then a separate eliminator or battery feed must be employed, the H.T. negative of each source being made common. Full neon lamp brilliancy is secured in this way, and

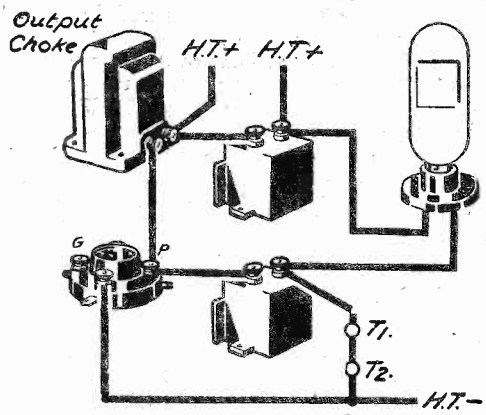


Fig. 5.—An alternative to the Fig. 3 method of coupling.

the incoming radio television signals, after amplification in the wireless set, produce fluctuations in the normal steady neon glow, this being observed through the apertures of the rotating scanning disc, to build up the desired television image in the usual way. The output transformer ratio for the best results generally is found to be one to one, but it is often interesting to experiment with other ratios to find what effects take place.

Choke Feeding

In several of the radio sets which may be used by readers for receiving the television signals, a "choke feed" output may already be incorporated. If so, one way to connect the television apparatus is illustrated in Fig. 3. The same type of

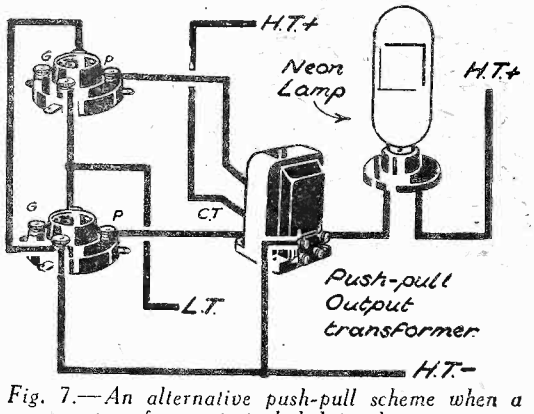


Fig. 7.—An alternative push-pull scheme when a transformer is included in the set.

output transformer must be used in the position indicated, and the adjustments of voltage are the same as in Fig. 2. It should be noted that "iron" is now introduced twice into the circuit, so very careful consideration must be given to the use of both a first-class choke and a transformer having the largest possible inductance. Poor quality material will only impair or spoil the resultant television image.

A combined power output valve stage and mains eliminator feed unit, using the choke capacity transformer connection to the neon lamp, is shown in Fig. 4, and exceedingly good results have been obtained with apparatus of this nature when the output power from the radio receiver has not been sufficient to fully modulate the neon lamp glow. It must be borne in mind that a flat plate neon lamp requires about 1½ watts undistorted output for the best results, but if a beehive or lettered neon lamp is used, then a much smaller output wattage will suffice, but the final television image is not so large or as bright.

Another way of using a choke capacity feed output is illustrated in Fig. 5. Here the usual output terminals T_1 and T_2 are shorted out, and a second condenser joined to the H.T. side of the anode choke, the neon lamp being connected between the two fixed condensers, the voltage and current adjustments being exactly as before.

Push-Pull or Class "B" Cases

A radio receiver incorporating push-pull low-frequency amplification is extremely good for television reception. As a matter of fact, this is the type of set used by Mr. Camm when he looks-in with the aid of a Baird "Televisor" receiver, and, according to the type of output, two methods may be used for joining the television apparatus to the set. The first is shown in Fig. 6, and is almost the same as Fig. 5, except that the output choke is centre-tapped in the usual push-pull fashion.

Then we have the arrangement of Fig. 7, where a push-pull output transformer is used. This is essentially similar to Fig. 2 (except for the centre tap), and gives very satisfactory results.

The advent of Class "B" amplification has enabled those experimenters who are forced to use batteries to obtain an output from their set amply sufficient for modulating the neon lamp, and yet not expensive from the battery cost point of view. The output scheme here is really the same as for push-pull, and is illustrated in Fig. 8. Another alternative is to use the primary winding of the output transformer as a centre-tapped L.F. choke, the connection to the neon lamp being as shown in Fig. 9, two fixed condensers (2 or 4 mfd. capacity) serving as the feed to the neon lamp. Incidentally, this method, shown in Fig. 9, can be used in lieu of Fig. 7 if preferred for ordinary push-pull. An advantage of this arrangement is that by means of simple switching the loud-speaker may be joined across the transformer secondary winding for tuning in the television note first of all, and then isolating the speaker when reverting to the feed to the television apparatus.

Separate Synchronizing

Another useful piece of apparatus to use in conjunction with the neon lamp is a milliammeter to measure the actual current passing through the lamp. In this way an exact adjustment of H.T. potential can be made, and, if desired, a variable resistance may be included in the circuit so that variations in brilliance can be made at will. A little unit made up specially for this purpose is illustrated in Fig. 10, together with a disc model television receiver and a power L.F. amplifier.

So far I have made no mention of the synchronizing gear. This usually takes the form of the popular cogged wheel method working in conjunction with two field coils, which need to be polarized with a direct current of the same order, or even more than the neon lamp current. In view of this fact, the synchronizing coils can, if desired, be wired in series with the neon lamp in every case which is illustrated in the preceding diagrams. On the other hand, for three reasons, it is found preferable to work the synchronizing separately. First of all, there are occasions when it is advisable to reduce or even increase the neon lamp polarizing current, and yet keep the coil current constant, and this is not possible if the two are in series. In addition, to keep the image steady a very strong synchronizing signal

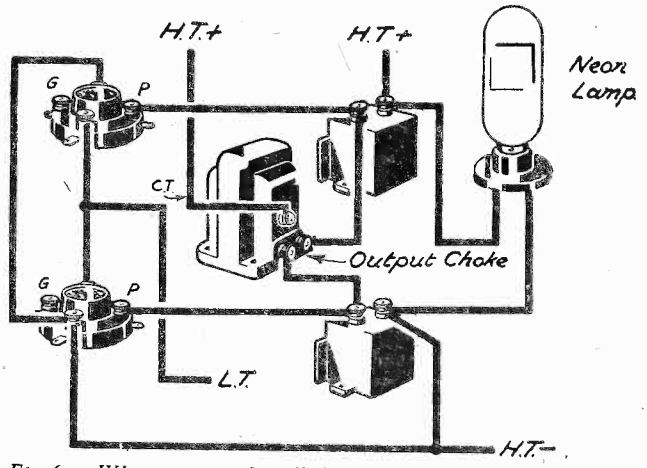


Fig. 6.—When using push-pull the reader can employ this scheme.

may be required, whereas the modulation on the neon lamp may be desired at a lower level. This again cannot work under the series conditions.

Thirdly, since I have mentioned the quality of any "iron" circuit used in conjunction with television reception, it may be thought advisable to exclude the iron-cored synchronizing circuit from the neon lamp so as to obtain a more perfect image. To meet these cases it is necessary to have a separate synchronizing valve. The arrangement is shown in Fig. 11, and consists merely in adding another resistance

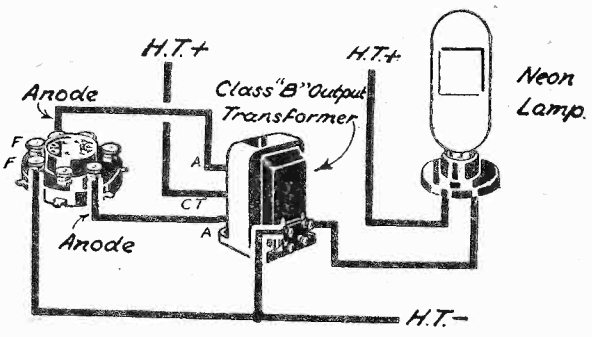


Fig. 8.—Class B working for television is really very similar to ordinary push-pull.

capacity coupled stage, joined to the grid circuit of the output valve feeding the neon lamp. Adjustments in both circuits are then quite independent, and a per-

Linking Radio & Television Receivers

fectly steady image is possible under these conditions.

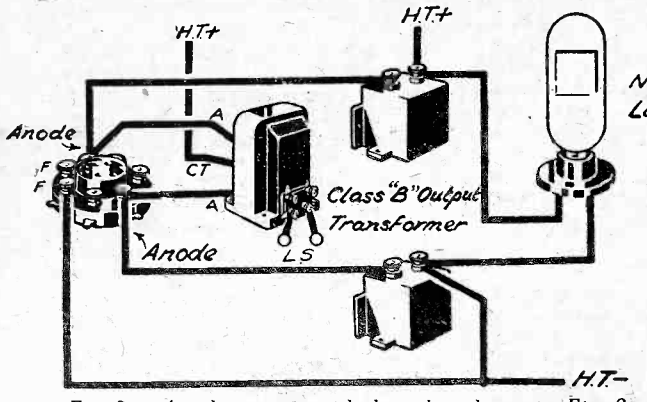


Fig. 9.—An alternative method to that shown in Fig. 8.

OBTAINING A POSITIVE IMAGE.

WE can well remember the astonishment shown by lookers when the first experimental transmission of television took place from the Brookmans Park station on September 30th, 1928. Sir Ambrose Fleming appeared on the television screen just as if he was a nigger, and, until the mistake was rectified, it looked very weird to see this eminent scientist in such a strange colour.

Technically speaking, he had been transmitted as a "negative image," and it is necessary to warn the television novice of this likelihood, and show how it takes place. In a negative image all the dark sections appear light, and all the light sections dark, bearing the same relation to the true image as a photographic plate does to the print which is taken from it. The illustration on page IV shows what is meant, so let us consider for a moment what happens in our television process. With spot light scanning, the reflected light causes an increase in current in the photo electric cell circuit when the spot is exploring the light sections or highly reflective parts of a televised subject, while correspondingly there is a current decrease for poorly reflective surfaces.

Current Direction

The resultant signal conveyed to the receiver, and after amplification to the light modulating device for reconstruction into an image, must, of course, be made to follow the same order. Taking, for example, the simple case of a disc machine working in conjunction with a neon lamp, the lamp brilliancy must increase for the high lights and decrease for the dark patches to give the true positive image.

Now in the radio set used for receiving the television signals this current direction must be studied. As far as sound reception is concerned, the matter is really of no consequence. Transformers, resistance capacity units, or combinations of the two, are used generally without a single thought as to current direction, for the ear does not detect the phase when the loud-speaker is in operation. Current reversals are definitely taking place, however, as witness the case of the detector stage.

With a grid-leak and condenser arrangement, the advent of the incoming radio signals brings about a decrease in the mean anode current, whereas, if an anode bend detector was used the mean anode current under similar circumstances shows an increase in value. Obviously there are other parts of the set where similar reversals happen, but the reader has not found it necessary to give them more than a passing thought. If, for example, you have two transformer coupled low-frequency stages, then the signal on the plate of the detector valve is in the same direction as that on the plate of the output valve at the same instant. A combination of a stage of resistance capacity coupling preceding a transformer, however, brings about a signal reversal. Other instances could be quoted, but enough has been said to indicate to the reader that he must watch these matters carefully if negative images are to be avoided.

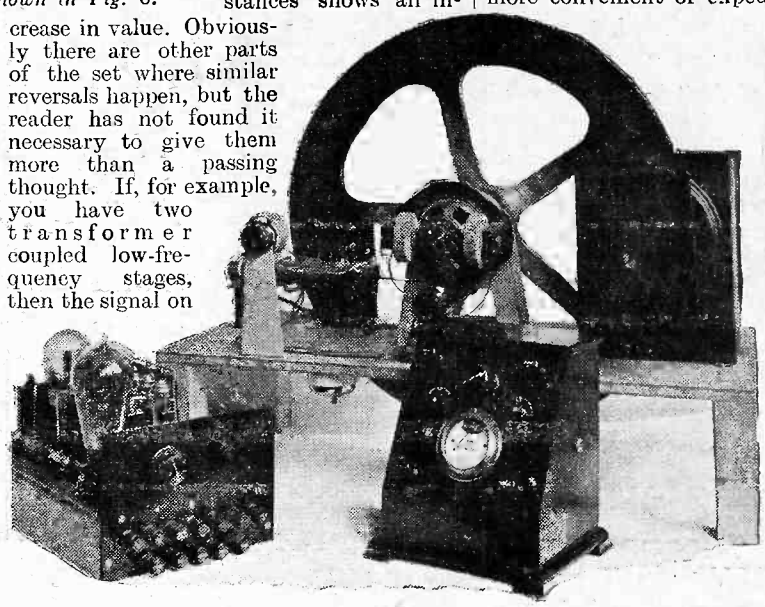


Fig. 10.—A meter to measure the actual current flowing through the neon lamp is a useful device.

A Clue

With the standard television signals as now sent out by the B.B.C., a positive image is given at the receiving end with an anode bend detector valve, followed by an *odd* number of resistance capacity coupled stages, or a grid-leak detector valve having associated with it an *even* number of resistance capacity coupled stages.

This piece of information gives the clue to one method for reversing a negative image into a positive one. Either change the method of rectification, or add or subtract a stage of R.C.C., whichever is more convenient or expedient. There are other ways in which this current reversal may be carried into effect, and if a low-frequency transformer is included in the set, then it is quite in order to reverse the connections to *either* the primary or the secondary windings, preferably the latter. Alternatively, if an output transformer is used for linking to the television receiver, then the same expedient of reversal of either winding will rectify matters. This

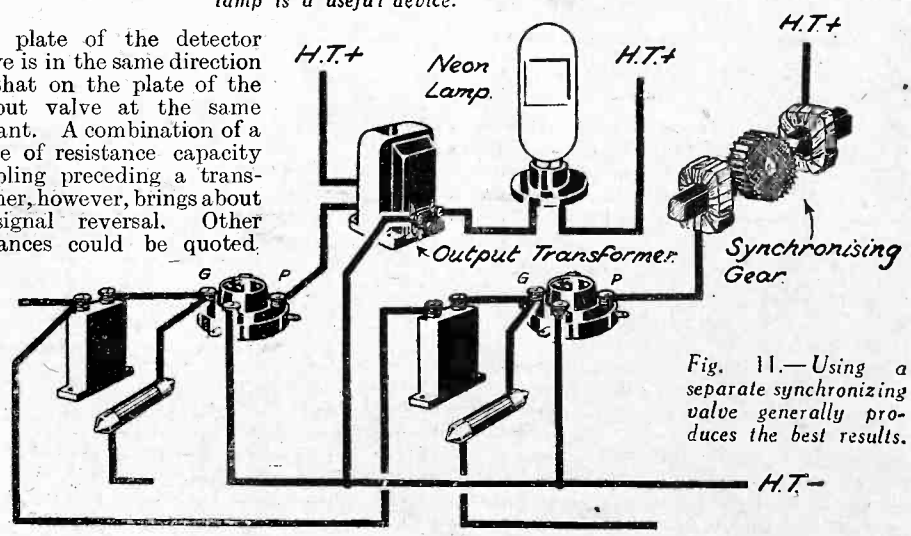


Fig. 11.—Using a separate synchronizing valve generally produces the best results.

also applies when a choke-transformer feed is used.

