BANISH YOUR BATTERY TROUBLES! *(See page 758)*

PRACTICAL HOME RADIO PICTURES

Amateur Wireless And Electrics

Vol. VIII. No. 207 SATURDAY, MAY 29, 1926 Price 3d

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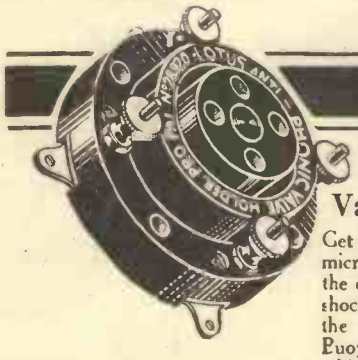

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Amateur Wireless and Electrics

The Leading Radio Weekly for the Constructor, Listener and Experimenterr

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Chief Contents

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CURIOSITIES OF WIRELESS

WIRELESS is full of oddities and queer happenings. Some of them can be explained, but the causes of others are either doubtful or altogether unknown. Take atmospherics, for instance, with whose crackling, tearing or rustling sounds everyone is familiar. It is pretty certain that they are produced sometimes by thunderstorms, sometimes by violent electrical disturbances in the atmosphere and sometimes by discharges between layers of air at different potentials.

The Nature of Atmospherics

Not long ago a great deal of research work was done with a view to discovering something about the actual nature of atmospherics. It was found that the waves produced by certain types of atmospherics were of much the same kind as those radiated by a spark transmitter; others again give rise to wave forms of all kinds of queer shapes. The average wavelength of an atmospheric appears to lie between 40,000 and 100,000 metres. From this it is easy to see why when atmospherics are about, the interference that they cause becomes more and more marked as the wavelength to which the receiving set is tuned is increased. But it does *not* explain other strange phenomena. If you have done any listening upon wavelengths of 100 metres and below you have probably found that there are numerous occasions when atmospheric interference may be pretty bad on, say, 60 metres but almost entirely absent on 100. Sometimes, again, when atmospherics are bad upon the broadcast wavelengths the short ones may be free from them; or conditions just the reverse of these may obtain.

Short-wave Phenomena

The short waves themselves are responsible for a great number of strange phenomena. Not long ago, when Senatore Marconi was conducting short-wave experiments between this country and South America, he found that the maximum range and the greatest signal strength were obtainable with a particular wavelength not, as you might expect, at night time but when the greatest portion of the route taken by the waves was bathed in sunlight. Short waves are also liable to peculiar distortion and fading effects of their own, but one of their most curious properties is that of "skipping" large areas altogether. It has been found that when certain short wavelengths are in use it is sometimes impossible to receive anything within a range of 100 miles or more of the transmitting station. Outside this area signals are strong, and they may be heard at distances of several thousand miles.

Why is it that on one night the receiving set seems to be full of "life," bringing in station after station as the controls are moved, whilst on the next one may be able to hear nothing but the local station? Investigations have show that as a rule receiving conditions are at their best for the broadcast waveband upon dark nights when the barometer is high; yet one often finds that on just such a night as this one's set is unable to reach out.

Puzzles in DX Work

During the past winter reception of American stations, despite the great improvements that have recently been made in wireless sets, was a complete failure. A year ago and in the two previous winters it was comparatively easy to tune in several whose rating was only about one kilowatt; the feat was in fact frequently accomplished with single-valve sets. Now not even Bound Brook, with its enormously powerful transmitter, can get across to this country. The failure has been put down to sun spots and a variety of other causes; but how is it that the short-wave transmissions of KDKA and WGY are unaffected and come in as well as ever?

Have you ever investigated the queer things that may be done with a crystal set? Try reversing the aerial and earth leads. In most cases you will not find

(Concluded at foot of next page)

GRID BIAS FOR THE DETECTOR

A NOVEL SUGGESTION

IN the most popular form of rectification, the leak and condenser (see Fig. 1), very few of us are aware that the efficiency of such an arrangement chiefly depends upon the grid-current effect of the valve functioning as the detector. In order to obtain the benefits of rectification by this method, the valve must necessarily function upon that part of its curve where grid current is present, and the grid potential will have to be somewhere between zero or near the commencement of the grid current and some value positive to the negative end of the filament. It will therefore be seen that this function is in direct contrast to the biasing of low-frequency amplifiers, where every endeavour is made to get away from grid current by using higher H.T. and a negative potential on the grids of the valves.

Leak and Condenser Method

As most of us know, when using the grid leak and condenser method of rectification it is usual to join the lower end of the grid leak to the positive side of the filament, and this automatically gives a positive bias to the grid through the leak, and causes the valve to function with a positive grid and a grid current passing from the filament to the grid.

Upon this principle the process of rectification takes place. The effect of this one-way current causes the grid condenser to become charged every time the received signal swings the grid negatively (and when positively is neutralised, as it were, by the grid current), the increasing charge in the condenser causes the H.T. current to drop accordingly.

One must not forget that the positive and negative swings upon the grid are at radio frequency, upon which is superimposed the audio frequency—or speech and music—with the result that the H.T. current rises and falls in accordance with the audio frequency of the wave received. The grid leak, of course, is of such a value as enables the charge to leak away from

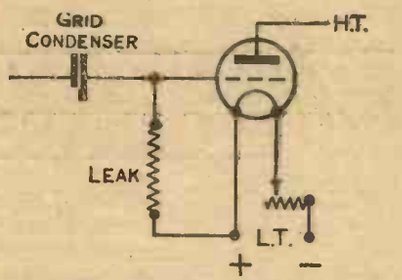


Fig. 1.—Usual Condenser and Leak Circuit.

the condenser, so that the grid is again ready for the next signal or low-frequency impulse.

From this it will be seen that not only does the value of the condenser, the resistance of the leak and the characteristic of the valve determine the efficiency of rectification, but, perhaps the most important

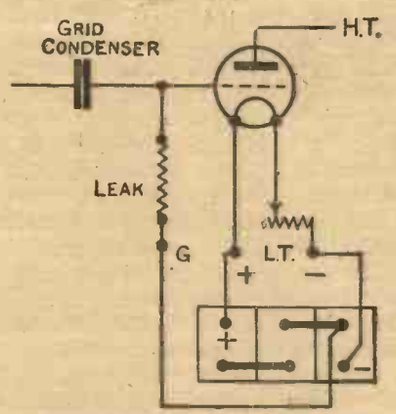


Fig. 2.—Method of Providing Bias.

of all, the value of the grid current available for this function.

It therefore becomes necessary for us to have some method whereby this current value may be varied to obtain the best results, and a variable positive bias to the grid of the valve is essential.

Providing Bias

To make this possible, instead of joining the lower end of the grid leak to the negative or positive side of the filament, connect this to a separate terminal on your set as shown in Fig. 2, and by means of an additional L.T. lead a tapping can be made at any point—2, 4 or 6 volts positive—on the L.T. battery. One can, by experiment, find the operating point on the detector valve to give the best rectification consistent with stability and selectivity of tuning. Generally speaking 2 or 4 volts positive will be found to give most excellent results on such Marconi valves as R5V, DE5B, DE5 and DE8, and in the case of dry-battery combinations using a 4½-volt dry battery and DE3, the 3-volt tapping may be found to be suitable for the purpose required.

The actual positive bias on the grid of the detector valve will also greatly depend upon the working value of the grid leak, and with a high-resistance leak the higher positive bias may produce the best results.

T. G. T.

There are now in the United States seven stations transmitting on short waves with a power of 20 kilowatts, namely: WBZ (Springfield), 50 metres; WQN (Rocky Point), 51.5 metres; KDKA (East Pittsburgh), 58.79 metres; WIR (New Brunswick), 74 metres; KIO (Kahuku), 90 metres; KEL (Bolinas), 95 metres; and WGH (Tuckerton), 103 metres.

"CURIOSITIES OF WIRELESS" (*continued from preceding page*)

the slightest difference in results. If the crystal cup is slightly tarnished you may be able after a little careful searching to find a sensitive spot, not upon the crystal itself but upon the rim of the cup. Should you care to make a few experiments with substitutes for the crystal itself you may obtain rectification with the help of a small piece of coke or of a lump of sugar instead of the crystal.

Any reader who lives within a few miles of a main station or of Daventry will probably be able to obtain quite good reception with nothing more elaborate than a pair of telephones and a detector. Wire the two in series, connecting the unoccupied terminal of the detector to the aerial and the second phone-tag to earth. Three or four people wearing rubber-soled shoes or standing upon a floor covering that is a good insulator make an excellent aerial if they stand holding hands at arms' length, whilst the one who is nearest the set places a wet finger on the aerial terminal. A similar human chain also makes quite a good telephone or loud-speaker lead.

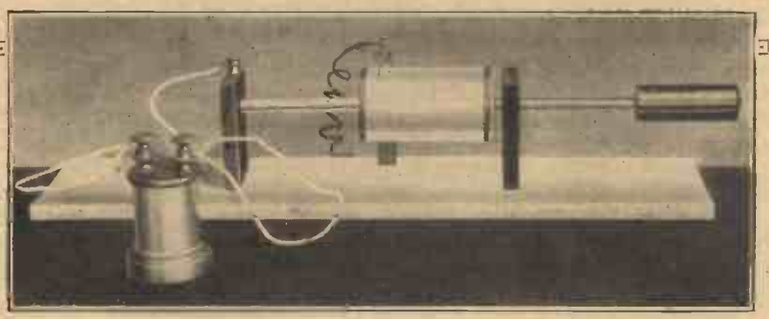
The Crystal Transmitter

Many crystal users have unwittingly become at times unlicensed transmitters! When two sets using neighbouring aerials are tuned to the same strong transmission it is often possible to conduct a conversation by alternately speaking into the headphones and using them for their proper purpose as receivers. In this case the receiver when spoken into plays the same part as it did in the old Bell telephone which was used before the microphone was invented. The carrier wave of the incoming signal is modulated by the vibrations of its diaphragm, and the owner of the set next door can hear all that is said. A similar effect is frequently observed by owners of valve sets who have crystal-using neighbours. Whenever the latter search with the catwhisker for a sensitive spot loud scratching noises are produced in the phones or loud-speaker of the valve set. Many amusing experiments may be conducted in this way.

J. H. R.

PRACTICAL HOME RADIO PICTURES

By T. THORNE BAKER, F.Inst.P., F.R.P.S.



Photograph of Radio Picture Transmitter.

ALTHOUGH it is practically certain that the broadcasting of wireless pictures will take place sooner or later, there are many amateurs who are anxious to take part in this fascinating branch of wireless work without waiting for it to become general. The great help that the amateur has given in the development of wireless generally is well recognised, and it is in the hope that they may begin to take an equal share in the development of picture-telegraphy that this article is written.

There is no reason why with a little mechanical skill, and a little ingenuity, the average amateur cannot construct an instrument capable of sending or receiving a picture. To transmit a picture by wireless, a transmitting licence is, of course, necessary, but in the early stages of the experiments it will be found easier and almost equally interesting to connect the two instruments by an ordinary wire.

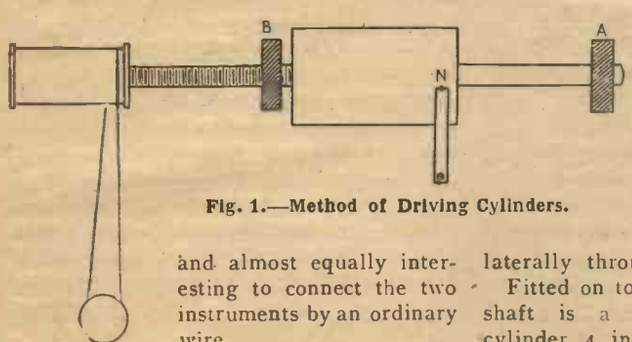


Fig. 1.—Method of Driving Cylinders.

The method about to be described will give perfectly good results using simple sketches, and has been specially designed to be driven by an ordinary gramophone. The cost of an instrument of this kind can be reduced to a few shillings, and can under suitable conditions be used for wireless transmission. The most important feature is the cylinder and shaft. This must revolve truly in order to achieve success. A convenient size of cylinder is 2 in. by 4 in., the diameter being 2 in. Brass tubing of this size can be easily obtained. After being cut and filed down to the correct length, each end should be turned true in the lathe and a flange sweated in each end. The flanges should first be carefully centred and drilled with a ⅜-in. hole.