Any device which brings about a reversal of grid voltage can cause a negative image, and, in the course of many tests we have made with radio sets designed specifically

Reversal of light and shade in a negative image.

for the reception of the television signals, we have found several instances of this happening. In the days when neutralizing was popular, it was noticed that over-neutralizing brought about a reversal, while curious reaction or bypass feed backs gave similar results. If the grid voltage adjustments are incorrectly made, so that both anode bend and grid-leak rectification take place, this also causes a combined positive and negative image, while, strangest of all, on one occasion a run-down filament accumulator gave a negative image. These cases which have just been cited are, of course, of somewhat rare occurrence, but if you bear in mind the points emphasized earlier, and apply the cures suggested, then negative images will not be a source of worry.

THE BAIRD MIRROR DRUM "TELEVISOR."

THE Baird Mirror Drum Televisor, complete with its radio receiver, is housed in a modern and distinctive cabinet of natural walnut, with dark brown fittings and mouldings. In the top section is accommodated the television projector and screen. This is a mirror drum revolving about a horizontal axis and driven by a small universal mains motor. The motor support also has a rectangular and hollow housing to which is screwed the Baird grid cell unit complete with its projector lamp.

Image Building

A light beam from the 100-watt projection lamp is modulated by the cell, and after being reflected from an inclined mirror is focused on to the drum mirrors by a 3in. diameter double-convex lens. Since each mirror on the drum surface is canted (with reference to the drum axis) by an amount of one-sixth of a degree with reference to its neighbour, the drum, when revolving, allows each mirror face in turn to take charge of the light beam and project a spot of light on to a front screen. This spot moves vertically, building up thirty strips of light laid side by side, the screen itself being pulled out similar to a camera bellows, for focusing purposes. When this is done the resultant active light area for showing the television image is 9in. high by 4in. wide.

The incoming radio television signals are fed to the grid cell after being amplified in the radio receiver, graduations of light and shade being produced on the screen to create an image which has the characteristics of a *wash drawing*, and not one made from dots, as in the print of a half-tone illustration.

Radio Side

Coming now to the radio side, we find a mains-driven set having a single high-frequency stage, anode bend detector, and three stages of resistance-capacity coupled L.F. The output valve is a large D.O.24, and this feeds the cell from a resistance-capacity output, the cell, of course, being a voltage-operated device. The appropriate voltage bias on the cell is furnished from a resistance network joined between the main positive high-tension feed and H.T. negative.

To maintain the projector apparatus in synchronism with the television transmitter, the familiar thirty-toothed cogged-wheel components are added to the motor at the end remote from the drum. The field coils of this synchronizer are fed from another D.O.24 output valve, which is R.C. coupled to the other D.O.24 valve. In this way a separate synchronizing feed is secured whose strength is adjusted by a potentiometer control on the grid of the D.O.24 valve. Finally, we have a D.W.4 rectifying valve furnishing the required current and voltage for the valve anodes. One of the accompanying illustrations gives an idea of the "solidly" built receiver.

Operation

A striking feature of this receiver is the comparative ease with which reception is accomplished. This once and for all kills the hitherto prevalent impression that working television apparatus is a tricky and difficult operation. First of all, the motor is switched on and allowed to build up to speed, and in order to "see" whether the motor is running at its correct speed of 750 r.p.m. a stroboscopic indicator is mounted on the motor shaft, being illuminated by a small neon lamp fed from the A.C. mains. The lines of the stroboscope appear to remain stationary when the speed is correct, any movement clockwise or counter-clockwise being checked by adjusting the variable resistance in the motor feed. It is advisable to "warm up" the motor by running it for about fifteen minutes before the television transmission starts.

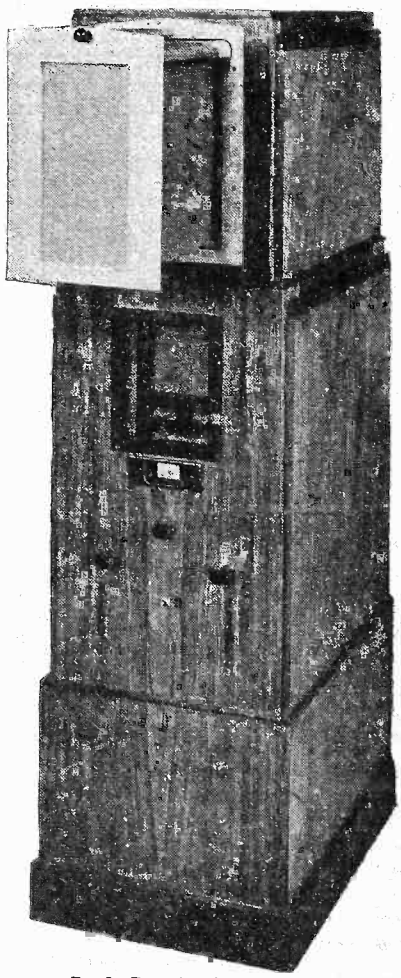
Only the medium waveband is covered by the coils in the set, as there are no television transmissions in this country on the long waveband, and since the signals emanate from the London National station on 261 metres, tuning is a very simple process. A loud-speaker is incorporated so that the "sound" of the signal may be heard, and when correctly tuned in, a changeover, *via* a switch at the back of the cabinet, is made to the vision equipment. If synchronism is correct the image will appear immediately on the screen, but if inclined strips of light having black patches are noticed, the motor rheostat must be altered slightly until the heavy black synchronizing lines, which border the image top and bottom, lie horizontal.

The image even then may be displaced vertically and horizontally from the centre of the screen frame, but matters are soon rectified by rotating the large knob on the left of the cabinet. This turns the carcase of the driving motor and so produces both a vertical displacement of the image, as well as a slight side drift to left or to right.

Results

Compared with the earlier "Televisors" the image remains very steady. One reason for this is the flexible coupling between the drum and the motor shaft, this providing a mechanical filter to damp hunting, while, in addition, the strength of the synchronizing signal is adapted readily by the potentiometer control to the grid of the D.O.24 valve feeding the synchronizer. A slight vertical swing may be noticed, but the image does not run away several times during the course of the half-hour's transmission, as was found in the earlier apparatus. Occasional reframing may be necessary, but this arises from the nature of the signals emanating from the transmitter.

Close-ups are remarkably good, it being possible to recognize easily any familiar face. On the long shots detail is, of course, not so pronounced, but here we are concerned more with rhythm of movement, shown, for example, by dancing, or special acrobatic turns. It is necessary to sit at least six feet away from the screen to get the best effects, and the black and white images are extremely bright, and may be seen by a whole roomful of people at the same time.



The new Bush-Baird television receiver, complete with sound apparatus. The loud-speaker fret is situated immediately below the viewing screen, and this is adjustable in the same manner as the focussing screen of a camera. There is no need to dim the lights of a room with this receiver.

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

THE DIFFERENTIAL CONDENSER.

How and Why It is Used.

THERE are two general types of variable condensers used in radio reception—the ordinary kind, with one set of fixed and one set of moving vanes, and the *differential*, which has two sets of fixed and one set of moving vanes. Fig. 1 shows the arrangement of the vanes of this latter type. You will see that, from the theoretical point of view, it is really two condensers in series. By rotating the spindle attached to the moving vanes one of these condensers gradually increases in capacity while the other one decreases. The moving vanes are semi-circular in shape, so that when the spindle is half-way through its total arc of rotation each condenser is of the same value, that is, half its maximum value. This position of the moving vanes is shown in the centre diagram in Fig. 2. The other two drawings show the position of the vanes at the fullest extent of the rotation of the spindle in first one direction and then the other. When the capacity of one condenser is at a maximum, that of the other is at a minimum.

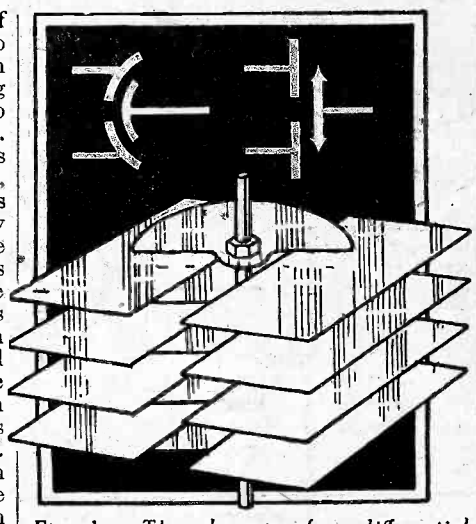


Fig. 1.—The elements of a differential condenser. Above, two ways of representing a differential condenser diagrammatically.

Now there are several uses to which a differential condenser may be put, but we will deal first with its most common application, namely its use as a reaction control.

By-passing the H.F. Currents

For many years now the standard method of controlling reaction has been by using a reaction coil with a fixed number of turns of wire and fixed coupling, and to vary the current through this by connecting it in series with a variable condenser. This method is illustrated in Fig. 3. However, as shown here, it has certain drawbacks. The most obvious is that when the reaction condenser is set at a minimum there is no easy path for the H.F. component of the anode current of the detector valve.

The anode current of the detector valve may be considered as consisting of three separate parts. There is the steady direct current from the high-tension supply, the rectified speech current, and the amplified H.F. impulses. It is the last-named which are used for reaction purposes. They are fed back by means of the reaction coil, and superimposed on the input current. Now, apart from its use for reaction purposes, this H.F. part of the anode current is not really wanted. If it finds its way to the grid of the next valve it will cause distortion and possibly actual howling. Again, if it is allowed to pass on round the anode circuit when an H.F. stage is used before the detector, then it is possible for it to cause undesirable back coupling through the medium of the common impedance of the H.T. source.

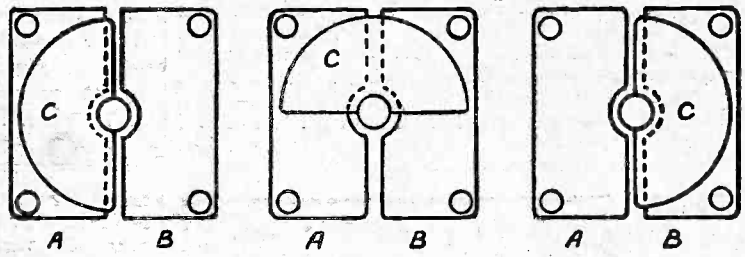


Fig. 2.—Plan of the vanes of a differential condenser, showing three different settings of the condenser.

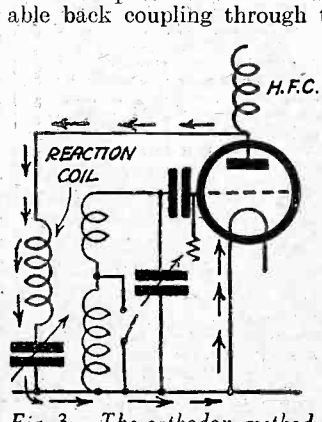


Fig. 3.—The orthodox method of controlling reaction, using an ordinary variable condenser.

The usual thing to do with this unwanted current is to impede its progress by including an H.F. choke in the anode circuit of the detector immediately following the anode itself, as shown in Fig. 3. This choke acts as a barrier, and prevents it travelling farther than the anode of the valve. However, the choke is not in itself sufficient, and the "unwanted current" may be strong enough to force through this barrier unless some alternative path is provided. In Fig. 3 this alternative path is through the reaction coil and reaction condenser to the filament. It is indicated by the arrows. Now when the reaction control is "turned on fully," that is, when the reaction condenser is set somewhere near its maximum capacity, this path offers a very easy exit, but when the reaction condenser is set to its minimum position it presents a very high impedance, and the "unwanted current" has no escape.

This is where the differential condenser comes in. It is connected as in Fig. 4. Now a moment's consideration shows us that whatever the setting of this condenser the by-pass effect is always constant. When the condenser is in the "full-on" position then the H.F. currents travel from the anode *via* the reaction coil, the fixed vanes A, and the moving vanes C, to the filament, as shown by the arrows in the left-hand diagram in Fig. 4. When the reaction is "turned-off," then the path of the H.F. impulses is from the anode to the fixed vanes B, thence *via* C, to the filament. In any intermediate position the currents follow a divided path—partly through the reaction coil and A C, and partly through the path B C.

High Note Cut Off

It may be argued that if the only drawback to the ordinary reaction condenser is that it does not provide an alternative path for the H.F. component when it is set at zero, then a fixed condenser between anode and filament, as in Fig. 5, is all that is needed. Admittedly, this often provides a solution of the problem if the value of the fixed condenser is carefully chosen, but even so it has not quite the same advantages as the differential method. For one thing the value of the fixed condenser must be sufficiently large to by-pass the H.F. current when the reaction condenser is at zero. However, this value may be *too* large when a reaction condenser is all in, for the total value of the by-pass condenser and the reaction condenser may be such as to by-pass some of the higher audio frequencies and thus mar reproduction by loss of the higher notes. It is also found in practice that the use of the differential condenser provides a smoother control of reaction. It certainly provides a greater *range* of control than an ordinary condenser of equivalent value used in conjunction with a by-pass condenser, for when the differential is in the "full-on" position nearly 100 per cent. of the current passes through the reaction coil, while when it is in the "off" position practically all of the current passes direct to the filament *via* B C. (see Fig. 4), and only the smallest fraction (due to the minimum capacity between A and C) passes through the reaction coil. This is an advantage with

(Continued on page 656)

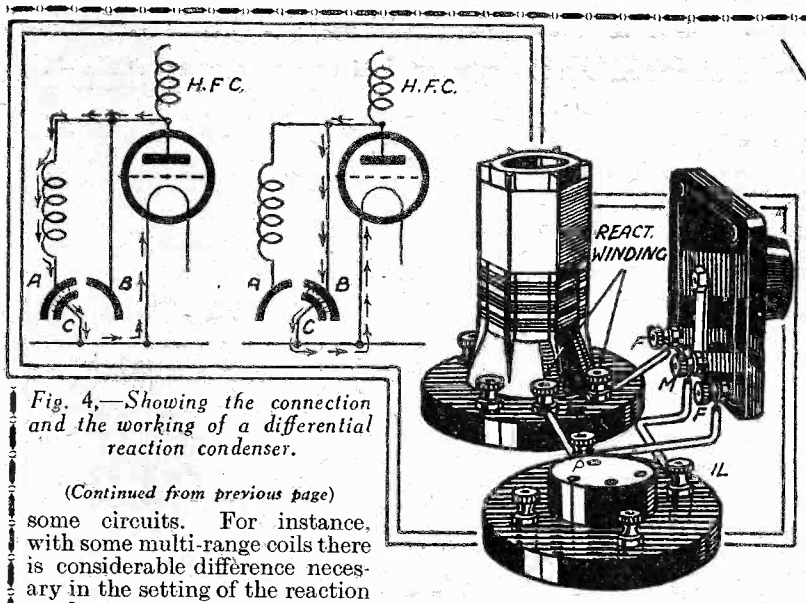


Fig. 4.—Showing the connection and the working of a differential reaction condenser.

(*Continued from previous page*)

some circuits. For instance, with some multi-range coils there is considerable difference necesary in the setting of the reaction condenser on one wave-band compared with another.

The "Differential" as a Volume Control

The connection for a differential reaction condenser, shown in Fig. 4, is not the only possible arrangement. Another version is shown in Fig. 6. Differential condensers are also used for a variety of other purposes besides reaction control. One of the best known is as a volume control which works by varying the aerial input. The circuit is shown in Fig. 7. When the moving vanes of the condenser are completely interleaved with the fixed vanes marked A, then the input to the tuning coil is at a maximum and loudest signals result As the moving vanes are rotated towards the other set of fixed vanes, so the input *via* C A is reduced and at the same time the aerial currents find an alternative path direct to earth *via* C B.