If the length of the cylinder be 4 in., a silver-steel shaft 15 or 16 in. long should be obtained. Five or six inches of one end of the shaft should be cut with a thread of about 25 or 30 to the inch pitch. Needless to say, identical cylinders and shafts must be obtained for the sending and receiving instruments. The scheme of mounting is seen in Fig. 1. The cylinder is mounted on the shaft 5 in. from one end, while the threaded portion projects from the other end. Two bearings are required, one A, a plain bearing (a ball bearing for preference), through which the plain portion of the shaft is fitted. The other bearing B must be tapped with a thread of the same pitch as the shaft. It will thus be seen that as the cylinder and shaft turn, the cylinder will be carried from left to right so that the needle N will trace a spiral path over its surface. If the pitch of the thread is 25 to the inch, and the width of the cylinder is 4 in., a hundred revolutions will make the cylinder travel laterally through its own length.

Fitted on to the extreme left end of the shaft is a carefully turned boxwood cylinder 4 in. by 1 in. This must be carefully centred and drilled so that it runs dead true. The last thing to be mounted is the needle holder. This can be conveniently made of an L-shaped brass upright H (Fig. 2), to which is screwed (not soldered) a piece of thin spring brass ⅛ in. thick. It is a good plan to attach the spring with a washer and cheese-head screw, as the latter acts as a convenient terminal when wiring up. To the end of the spring is soldered an ordinary gramophone needle N at an angle of 45 degrees in the manner shown in the diagram, care being taken that the cylinder revolves in the direction of inclination of the needle. We have thus a simple instrument consisting of a metal cylinder, which, as it revolves, travels along its own length so that the spring needle traces a spiral path over its surface.

We have now to describe how two such instruments can be used for sending and receiving a picture by wireless.

If we look at the instrument in section as shown in Fig. 3 we see the needle N in contact with the cylinder C. Now if we place around the cylinder a thin sheet of tin- or copper-foil on which a sketch has been drawn in shellac ink, as the cylinder revolves the shellac lines composing the picture will come one by one underneath the needle N. Whenever the needle is in contact with the bare metal it will short-circuit the condenser, indicated by K, of a wireless transmitting circuit. When, however, one of the shellac lines of the sketch comes between the needle and the surface of the cylinder, this metallic circuit will be broken and the circuit K R L will be free to oscillate. Thus as the cylinder rotates and the different lines constituting the sketch come successively under the needle, the oscillating circuit is cut out for intervals of time corresponding to the width of the shellac lines.

An ink suitable for writing on the metal may be made by dissolving ½ oz. of best shellac in 2 oz. of methylated spirit; a little aniline violet or Gentian violet should be added to the mixture and well stirred in so as to make the ink easily visible. The surface of the metal foil should be thoroughly cleaned, either by rubbing it over with a clean rag dipped in benzol, or by polishing with french chalk. It is most important to have the surface perfectly clean, not only for the shellac ink to take well, but because dirt or grease is often quite sufficient to cause an interruption of the current when it comes beneath the needle. The pressure of the spring carrying the needle should be so adjusted that while the best possible contact is obtained between the needle and the cylinder, the point of the needle does not cut through the shellac lines. For this purpose, too, great care must be taken that the sketch or writing is thoroughly *dry* before it is mounted on the cylinder. Seccotine should be sufficient to attach it, but in the case of copper-foil, which is springy, it may be necessary to tie it on

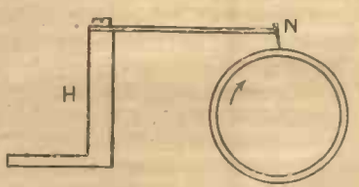


Fig. 2.—Arrangement of Stylus.

to the cylinder with three or four pieces of thin string until the glue has dried.

Before describing the method of reception, the driving of the sending and receiving apparatus must be explained. It is well known that one of the most accurate motors obtainable is the type used for driving a gramophone; regular speed is necessary because any variation in the speed of the motor would cause a change of pitch, and would entirely ruin the reproduction of music or the human voice. If two gramophones are placed side by

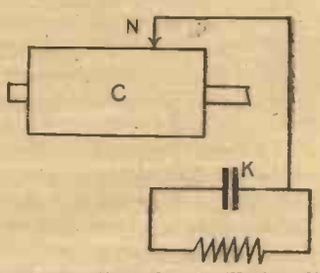


Fig. 3.—Connections for Oscillating Circuit.

side with the same record on each, and the motors of each are so adjusted that the two tunes played are in exactly the same key, it may be taken for granted that both instruments are running at identical speeds. If now the record is removed, and a small boxwood pulley wheel is glued to the centre of the turn-table, the gramophone can be used as a driving motor for the wireless-picture instrument, a thin elastic band being used as a belt as indicated in Fig. 1. The diameter of the pulley wheel should be about ¾ in.; this will mean that with the 1-in. diameter drum mounted on one end of the shaft of the transmitting or receiving instrument, and with the gramophone turn-table revolving at about eighty revolutions a minute, the brass cylinder will revolve roughly one revolution a second—a very suitable speed.

Receiving the Picture

To come now to the reception of the picture, a little weak starch paste should be made by grinding up half a teaspoonful of household starch in half a teacupful of water, and then pouring half a pint of boiling water upon it, stirring all the time with a spoon. A tablespoonful of glycerine is now added, and ¼ oz. of potassium iodide (which can be obtained from any chemist) dissolved in two tablespoonfuls of water is finally stirred in. A piece of good-quality blotting-paper is now cut of such a size that it just wraps round the cylinder with sufficient overlap to admit of its being attached with a little Seccotine. The paper, after attachment to the cylinder, is brushed over with the starch-paste solution as evenly as possible.

In the first instance it will be essential to tune up the two instruments by having them side by side on the table and connected with wire—the simplest case of an artificial telegraph line. We have then a straightforward circuit as represented in Fig. 4. C1 represents the drum of the transmitter, and C2 that of the receiving instrument. The needle N1 is connected to N2, and the cylinders or bearings are connected also, so that there is a metallic circuit through the two machines. In the line N1 N2 is interposed a battery of 4 volts, the negative going to the needle of the receiver. This needle, by the way, should preferably be of gold; a piece of gold wire about ¼ in. long and of No. 22 or 24 gauge should only cost a few pence, and can be soldered or riveted by a watchmaker on to the spring holder.

The joint in the paper should be brought under the needle in each machine, so that both cylinders start off in the same relative position. The gramophones are then started, and if they have been correctly tuned the two cylinders will keep in very fair synchronism during the length of the run.

Shunted on to the receiving instrument as shown in Fig. 4 is another 4-volt battery, the *positive* terminal of which goes to the needle. The *modus operandi* is then as follows: As long as the bare metal is in contact with the needle on the sending cylinder, the two batteries B1 and B2 balance each other and no current flows through the receiver. But when a shellac line of the sketch comes under the needle N1, the battery B1 is thrown out of action and the needle of the receiver becomes positive and leaves a deep violet ink mark on the sensitive paper.

Every time a shellac line comes under the needle of the transmitter a mark will

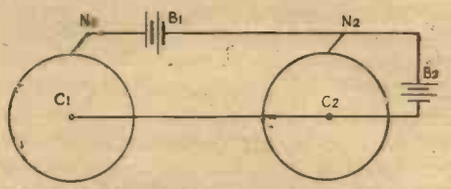


Fig. 4.—Diagram of Connections for Transmitting and Receiving Apparatus.

thus appear under the receiving needle, and by the time the two cylinders have run their course quite a good reproduction of the original should have been obtained. If a meaningless result be obtained at first, do not be discouraged; it is astonishing how as soon as the speed of the two cylinders is adjusted the picture becomes reproduced with remarkably good detail; on the other hand, a very little lack of adjustment in the timing will entirely obliterate the details.

Needless to say, it is advisable to get some first-class results with the two machines on the table or bench running side by side before making any attempt at anything in the nature of a wireless transmission. Some details of actual transmissions with the author's apparatus by wireless across London will be described in an early issue. T. T. B.

THE L.F. CUT-OUT SWITCH

A TWO-POLE or three-pole switch is often indicated in circuit diagrams for throwing in the last stage of L.F. amplification, the switch serving the dual purpose of transferring the loud-speaker to the anode circuit of the last valve and lighting the filament of that valve. This is normally a convenient arrangement, but when dull-emitter valves are used with dry batteries, or with an accumulator of small capacity, the L.T. current demand of an additional valve may be sufficient to affect the brightness of the valves already in use, and the strength of signals after throwing in the last valve may be no greater than before doing so.

To those who have learned the knack of tuning-in with the rheostat, this is annoying, and in such circumstances it is better to use an arrangement which allows one to tune in the wanted station on the earlier valves while the last valve is already lit, although not otherwise functioning.

In order to do this, a single-pole switch only is required. This connects the loud-speaker to the anode of the final valve, and filament control becomes the concern of the rheostat only. Apart from other considerations, the use of a single-pole switch has the merit of simplifying the wiring of the set. H. P.

THE EIFFEL TOWER TRANSMISSIONS

WITH the introduction of Summer time in France, the daily programme of the Eiffel Tower transmissions has been slightly altered. In telegraphy a weather forecast is given on 23 metres C.W. at 10.45 and 23.50 B.S.T.; time signal at 08.56 and 20.55 B.S.T. On 75 metres, C.W. weather forecasts are given at 05.20, 09.40, 17.00 and 23.50 B.S.T.; time signals at 08.56 and 20.55; tests at 21.10. On a wavelength of 2,650 metres, time signals are given at 08.56, 10.25, 20.55 and 23.44, also weather reports at intervals from 03.20 to 18.20 B.S.T. Meteorological bulletins are also given on 3,700 metres at 09.20, 10.45, and 17.20, 20.20 and 22.00 B.S.T.

As regards broadcast telephony, the Eiffel Tower is now using a wavelength of 2,650 metres, sending weather forecasts at 07.30, 09.40, 12.20, 20.00 and 23.20 B.S.T.; market reports at 11.30, 14.45, 15.50 and 17.15. Two concerts are given daily from respectively 19.30 to 20.35 and from 21.10 to 11.10 B.S.T. The use of the 2,740-metre wavelength for the late concert has been discontinued. GRIDDA.

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EXPERIMENTING WITH TWO-GRID VALVES

TWO of the main advantages of the two-grid valve are (1) low filament-current consumption, and (2) the very low plate potential required. During reception on a frame aerial with a plate potential of 6 volts the filament current was found to

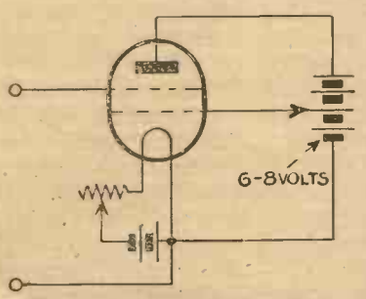

Fig. 1.—Position of Extra Grid.

be a trifle under .25 ampere. The usual consumption of the particular valve (French) with a 4-volt accumulator and no filament resistance is .35 ampere.

These two important advantages are due to the function of the extra grid, which is situated between the filament and the usual grid (Fig. 1). By raising this extra grid to a suitable positive potential with respect to the filament, the electrons emitted by the latter are helped on their way to the plate. This extra grid attracts and projects the electrons towards the plate, which they reach by passing through the large spirals of this grid. From this it will be seen that the plate potential and also the filament current can be greatly reduced and the same resultant flux still be obtained.

This is possible either by connecting the auxiliary grid to about the middle of the H.T. battery (Fig. 1), or still simpler by connecting it through a resistance to the H.T. battery as in Fig. 2.

Another important characteristic of the two-grid valve may be seen by examination of the characteristic curve of this valve. From the curve (Fig. 3) it will be seen that the valve in itself is a negative-resistance device, and therefore if placed in an oscillatory circuit will produce continuous oscillations.

The circuit Fig. 4 illustrates a stable and sensitive "one-lunger" employing a frame aerial. It would now be perhaps not out of place to describe the action of some of the constituent parts.

The frame aerial F.A. is tuned to the required wavelength by means of the variable condenser C1. This condenser should be of the vernier type and may have a value of .001 microfarad. C2 is the usual grid condenser, and R1 is the grid leak; the two-grid valve is rather sensitive as to this value, and it should be of the progressively variable carbon-pellet type. C2 may have a value of .0002 microfarad and R1 usually about 3 megohms.

The H.T. battery should, if possible, be variable in steps of 1½ volts, and may have a maximum of 10 volts. (For experimenting with various valves a battery of 20 volts is useful.) The filament rheostat R2 should be *very* progressive, as it is an important and critical control; the Lissenstat type is suitable. The resistance R3 prevents the set from oscillating at low frequency; it may have a value of 20,000 ohms, but is not always necessary. The telephones should not be shunted by a condenser, as it prevents the circuit from oscillating.

Care should also be taken when employing note magnification that the primary winding of the low-frequency transformer has not too high a self-capacity. The variable condenser C3 is used to start the circuit oscillating. It should have a low minimum capacity and a maximum of about .001 microfarad. If necessary, to obtain the above conditions a small variable condenser may be used, with the addition of fixed condensers in parallel, the number being varied by means of a switch. To receive a station, the switch CH is put in position II, thus disconnecting the condenser C3. Then with the frame tuned to the required wavelength and a plate potential of about 6 volts, turn on the filament current till a rustling sound of maximum intensity is heard. This does not necessarily correspond with maximum heating, as for every value of plate

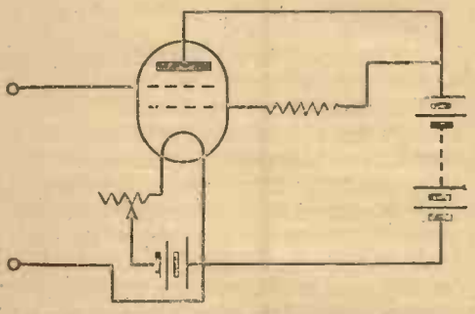

Fig. 2.—Connection through a Resistance.

potential there is a fairly critical value of filament current. Next start the circuit oscillating by touching with the finger the auxiliary grid and search for the carrier wave with the variable condenser C1. (If the station is a powerful one it is not necessary to make the circuit oscillate.) Having found the station, switch condenser C3 into circuit and adjust to the limit of oscillation; if necessary, adjust also grid leak R1 and find the best combination for plate voltage and filament current.

The circuit Fig. 4 will oscillate on any wavelength by touching the auxiliary grid with the finger or by earthing it through the condenser C3. If the set shows signs of spontaneously bursting into oscillation, this can be stopped by touching the plate, or controlled by shunting the telephones by a variable condenser.

The signal strength can be greatly increased by using an outside aerial, and Fig. 5 shows a suitable circuit. All the values remain unaltered except for the variable condenser C3 shunting the telephone; its action was described in the preceding paragraph. It is nearly always

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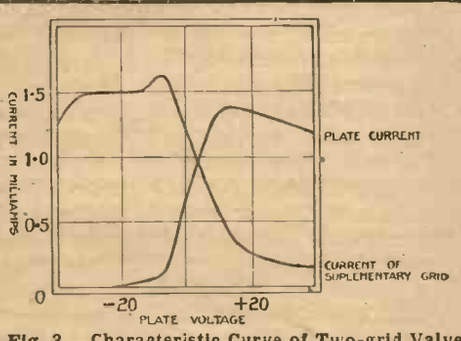

Fig. 3.—Characteristic Curve of Two-grid Valve.

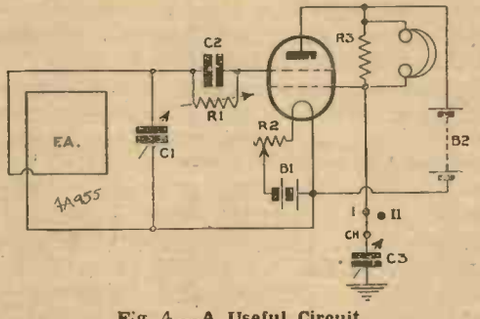

Fig. 4.—A Useful Circuit.

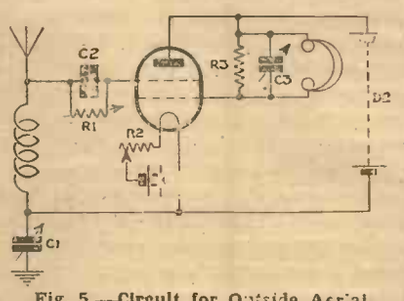

Fig. 5.—Circuit for Outside Aerial.

STRAIGHT-LINE CONDENSERS

A simple explanation of the tuning characteristics of three different types of condenser

PROGRESS in the design of variable condensers has been towards the production of an instrument in which the losses are negligible and the tuning simple and suitable for existing requirements of reception.

In the early days of broadcasting, the stations working were so few that their distribution over the allotted broadcast band of wavelengths was a simple matter and allowed of ample separation, so that there was little risk of two stations heterodyning each other. For such conditions, the old type of condenser, with semicircular plates, was quite satisfactory, but as the number of stations increased its disadvantages became very apparent.

"Straight-line Capacity"

The condenser with semicircular plates is a "straight-line-capacity" condenser; that is to say, the change in *capacity* is proportional to the movement of the vanes, and the rate of increase in wavelength in proportion to movement is much more rapid near the minimum end of the condenser scale. Under present conditions of reception this is most undesirable; not only is a plotted curve of little use for determining the positions of stations, but the majority of the broadcasting stations are crowded within a very small portion of the dial.

In order to improve tuning and to make calibration easier, the "square-law" or "straight-line wavelength" condenser was developed, and there are some very fine examples on the market. With such a condenser the change in *wavelength* is proportional to the movement of the dial. This helps to separate stations on the condenser dial, but as the majority of the B.B.C. stations work on wavelengths between 300 and 400 metres, tuning is still fairly crowded on the dial, although calibration is simplified considerably.

The overcrowding on the broadcast band of wavelengths, both in Europe and America, is becoming so acute that reallocation of wavelengths is becoming essential and a matter of considerable difficulty. It has been determined that, in order to avoid audible heterodyning, each station must be allotted a band of at least 10 kilocycles—note that this is terms of frequency and not wavelength.

Frequency and Wavelength

Frequency is obtained by dividing 300,000 by the wavelength in metres; thus the frequency of 2LO is 821 kilocycles. At first sight it might appear that there is no advantage in simply making a calculation which alters one figure to another; the advantage will, however, be apparent on comparing certain figures.

The wavelength of a station working at 3,000 kilocycles is 100 metres, and the wavelength corresponding to 3,010 kilocycles is 99.66 metres. The wavelength of a 500-kilocycle station is 600 metres and of a 510-kilocycle station it is 588.2 metres.

Thus it will be seen that although the frequency difference in each case is 10 kilocycles, the wavelength difference in one case is only .34 metre and in the other 11.8 metres. From these figures it will be seen that the lower the wavelength the smaller the wavelength difference necessary to avoid interference, and the use of kilocycles instead of metres becomes far more convenient for allocation purposes. The advantage for tuning will be apparent presently.

A straight-line frequency condenser, as the name indicates, alters the *frequency* in proportion to the movement of the dial, and as the lower the wavelength the greater the frequency difference, stations are more widely separated near the minimum position of the condenser.

As a comparison of the tuning characteristics of the three types of condenser, we will assume that we have one of each type of similar capacity, connected to similar inductances which will give a tuning range of 300 to 600 metres. We will also assume that each condenser is fitted with a dial divided into one hundred divisions.

With the semicircular-vane type of condenser the change in capacity for a movement over the first ten divisions of the dial will cause a wavelength change of approximately 40 metres.

With the square-law condenser the corresponding movement will give a wavelength change of about 30 metres, but with the straight-line frequency condenser the frequency change for the same movement of the dial corresponds approximately to a wavelength change of only about 15 metres.

Ten of the B.B.C. stations (not to mention Continental stations) are working on wavelengths between 300 and 340 metres. With the three condensers mentioned above, these ten stations would be tuned in on the first ten divisions of the straight-line capacity condenser. On the square-law condenser these stations would be spread over about fourteen divisions, but with the straight-line-frequency condenser they will be spread over about twenty-four divisions.

Easy Tuning

From these figures the greater ease of tuning with the straight-line frequency condenser (or, as it is often called, the S.L.F. condenser) will be apparent, whilst the tuning positions of other stations can be quite as easily determined as with the square-law condenser by converting the frequency to wavelength.

To compensate for the wider separation of stations near the minimum position of the square-law and S.L.F. condensers, they will be more crowded near the maximum position, and this is particularly so with the S.L.F. condenser. In actual practice this is no disadvantage; tuning is generally carried out on the lower range, and, more particularly, there are only six B.B.C. stations working on wavelengths between 400 and 500, as against fourteen between 300 and 400 metres. R. H. B.

"EXPERIMENTING WITH TWO-GRID VALVES"
(*continued from preceding page*)

necessary, as the circuit is liable to burst suddenly into oscillation.

Reaction may also be added as is depicted in Fig. 6, where Re is the reaction coil which is variably coupled to L, a small coil in series with the frame or, in case an outside aerial should be used, directly to the A.T.I.

In this circuit the telephones may conveniently be shunted by a fixed condenser. The resistance R3 is to prevent low-frequency oscillations, and its value varies with different types of phones. The best method of determining its value is to make a pencil line on the space between two terminals mounted on a small piece of ebonite and connect it in place of R3. The optimum value is then found by varying the amount of graphite present, stopping as soon as the howl ceases. Care should be taken to keep its value as high as possible.

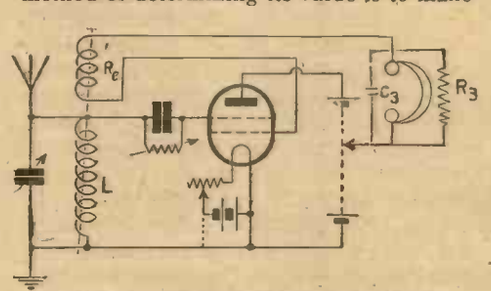

Fig. 6.—Two-grid Valve Circuit with Reaction.

In this circuit it was found that the condenser C3 and resistance R3 might sometimes be omitted. The reason for this will be explained later, when a few other two-grid valve circuits will be considered.

C. H.

(*To be concluded*)

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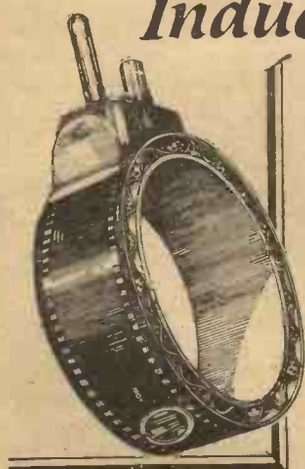

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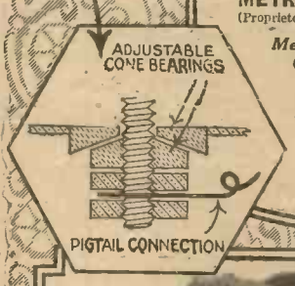

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If you get it right, you win £200!

Whatever your skill in counting capacities, however, the purchase of a Dubilicon will bring you one sure reward. The Dubilicon gives any capacity up to 0·011 mfd. simply by varying the connections of the eight unit capacities of which it is composed; so that by using the Dubilicon you will be able to select with unfailing certainty the best value of fixed capacity for any desired part of your circuit.

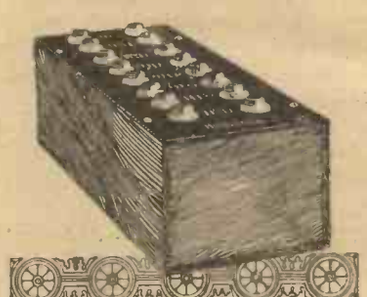
The Dubilicon is a multiple condenser containing eight separate units, the terminals of each unit being brought out to sockets on the lid. By using Clix plugs (made by Messrs. Autoveyors, Ltd., 84, Victoria Street, S.W.1) of which two are given with every Dubilicon, the units can be connected in a variety of series, parallel and combined series parallel arrangements giving a very large number of different capacities.

The uses and advantages of the Dubilicon, which we have summarised above, make it more than worth its low price of 30/-.