This type of volume control has the advantage that it is very simple, noiseless in operation, and covers a large range, it being possible to cut down the most powerful stations to a whisper. Its disadvantages are, firstly, that even at the full volume setting there is some slight reduction of input owing to the fact that there is still a small minimum capacity existing between C and B. Secondly, that variation of the control means slight variation in the wavelength of the aerial circuit, so that when the volume control is operated it may be necessary to readjust the aerial tuning condenser. If this latter is ganged this will naturally be impossible. Incidentally, with this form of volume control the selectivity will be increased as the volume is reduced.

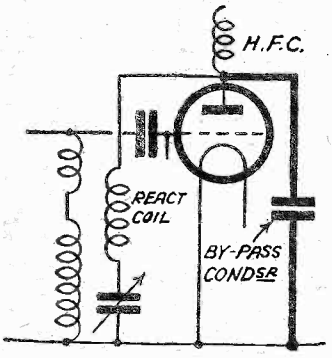


Fig. 5.—The use of a by-pass condenser. See text.

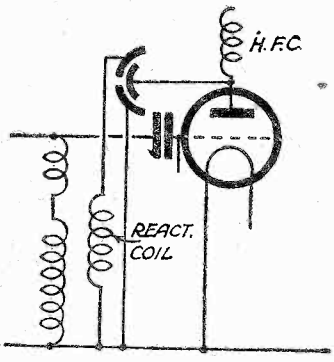


Fig. 6.—Alternative connections for a differential reaction condenser.

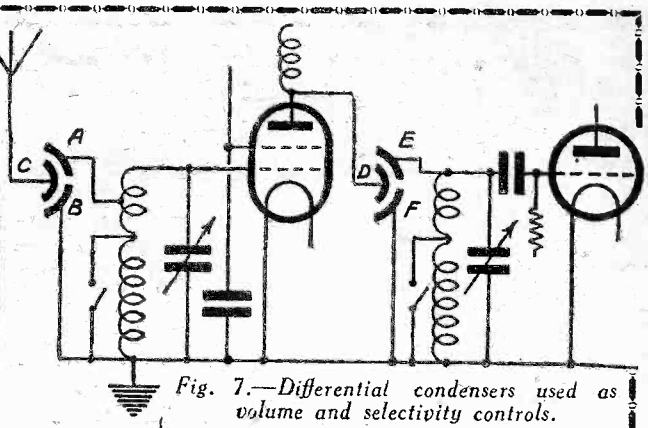


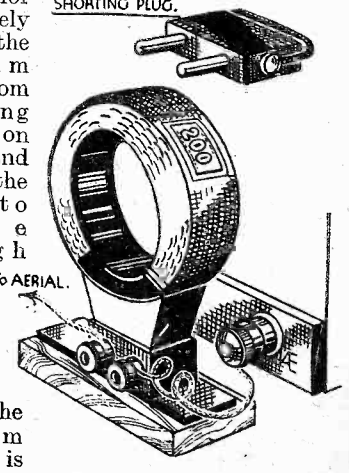
Fig. 7.—Differential condensers used as volume and selectivity controls.

A similar use for a differential condenser is as a variable coupling between the H.F. valve and the following grid coil in a tuned-grid circuit. This is also shown in Fig. 7. The condenser used as a variable coupler is represented at D E F. Here the action is precisely similar to that of the differential condenser A B C. In the same way that A B C controls the input to the first valve so D E F controls that to the next valve (in this case the detector). In practice it is hardly necessary to include both devices in the one circuit, as in Fig. 7, as more than sufficient control can usually be obtained with either one or the other. The variable coupler, however, is sometimes used, in conjunction with an ordinary pre-set or variable condenser, in series with the aerial as an additional selectivity control.

A Simple Anti-break-through Dodge.

THE references to anti-break-through devices in recent issues of PRACTICAL WIRELESS contain no mention of the following simple expedient. It is not everyone who would care to go to the trouble involved in making up the device mentioned in "Wrinkles" of November 4th issue; nor go to the expense of buying a special choke, so that perhaps my own simple but efficient method of preventing break-through may prove of interest to others, especially those who have on hand a number of old plug-in coils.

I recently changed my coils for a dual-wave iron-cored tuner, and am immensely pleased with its performance. The one snag, however, was break-through, as I am rather near to Moorside Edge. I thought of buying one of the special chokes intended to prevent this nuisance, but before doing so I decided to try out the following experiment. I mounted an ordinary plug-in coil-holder on a small square of half-inch thick board, and then connected one of its terminals by a short length of flex to the aerial terminal of the set, and took the aerial lead to the other terminal. I then plugged in various sized coils, and eventually found that a No. 200 did what I wanted, for it effectively blocked the medium waves from breaking through on the long, and allowed the latter to come through without any interference. On switching over again to the medium waves it is only necessary to pull the coil out of its holder, and insert a shorting plug in its place.—A. J. WOOD (Manchester).



TOPICAL TECHNICALITIES

The Carrier Wave and Side Bands.

AS might be imagined, the name carrier wave is applied to the wave sent out by a broadcasting station for the purpose of "carrying" the modulation or sound frequencies. It is the carrier wave which takes the frequency or wavelength upon which the station is said to transmit, and thus the carrier-wave is of constan. frequency. For example, the wavelength of London Regional is 355.9 metres, and the frequency, 843 kilocycles. By this it is meant that a constant oscillation of 843 kilocycles is emitted by the station. But this is not the only series of oscillations to be sent out, for others, corresponding to the audible frequencies (generally taken as ranging from 10 to 10,000 cycles per second) are also transmitted. As a matter of fact, it is the latter series of frequencies which are actually employed to drive the loud-speaker, the carrier-wave serving merely to transport the audible frequencies from the transmitting aerial to that used for receiving.

The audible frequencies are generally referred to as side-bands, because they occupy a band of frequencies on each side of that representing the carrier wave. For instance, suppose a note of frequency 1000 cycles were being sent out from London Regional the frequency of that station would not be just 843 kilocycles, but would be 843 kilocycles plus and minus 500 cycles (half of 1,000 cycles.) A tuner giving 9 kilocycles separation will give full response to all audio-frequencies up to 9,000 cycles (9 kilocycles).

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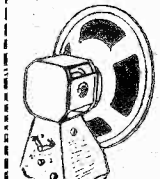

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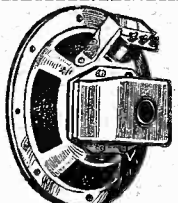

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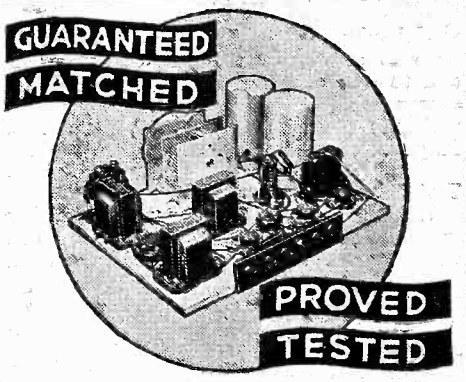

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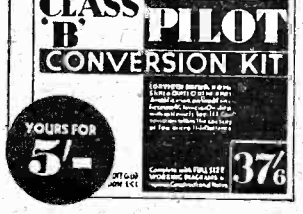

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OUR VIEWS ON RECEIVERS

Ready Radio E.M. Plus Four

IN this receiver we have what was at one time a most popular circuit, but which ceased to have appeal principally owing to lack of long-wave tuning facilities, and also owing to the fact that it was designed for the valves which were then obtainable, and which were later much improved. Thus it became possible to obtain better results with a simpler form of circuit and, in addition, to obtain long-wave signals. Messrs. Ready Radio have been experimenting with the various circuit details of this receiver and have succeeded in incorporating long-wave tuning, together with other modifications which have enabled the modern screen-grid valve to be employed in the H.F. stage, and have thus introduced a very fine example of a receiver which does not embody some of the points which have been thought essential in modern receivers. For instance, no screens are included for the coils, a simple vertical metal partition sufficing to separate H.F. and succeeding stages. The coils themselves are wound on 3in. diameter ebonite formers, Litz wire being employed for the grid tuning circuit and the coupling coil in the aerial circuit, and the primary of the H.F. transformer being wound with very fine wire on ebonite spacers arranged over the former winding. The fine wire offers a maximum of inductive coupling with a minimum of capacity coupling and has several beneficial points. The long-wave winding on both coils is arranged on a smaller ebonite former fitted inside the first-mentioned former, and is rigidly held in position with ebonite spacing tubes. Obviously the external field of this type of coil is very extensive, and the receiver in question has been designed with the H.F. section occupying quite a large portion of the chassis. A two-gang condenser is employed for tuning the two circuits, and this is of the totally screened type, having a concentric trimming knob for accurate matching of the two circuits. The remaining controls on the front of the cabinet are for volume (operating on the S.G. valve), reaction, and wave-change and on-off switches.

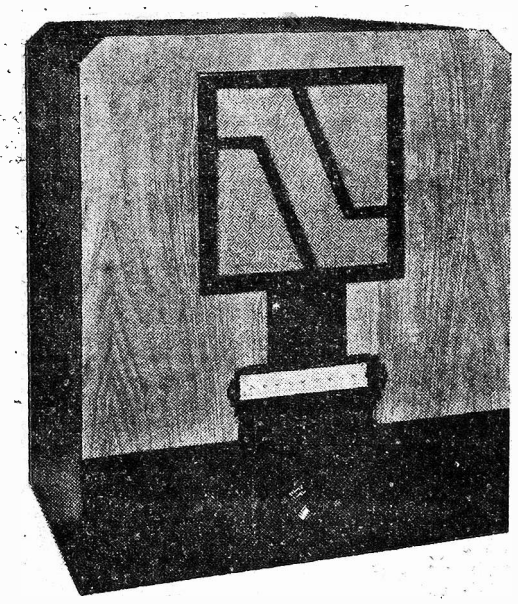
The Layout

We have already mentioned the arrangement of the chassis, and the only other point of importance is the connection to the anode of the S.G. valve. This is of the metal-braided type and is passed through a hole in the screen and is also connected to earth to avoid instability. The receiver is mounted in the lower portion of the cabinet, no sub-chassis form of construction being employed. A shelf is fitted across the centre of the cabinet and this is intended for the batteries. Unfortunately, in the particular model submitted to us it was found impossible to connect a standard L.T. battery and to place it on this shelf owing to the shortness of the battery leads. The speaker which is fitted in the upper portion is a Magnavox moving-coil.

Test Report

When testing the receiver we were rather surprised at the large number of connections which were necessary, no less than seven separate H.T. and G.B. adjustments having to be made. Perhaps this could have been modified by using voltage dropping resistances in the circuit, although doubtless the designer had in mind the possibility of getting that little bit extra from a more accurate adjustment of H.T. voltage. However, that is a personal prejudice, and no doubt many listeners prefer to have every adjustment at their finger-tips in order that they may satisfy themselves that they are getting the last ounce from a receiver. The voltages were adjusted according to the makers' recommendations and the necessary valves plugged in. The receiver was very lively and quite a number of stations could be obtained as the tuning dial was rotated. To get the best from the receiver, however, a certain amount of care was necessary to enable selectivity to be adjusted to suit the local conditions. Thus the volume control and the reaction control are adjusted together to obtain the desired volume and separation of stations. Under average conditions the receiver should prove highly satisfactory from every point of view.

The receiver is obtainable as a kit at £4 17s. 6d., and cabinets, complete with loud-speaker, are obtainable from £2 upwards.



The finished receiver in one of the neat cabinets which Messrs. Ready Radio also supply.

IMPROVING SUPERHETERODYNE PERFORMANCE

(*Concluded from page 573, Dec. 2nd issue*)

An article dealing with adjustments necessary to ensure maximum results.

By P. E. BARNES, B.Sc.

THE adjustments necessary can be considered under three headings: firstly, the adjustment of the trimmers to balance up the stray capacities in the circuits; secondly, the fixing of the relative positions of the coils so as to give the desired band width; and lastly, the adjustment of the oscillator to ensure that the intermediates are fed with the correct frequency.

The first of these points is simple, and the trimmers are simply set by ear to give the maximum signal strength. If this should involve one trimmer being set at its extreme position, then the remaining ones should be moved slightly in the opposite direction, and this continued until all trimmers are adjusted, without any one being at either its maximum or minimum position.

Selection of the Intermediate Band Width

This adjustment, too, can be made by ear. In general, the further apart the coils in each intermediate are set, the more selective the set, but the side-band cutting may become so severe that the tone control will not be able to cope with it. The intermediate immediately preceding the second detector may be so adjusted, as it is usually fairly heavily damped. The remaining ones must be set to give the best compromise between sensitivity, selectivity, and quality.

If a separate oscillator is available, or if one can be rigged up out of parts already on hand and calibrated, then it would be possible to set the intermediate stages to give any desired degree of band-pass action at the particular intermediate frequency chosen, but this is rather a difficult operation for the ordinary constructor, and, furthermore, is usually unnecessary.

Adjusting the Oscillator

The adjustments necessary to the oscillator cannot very well be described in detail, as the many different methods of tuning render any general discussion too vague to be practical, and the instructions of the designer must be followed.

There are, however, one or two points which can be mentioned.

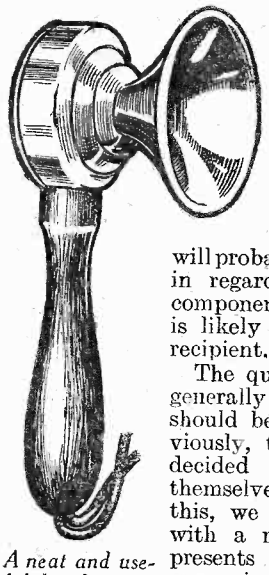
In general, the preliminary adjustment should be made on the tuning coil trimmers, on a low-wave station such as Fécamp. If the oscillator is tuned by one section of a ganged condenser with specially shaped vanes, its trimmer should be adjusted at a station near the top of the medium wave-band, such as Munich or Brussels No. 1, swinging the ganged condenser slowly over a few degrees until the optimum setting of the trimmer is found. A slight readjustment may then be needed on the tuning trimmers at the lower waves. Repeat the procedure to make absolutely sure that the settings are correct, for care here will be well repaid in operation. The long-wave adjustments should be made by means of another semi-variable condenser which is introduced in series with the oscillator condenser, known as a "padding" condenser, and the trimmers already set must on no account be touched.

All this procedure demands accurate matching of the coils, which is why many

(*Continued on page 672*)

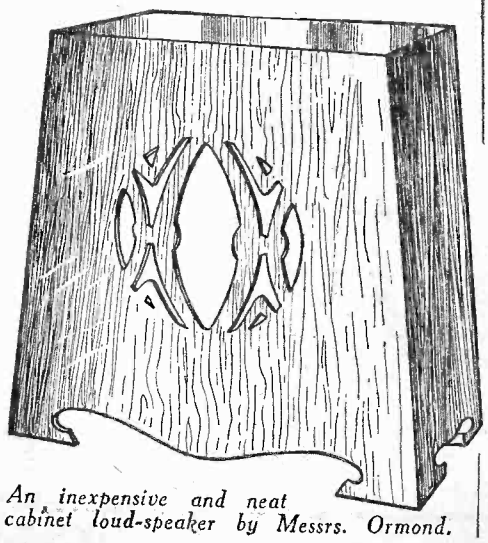
By THE TECHNICAL STAFF.

THE problem of deciding what Christmas presents are to be given to one's friends and relations is always a difficult one, which sorely taxes the resources of the buyer and not infrequently results in the purchase of a neck-tie or a pair of socks which are never worn. But when buying a present for a wireless "fan," there is a very wide choice, and the intending buyer need never run the risk of giving a useless present. At the same time, a few suggestions will probably be appreciated in regard to the type of component or gadget that is likely to appeal to the recipient.

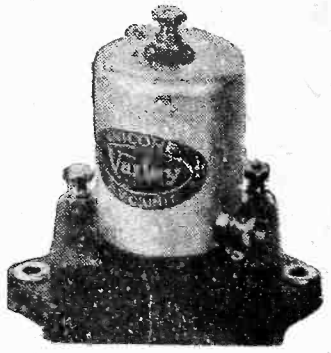


A neat and useful hand microphone, made by Messrs. R. C. and Wilson Electric Ltd.

The question of price is generally the first that should be settled, and obviously, this can only be decided by our readers themselves. In view of this, we propose to deal with a range of suitable presents in order of their approximate prices. For instance, the first section will refer to components that can be bought for less than five shillings, whilst in the following sections, gradually increasing price levels will be considered. We might point out here that should further details be required in connection with any of the items referred to, they can be obtained from the makers concerned or by making reference to our advertisement pages. As an additional help to readers, however, it ought to be mentioned that catalogues dealing with the products of our advertisers can be obtained by addressing a postcard to: "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton Street, Strand, London, W.C.2. The names of the firms whose catalogues are required should simply be stated on the card.



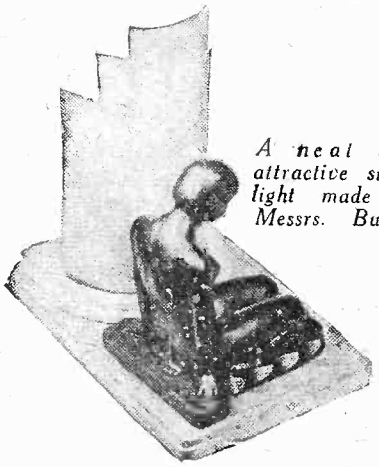
An inexpensive and neat cabinet loud-speaker by Messrs. Ormond.



This is the interesting Varley A.V.C. Unit, which was specified for the "Orbit."

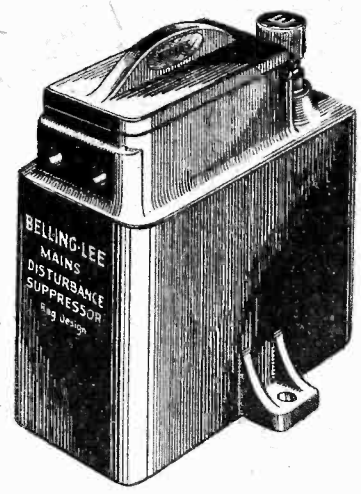
Under Five Shillings

Even if you wish to spend only a small amount on your present, something really useful can be bought. For instance, a friend might have a receiver of rather an old type which is at present insufficiently selective to enable the local station to be eliminated in favour of more distant ones. In such a case, a pre-set aerial condenser of the type made by Messrs. Ward and Goldstone, Sovereign Products, Wingrove and Rogers, and several other firms will be useful; a value of about .0003 mfd. maximum is most convenient and can be bought at prices between a shilling and two shillings. On the other hand, the friend might be suffering from medium-wave break-through when listening to long-wave stations; an anti-break-through choke, as made by Messrs. Lissen, will be much appreciated by him, and it can be bought for four shillings.



A neat and attractive signal light made by Messrs. Bulgin.

Whilst on the subject of increasing selectivity, mention should be made of the "Airclipse" "Auto-Inductive Aerial," which sells for five shillings. This gadget can be used by itself to replace an elevated aerial, or it may be used in conjunction with the aerial to reduce static interference.



A Belling-Lee Mains Interference Suppressor.

There might be a friend who has recently purchased a pick-up or microphone and whose receiver is not at present provided with a switch for changing over from "radio" to "gram," and he would certainly appreciate a neat radio-gram switch, such as is made by a number of firms in various patterns. A neat rotary switch

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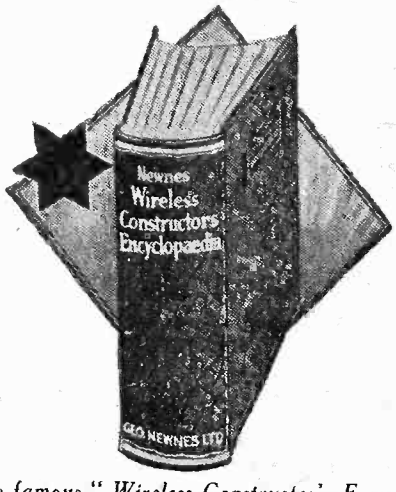

The famous "Wireless Constructor's Encyclopædia," which is so well known to our readers.

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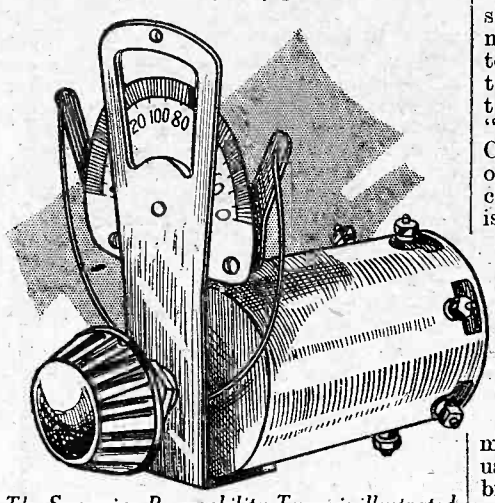
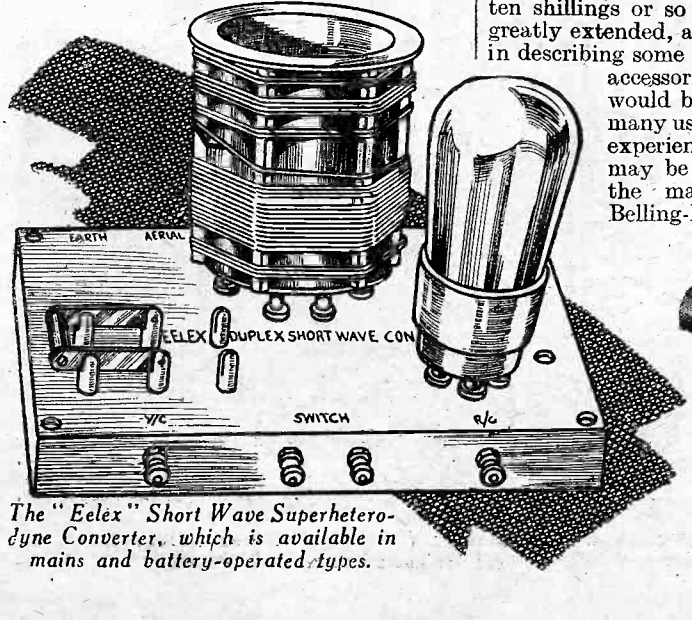


The Sovereign Permeability Tuner is illustrated above.

of this type is made by Messrs. Bulgin, and can be bought for 1s. 9d., whilst another, of rather similar pattern, is sold by Messrs. British Radiogram at 2s. The same friend might have a set which is already provided with such a switch, but which has no volume control device, and it may be found useful to provide him with a volume control, which may be attached to the motor-board of the radiogram or fitted to some convenient position on the receiver. Typical volume controls are made by Messrs. Watmel, Igranic, Bulgin, British Radiophone, Graham Farish, and so on, and the prices will vary between 3s. and 5s.

Tone control devices may be thought useful for the purpose of modifying the tone of a loud-speaker, and although there are only one or two complete controls, such as the Bulgin Controlatone, a variable resistance of a value of 50,000 ohms, in conjunction with a fixed condenser of .01 mfds., may be purchased separately and used for the purpose.

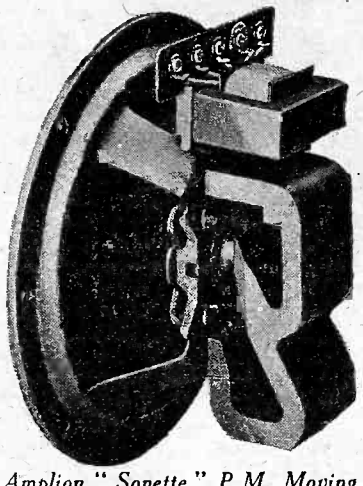
In addition to all the above small accessories there are, of course, variable condensers, transformers, and other parts of the actual receiver which may be provided to replace those which are being used but which are of old design. It may be possible to make quite an appreciable difference in a set's performance by replacing an old part in this manner.



The "Eelex" Short Wave Superheterodyne Converter, which is available in mains and battery-operated types.

It is scarcely necessary to mention the fact that the "Wireless Constructor's Encyclopædia" is undoubtedly one of the most acceptable presents that any enthusiastic amateur could possibly receive. This is a most thorough and comprehensive guide to practical wireless matters, and contains a greater amount of useful and practical information on all branches of wireless than any other book ever published. Arranged in alphabetical order are every term, expression, and name used in connection with wireless. The original Encyclopædia was published in September, 1932, but since that time more than 100,000 copies have been sold, and the revised book is now in its third edition.

The Graham Farish "Aeroficient" Aerial-earth Kit.



The Amplion "Sonette" P.M. Moving Coil Speaker.

The "Wireless Constructor's Encyclopædia" is published by Messrs. Geo. Newnes at 5s., or 5s. 4d. post paid.

Ten Shillings

When it is desired to spend a sum of ten shillings or so the choice is naturally greatly extended, and pages could be filled in describing some of the extremely handy accessories which this sum would buy. The trouble which many users of all-mains receivers experience, due to noisy mains, may be cured by fitting one of the mains suppressors. The Belling-Lee, for instance, is fitted into a neat bakelite box and is easily fitted, even by a non-technical person, and costs 10s. 6d. Other interference removers are obtainable in the form of screened aerial leads and special transformers which fit to the ends of this lead. There is, for instance, the Ward and Goldstone Statoformer, which will cost 4s. 6d. and may be used in conjunction with the receiver Statoformer at 5s. The screened down-lead must be used in conjunction with these, and costs 15s. for 10ft., with bracket, etc. Ten shillings and sixpence will also buy an efficient power output valve, and this will no doubt be very acceptable to a listener who is still carrying on with valves which are near the end of their useful life, or which are of obsolete pattern. A new accumulator, such as the Oldham, the Ediswan, or the Anodex, or a small H.T. battery (for a small receiver, of course), chosen from the extensive range of Ediswan, Anodex, Drydex, or Lissen lists, will also prove useful.

Again, there are the numerous small accessories of the receiver proper, such as L.F. transformer, coils, condensers, tuning dials, etc., which may be purchased to add pleasure to the ease of tuning or to improve the quality of performance set up by a receiver which is not of recent design.

Up to a Pound

If you are prepared to spend up to twenty shillings or so on a present you have a very wide range of components from which to choose. For instance, a new moving-coil loud-speaker unit, such as the Peto-Scott, selling at 15s., would be very acceptable to a listener who is still "carrying on" with an old moving-iron or balanced armature type of instrument. On the other hand, your friend might be contemplating the addition of a

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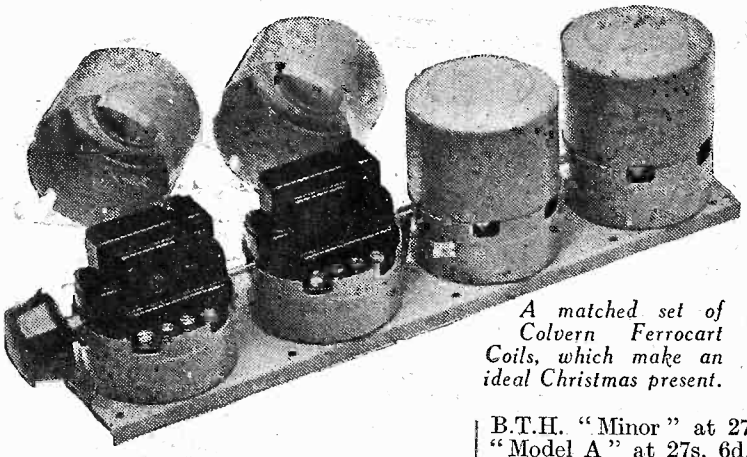
This is the interesting Belling-Lee "Clip-on" Pick-up Unit.



A matched set of Colvern Ferrocart Coils, which make an ideal Christmas present.

(*Continued from page 663*)

Class B stage to his receiver, in which case a Class B speaker unit, also made by Messrs. Peto-Scott and retailing at 15s., would prove extremely useful. To the experimenter friend, one or more iron-cored coils would be particularly valued, and one from the Colvern "Ferrocart" range could be bought for 12s. 6d., or a pair of Wearite "Junior" iron-core coils could be bought for 17s. 6d.

A present that will be highly prized by any radio "fan" is a measuring instrument of some type. Messrs. Bulgin do a wide range of milliammeters and voltmeters at 12s. 6d. each. These are of the moving-iron pattern, but they are accurately calibrated and suitable for measuring either A.C. or D.C., and have thus a variety of uses.

One of the newest types of microphone will have a strong appeal to almost any wireless set user, and in this direction mention might be made of the G.E.C. "Home Broadcaster," which consists of a neat microphone combined with a stand fitted with a volume control and battery. Another useful microphone is the Roberts, which is sold complete with a stand. This has the noticeable advantage of being non-directional; it is also very light and can either be held in the hand or stood on a table.

A third microphone, which has many unique features, is the hand microphone made by Messrs. R. C. and Wilson Electric, Ltd., and sold for 7s. 6d., or complete with transformer, for 13s. 6d.

The idea of mounting an electric clock on the panel of the receiver is now very popular and in this respect we might suggest that the clock made by the Riverside Manufacturing Company and costing only 12s. 6d. would make an admirable present. This efficient little clock is worked off a small battery (self-contained) on which the current drain is so small that a useful life of at least twelve months can be expected from it.

Another excellent suggestion for a present suitable for any wireless amateur is an Automatic Volume Control Unit, a splendid example of which is made by Messrs. Varley and sold at 15s. 6d. This unit combines all the A.V.C. components with a "Nicore" H.F. choke, whilst it can easily be fitted into any receiver by following the complete instructions supplied with it. Another A.V.C. unit, in this case without H.F. choke, is made by Messrs. Wearite; this component costs 12s. 6d.

By paying up to thirty shillings for a present you can buy a complete cabinet loud-speaker, such as the Ormond "Junior," at 22s. 6d., in oak, or 25s. in mahogany, or a variety of moving coil speaker units, like the Amplion "Sonette," R. and A. "Bantam," Epoch "Super-Dwarfe," Baker Selhurst "Permag," Celestion "Soundex," Igranic "D9," and many others. A gramophone pick-up is another item which will make an acceptable present, and the "Cosmocord" at 20s., B.T.H. "Minor" at 27s. 6d., Belling-Lee "Model A" at 27s. 6d., might be mentioned, as well as a number of other makes which were referred to in the article entitled "Choosing a Pick-Up" published last week.