In addition, the purchase of a Dubilicon entitles you to enter for the £200 prize competition. All you have to do is to estimate the number of different capacities you can get by connecting up the first five units in various ways.

Ask your dealer about one to-day—and mind you enter for the £200 competition! He will tell you all about it!

The Dubilicon



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On Your Wavelength!

Testing Earth Systems

THE amateur is very often puzzled as to the best method of definitely ascertaining the merits of earthing systems available. There is one fairly inexpensive method of testing, however, which is available to every amateur who possesses an ordinary moving-coil voltmeter or a milliammeter with a range of from 3 to about 6 milliamperes. In order to carry out the measurement it will be necessary first of all to remove the reaction coil or short-circuit this with a piece of thick wire. The meter is next inserted in the plate or anode circuit of the detector valve, and when signals are being received from a local station the set is tuned as sharply as possible. It will be noted that the needle of the meter will dip towards zero when signals are passed over, and when tuning is as sharp as possible the needle will be at the maximum point of deflection from the previous reading at which signals are being received. It will now be found that attaching the various earths or combinations of them or a counterpoise will result in different readings in the meter. Care must be taken, however, that the set is retuned for each setting as each earthing system possesses sufficient capacity and inductance of its own to alter entirely the wavelength of the set from the setting used on the earler tests. Apart from other considerations, the test is of scientific interest, as it visibly indicates the effect of applying a positive potential to the grid of the valve. The reason for the meter indicating a drop in the current flowing in the plate circuit is because the grid becomes slightly positive, thus blocking the flow of current between the anode and cathode of the valve. The amount by which the needle dips is a measure of the high-frequency voltage received on the grid.

The Elimination of Static

With the advent of summer, as shown by the calendar, we are again faced with our old wireless bugbear, static disturbances. As is well known, these difficulties take the form of crackling and crashings in the telephones, and sometimes they are more prevalent on one wavelength than on another, but generally they can be heard over the whole tuning range of the ordinary broadcast receiver. The question as to how these may be avoided is bound to arise, and the usual answer has to be given once again, it cannot be done—yet. Nevertheless, those people with very low aerials will find that they are able to crow over their neighbour's 60-ft. mast double-wired, double oscillating aerial in this respect, for the ratio of static interference decreases with the reduction in the electrical height of the aerial. A high multi-wire aerial will collect far more static and other interference than will a low single wire, and also a single-wire high aerial will collect less static than a multi-wire aerial of similar height. Therefore should the inquirer live within reasonable range of a broadcasting station, he may reduce the height of his aerial in order to gain the desired effect.

One thing must be borne in mind when so doing, and this is that it is a mistake to add high-frequency amplification to any set when a minimum of static interference is desired. Also static interference may be overcome to a certain extent by reducing the high-tension voltage on the detector anode and by abandoning the use of reaction. I do not expect, however, that the last-mentioned alternative will be very popular. A frame aerial is beneficial in overcoming the difficulty, but since the efficiency of such an aerial is somewhat low when compared to an elevated collector, this again is hardly likely to be popular.

Volts versus Resistance

I found a would-be enthusiast very perplexed the other day over the problem of getting his new resistance-capacity-coupled amplifier to work as efficiently as his old transformer-coupled affair. He had a milliammeter in circuit with his plate current, and pointed a despairing forefinger at the very meagre reading of half a milliampere which he was drawing through his valve. It took me some time to convince him that his 100-volt high-tension unit would not under any circumstances drive any more current through the valve except by way of the filament circuit, which, of course, is rather an undesirable path for it to follow! The next time I met him he seemed somewhat elated, and explained that my theory was wholly incorrect, for his valve absorbed the proper current. He further explained that it was the valve which was faulty, for he could still get nothing through in the shape of signals. I examined the set, and found that he had carefully shorted the anode resistance in order to get the normal three milliamps of current to which he was accustomed. I gazed, said nothing, and have left him to continue his argument with the valve manufacturers. My sympathy would have been wasted on him.

Is It a Good Transformer?

Too often we hear an amateur discoursing on the merits or demerits of particular transformers without fully understanding the principles involved, with the result that a very good transformer is sometimes ruthlessly condemned on very flimsy grounds. It cannot be too clearly emphasised that the average amateur has not got the technical equipment necessary for the passing of judgment upon these articles, for there are so many factors which control the results obtained with a given instrument that it is wellnigh impossible to gauge their performance unless they are used under the exact conditions laid down by the manufacturers. Even then the electrical as well as the mechanical construction of the loud-speaker and the impedance of the valve in connection with which the transformer is used may be such as to give the user an altogether erroneous impression of the results obtainable by its use. It is therefore hardly fair for anybody not properly equipped both in apparatus and in knowledge and skill to condemn a particular transformer because it does not give to them the results which they desire. Such judgment can only be given by a skilled radio experimenter who has had an extensive experience of transformer practice. It may be taken, however that almost any modern transformer will give excellent results if used under proper working conditions, but, needless to say, some will appear to be better than others. The position is therefore that all transformers of modern design will give good service but that some will be better than others.

Broadcasting the News

Although, fortunately, the great strike is now a thing of the past, an account of my peeps into 2 L O during the strike will probably interest my readers. Outside the entrance I was met by two "Metropolitans," but my acquaintance with the commissionaire during normal times proved sufficient to allow of my entry.

Inside one felt the abnormal atmosphere, for the activities of the B.B.C. being acutely topical, its members were given to speculation as to their best line of immediate action. My friends the announcers had left their quarters, and into their offices and several others furniture was being carried. There were telephone engineers putting in extra telephones and fitting them with the familiar headphones, for at such a time the ordinary means of telephoning were out of the question.

No sooner had a floor of offices been converted into a temporary news-agency than the telephones were blocked with inquiries from all over the country. The newspapers had ceased to publish, and immediately the mind of the public swung to the B.B.C. All and sundry rung up

On Your Wavelength! (continued)

the company, asking every conceivable kind of question, personal and otherwise. Members of business concerns desired to make announcements, promoters of impending functions required notices to be sent out to their patrons, tipsters wished to keep in touch with their clients and others feared for the safety of their relatives; thousands wanted to volunteer and demanded information.

During all this time, while relays of people waited patiently for their "call" to be dealt with, lines were being installed direct to the Admiralty. News was to be controlled by that department.

Routine Uninterrupted

In addition to this news centre there was the dependence of provincial stations upon London for the supply of bands and artistes. How was the normal programme to proceed? The absence of printed matter complicated the control of the intricate system of simultaneous broadcast, which owing to the extended news bulletins was completely dislocated.

As the strike proceeded it was but natural that the Government's "mouthpiece" should be protected. My next visit to the B.B.C. was made through a posse of business-like "specials," complete with blue uniforms, and on proceeding inside I found that every danger spot had its quota. The telephone exchange was blocked by a very bored special "Robert," the control room had both "Metropolitans" and "specials," while various exits had emergency "Roberts," who sometimes must have wondered why they were there.

Listeners may have noticed that during the strike they frequently heard some lusty applause. Such appreciation came from the band of "specials," who were provided with entertainment from the "echo" room. Their applause went back to the "control" via a special microphone.

News Service

Readers can picture the emergency news service offices at Savoy Hill when it is mentioned that thousands felt it their mission to keep the B.B.C. informed of happenings all over the country. In addition, there were representatives of the established news agencies and typewriters hammering out reports straight from the telephone. These operators wore headphones and were oblivious to noise. One wandered down the passages and by careful "peeps" discovered that all the daintily decorated waiting rooms had become bedrooms, while many artistes had to wait from morning to midnight, dependent on the transport organised by the company and supplied by volunteers.

I ventured into a room downstairs and discovered a quiet individual poring over a map of London. From this room the volunteer transport was directed. Staff and artistes were collected from morning to night, and then came the homeward trek. Few persons after the first disorganisation were seriously inconvenienced by lack of transport. The last to leave the building were the "leather-lunged" announcers.

Owing to the simultaneous system of broadcasting and the knowledge artistes have of this system, cross-country engagements were kept by artistes in different parts of the country. They simply wandered into the nearest station of the company. An artiste who should have been at Glasgow at 9 o'clock was, perhaps, at Birmingham. What matter? London told Birmingham to put him in a spare studio and at 9 o'clock the listener at Glasgow heard the artiste.

Public Opinion

In the street have been heard comments on the B.B.C. but no criticism. Yet it is difficult to say whether the charge, that there was too ruthless a pruning of all sensationalism by the censor, is correct. The bare facts were all that serious people required, and the vast majority felt that they could trust the B.B.C. in its policy of public service. Now all is over—a hectic, worrying and painful period in the B.B.C. history has passed, one hopes for ever.

First Rate

I have been very much struck recently by the number of really good variable condensers at most reasonable prices which are now available for amateur use. There is a great deal more in condenser design than the average person thinks, though probably the importance of the low-loss idea has been greatly exaggerated. What one really does want in a condenser is that it should be up to its stated maximum capacity, that its minimum capacity should be very low indeed, and that there should be no wobble about the moving parts. I have used recently a number of different types priced at from five shillings to fifteen shillings, and in most cases I have found that they are a very vast improvement upon the cheaper makes available a year or so ago. Another good thing is the introduction at a moderate price of the so-called "vernier" dial, a geared arrangement which can be fitted to existing variable condensers. If these are well made and well designed they help one enormously in tuning, since tiny variations in capacity may be made with their help. But one word of warning: if you buy a vernier dial, see that there is no backlash in its gears. Should this be present you will find the dial anything but a blessing.

£100 for an Opinion
See The ARGOSY NOW ON SALE 1s

Valve Holders

Another component which has been improved almost out of recognition is the valve holder. Until quite recently almost the only type available at anything like a low price was that which consisted of four stout brass legs embedded in a solid chunk of what was sometimes ebonite—and sometimes was not. Though it is not always realised, the valve holder may considerably affect the stability of a receiving set. Most of us know that the capacity between the grid and the plate of a valve within the bulb allows reaction effects to take place, even though no reaction coil is used, especially upon the shorter waves. Reduce this capacity and you decrease the reaction effects, thus making the set less liable to oscillate. Now with a solid valve holder there may be a not inconsiderable amount of capacity, not between the plate and grid, but between the plate and grid sockets. The thicker the sockets and the more ebonite there is, the greater will its capacity be. Several modern types of valve holder have air-spaced sockets and the extra capacity that they introduce is very small indeed. If you have solid valve holders and find your set hard to control, try the effect of substituting those which contain very little ebonite.

Wet Cells for H.T.B.s?

From time to time I have told you of the gloom and despondency into which I am plunged by trying unsuccessfully to find a solution of the great high-tension battery problem. I cannot install an accumulator because of the difficulty of getting such a battery recharged satisfactorily in my particular locality. Dry-cell batteries, even if I purchase those of the largest size, refuse to stand up to the work for long—and there you are, or, rather, there I am not! A correspondent tells me that he is obtaining excellent results with a battery made up of small wet cells of the Leclanché type. He does not, however, give details either of the average life of his battery on one charge, or of its annual upkeep costs. Nor does he state whether his battery requires a great deal of attention to keep it in proper condition.

The cost of installing such a battery is rather high in the first instance, for cells of suitable size seem to run to about a shilling apiece. Still, if the battery lasts well and gives little or no trouble, it will be economical in the long run. One of the worst features of the ordinary wet Leclanché cell is the way in which solid matter from the electrolyte "creeps" over the jar; I am told, though, that this can be prevented by topping each cell with a little oil.

THERMION.

A TWO-STATION SPADE-TUNED CRYSTAL SET

The Complete Receiver.

THE method of tuning employed in the crystal set described below is the well-known one of varying the inductance by adjusting a metal plate in relation to the coil. This is such a simple method that it is surprising to find it so little employed.

The set is so made that it can be tuned to the local station and to 5XX at will. Two coils are used, one of a special character contained inside the box and the other an ordinary 5XX coil of 200-300 turns, which is set in a coil holder on the panel when required. Otherwise the coil plug is shorted by means of an ordinary

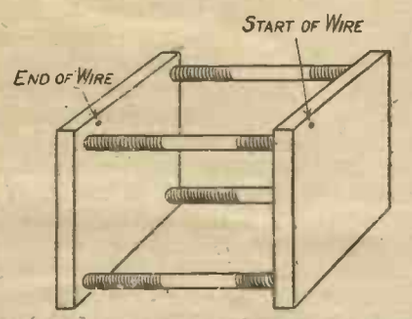


Fig. 1.—Former for Low-wavelength Coil.

short-circuiting link, which may be seen in the photographs.

The large coil is tuned by the zinc spade behind it. This is of the same diameter as the coil, and is mounted on a wooden bar, which is pivoted on a screw attached to the back of the case. There is no connection between the spade and the coil; the tuning is done by passing the spade behind the coil. The zinc should not touch the coil, but be fitted to move as close to it as possible.

Low-wavelength Coil

The other coil (for the lower wavelengths) is built on a simple low-loss former, and ordinary bare tinned wire is used. The former (Fig. 1) is built of two pieces of wood 4 in. square. Joining these together are four rods, which may be of wood, bone, ebonite or other material. These four rods are nicked throughout their length, with the exception of a space of about ½ in. in the middle, which is left clear. In the original set they are 3 in. long and carry thirty grooves, but they may be longer if necessary; in fact, the former itself can be built so that the two wooden sides form the actual sides of the cabinet itself, in which case they should be 4 in. by 5½ in. (Fig. 2), so that the top panel may be screwed down on the top, leaving sufficient space between the ends of the terminals, etc., and the upper surface of the wire.

The wire, No. 17 or 18 S.W.G., is wound by first passing one end through a hole in the wood (or, if there is plenty of room, it is better to pass it through a hole in the end of one of the rods), leaving a few inches free for connecting purposes. It is wound in the grooves round the outside of the former. Having completed the fifteenth turn, it passes across the ungrooved space and goes on to the remainder of the grooves, finally passing through another hole in the opposite piece of wood or end of the rod.

The Spade Tuner

The spade with which this coil is tuned consists of a rectangular piece of zinc, just large enough to go inside the coil through the space left in the middle of the turns. It is attached to a wooden spindle, at the upper end of which a knob is finally fixed as a handle. The upper end of the spindle passes through the panel and the lower end into the bottom of the case. The spade must be just large enough to revolve inside the coil without touching the wire.

It will be found that 30 turns of wire are sufficient to tune 2LO in and out, but for higher wavelengths a few more turns will be needed.

It is scarcely necessary to point out that in putting the set together, if the former does not form part of the case, it should be secured to the under side of the panel by

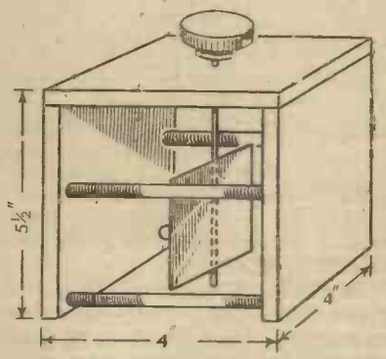


Fig. 2.—Arrangement of Spade Tuner for Low-wavelength Coil.

means of ordinary wood screws; then the spade can be inserted and the knob fixed to the upper end of the spindle last of all.

In the particular set shown by the photographs the crystal is underneath the panel, but this is a matter of convenience. The aerial and earth terminals are on one side of the panel, and the phone terminals on the other, and the very simple wiring may be followed easily from the diagram Fig. 3. When using the inner coil the

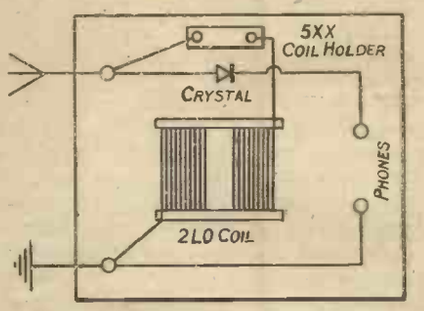


Fig. 3.—Diagram of Connections.

5XX coil should be removed, of course, and its sockets short-circuited by the link. For tuning purposes the smaller spade may be left alone and the 5XX spade used by itself.

As to the 5XX coil, if two ordinary commercial basket coils (such as those sold by any dealer at eightpence each) are obtained, and the inner end of one joined to the outer end of the other, and the pair mounted back to back with a piece of cardboard between them; such a "twin coil" will serve admirably, and 5XX can be readily tuned in and out by the spade.

S. M. S.

SHORT AERIALS

MANY amateurs seem to have the mistaken impression that a long aerial is a necessity for loud signals and long-distance reception. This, however, is by no means correct. For receiving on wavelengths of the order of 50 to 100 metres, a long aerial is of no advantage over a short one, and often a short wire will give better results. Freedom from atmospherics is obtained by the use of a small aerial of low electrical height and, on the short waves at least, there does not seem to be a great difference in sensitivity between the long aerial and the short one.

P.

DO YOU UNDERSTAND THE TROPADYNE?

Some interesting facts of a development of the super-het

WHILE it is possible with an efficient aerial and earth installation to tune in most of the British and Continental, and a few American, stations on a good night on a single valve, yet such results are not consistent and as a rule are of such inferior quality that any attempt to amplify the speech or music with low-frequency valves only produces horrible distortion. Apart from the unsatisfactory results, such a procedure cannot be too severely condemned owing to the great amount of interference caused to other listeners.

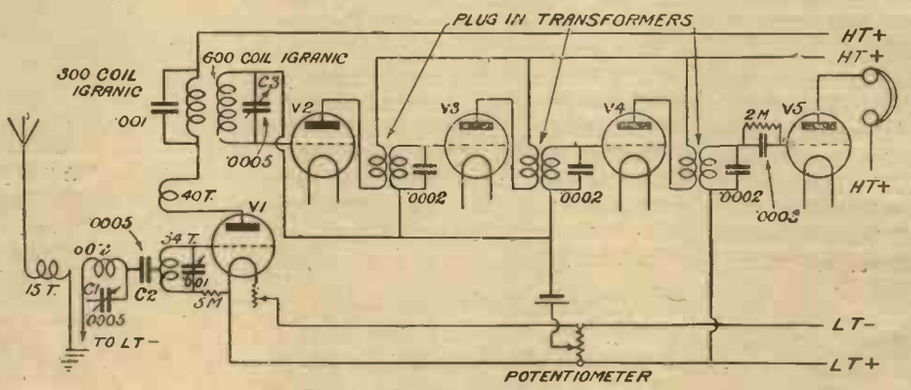


Fig. 1—The Tropadyne Circuit.

The supersonic heterodyne receiver is undoubtedly the best receiver for weak signals on the medium and short band of wavelengths, but the principal objections to this class of receiver have been the cost of valves and the heavy drain on the batteries, and the fact that if used with an outdoor aerial they radiate badly.

The principle of the supersonic heterodyne receiver, briefly, is to alter the wavelength of the incoming signal to a predetermined figure—say 6,900 metres—and then to amplify this altered wavelength at high frequency before finally rectifying the signals. The object of increasing the wavelength is, of course, that high-frequency amplification can be carried out far more efficiently at high wavelengths than at low. Moreover, in the process of increasing the wavelength we obtain a selectivity with a minimum of controls unknown in any other type of receiver.

Wavelength Changes

The usual method of obtaining this change in wavelength is to employ a separate oscillating valve tuned to a different frequency to the incoming signals, and which is superimposed on the incoming frequency, producing a frequency equal to the difference between the two.

Efforts have been made in America—the home of the super-heterodyne—to dispense with this separate oscillator valve, and two methods have been evolved; the first of these methods is known as the second harmonic method, with which, however, we are not dealing in this article, and the other method, which is due to Mr. Clyde Fetch, is known as the Tropadyne circuit.

This latter method, apart from saving a valve, produces a receiver which is simple to build, is extremely selective, and which does not radiate when used with an outdoor aerial.

On reference to the theoretical circuit, shown by Fig. 1, it will be seen that an aperiodic aerial circuit induces oscillation into a tuned secondary circuit, the output of which goes through a .0005 fixed condenser to the centre point of another circuit which is generating oscillations at a different frequency.

These two circuits can be tuned to different frequencies without interaction between them. The incoming frequency blending with the locally-produced frequency produces the required lower frequency, which is then amplified by three H.F. valves and finally rectified by the detector valve.

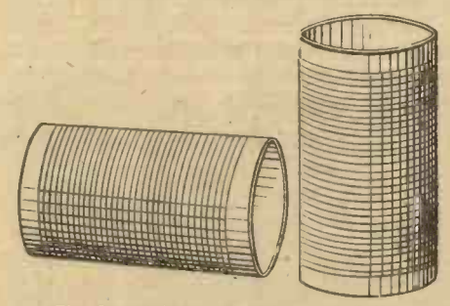


Fig. 2.—Relative Positions of Coils.

As to results, all stations in this country and practically every Continental station between 250 to 530 metres can be received loudly and clearly, subject to morse and heterodyne interference, on an outdoor aerial, and on a good night the majority of these stations can be heard clearly without either aerial or earth connected to the set, sufficient energy being picked up from the aerial lead-in hanging 2 ft. away.

Some Constructional Hints

Now as to the construction of the set, it is recommended that the American system of placing all the valves, coils, etc., behind the panel be adopted.

First wind 15 turns of 18 d.c.c. wire on a 3½-in. cardboard or ebonite former, and half an inch away wind 60 turns of the same wire. On a similar former wind 54 turns of No. 18 or 20 d.c.c. wire—making a tapping at the centre turn — and half an inch away wind 40 turns of 22 d.c.c. wire —all windings in the same direction. These coils should be mounted on the baseboard by means of small brackets made of bent strip brass, and placed in non-inductive relation to one another as shown in Fig. 2.

In the plate circuit of the first valve there is a 300-turn duolateral coil, with a fixed .001 condenser in parallel, and the 40 turns of the coil already described. This 300 coil is closely coupled to a similar coil of 600 turns which is tuned by a .0005 variable condenser. The mica type, such as the Polar, may safely be used here, but good quality air dielectric condensers of .0005 and .001 microfarad (with vernier) should be used in the other positions as indicated in the diagram.

Now we come to an important point, on which the success of the set will depend, and that is that all the H.F. stages must be tuned to the same frequency. The writer obtained three matched 2,500-7,000 metre transformers from Messrs. McMichael, Strand, W.C., and three matched .0002 fixed condensers from Messrs. Dubilier. The condensers were placed across the secondaries of the transformers, and the resulting wavelength is about 5,500 metres.

A variable grid leak, with a minimum of not more than ½ megohm, is connected on the filament side of the grid circuit of the first valve, and the usual .0003 condenser and 2-megohm grid leak is placed in the grid circuit of the last valve.

As to valves, a Wecovalve functions excellently in the first position V1; V2, V3 and V4 are Edison .06 valves, and V5 should be for preference a valve capable of detecting loud signals; one of the DE6 or B.T.H. B6 type works well here.

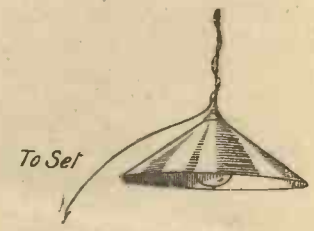
The filament ends of the grid circuits of the three H.F. valves are joined together and connected to the negative side of a small 1½-volt dry cell, the positive

(*Continued on page 766*)

PRACTICAL ODDS AND ENDS

Electric-light Aerial

WHEN reception from the local station only is desired there is really no need to erect an elaborate outdoor aerial, as quite good results and loud

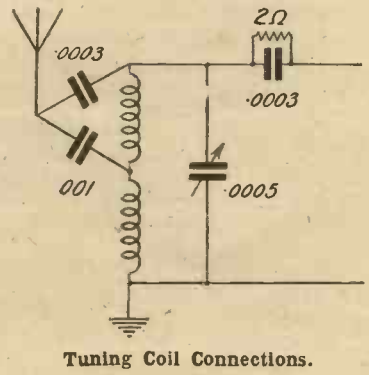


Electric-light Aerial.

signal strength are obtained on improvised indoor aerials. The electric-lighting system can be used as a collector of energy without interfering in any way with the wiring. Simply twist a length of about 2 ft. of rubber-covered wire around the flex lead to one of the lamps, connect one end to the aerial terminal of the set and leave the other disconnected. The lighting main supply forms quite an efficient aerial and the signals are by-passed (through the capacity of the twisted wires) to the receiver. L. S.