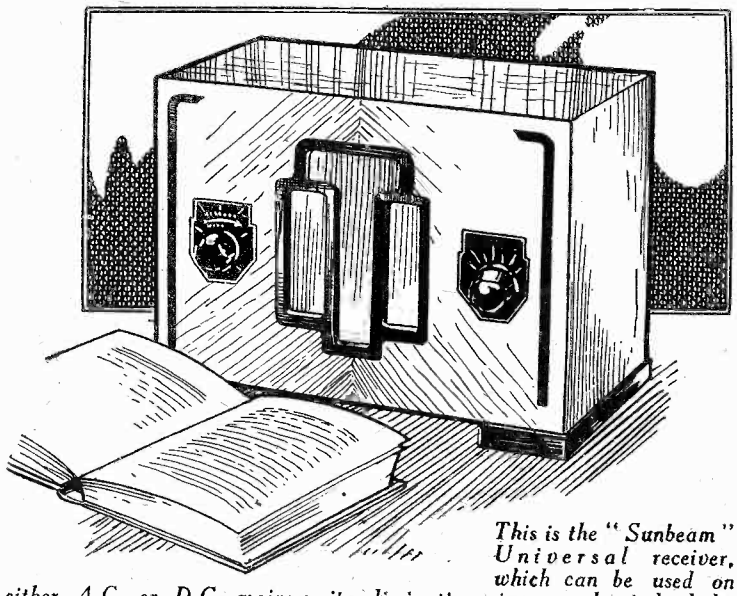
This Ekco console receiver, mounted on a chromium stand, strikes a very modern note.

To the amateur who has a receiver of comparatively old type, and who has valves which have been in use for two years or more, a new set of valves will make an ideal present. Naturally, the cost of these will depend upon the number required, the types and the make decided upon, but where the set has, say, five valves, and the price of these would come to more than you are prepared to spend, it is a good plan to buy a power or pentode output valve and adjust the expenditure by buying a detector, and as many of the others as it is thought fit. The power valve is the one which "ages" most rapidly, and also the one which has most effect upon the quality of reproduction whilst the detector comes next in importance. Power valves made by "Ring" firms, such as Cossor and Mullard, vary in price from 8s. 9d. for a small power valve of the battery-operated kind to 14s. for an A.C. indirectly-heated one. For the friend who runs a mains set with valve rectifier, a new rectifying valve should prove very acceptable, and there are various types available at prices from 12s. 6d. to 20s.

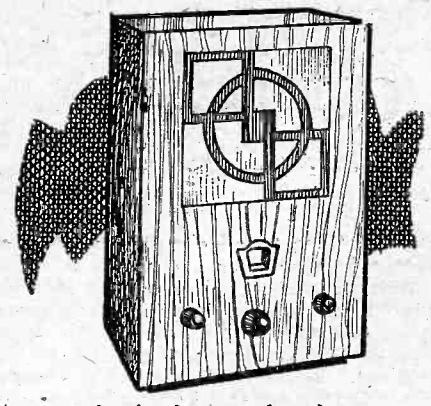
Loud-speakers provide excellent presents, and one of a type which can be used in conjunction with that normally fitted in the set without affecting correct matching is particularly useful at Christmas time and during the party season. A new speaker of this particular kind is the W.B. "Equilode," which is designed solely for use as an "extension," and it is claimed by the makers to be the first and only moving-coil instrument which will work perfectly from the "extra speaker" terminals of any set, no matter what the make or type. It is well known that the lack of standard practice among set manufacturers has caused some confusion in the minds of both public and trade where the fitting of an extra speaker is concerned, and it is this inconvenience which the W.B. Equilode has been designed to remove.

A single switch arm is used to adjust the impedance to the required value. Suitable adjustment of this arm also provides a volume-control effect independent of the volume control in the set itself. There is an "off" position, switching out the extension speaker only. The price is moderate, and the "Equilode" will be a boon to those who are racking their brains for unusual and acceptable Christmas presents. The makers guarantee that there is no set from which it will not work perfectly as a moving-coil extension. The price is 33s. 6d. in chassis form and 48s. 6d. in walnut finish cabinet of characteristic W.B. design. "Equilodes" are available during the next few weeks in a special "Christmas Gift" carton.

Another interesting extension speaker which has recently been introduced is the R. and A. "Multex." This is designed to



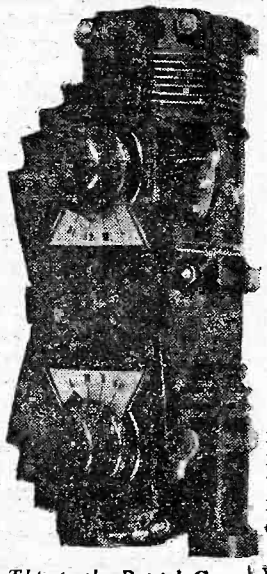
This is the "Sunbeam" Universal receiver, which can be used on either A.C. or D.C. mains; its diminutive size can be judged by comparison with the book.



An example of a low-priced modern receiver.

correctly match up to any type of receiver, whether it employs a power valve, Class B, or Q.P.P. in the output stage. This speaker is an excellent instrument having an 8in. chassis with Reflex diaphragm and a powerful 15 per cent. cobalt-steel magnet. The price is 30s. for the chassis only, or 45s. mounted in a beautiful walnut cabinet.

Many battery set users would like to obtain an increased output from their receivers, and for them a speaker of the type fitted with a matched Class B amplifier would prove a welcome present. There are now several speakers of this type available, among which might be mentioned the Peto-Scott, Ferranti, Sound Sales, Rola, Epoch, and Celestion. This type of speaker is extremely useful for use as an extension to the ordinary receiver, since it can be used in one room to provide sufficient volume for dancing, whilst the speaker normally connected to the set remains in another room, where the older folks wish to listen and talk.



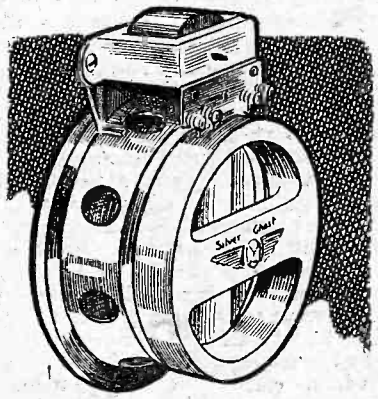
This is the British General All-Wave Tuner, which covers all the important wavelengths, from 14.5 to 2,000 metres.

In addition to the Class B speakers mentioned, there are also a number of neat Class B units which are interesting and extremely useful. One of these is the Sound Sales one illustrated, whilst others are made by Messrs. Multitone, Burton, Ferranti, Baker's Selhurst, and Peto-Scott. All these units can be fitted to practically any type of battery receiver with a minimum of trouble and merely by fitting a plug-adaptor into the output valve-holder. In the same way they can instantly be disconnected when a lower volume level is called for, and a saving in H.T. and L.T. current consumption can thereby be effected.

Miscellaneous Presents

Quite apart from components and accessories directly associated with the receiver, there are a number of other items of especial interest to the buyer of Christmas presents. The aerial-earth system is one of particular importance, although it is so frequently neglected, and a complete kit of parts for the "external" equipment is an item which is bound to appeal to a large number of enthusiasts. A very comprehensive and efficient kit of parts for the aerial and earth is made by Messrs. Graham Farish and sold complete in an attractive cardboard box under the name of the "aerofficient" kit. This includes an ample length of insulated aerial wire, insulators, lead-in tube, "Gard" lightning arrestor, "Filt" chemical earth, and Insurance Policy covering damage by lightning, a tuning chart, and full instructions for erection. Despite the completeness of the kit, the price is only 6s. 6d.

The "Gard" lightning arrestor included in the above kit can be bought separately for 1s. 6d. This is a real safety device which, when connected in series with the aerial lead-in, offers complete protection against lightning and powerful static discharges. It is easily fitted, and is so small as to be quite inconspicuous. In the same way, the "Filt" chemical earth, which is perhaps too well known to our readers to require a full description here. This comprises a small copper container in which is enclosed a glass tube of deliquescent chemical which has to be emptied into the container, which is then buried in any convenient spot. Connection to the container is made by means of a terminal, and this provides a highly efficient earth connection.

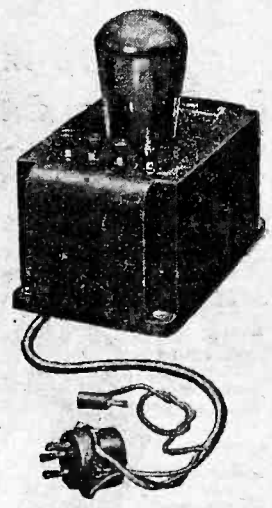


The Lamplugh "Silver Ghost" Moving-Coil Speaker.

Another ideal Christmas Gift for the wireless constructor is Henley's "Solon" Electric Soldering Iron, which helps him to wire up his receiver in the simplest manner. This useful little tool simplifies soldering, so that even the beginner can make a neat and satisfactory repair or join, whilst those accustomed to soldering will welcome its efficiency and entire absence of mess. It is only necessary to plug in to any lampholder, switch on, and in four minutes the Solon is ready for continuous use. The price, complete with flex, plug, and a supply of special resin cored solder, which requires no flux, is only 7s. 6d. It is obtainable from the big stores, ironmongers, and wireless shops, everywhere.

Modern Cabinets

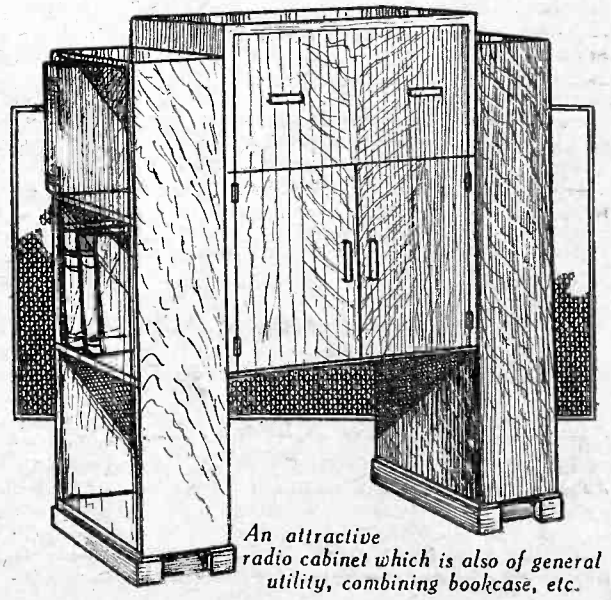
The home-constructor often makes his own cabinet, and therefore a ready-made cabinet, designed not only to house the receiver, but also to provide some form of storage for, say, gramophone records, or even books, may also prove very acceptable, and there are a number of such cabinets, ranging in price from a few pounds to quite substantial amounts. The illustration at the foot of this page shows one of the more elaborate cabinets which houses, in addition to the articles above-mentioned, a cocktail bar. Messrs. Osborn, Peto-Scott, Carrington Manufacturing Company, Smith's, Stenibac and Picketts are names quite familiar to our readers as designers of high-class cabinets, and many of their products have been utilized in housing receivers which have been described in these pages. The firms mentioned, together with others who specialize in this type of work, are quite prepared, if required, to design or build cabinets to suit individual requirements.



A neat Class "B" Adaptor, made by Messrs. Sound Sales.

Complete Receivers

Although we are primarily concerned with home-construction, there are many who for some reason or another are unable to make a receiver, or who prefer the general appearance and performance of a ready-made receiver. It is possible to obtain such a receiver for £5 upwards, and they may be obtained for either battery or mains operation. The choice of the latter type of receiver is rendered difficult when the recipient is situated at some distance, and the knowledge of the particular type of mains (either A.C. or D.C.) is uncertain. The Universal type of receiver will, of course, solve this difficulty, as it may be used indiscriminately on either type of mains. A glance through our advertisement pages will reveal many very good types of receivers.



An attractive radio cabinet which is also of general utility, combining bookcase, etc.

GETTING THE BEST RESULTS FROM THE "A.C. QUADPAK"

Hints on Adjusting the Powerful A.C. Receiver which was described Last Week.

I ASSUME that by now you have completed the constructional work and given your "Quadpak" a preliminary trial. No doubt it has been found that an almost unending string of stations can be received at full loud-speaker strength, although at first it might be found that the degree of selectivity is not quite sufficient to make it an easy matter entirely to separate some of the signals that come in at "full blast" within a degree or so on the tuning dial. If that is the case it will merely be an indication that the three trimmers on the gang condenser have not been correctly adjusted. You should therefore tune to a point on the dial where some interference is experienced, setting the condenser so that the desired station is received at maximum strength. Then reduce the volume by means of the potentiometer control until the signals are as weak as they can be made without the interfering station vanishing altogether. After that, the trimmers can be set with perfect accuracy, commencing with that on the middle section of the condenser. Incidentally, it might be found necessary slightly to vary the setting of the main tuning control whilst carrying out the trimming operations in order that the set may be kept constantly in tune with the station.

Final Trimming Adjustments

Once the interference has been eliminated in the manner just described the volume should be increased slightly, and if the interference then returns, the trimming adjustments should be repeated. This process should be continued until all trace of interference vanishes. From the above explanation it might seem that the method outlined is somewhat long and laborious, but actually it is perfectly simple to put into operation and will not occupy more than a few minutes.

Theoretically it would seem possible to do the trimming in a single stage by leaving the receiver in its most sensitive condition—with the volume control full on—but in practice this is scarcely a practicable system, due to the fact that the volume of output is so tremendous that the interference might easily be "hidden" by the much greater strength of the required signal. At this juncture I would say that you should not be satisfied with your trimming adjustments until they are such that no signs of interference can be detected at any point on either wavelength range. I know the "Quadpak" to be extremely selective, and it is up to you to make sure of obtaining the very best from it. Of course, it cannot separate stations which heterodyne each other, that is, which together produce a constant whistle. There is no receiver in the world that can perform such a feat, and the only cure for interference of that nature is at the transmitting end.

If you remove the cover from the gang condenser you will see that the end vane in each section has a number of radial cuts, and that the sectors so formed are bent to various angles. Please do not, through curiosity, try to alter these in any way, because they were very carefully set before leaving the maker's laboratories to ensure that all three tuned circuits would keep exactly in step over the whole of both wavelength ranges. It is certain that no improvement would be obtained by making alterations, and it is almost equally certain that the receiver's selectivity would be impaired. When replacing the cover see that it is properly fitted and take care not to bend any of condenser plates with it.

Using a Mains Aerial

The "Quadpak" is not at all critical in regard to the aerial with which it is employed, and consequently good reception can be obtained by using anything from a 6ft. length of wire tied to the picture moulding to a "regulation" 100ft. outdoor aerial. This is because a loose-coupled aerial winding is fitted to the first tuning coil. At the same time it cannot give of its best if the aerial is not reasonably good and at least 20ft. long; nor can the full benefit of its selectivity be obtained if the aerial is more than some 75ft. and situated near to a roof or trees, which increase its self-capacity. The ideal arrangement has been found to be a 60ft. outside wire erected clear of all obstructions, although wonderfully good results have been obtained from at least fifty stations by making use of a 20ft. length of indoor-aerial wire attached to the picture moulding.

It is not essential to employ an earth lead, but if this connection is not used there is some slight liability of mains hum being present as a background to loud-speaker reproduction. Additionally, of course, the I.E.E. recommend that an earth connection should always be used in conjunction with a receiver taking its supply from the A.C. mains, in the interests of safety.

In many cases it might be desired to operate the "Quadpak" without any aerial at all, and this can certainly be done with the greatest of ease by making use of a "mains aerial" connection. To do this a .0003 mfd. Dubilier type 670 fixed condenser should be mounted on the chassis immediately behind the fuse-holder. One terminal of the fixed condenser is connected (along with one lead from the mains flex) to the mains transformer, whilst the other is joined to the aerial terminal. When it is frequently wished to change over from an outside aerial to the "mains aerial"—for example, when moving the set from one room to another—it is a good plan to make the lead from the fixed condenser to the aerial terminal of flex and to fit a spade terminal to the end so that quick connection can be made at any time.