Novel Aerial Coupling

A NOVEL method of coupling the aerial to the tuning inductance is shown in the accompanying diagram. The tuner consists of two coils coupled in series and the aerial lead is split. One part is con-



Tuning Coil Connections.

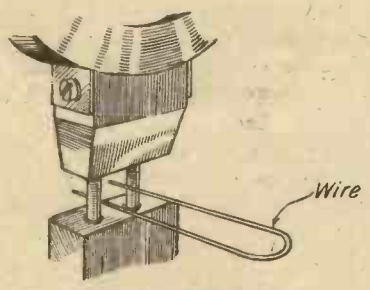
nected, through a .0003-microfarad fixed condenser, to the aerial terminal and the other, through a .001-microfarad fixed condenser, to the joint of the two coils.

The result is a form of auto-coupling which, especially in use with a poor aerial, will give sharper tuning and possibly a slight increase in signal strength. F. K.

Short-circuiting Device

A SHORT-CIRCUITING device for loading coils which does not necessitate the removal of the coil from the coil holder is shown in the accompanying diagram. A **U**-shaped piece of springy brass or copper wire is used for shorting the coil sockets and the limbs of the wire being spaced a little larger than the distance between the two sockets so that the shorting-piece can hold itself in position.

The device is of great use in connection with crystal sets, as it enables the loading coil to be placed in or out of circuit with the minimum of trouble, but in valve sets care must be taken that the capacity of the coil (when out of circuit) does not influence near-by components. P. P.



Short-circuiting Device.

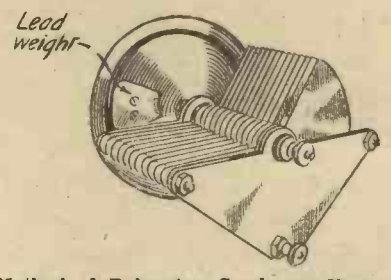
The Earth Connection

IF an outdoor earth is used it is important to give it a little attention from time to time in hot weather. A great many of the troubles complained of in summer-time are due to the fact that the earth contact becomes very poor owing to the drying up of the soil in which it is situated, with the result that a high resistance is set up.

A good tip is to place an old piece of stove-piping upright upon the earth plate, the length of the pipe being sufficient to allow a few inches to protrude above the surface of the ground when the hole has been filled in. A number of holes should be drilled or punched near the lower end of the pipe. In dry weather a bucketful of water poured into the pipe will make a great difference in results. P.

Balanced Condensers

THE bearings of variable condensers, when new, are usually stiff enough to prevent undue movement of the vanes, but it is sometimes found when the condenser has been in use a short time that the vanes do not stay in the correct position and are apt to fall (by reason of their weight), so that the capacity is altered. The trouble can be quite simply cured in the following manner. Cut a piece of thick sheet lead

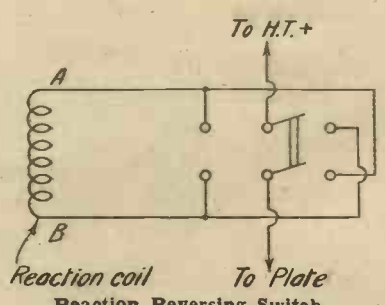


Method of Balancing Condenser Vanes.

to make a weight to fit the recess usually to be found at the back of large ebonite dials and screw it into the position where it balances the moving vanes of the condenser. It will then be found that the condenser can be set to any desired position and the vanes will not cause any accidental alteration of this value. B. I.

Reversing Reaction

WHEN a valve set is under construction it is necessary to discover the correct way of connecting up the reaction coil, since otherwise the receiver will not function properly. The best method of doing this is to make use of a double-pole change-over switch wired as shown in the diagram. It will be seen that if the switch is turned over to the left current from the plate enters the coil at the end marked B and leaves it at A. When the switch is



Reaction Reversing Switch.

turned over to the right, the direction of the flow is reversed, current entering at A and leaving at B. By means of the switch one can discover in a matter of moments which way round the coil should be wired up and there is no possibility of making a mistake. J. H. R.

Ask "A.W." for List of Technical Books

Fig. 6.—Choke Coil.

THE longer one uses a wireless set, the more evident it becomes that batteries —especially the H.T. battery—are the source of more annoyance than any other component. The life of the usual H.T. dry-cell battery is a variable quantity; it has a duration of from two or three weeks to six or seven months. Even during its short span of life the H.T. battery makes its presence felt by frequent spasms of crackling, causing the owner to suspect innocent and far more trustworthy apparatus, such as transformers, coils and valves. Accumulator H.T. batteries are more reliable in this latter respect, but even they wear out in time.

Using the Lighting Mains

We must therefore consider the house-lighting supply as, so far, the most dependable and practical means of obtaining the necessary current and voltage for the operation of the valve, and it is intended to give a short description with practical constructional details of the most successful of the several methods of harnessing the house-lighting supply to the wireless set. Unfortunately we have in England a most amazing assortment of house-lighting systems, the voltages and frequencies of which vary from 50 to 250 volts and 25 to 100 cycles. If we had a uniform supply the problem with which we are confronted would be easily solved, for then it would only be necessary to give particulars of one "battery eliminator." As it is, nearly every house-lighting supply requires an eliminator specially designed for the purpose, having chokes and condensers suitable for the particular supply.

Alternating current has been used with success to heat the filaments of valves without rectification. The method of doing this is shown in Figs. 1 and 2. In order that the voltage of the mains may be reduced to a suitable value for the rated filament voltage of the valve, a step-down transformer is inserted in the circuit between the mains and the valve filaments. The secondary of the transformer consists of few turns of wire in comparison with the number of primary turns, and possesses a centre-tap to which the grid returns of the valves are connected. The centre-tap helps to neutralise the A.C. hum, which, without the centre-tap, would interfere seriously with reception. Such a method is eminently suitable for transmitting purposes, but the reader is cautioned that with a valve receiver using the system shown in Fig. 1 there will always be a slight hum in evidence.

For absolutely smooth reception the A.C. must first be rectified and then filtered. Now as A.C. consists of a positive half-cycle followed by a negative half-cycle, it is possible to suppress, say, the negative half-cycle and allow the positive half-cycle to pass, thus obtaining a series of D.C. impulses. A more efficient method is to employ what is known as full-wave rectification, in which both positive and negative half-cycles are rectified, producing a comparatively smooth D.C. In this case the rectifier may conveniently consist of four large chemical rectifying cells, known as Nodon valves. Fig. 3

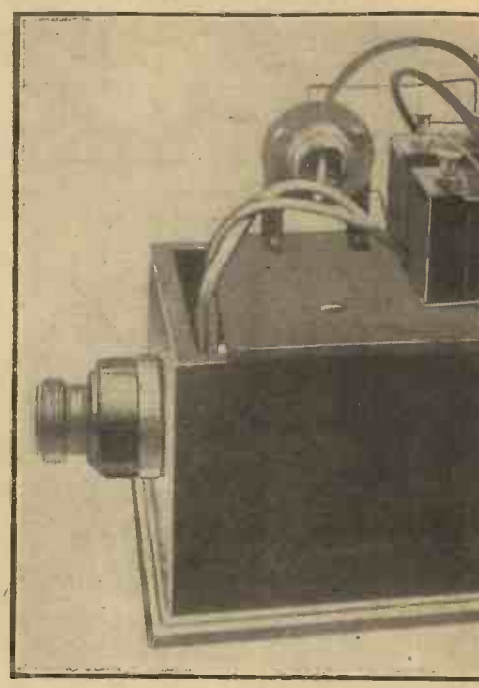


Fig. 12.—Under-panel View of

BANISH YOUR BAT

Constructional Details of Systems of C
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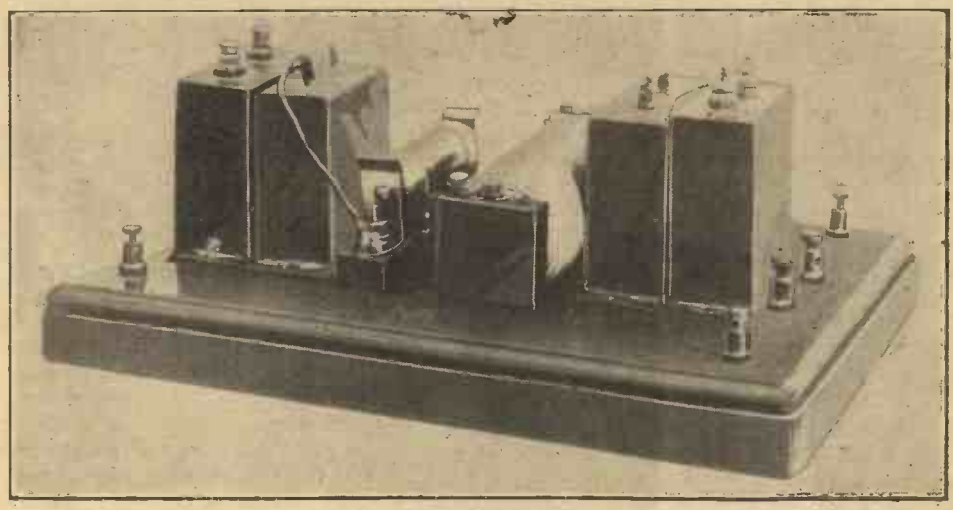


Fig. 7.—Smoothing Chokes and Condensers.

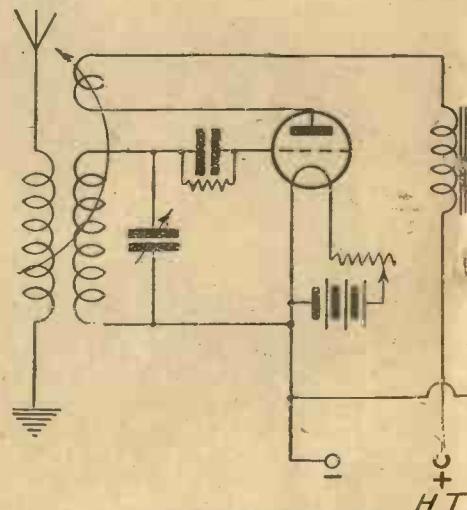
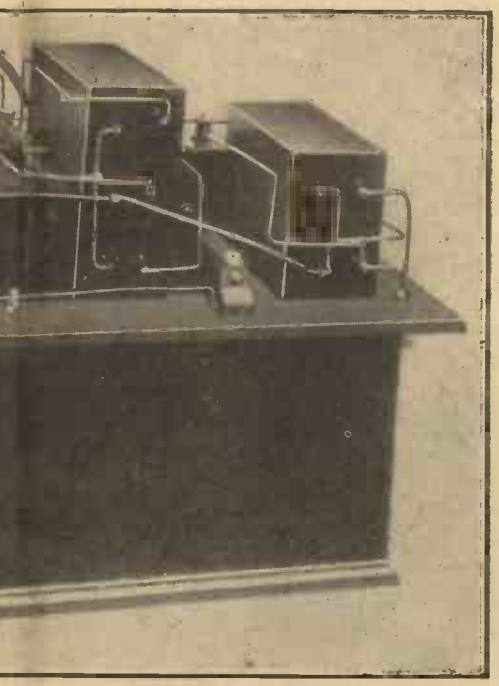


Fig. 1.—Circuit Diagram for Fi



Fuller H.T. Battery Eliminator.

TTERY TROUBLES!

Obtaining H.T. and L.T. Supplies from ating-current Lighting Mains

(page 760) shows the circuit diagram of the whole arrangement.

The Nodon valve (Fig. 4) consists of a 2-lb. earthenware jam-pot lined round the sides with pure lead sheet $\frac{3}{16}$ in. thick. A space of 1½ in. is left between the bottom of the jar and the bottom of the lead sheet, and the latter is so cut that a strip of lead ½ in. wide projects from the top of the jam-pot. To the projecting lead strip a terminal is attached. The jam-pot is then filled to within 2 in. from the top with a normal saturated solution of ammonium phosphate, which may be obtained ready for use from a chemist. It is important to note that the solution must be saturated and not acid. A centre electrode of pure aluminium rod ¼ in. in diameter is suspended from a paraffined wooden strip resting on the top of the jam-pot. A second terminal is attached to the top of the aluminium rod. It may be found advantageous to cover the aluminium rod with some black chemical rubber tubing, covering the entire length of the immersed portion of the rod with the exception of about ½ in. from the bottom. This, however, is a matter for experiment.

Four cells or jars are required joined up as shown in Fig. 3; the aluminium rods are shown as small black circles and the lead electrodes as the major arcs of circles having a much larger diameter. These connections should be carefully noted, for it is important that the polarity of the wires connected to the L.T. terminals of the set should be correct.

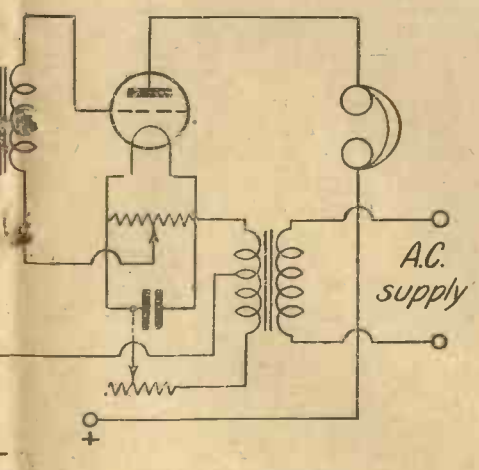
So much for the L.T. battery eliminator. We have now to consider the H.T. problem. In this case the current obtained must be quite smooth, the slightest ripple having a disastrous effect on reception and, indeed, it will entirely annihilate any weak signal. As in the case of the L.T. problem, a transformer is practically essential, but, happily, the same transformer may be used for both purposes. Details of suitable transformers will be given further on in this article. For the plates of the valves a much higher voltage is required than that necessary for the filaments. Moreover, the voltage must be sufficiently high to overcome the voltage drop caused by the rectifier and smoothing system. The current required is small.

Fig. 4.—The Nodon Valve.

H.T. and L.T. from A.C. Mains

A circuit diagram of the system used to supply H.T. and L.T. from A.C. mains is shown in Fig. 5. Two separate rectifiers are used, but that for the H.T. supply consists of two thermionic valves giving full-wave rectification, while that for the L.T. supply is the chemical rectifier previously described. A transformer with three secondaries is required, one for the H.T. supply, one for the valve filament supply to the set, and the third for the filament supply to the two thermionic rectifying valves. In the H.T. supply output from the rectifier a smoothing system is inserted consisting of chokes and condensers. Fig. 6 is a photograph of such a smoother.

If several H.T. tappings are required it is easy to insert a fairly high resistance in series with the existing H.T. positive



lament Supply from A.C. Mains.

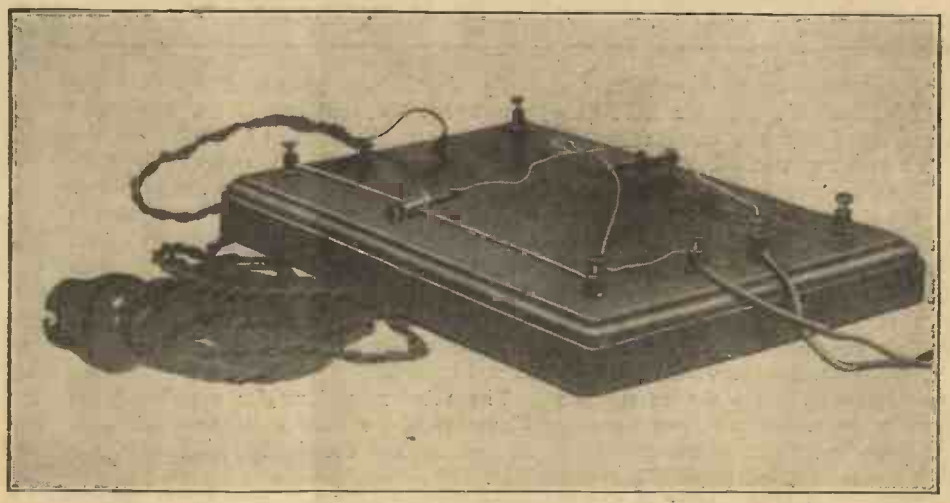


Fig. 10.—Resistance for Direct-current System.

tapping, bringing the free side of the resistance out to a separate terminal, as shown in Fig. 5. Another alteration that will tend to eliminate A.C. hum is to be made in the set itself. Anode rectification, although not quite so sensitive as grid rectification, is still very efficient provided the right type of valve is used. A.C. hum, moreover, is considerably reduced by employing anode rectification. There is no reason, of course, why grid rectification should not be used if a separate L T. battery is employed for the detector valve alone. This latter method is shown in circuit diagram form in Fig. 1.

With regard to the choke, as shown in Figs. 6 and 7, the latter should be wound on an iron core having a diameter of ¾ in. and 5 in. in length, on which two ebonite or wood cheeks are mounted at each end. The winding consists of 32,000 turns of No. 36 S.W.G. s.s.c. copper wire wound on in layers. If desired, two chokes may be wound on the same iron core, one winding on top of the other. The core may consist of soft iron wires cut off in 5-in. lengths.

Unfortunately the transformer is not so easy to specify, for the windings depend on the voltage and frequency of the supply and also on the type of thermionic rectifying valves used. Assuming that ordinary 6-volt power valves, having a high total emission, are used for this purpose, the voltage output of the secondary supplying the filaments of these valves would be 12 volts, as both filaments are connected in series. In order to adjust the filament current to a nicety, a 10-ohm rheostat should be connected in series.

For the H.T. supply a total voltage of about 400 is required from the next secondary winding. With full-wave rectification only half of this voltage is applied to each valve during the complete cycle and a further decrease due to the smoothing system will bring the total voltage applied to the H.T. terminals on the set to about 120 volts. With a 30,000-ohm resistance in series a 60-volt tapping will be obtained. Both secondaries are centre-tapped.

The third secondary for supplying the filaments of the valves in the set is connected to the chemical rectifier in the manner shown. The output of this secondary should be about 30 volts 3 amperes, allowing for a voltage drop of about 25 volts across the rectifier. A list of transformer specifications is given in a table which covers most of the common A.C. supplies of this country. The cross-sectional area of the iron core of the transformer should be 2 sq. in. in all cases. Other dimensions of the core are given in Fig. 8. Both primary and secondary coils should be wound on the same limb of the iron core and the latter should be built of Stalloy laminations .014 in. thick. In all cases the frequency is to be taken as 50 cycles.

Now we come to D.C. mains. With D.C. mains the whole matter is much simpler, and Fig. 9 shows the complete arrangement for H.T. and L.T. supplies. For the filament supply quite a neat arrangement, which is very satisfactory, can be made from two long pieces of pencil lead mounted as in Fig. 10. A variation of resistance is obtained by moving the metal contacts (these can be pin terminals) along the pencil leads. The smoothing system, as before, consists of 10-henry chokes and fixed condensers of large capacity. When using this system a fixed condenser of .5 microfarad should be inserted in the earth lead of the set or

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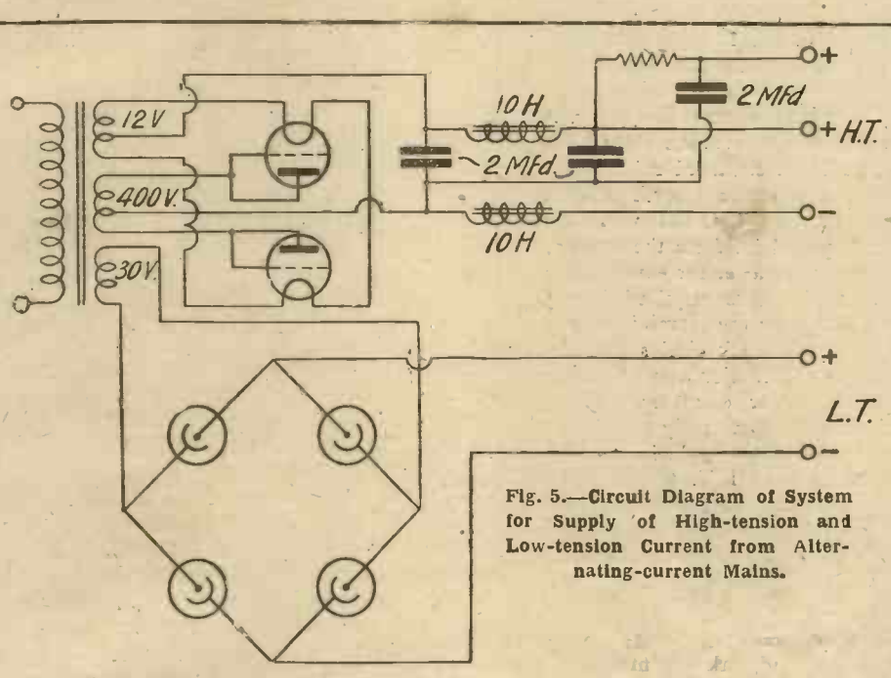


Fig. 5.—Circuit Diagram of System for Supply of High-tension and Low-tension Current from Alternating-current Mains.

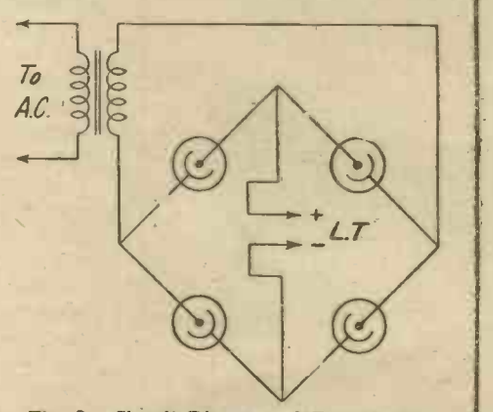


Fig. 3.—Circuit Diagram of Transformer and Rectifier.

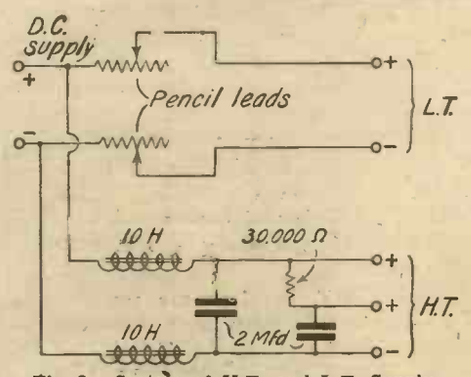


Fig. 9.—System of H.T. and L.T. Supply from Direct-current Mains.

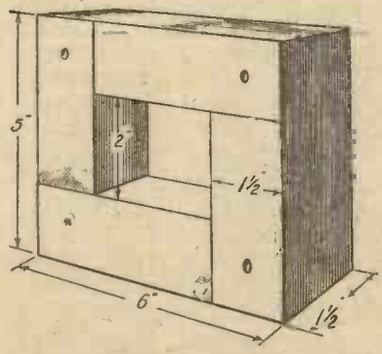


Fig. 8.—Details of Transformer Core.

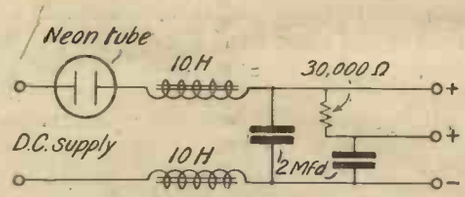


Fig. 11.—Direct-current System with Neon Tube.

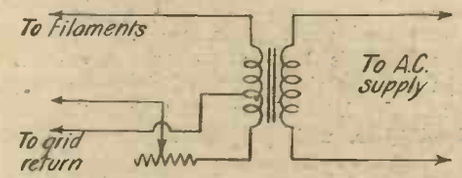


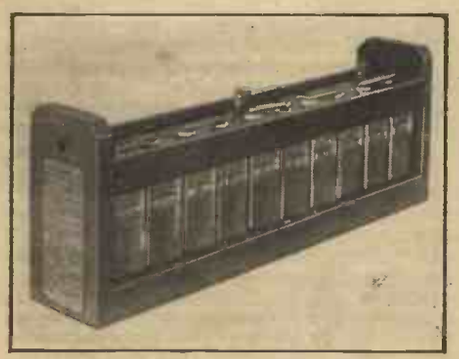
Fig. 2.—Details of A.C. Filament Supply.