Pick-up Connection

Some readers have asked if the "Quadpak" can be used in conjunction with a gramophone pick-up. The set was not originally designed for this purpose, but there is no difficulty whatever in modifying it. All that is required is to connect the pick-up leads to the terminals marked "Grid" and "G.B." on the "transcoupler." In order to prevent the possibility of "radio breakthrough" the volume control should be turned to its minimum position, or else the aerial lead should be disconnected. It

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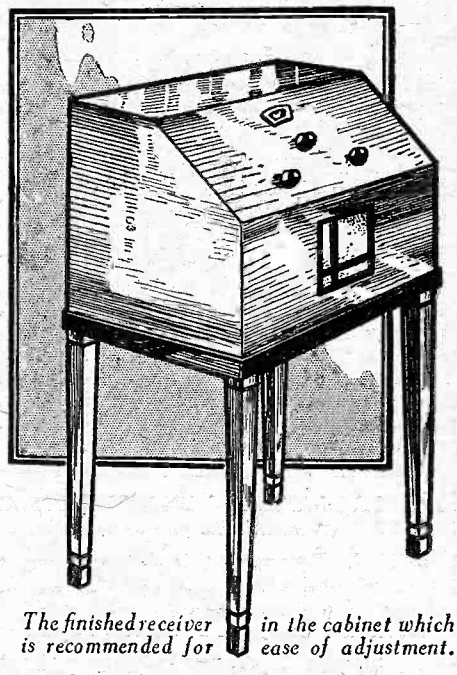
will be appreciated that by connecting the pick-up in this way there will not be a very great amount of amplification given to record reproduction, since only a single valve is used for this purpose. For that reason it is preferable to employ a pick-up of the type designed to give a large voltage output; the Belling-Lee is one that I can specially recommend for this particular set. There is another point which must be considered in connection with some types of pick-up, which is that the secondary winding of the "transcoupler" is in parallel with the pick-up when the connections above-mentioned are adopted. As this would adversely affect the performance of some makes, it is a good plan to try the effect of disconnecting the lead from the "grid" terminal of the "transcoupler" to the grid terminal of the valve-holder and connecting the pick-up lead directly to the latter point. In that case it would be more convenient to fit a Bulgin rotary radiogram switch between the grid of the valve, the corresponding terminal on the "transcoupler," and the pick-up lead. Whatever



The finished receiver in the cabinet which is recommended for ease of adjustment.

method is adopted, it will be more convenient to fit pick-up terminals, and a pair of Belling-Lee terminals and a terminal mount can easily be accommodated just behind the pentode valve-holder.

The Cabinet

Our artist's impression of the "Quadpak" in its unusual, though attractive, cabinet can be seen above. The height of the cabinet is 2ft. 10in. to the lower edge of the sloping front, and the controls can thus be manipulated with perfect ease whether the operator is sitting or standing. A further advantage of the sloping front is that the dial can be seen very easily and clearly from any position.

There is no difficulty in fitting the receiver chassis into the cabinet, since the latter is supplied with the sloping panel ready drilled with holes for the three control spindles and for the dial escutcheon. The first thing is to fit the escutcheon by means of the two bolts with which it is supplied. Then remove the knobs, fit the chassis on the inclined runners and replace the knobs. The speaker unit is attached to the baffle by means of ¼in. wood screws.

MAKING YOUR OWN SCREENED COILS

(Continued from page 634)

direction, and after putting 150 in the first section make a twisted loop (to form a centre-tapping) and continue with the rest of the winding. The end can be secured in the same way as the end of the reaction winding.

Mounting the Coil

That completes the windings, so the next step is to mount the coil and arrange for suitable terminal connections. If desired, the tuner can be mounted directly on the baseboard or chassis of the receiver and connected to the appropriate points by means of the projecting leads, but a much neater method is that illustrated in Fig. 1. An ebonite baseplate measuring 3in. by 2in. by 3-16in. thick is employed, and should be marked out and drilled, as shown in Fig. 4. It will be observed that all the terminal holes are recessed on the underside so that the heads of the round-head terminals cannot short-circuit on to the metallized chassis (if used). The recesses are made after drilling the 7-64in. holes, by running a ¼in. drill half-way through the ebonite.

When the base has been prepared, the "lid" of the screening can should be mounted, after which the coil itself can be fixed in position. Next, fit the terminals, and place a soldering tag underneath the collar of each. A second soldering tag is fitted under the collar of terminal 2, and this makes contact with the "lid" of the screen, so earthing it.

The method of connecting the finished tuner in circuit will be fairly evident from Fig. 2, but I give a suitable Det.-L.F. arrangement in Fig. 7, and this will be found to produce excellent results. I have indicated the most suitable values for all the more important components, but I would say that this circuit is offered as a suggested one for experimental use.

THE PROGRESSIVE EXPERIMENTER

(Continued from page 650)

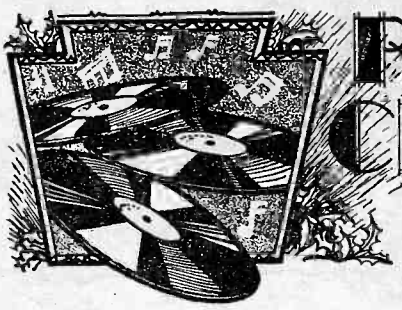
amplified. Because of this, the arrangement is more efficient, and a slight saving of high-tension current is effected.

Different effects can be obtained by using various condenser capacities between about .01 mfd. and .5 mfd., and if you have any spare condensers on hand it will be found quite interesting to try them and observe their effects.

When using the power valve as driver its grid-bias voltage can generally be increased by at least 1½ volts, and this will result in stlil greater economy of working, without in any way affecting the set's performance. You should, therefore, try various positions for the wander plug marked "G.B.—" just as you did in some of the earlier experiments. Do not forget to switch off the receiver before each alteration to the G.B. voltage.

LIST OF COMPONENTS REQUIRED THIS WEEK.

One Igranic Driver Transformer.
One Clix Chassis Mounting 7-pin Valveholder.
One Bulgin "Compact" 50,000 ohm Potentiometer.
One T.C.C. .02 mfd. Fixed Condenser.
One British Radiogram Component Bracket, Type No. 22.
One Clix Spade Terminal, marked H.T.—, length of flex, connecting wire, screws, etc.
One Cossor 220 B Class B Valve.



RECORDS for CHRISTMAS

A Selection of Some Bright Numbers for the Festive Season

AMONG the November releases of the British Homophone Co. appear a fine number of records that will appeal to all tastes. The popular hit tune, *Night and Day*, from the musical comedy, "Gay Divorce," at present running in London, is obtainable on *Sterno* 1288, played by Sydney Lipton's Grosvenor House Band. On the other side of this record the same band play *Blue Prelude*, a slow blues. You should get this record. *The Day You Came Along* and *Thanks*, *Sterno* 1286, two popular numbers from the film, "Too Much Harmony," played by the Casani Club Dance Band, directed by Charles Kunz, are well worth hearing. Other dance tunes all equally good are *Did My Heart Beat ?* and *The Last Round Up*, the latter being a rather touching cowboy song, *Sterno* 1271, played by the Casani Dance Band, *Trouble in Paradise* and *Good Night Little Girl of My Dreams*, *Sterno* 1274, played by Sydney Lipton's Band, *Dinner at Eight* and *The Song That You Gave Me*, *Sterno* 1270, played by the Casani Dance Band. Of outstanding interest is a record by the Barnstormers (the ten boys who left Jack Payne's Band and who are now performing at the Barn Club Roadhouse), who record for the first time on *Sterno* 1292. They play two up-to-the-minute tunes in *Dinner at Eight* and *Reflections in the Water*, and this record is undoubtedly a fine piece of recording.

H. Carmichael, the composer of that famous tune, *Lazy Bones*, gives us a new tune in *Snowball* that may well rival the popularity of his former hit. This is played by Sydney Lipton's Band on *Sterno* 1273, who also record on the other side *That's What Life is Made of*.

Novelty Records

The Wedding of Mr. Mickey Mouse and *Who's Afraid of the Big Bad Wolf* are two tunes that are both novel and laughable. The former is an excellent example of a dance tune that can only be produced with the aid of a microphone. Unless played on a record most of the effects produced would be lost. All the amusing sounds associated with a Mickey Mouse film are re-created on this record. The latter tune is a musical arrangement of another Walt Disney film, "The Three Pigs," which is both amusing and entertaining. Make a careful note of the number of this record, *Sterno* 1287, both tunes being played by Sydney Lipton's Band. Another riot of comedy is *The Wedding of the Grave-Diggers' Daughter*, Parts 1 and 2, played by Billy Seymour and the Boys on *Sterno* 1291.

More Dance Tunes

George Glover and his Band give us four popular dance numbers in *Blue Moments* and *It's the Talk of the Town*, *Sterno* 1290, and *Yvonne* and *Symphony of the Breeze*, *Sterno* 1289. For those who like accordion bands, Zigano's records, *June Nights*, a waltz, and *Good Old Times*, a polka, on *Sterno* 1279.

Most of the dance tunes previously mentioned are also recorded on the Homochord Records. *Night and Day* and *I've Gotta Get Up and Go To Work*, played by Al Gold and His Band, Homochord *H.R.*16, and *Remember My Forgotten Man* and *Shadow Waltz*, which are two of the numbers from the film, "The Gold Diggers of 1933," played by Dick Rose and His Band on Homochord *H.R.*18 are rather catchy tunes. *Oh, Johanna* and *Dear Stranger*, Homochord *H.R.*19 the former tune, which is a quick step, gives us something rather novel in a step dance which is both clever and amusing.

Vocal Records

Patsy Donovan, the well-known tenor, who records for this company, sings two popular Irish ballads in *Sweetheart Darlin'* and *I'm Away in Killarney With You* on Homochord *H.N.*12. The two duettists Best and Best make yet another fine record in *I've Found the Right Girl* and *I Like To Go Back In the Evenings* on Homochord *H.R.*23. Two amusing numbers, *My Girl Ran Away* and *Yodel-o-de-ay*, the latter being a yodelling song, are recorded by Billy Weston and his Pioneers on Homochord *H.R.*25.

Plaza records, which are wonderful value for money at 6d. each, and play as long as the ten-inch records, have Fergus Kelly, tenor, singing *Rose of Tralee* and *I'm Away in Killarney With You* on *Plaza P*158.

Of Outstanding Note

I Cover the Waterfront, *Let's Call it a Day*, *Isn't it Heavenly ?*, and *Learn to Croon* are four tunes that are both popular and well known to most readers, and they are included in "Popular Tunes," *Plaza P*154, played by Alf Bertram and his Band. On the other side is an accordion band playing *Oh Ella*; don't forget to hear this record. A companion record to this is *Plaza P*155, *All the Winners*, including *I've Found the Right Girl*, *In the Valley of the Moon*, *Hold Me* and *Don't Blame Me*, on the other side being *Romany Blues*, both played by Alf Bertram and his Band. Other tunes include *Never Too Old* and *Them Good Old Times*, by the Hill-billys, *Plaza P*146; *That's What Life is Made Of* and *Trouble in Paradise*, by Alf Bertram and his Band, *Plaza P*141; *Oh, Johanna* and *Darling Boy*, by Ben Fields and his Band, *Plaza P*143, *Night and Day* and *Give a Cheer*, by the Plaza Dance Band, *Plaza P*157, and *The Last Round Up* and *Wasting the Evening Away*, by Eddie Walters' Dance Band, *Plaza P*156.

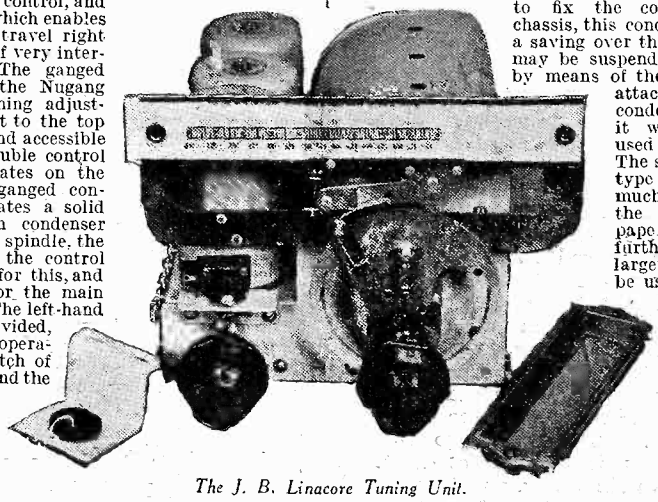
For those readers desirous of obtaining any of the above records the price of Sterno are 1s. 6d., Homochord 1s., and Plaza 6d., all of which are wonderful value for money.

FACTS & FIGURES

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

J. B. LINACORE

THE illustration below shows the new tuning unit which has been developed by Messrs. Jackson Bros., and which is obtainable for battery or mains-operated receivers. There are a number of very interesting features incorporated in this unit, one of the most striking being the ingenious tuning scale. This is of the straight-line, full-vision type, and in place of the customary pointer a thin strip of celluloid with an engraved hair-line moves across the scale and thus provides very exact indication of the condenser setting. As can be seen in the photograph, the scale ends above the centre of the control, and the mechanism which enables the indicator to travel right out to the left is of very interesting design. The ganged condenser is of the Nugang type, with trimming adjustments brought out to the top in a convenient and accessible position. The double control knob which operates on the spindle of this ganged condenser also operates a solid dielectric reaction condenser fitted to the same spindle, the small portion of the control knob being used for this, and the large knob for the main tuning control. The left-hand knob is similarly divided, the large portion operating an on-off switch of the Q.M.B. type, and the small knob operating on the wave-change switch. This is an ebonite rod extending for the whole length of the unit and engaging with a number of spring fingers connected to the various circuit tappings, and provides a very firm and certain contact at each position. Owing to the manner in which these fingers are bent a slight rubbing movement is imparted to the contact points, and there should thus be no trouble from dirty or corroded contacts. The actual coils are of the iron-core type, of small diameter, and giving very efficient tuning throughout the range. The provision of pick-up terminals shows that the entire arrangement has been very well thought out, and it receives our entire approval. The price is 69s. 6d. complete.



The J. B. Linacore Tuning Unit.

NEW G.E.C. BATTERY PENTODE

WE are informed by the General Electric Company that the new battery pentode, V.P.21, is now available. This is the first high-frequency pentode to be placed on the market for the home-constructor, and is of especial interest in that it is of the variable-mu type, requiring a 9-volt biasing battery only for a full range of control. The main advantage of this type of valve is that much lower anode voltages may be employed than with the standard S.G. valves, with no risk of distortion, and by utilizing one of these valves an admirable automatic volume-controlled receiver may be constructed to operate from a standard 100-volt H.T. battery with increased amplification and greater range. The standard 7-pin base is fitted, and the metallized coating is joined to one of the pins for earthing purposes. The price is 15s. 6d.

THE WESTRIC CHARGER

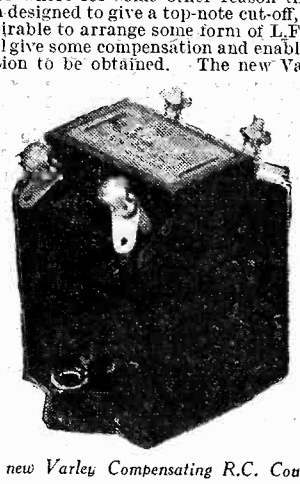
ALTHOUGH intended for the car user, this ingenious charger will find many applications with the wireless enthusiast. It is a simple accumulator charger designed to plug into the electric-light mains and to give sufficient output to put the standard-car battery in good condition. One model provides an output of six volts at 2 amps, and the other is designed for twelve-volt accumulators charging at 1 amp. A special charging socket is supplied with the device, and this is fitted to the dashboard of the car, the charger being provided with a plug which fits into this socket. Thus, when it is desired to charge the accumulator, the charger is connected to the mains and the plug inserted into the socket on the dash. There are still a number of listeners who use a six-volt accumulator for operating their receivers, and experimenters and others who require a current of the order given by either of these models will no doubt find them of use. The price is 75s. for either the six or the twelve-volt model.

NEW DUBILIER ELECTROLYTIC CONDENSER

A NEW type of electrolytic condenser is announced by the Dubilier Company, a cardboard container being used in place of the standard aluminium case. Wire ends, suitably identified, are employed for connection purposes, and the ends of the container are sealed with hard wax. Where it is not found necessary to fix the condenser to the chassis, this condenser represents a saving over the older type, and may be suspended in the wiring by means of the leads or firmly attached to a fixed condenser with which it will normally be used in conjunction. The smoothing of this type of condenser is much better than with the usual type of paper condenser, and, furthermore, a much larger capacity may be used with a saving in space. The 10 mfd. 100-volt test condenser costs 3s. In addition to this particular specimen, there is a large number of other values obtainable with various voltage ratings, and the prices range from 2s. Details of these will be found in the exhaustive Dubilier Catalogue, obtainable post free from the makers at Ducon Works, Victoria Road, North Acton, W.3.

VARLEY COMPENSATING R.C. COUPLER

THE modern receiver is usually fairly sharply tuned, and the result is quite naturally a reduction of the higher frequencies. Where extreme selectivity is desired, or where for some other reason the circuits have been designed to give a top-note cut-off, it may be found desirable to arrange some form of L.F. coupling which will give some compensation and enable brilliant reproduction to be obtained. The new Varley R.C.



The new Varley Compensating R.C. Coupler.

Unit is designed on the lines of a standard resistance capacity coupling unit, with the addition of a special resonant circuit to provide a rising characteristic. The usual type of anode resistance is fitted, together with a coupling condenser and grid leak, but the latter is shunted by a fixed condenser, whilst an iron-core choke is inserted between the coupling condenser and the grid connection for the succeeding valve. The complete apparatus is housed in a bakelite case similar to the well-known Nicore transformers. The unit was tested in a standard receiver, which was adjusted to

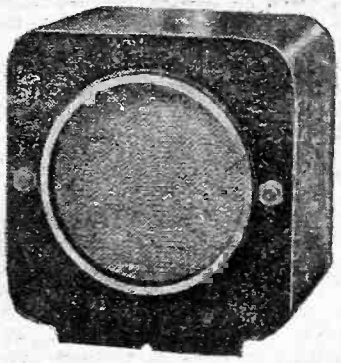
provide a noticeable cut-off, and when compared with a standard R.C. unit the reproduction was very noticeably improved. In a standard receiver it was found possible to use a simple tone-control device across the speaker, and thus make full use of reaction on distant stations whilst preserving full brilliancy, and wh n the local station was received the tone control enabled the extra high-note response to be suitably modified. The device is most useful and works very well indeed. The price is 11s. 6d.

FURTHER TUNGSRAM VALVES

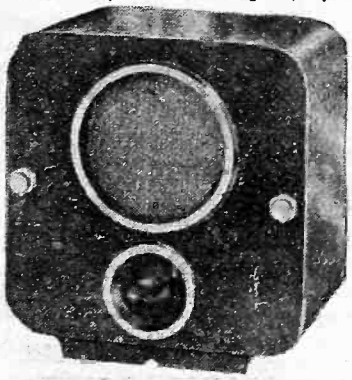
A SPECIALIZED range of high efficiency A.C. mains type valve has been designed by Tungsram with the particular purpose of what might be called "revitalizing" the performance of old-mains sets. These are known as Tungsram Symphonic valves. The idea behind the design is, in simple terms, to associate volume and quality in their correct proportions, permitting side-by-side team-work instead of a compromise. A remarkable degree of extra volume is thus achieved with a corresponding brilliance of tone. The range compromises Symphonic straight or variable-mu screen-grid, Symphonic straight or variable-mu high-frequency pentodes, Symphonic indirectly-heated multi-grid output valves, and Symphonic detectors. For battery users there is a new high-efficiency valve, type SV.220—a variable-mu, high slope screen-grid valve of exceptionally high sensitivity. It gives a remarkable high-frequency amplification. The S.220 corresponds to the above, but is a straight slope type. For moderate power output with extraordinary low consumption (ideal in these days of lean purses) there is the PP.220—a multi-grid valve. There is also a fine Class B valve—in Tungsram's new chatterproof, dome-shaped structure. Two new completely non-microphonic midget valves are the HR.210 high impedance and the LD.210 low impedance—for either detector or high and low-frequency amplification respectively. Tungsram are also making a speciality of Universal A.C./D.C. valves, and also valves of American type for the many American sets in this country that will not operate on English valves.

NEW BAKER SPEAKERS

THE two speakers illustrated below are from Baker's Selhurst Radio and, as may be gathered from the size of the switch fitted to one of these, they are of



The new Baker's Selhurst Midget Speakers.



extremely small dimensions. The lower model is fitted with a tone-control switch and is, in other respects, similar to the upper model. We hope to have an opportunity of testing one of these models and giving a test report at an early date.

IMPROVING SUPERHETERODYNE PERFORMANCE

(Continued from page 658)

designers prefer to use a separate oscillator condenser, sacrificing a little of the ease of control in the cause of efficiency.

There remains one further type of oscillator control to be considered, namely the use of one section of an ordinary ganged condenser, using padding condensers on both wavebands in order to give the correct characteristic. This is seldom done except where the receiver is largely constructed from parts already on hand. The procedure is generally similar, the tuning coil trimmers being adjusted for maximum response at a low wavelength, and the "padding" condenser (instead of the oscillator trimmer), being set at the higher point, rocking the ganged condenser a few degrees as each alteration is made in the capacity of the padding condenser, until the point for maximum response has been found. The tuning trimmers may now be reset if necessary, and then the settings should be checked. A few extra minutes spent here will often make a considerable difference in the performance of the set.

On the Long Waves

On the long-wave band, the adjustments are, as a rule, carried out by means of a trimming condenser in parallel with the long-wave portion of the tuning coil, and this should be adjusted for maximum response.

In making all these adjustments it is preferable to tune the receiver to a weak station, or to use the volume control to reduce the station to a low sound level so that alterations in volume are more easily detected.

Economy in Anode Current

There is one final point in the use of a set employing several screen-grid valves which is of importance, and that is the fact that such a valve will take only a fraction of the anode current, but without anything like the same decrease in amplification. This feature is of most importance to battery users, or those who have eliminators which are working at their maximum output. If the H.F. and I.F. valves, or any of them, are not of the variable-mu type, it will be advisable to arrange for the screen voltage to be low (say 40 volts instead of 70). It can always be raised on the rare occasions where the set is worked at absolutely its maximum sensitivity. It is quite possible to operate a six-valve battery superhet at 11 or 12 milliamps, and obtain a good volume output.

PRACTICAL LETTERS FROM READERS

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

"Still Coming Along in Leaps and Bounds."

SIR,—I thank you for the book "Not so Quiet . . ." awarded me in connection with Problem 58. I have just finished reading this, and I think it is a fine book. PRACTICAL WIRELESS is still coming along in leaps and bounds, and for any other wireless paper to try and beat, or even equal it, seems to me to be a sheer waste of their time.—A. COOK (Manchester).

S.S. "Jacob Ruppert" Call Sign: A Correction.

SIR,—With reference to paragraph entitled "Radio in the Polar Regions" (under section "Round the World of Wireless, November 18 issue, page 459), I would inform you that the call sign of the S.S. *Jacob Ruppert* (Byrd's Antarctic Expedition II) is K T J Y and not K J J Y as stated.—F. POSTLETHWAITE (Goodmayes).

A Radio Enthusiast's Appreciation.

SIR,—I nearly wrote "The Editor, Britain's Leading Wireless Weekly," not doubting it would find you. I have been keen on radio since I can remember. That was the time when we talked half a mile with a Ford ignition coil and carborundum crystals and got quite a kick out of it. Being also in the radio trade and having to be on the spot with every new phase and gadget, I find PRACTICAL WIRELESS equal to every emergency. Having held important positions in radio, I know what a keen amateur wants. However, continue the good work. I for one have cancelled all the other weeklies for the simple reason they are not like PRACTICAL WIRELESS, which I have had from No. 1, and it has stayed the same every week; Wednesday is a day to look forward to.

I have one suggestion to make: why stop, after describing how to make transformers, chokes, etc. Surely some of your technical staff can give us some more "How to Make" articles.—J. M. DAVIE (Chingford).

Design for Universal All-Mains Set Wanted.

SIR,—Having been a reader of your valuable paper since its first publication, I must say you do your best to keep up to date. What I should like to see, however, is a good set designed for both A.C. and D.C. mains. Foreign designers seem to have got over this difficulty, so I am certain English designers can. There must be thousands of listeners like myself situated in a D.C. district that must eventually come under the grid system and then have to change over to A.C. I know commercial sets can be bought incorporating this idea, but there are still a good many constructors who would like to build their own universal all-mains sets.—J. R. REEDS (Barnes).

Replies of Broadcast Queries.

SIR,—With reference to the portion of your publication dealing with Q.R.A's. of various stations, I may say that these replies prove quite interesting, as they show what station has been coming in at a certain spot. Probably the information would be of more use to the amateur if the waveband and date received could be added where known. I have a Radio Amateur Call Book Fall 1933, and keep a small log of 3.5 stations heard here, and am a member of the R.S.G.B. Group for that band. The addition of the information I here suggest would be of particular interest to stations that are over 900 miles away, or that are on very low power nearer than that to the receiver.—H. O. CRISP (Forest Gate).

An Ideal Circuit?

SIR,—I also have been a reader of PRACTICAL WIRELESS since No. 1, and am certainly very interested in its contents. There is a letter in the November 11th issue from "F. G. P." (London, N.W.) which greatly interests me, because I think he has got hold of an ideal circuit. There is no doubt whatever that a straight Det. and 2 L.F. set is not selective enough these days. Where I am situated (about 20 miles from Washford Cross) the interference with both wavelengths is beyond control, the power also is so great that other stations are simply drowned out.—F. G. THORNE (Weston-super-Mare).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT an H.F. metal rectifier can be used as an economizer of high-tension current.

—THAT a thermal delay switch is unnecessary when using an indirectly-heated rectifying valve.

—THAT a portion of a tuning coil or frame aerial may be employed in the dual capacity of tuning coil and reaction coil.

—THAT all by-pass condensers in H.F. circuits should be of the non-inductive type to ensure correct working.

—THAT when choosing a condenser for a circuit the peak voltage should be considered and not the actual working voltage.

—THAT aerial systems consisting of two or more wires spaced apart are inefficient unless the spacing is greater than three feet.

—THAT an H.F. choke should always be included in the anode circuit of a detector valve, even although a high resistance is used in that portion of the circuit.

—THAT all metal casing, etc., in a receiver should be joined to earth, a separate lead being taken to each part and a common connection not relied upon when instability is experienced.

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 and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

Arrangements have been made to demonstrate television apparatus at future meetings of this Society, and lectures, social functions, etc., will shortly be organized. Full particulars from Leslie W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge.

A branch of the above Society has recently been formed in Manchester and is open to receive new members. Membership is free and should be an inducement to the many short-wave amateurs in the district. The Society deals with most branches of radio work, including Short Wave, Ultra Short Wave, and Television. During the next fortnight we shall have secured a local hall or club room where we can hold our demonstrations and lectures, etc. Will interested amateurs please write for particulars (enclosing a stamp for reply), to Henry B. Shields, 39, Hardman Lane, Failsworth, Lancs.

The High Wycombe branch of the A.-A. R. & T. S. held its first meeting recently. Particulars from the organizing secretary, "Carriers Arms," Wycombe Road, Marlow, Bucks.

INTERNATIONAL SHORT-WAVE CLUB, LONDON

The meeting of the London Chapter held at the R.A.C.S. Hall, Wandsworth Road, S.W.8, on Friday, 17th November, provided a very interesting evening for the short-wave listener. Mr. A. E. Bear opened the meeting by a talk on the thrills and fascination of short-wave listening. He said he looked forward to the day when the ordinary listener would take interest in short-wave reception. This was followed by a short-wave demonstration by Mr. F. R. Hornby. Among the receivers demonstrated were a Philco 16B, which is an 11 valve allwave receiver, and a 3 valve short-wave converter. World-wide reception was obtained and it was agreed that these were exceptionally fine receivers. A recital of records of short-wave reception overseas then followed, and members heard how the British Empire Station at Daventry was received in far distant lands. We have several ladies among our members, and we invite any ladies who are interested in short-wave reception to attend our meetings.—A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

SMETHWICK WIRELESS SOCIETY

At a recent meeting of this Society, Mr. Shaw, of the Marconiphone Co., Ltd., gave a lecture on "Multi-electrode Valves." In tracing the development of the new valves, the lecturer pointed out that in every case there was a definite purpose behind the addition of each new electrode. He dealt briefly with the S.G. valve and L.F. pentode, and went on to consider the H.F. pentode, the pentagrid, and "Class B" valves. Coming to the double diode-triode, Mr. Shaw described the construction of the valve and gave the fundamental circuits (with explanations) for simple A.V.C., delayed A.V.C., amplified A.V.C., and "Squelch Control."—Hon. Sec., Mr. E. Fisher, 33, Freeth St., Oldbury, nr. Birmingham.

THE SOUTHALL RADIO SOCIETY

A lecture, entitled "Mains Transformer Design," was given by Mr. Swan, at the meeting of the above Society held last week. He explained the various factors which have to be taken into account in order to avoid hysterisis and eddy-current loss, and also the various methods adopted to prevent excessive temperature rise and to obtain good voltage regulation under load.—Hon. Sec., Mr. A. J. Stephens, 98, Pole Hill Road, Hillingdon.

THE CATFORD RADIO AND TELEVISION SOCIETY

The first of the practical evenings arranged by this Society for the winter session was held at 257, Bromley Road, on Wednesday, November 15th. As the chairman, Mr. H. S. Ryland, pointed out, all practical work must be based on measurement, and he proceeded to describe a simple and inexpensive form of universal meter which could be used with a reasonable degree of accuracy for all the work likely to be encountered by the members in the course of their experiments. Starting with one milliammeter as a basis, it was shown that by means of the appropriate shunts and multipliers it was possible to carry out measurements over a wide field with a degree of accuracy comparable with that of an expensive multi-range instrument. Mr. Ryland did not neglect the problems connected with the measurements of A.C. current, for not only did he show how this could be done, he also gave away small metal-oxide rectifiers suitable for the conversion of a D.C. meter for this purpose. As, on this occasion, it will be the object of these practical evenings to assist the ordinary amateur to understand the construction and operation of his receiver, members and non-members alike are welcome to come along with their own particular problems to any of the Society's meetings. Particulars of the Society's future programme may be had on application to the Hon. Secretary, at 38, Como Road, London, S.E.23.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE.

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

(1) Supply circuit diagrams of complete multi-valve receivers.

(2) Suggest alterations or modifications a receivers described in our contemporaries.

(3) Suggest alterations or modifications to commercial receivers.

(4) Answer queries over the telephone.

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

THE LUXUS A.C. SUPERHET.

"I am constructing the Luxus receiver, but am in doubt regarding the values of certain resistances. I see on the wiring diagram on page 203 that there are two 25,000 ohm resistances used, and two of the resistances on the under surface of the chassis are very indistinct in my copy of "Practical Wireless." I have left over one 25,000 ohms resistance, one 250,000 ohms, one 1,000 ohms, and one 100,000 ohms, and I should like to know exactly where these go."—T. B. C. (Hampstead, N.W.).

If you obtain the full size Blue Print you will find that the resistances are quite clearly indicated. You have, however, apparently wired the receiver from the small diagram reproduced in the pages of PRACTICAL WIRELESS, and, therefore, we give you the positions for the four resistances which you are unable to locate. The resistance on the top of the chassis which is joined to the arm of the potentiometer and passes through hole No. 14 is 250,000 ohms. The resistance of 100,000 ohms joins the two .0001 condensers on the underside of the chassis, and the remaining resistance (1,000 ohms) is situated between the 25 mfd. electrolytic and the .01 mfd. fixed condensers, close to hole No. 10.

VOLUME CONTROL

"I should like to make up a set using for a volume control a variable anode resistance. Thus, the circuit would consist of a detector valve, R.C. coupled to the next valve, and the coupling condenser joined to the arm of the anode resistance which takes the form of a variable potentiometer. Do you approve of this, or is there any better method?"—A. H. (Boston).

The circuit arrangement is quite in order, and was, in fact, used in the Sixty-Shilling Three recently published. The only point to watch is the choice of the actual resistance. It will be appreciated that the anode current is passing through the resistance and, therefore, it must, in the first place, be capable of passing that current. Secondly, the movement of the arm must be so arranged that it passes gradually, without any sudden changes, from one portion of the winding to another. Some variable resistances of this type are arranged with a fairly large winding of fine wire and tapping points are made to heavier gauge wire or to separate contact points. Thus the arm progresses in a series of sudden jumps, and this results in a very noisy operation as the condenser charges and discharges with every change. You must, therefore, ensure that a smooth variation is made by the component. The alternative is to use a variable grid leak with the grid joined to the arm, and here no current-carrying capacity has to be taken into account. We prefer the former method.

Q.M.B. OR PUSH-PULL SWITCH?

"In the set I have got the switch has become faulty, and when I go to switch on sometimes it works and sometimes it does not. The knob sticks through a small opening and this has to be pushed down to switch on and up to switch off. Can you tell me what type of switch it is, and if an ordinary sixpenny on-and-off switch will do?"—O. T. (Whetstone).

As the switch operates by an up and down movement, it is almost certain that it is of the Q.M.B. type, and this is essential, of course, if the receiver is mains-operated—a point you do not mention. Without further notes concerning the type of receiver, we cannot say whether it is a single on-off switch or whether other components are disconnected by the same movement, but we would certainly not advise you to replace it with a cheap push-pull switch, unless you can be absolutely certain that there is no great current passed. It is a safe rule to use only the Q.M.B. type of switch for operating all-mains receivers, and even for switching on and off the ordinary battery valves it will be found extremely efficient.

DATA SHEET No. 64.

Cut this out each week and paste it in a notebook

TELEVISION DISC DATA FOR PRESENT TRANSMISSIONS.

Diameter of Disc, Inches.	Radius for First Hole Inches.	Size of Hole, Inches.	Picture Width, Inches.	Revolutions per Minute
26	12.0	.0358	1.0751	750
25	11.5	.0343	1.0303	750
23	11.0	.0328	.9855	750
23	10.5	.0313	.9407	750
21	10.0	.0299	.8959	750
20	9.5	.0284	.8511	750
19	9.0	.0269	.8063	750
18	8.5	.0254	.7615	750
17	8.0	.0239	.7167	750
16	7.5	.0224	.6719	750

The above details are for thirty-line scanning, and the dimensions for hole sizes are worked to the nearest decimal point. To obtain actual figures the measurement in the second column should be multiplied by .08959 and the result divided by thirty.

A.V.C. AND THE BATTERY SET

"I was very interested in the circuit of your recent A.C. Superhet, and would like very much to make up one on these lines, but using battery valves. Would it be sufficient to wire up the circuit with 4-pin holders and use the same types of battery valves, or would the circuit need re-designing?"—E. W. G. (Cardiff).

At the present moment valves of the same type as were used in the Luxus are not obtainable for battery operation, although they will not be long before they appear on the market. You could not, we are afraid, simply alter the circuit by changing valves, as several resistances used in that circuit were designed to operate only with the valves of certain characteristics, and those which apply to the battery valves in question are quite dissimilar. We are, however, experimenting with a receiver on these lines, and as soon as the design is completed it will be published in our pages.

TELEVISION AND SOUND

"I would like to raise a point which occurs to me in regard to modern television systems. At present the sound is transmitted from one station and the vision from another, which means that two receivers are necessary, tuned to each station. Is it not possible to transmit the sound and vision together from one station and receive them on one set, separating them out at the detector or output end of the receiver and thus give more economical results? I think the speech could be given on one side-band and the 'vision' on the other, and the circuits made sufficiently selective to tune each half separately. I may be wrong, of course."—Y. A. (Blackpool).

Many schemes have been tried for the adoption of an arrangement on the lines you suggest, but there are many difficulties in the way of its correct application. Whilst one side-band can be removed from a transmission, and replaced at the receiving end, the quality would not be of a sufficiently high standard to warrant the broadcasting of musical items. Speech is certainly intelligible by this means, but really only because it consists of words which are readily recognizable, no matter what distortion accompanies it. Alternatively, the picture which could be transmitted on one side-band would be very lacking in detail (with the present methods of transmission), and we are afraid, therefore, that your scheme is not technically sound. One American system has been tried with very great success (with silhouette pictures) where vision and sound was combined and transmitted from one aerial at different frequencies, but it has not yet become practicable beyond the laboratory stage.

TELEVISION DISC DATA

"After following many of your television notes I am seized with a desire to make up a receiver, but have not got a motor which will be powerful enough to drive a disc as large as you suggest. Is there any reason why I cannot use a disc of, say, 6 or 7in. in diameter, with corresponding alteration in the spacing of the holes? Any suggestions regarding the disc would be appreciated."—A. T. Y. (Hendon, N.W.).

The picture ratio must be maintained, no matter what size the disc. In England this is 8 to 7, and this ratio must be maintained by making the size of the holes such that the spiral occupies a width which will permit of thirty-line scanning with the holes accurately aligning. This means that for a disc having a diameter of 8in. and allowing a small margin from the edge of the disc for the first hole, the thirty holes would have to be cut in a total distance of less than three-quarters of an inch, and they would, therefore, have to be less than one-fortieth of an inch in diameter. The total light space will therefore be so small that the picture will be very poorly lighted, and we do not think you would gain anything from your proposed economy. The standard disc of 10in. permits of holes having a diameter of .02 of an inch and a picture width of .85in., thus providing not only more illumination, but a more reasonable size of picture. We would advise you, therefore, to obtain a better motor and use this size of disc.

FREE ADVICE BUREAU COUPON

This coupon is available until Dec. 16th, 1933, and must be attached to all letters, containing queries.

PRACTICAL WIRELESS, 9/12/33.

PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these columns at the rate of 3d. per word. Minimum charge 3/-. All advertisements must be prepaid.

PREMIER SUPPLY STORES Offer the following Set Manufacturerers' Surplus New Goods at a fraction of the Original Cost, all goods guaranteed perfect, carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, T.C.C. condensers resistances and diagram, 120v. 20 m.a. 20/-; trickle charger 8/- extra; 150v. 30 milliamps, with 4v. 2-4 amps. C.T., L.T. 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps, with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 milliamps with 4v. 3-5 amps. C.T., L.T., 37/6.

T.C.C. Condensers, 750v. working, 2 mf. 3/6, 4mf. 6/-, 4 mf. 450v. working 4/-, 250v. working 1 mf. 1/3, 2mf. 1/9, 4 mf. 2/6; aqueous electrolytic 440v. working, 4 mf. 3/-, 8 mf. 3/6.

ALL the following Lines 6d. each or 5/- per dozen; 5-pin chassis mounting valve holders; shielded screen grid or pentode leads 1-watt wire end resistances, any value; 0.1 condensers; on-off switches push-pull; .01, .05 and 0.5 condensers.

AMSCO Triple-gang 0.0005 Condensers, with trimmers, 4/11.

T.C.C. Electrolytic Condensers, 100 volts working 15 mfd.; 1/3.

PREMIER Chokes, 40 m.a., 25 hys., 4/-; 65 m.a., 30 hys., 6/-; 150 m.a., 30 hys., 10/6.

PYE Chokes 20 hyns., 4/-; Premier multi-ratio output transformers, giving 15 different ratios, 7/6.

HARLEY Pick-up, complete with arm and volume control; 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 50,000 ohms, any value; 3/6.

KOLSTER BRANDES Gramophone Motors, dual type, can be worked by clockwork or mains, induction type 100-250 volts, 27/6; complete with all fittings and turntable.

SPECIAL Offer.—Microphones by prominent manufacturer, high sensitivity, uniform response, complete with stand, transformer and battery; listed £3/15, our price 18/6.

PREMIER British Made Meters, moving iron, flush mounting, accurate; 0-15, 0-50, 0-100, 0-250 milliamps., 0-1, 0-5 amps., all at 6/-.

ORMOND Condensers, 2-gang, semi-shielded; 2/6.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-115v. or 200-250v., output 180-0-180 volts, 40 m.a., 4v. 1a., and 4v. 3a., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have engraved terminal strips with terminal connections, input 200-250 volts, 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformers, 250v., 60 m.a., rectified, with 4v. 1-2a and 4v. 3-5a., L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER H.T.9 Transformer, 300v. 60 m.a., rectified, with 4v. 1-2a and 4v. 3-5a, L.T. (both C.T.) and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a, L.T. and screened primary, 15/-; with Westinghouse rectifier, 26/-.

CENTRALAB POTENTIOMETERS, 200 ohms and 400 ohms 1/-. 250,000 ohms, 50,000 ohms and 500,000 ohms 2/6.

ROLA F7 MOVING COILS, 1000 Ohms. FIELD. 20/-; MAGNAVOX 142. 1,000 Ohms. FIELD 22/-. PLEASE STATE WHETHER POWER OR PENTODE TRANSFORMER REQUIRED. A.C. CONVERSION KIT 10/- extra.

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PREMIER Mains Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., c.t. L.T., 2/- extra; Westinghouse rectifiers for above, giving 180v. 30 m.a., 8/6.

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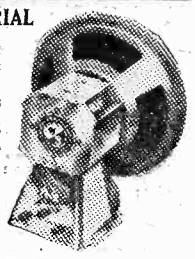

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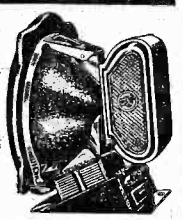

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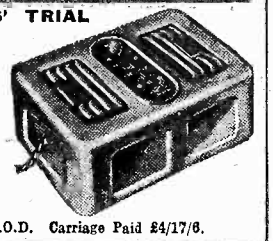

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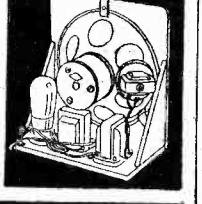

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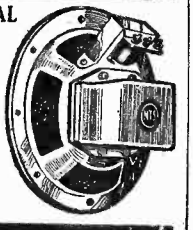

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WESTERN ELECTRIC Condensers, 250v. working 1 mfd., 6d., 2mfd. 1/-; 500v. working, 1 mfd., 1/-.

T.C.C. Condensers, 250v. working 4x4x1x1x. 5mfd., 3/6; 6x4x2x2x2 mfd., 375v. working, 6/11; H.M.V. 4x4x1x1x1x.5 6/-. 400v. working.

SPECIAL Offer of Wire Wound Resistances.—4 watts, any value up to 10,000 ohms., 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms. 2/6.

MAGNAVOX P.M. M.C. Speakers, 7-inch cone, 18/6. Please state whether Power or Pentode Transformer required.

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WESTINGHOUSE Rectifiers, 120v. 15mA., 6/6; 200v. 30 mA, 8/6; 200v. 60 mA, 10/-.

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VARIABLE Condensers.—Lotus 2-gang 0.0005, complete with dial, knob, escutcheon, 8/6; all ganged condensers are fully screened, with trimmers and boxed; Hydra block condensers, new, 16 mfd., 2+2+8+2+1+1, 1,000 volt test, 7/- each; 4 mfd., 2/6; 2 mfd., 1/9; 1 mfd., 1/-.

RADIOPHONE Volume Controls and Switch. 50,000 and 10,000 ohms, 3/3 each (list 10/6).

HELLESENS 8 mfd., Electrolytic Condensers, 3/6 each, 4 mfd., 3/- each.

SPEAKERS.—Permanent magnet, 28/- (listed 49/6); D.C. mains energised, 2,500 to 6,500 ohms, complete with humbucking coils and transformers, 16/6 (list 39/6); G.E.C. Stork speakers, complete in magnificent cabinet, 19/6 (listed £3/15); Ormond speakers, complete in cabinets, 10/- (listed 25/-); Blue Spot, 100 U, 13/6 (list 37/6).

CONSTRUCTORS' Kits.—Ready Radio Meteor screen grid 3-valve kit, less valves, 26/-; with 3 Mullard valves (P.M.12a, P.M.2D.X., P.M.2a), 49/- (list £5/7/6).

READY Radio "303" A Kits, complete with cabinet, M.C. speaker, less valves, £2/5; with 3 Mullard valves (P.M.1L.F., P.M.2D.X., P.M.2), £3/5 (list £6/17/6).

READY Radio Meteor "A" 3-Valve Screen Grid Kit, complete with cabinet, M.C. speaker, less valves, £3/7/6; with 3 Mullard valves (P.M.12A., P.M.2D.X., P.M.2.A.), £4/10 (list £8/7/6).

READY RADIO ST.400 Kits, as specified by Scott Taggart, £2/19/6 each (list £4/17/6); Mullard Radio for Million 3-valve battery kits, complete with 3 Mullard valves, £3/3 (list £6/2/6), all kits brand new in original sealed cartons.

MARCONI 1934 Pick-up No. 19, 26/- (list 32/6); Ferranti Chokes, C.T., 20 Hys., 50 m.a., 6/9 each (list 35/-); H.M.V. volume controls 1/6 each (list 12/6). We have purchased the complete liquidated stock of large northern Manufacturer and Factor and can offer the following special bargains:—Dubilier 4 mfd. condensers (2+1+1), 1,000 volt, 2/9 each. 4.5 mfd. (2.25+2.25), 1,000 volt., 3/- each, Lumophon D.C. Moving Coil Speakers with terminals, 11/6 each (list 39/6). Mains Switches, 3 amp., 250 volt, 8d. each, 7/6 doz. Edison Bell Centre Tapped Inductance Coils, all values from 20 upwards, 9d. each, 7/6 doz. assorted. Amplion Loudspeaker Units, 2/3 each (list 12/6). Every article perfectly new.

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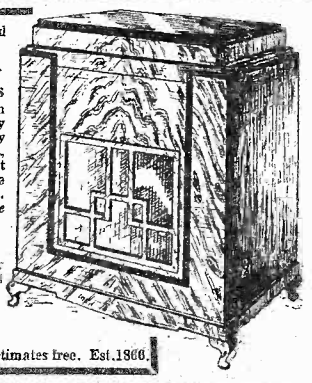

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