"A.W." TESTS OF APPARATUS

Conducted in the "Amateur Wireless" Research and Test Department

Exide H.T. Accumulator

NOW that amateurs are realising the necessity for accumulator H.T. batteries where a large number of valves are used, there will doubtless be a demand for really well-made batteries of this type. The example illustrated in the photograph is made by The Chloride Electrical Storage Co., Ltd., of Clifton Junction, nr. Manchester. It is a 20-volt unit with a terminal in the centre giving a ten-volt tapping. The H.T. unit is very sturdy in construction and compact. The varnished wooden case containing the cells is 14 in. long, while its width is under 2¾ in. The space taken up by four such units (giving 60 volts) would not be unduly great. The top of the case is covered with a black insulating compound, in which are embedded the ten porcelain vent-holes of the cells. A point which saves time when charging is the grouping of the vent-plugs in pairs in the form of rubber plugs joined by rubber strips. The sturdily-built glass containers all have the acid level clearly marked on the sides. The plates are well separated from each other and from the bottom of the container. Judging from the actual ampere-hour capacity—2,500 milliamps.—we should say that in conjunction with other similar units it should be able to deal with heavy current outputs.



Exide H.T. Accumulator.

Mullard PM2 Valve

A USEFUL addition to the series of PM valves is the new PM2, recently submitted to us for test by the Mullard Wireless Service Co. From the accompanying table of constants it will be seen that this valve is very economical in filament current consumption; it is also particularly suitable for use in portable receivers, as there is an entire absence of microphonic noises. It will also be seen from the table that the impedance of the valve is low, and on that account is suitable for L.F. power amplification. In this it certainly lives up to the maker's claims, and for a two-volt valve is one of the best power amplifiers we have tested. It is important, however, to follow closely the maker's instructions as to grid bias, H.T. and L.T. voltages, etc., as if this is done the life of the valve will be much longer.

Mullard PM2 Valve.

As a detector the PM2 gives good results if a grid leak of 3 megohms is connected to the positive L.T. terminal of the accumulator.

Characteristic		*Values*
Overall length		4⅛ in.
Overall diameter		1¾ in.
Filament voltage		1.4 to 1.8 volts
Filament current		.14 ampere
Anode voltage		50 to 100 volts
Total Electron Emission		20 m.A.
Impedance	At 75 anode volts and zero grid volts	8750
Amplication factor		5·4
Mutual conductance		.62 m.A/volt

The address of The Mullard Wireless Service Co. is Nightingale Lane, Balham, S.W.12.

Unica Cabinets

NOW that wireless reception has ceased to be a novelty, constructors are turning their attention to more artistic cabinets in which to house their latest sets. It is to meet this demand for a cabinet which is a presentable piece of furniture that the Unica series of cabinets has been designed. These range from the simple cabinets to take upright panels with sliding baseboards to the most ornate pieces of furniture of various periods and in various woods. Then there are several excellent designs of cabinets for enclosing loud-speakers and rendering them artistic and pleasing in appearance. Included in the series are cabinets for portable receivers, one of which contains a loud-speaker and detachable frame aerial. We have used many of the models, and can confidently recommend them to our readers. The makers of the Unica series are The Unica Cabinet Co., of 73, Camden Street, London, N.W.1.

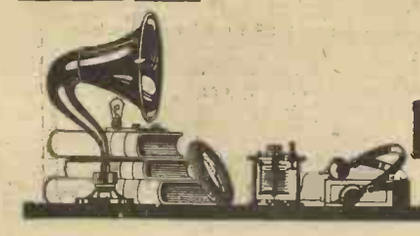
Lotus Coil Holders

WE have received from Garnett, Whiteley and Co., Ltd., of Lotus Works, Broadgreen Road, Liverpool, samples of their range of slow-motion coil holders, including two-way and three-way models. These components are extremely well made and are fitted with control arms of various lengths, thus enabling the coil holder to be mounted on a panel or at the back of a baseboard. Both end-plates consist of well-shaped bakelite mouldings, the insulating properties of which are very high. In action the slow-motion mechanism, which is entirely concealed, affords a very smooth and fine control of the coupling between the coils.

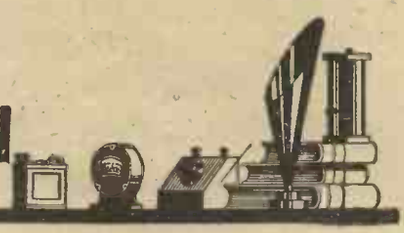
Empire Transformer

THE small transformer illustrated has been sent us for test by The H.T.C. Electrical Co., Ltd., of 2, Boundaries Road, Balham, S.W.12. The construction of this component is very neat. Four terminals are mounted on a small ebonite panel on the top of the transformer, and clamped under the terminal heads are soldering lugs of a commendably large size. The panel is clearly engraved to indicate the terminal connections. The insulation between windings was tested at 500 volts and found to be satisfactory. Tested in conjunction with a two-valve receiver using a low-impedance detector valve and low-impedance amplifying valve, it gave fair results as regards quality, although the volume was not great. The ratio is 4 to 1, a suitable value for general purposes. In comparison with similar transformers its performance was found to be quite satisfactory.

Empire L.F. Transformer.



OUR INFORMATION BUREAU



RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, layouts, diagrams, etc., on separate sheets containing your name and address. Always send stamped, addressed envelope and attach Coupon (p. 772).

H.T. Accumulators

Q.—*Can you tell me where it is possible to obtain the lead and aluminium rods for the A.C. rectifier described in the recent article on "The Maintenance of the H.T. Accumulator"? How long does the ammonium phosphate solution last? Does it have to be fresh for each charge or can it be revived by any means, and how can I tell when it is becoming weak?—E. M. (Watford).*

A.—The lead sheet and aluminium rod can be obtained from Stantion and Co., of Shoe Lane, E.C., although most metal dealers can usually supply both metals. As the amount of current passing through the rectifier cells when charging high-tension batteries is so small that there are no appreciable heating effects, the solution will be found to last well, provided that the aluminium and ammonium phosphate are chemically pure. Failure of the rectifying action is indicated by an increase in the time needed to get the battery fully charged, and by the complete or partial disappearance of flicker from the resistance lamp. Rectification may be tested for by connecting two lead wires in series with the battery and valves, dipping the ends of the two leads into a small jar of water while the charging current is switched on. One of the wires will rapidly assume a brown colour, and the other will remain grey if rectification is taking place satisfactorily.—M. M.

Effect of Grid Bias

Q.—*What is the effect of applying grid bias to an L.F. amplifying valve.—L. S. (Middlesex).*

A.—In order that perfect amplification may be given by an L.F. valve it is necessary that the valve be worked under certain conditions. It is, for instance, necessary that the characteristic curve shall have a long straight portion and that the normal operating point shall be situated somewhere near the centre of this straight part of the curve. It is also undesirable that the operating point shall become positive, as this might lead to a flow of grid current which would cause unequal damping of the signals and so result in the reproduction being distorted. As the whole of the straight part of the characteristic curve may be required for the amplification of powerful signals it follows that the whole of this should lie on the negative side of the zero grid-volts line. This can be accomplished by raising the H.T. voltage to a sufficiently high value, but then the centre of the straight portion (where it is desired that the mean operating point shall be) will lie considerably to the left of the above-mentioned line. In order to make the mean potential of the grid sufficiently negative to satisfy the above condition, it is necessary to apply a suitable bias voltage to the grid of the valve and hence the need for the grid-bias battery. While it should not be expected that the application of grid bias will, in every case, result in an increase of signal strength, signals are often stronger after the H.T. voltage has been raised and the grid bias suitably adjusted owing to a steepening of the characteristic curve. An increase in the value of the grid-bias voltage alone will not cause an increase in signal strength.—B.

Windings for Transformers

Q.—*Please give me core dimensions and a winding specification for four static transformers as particulars stated below?—B. W. F. (Forest Gate).*

OUR WEEKLY NOTE

ACCUMULATORS

The feature which makes an accumulator such a desirable source of L.T. supply for all types of valves is that its voltage remains practically constant until the charge is approaching total exhaustion. When this occurs, however, the voltage falls rapidly, though the battery will recuperate considerably if switched off for a few minutes.

An accumulator should never be worked further when once its voltage has started to fall; neither should it be left uncharged for a moment longer than is necessary. When bright-emitters were the only valves available and the accumulator failed during an interesting programme, there was a great temptation to overrun the battery by switching it off and on at frequent intervals. In this manner snatches of the programme could still be received though the battery was being seriously overrun.

In these days of dull-emitter valves, however, the temptation to use an accumulator long after it should have gone to the charging station is more than ever put before the amateur. Any such temptation should be strongly resisted. To use a four- or six-volt accumulator until it can no longer light the filaments of valves requiring only three volts may easily result in sulphated plates, and then the battery will be permanently injured. THE BUREAU.

A.—The various ratings asked for are: (1) 30-watts capacity, with alternative windings to suit 100 volts 50 cycles or 400 volts 50 cycles primary, and in each case an output of 1,000 volts, 0.03 ampere on the secondary; (2) 18 watts capacity, with alternative windings for 100 volts 50 cycles or 200 volts 50 cycles primary, and in both cases 6 volts 3 amperes secondary output. The core for No. 1 will be built from Stalloy strips 1½ in. wide by 0.018 in. thick to the following overall dimensions: 6 in. wide by 4½ in. high by 1½ in. deep. This will leave a central opening 3 in. long and 1½ in. deep for the windings, a considerable space being necessary owing to the high voltage of the secondary and consequent unusual amount of insulation. The turns-per-volt constant for a core of these dimensions (working on a 50-cycle circuit) will be 2.6, so that the required number of turns for any of the specified voltages is arrived at by multiplying volts by constant. 100 volt primary = 100 × 2.6 = 260 turns; 200 volt primary = 200 × 2.6 = 520 turns; 1,000 volt secondary = 1,000 × 2.6 = 2,600 turns. The gauges of wire are settled by the current carried in the respective windings, which again is found by dividing the watts by the volts generated in each coil. Thus: 30 watts ÷ 100 volts = 0.3 amps. = No. 26 S.W.G. 30 watts ÷ 400 volts = 0.15 amps. = No. 30 S.W.G. 30 watts ÷ 1,000 volts = 0.03 amps. = No. 40 S.W.G. The primaries may be wound with d.s.c. wire. After insulating with Ohmaline varnish and baking out, they are taped all round with two layers of cotton tape and replaced on the former to have the secondary wound over them. Before starting this put on 2 layers of 10-mil. Empire cloth and do not wind to the extreme edge of the flanges but stop the layers ⅛ in. from each end. At every second layer interleave with a double layer of 5-mil Empire silk and repeat this until the full number of turns are on. The finish of the secondary should be taken out at the opposite side of the coil to the start, and both be protected with varnished silk sleeving. Over the last layer of the secondary wrap three more thicknesses of 10-mil Empire cloth and again tape round to finish off. A final impregnation in Ohmaline and a good baking out is essential before assembling on the iron core, since 1,000 volts is a pressure that requires very careful treatment. If any terminals are used on the metal frame see that they are insulated with porcelain bushes of liberal dimensions. The 18-watt. transformers in specification No. 2 are a much simpler proposition, being relatively of a low voltage. The core dimensions for these can be reduced to an overall size of 5 in. wide by 3¼ in. high by 1 in. deep, the internal wire space being 3 in. by 1¼ in. The core is built up of Stalloy strips 0.018 in. thick and 1 in. wide. The turns-per-volt constant is in this case 8, therefore the winding specification will work out: 100 volts primary = 100 × 8 = 800 turns; 200 volts primary = 200 × 8 = 1,600 turns; 6 volt secondary = 6 × 8 = 48 turns. The respective currents will be found as before, by dividing watts by volts: 18 watts ÷ 100 volts = 0.18 amps. = No. 30 S.W.G.; 18 watts ÷ 200 volts = 0.09 amps. = No. 34 S.W.G.; 18 watts ÷ 6 volts = 3 amps. = No. 17 S.W.G.; d.c.c. wire can be used throughout for these windings, no special interleaving of layers being necessary, beyond 20 mils of Empire cloth to separate the primary coil from the secondary. Impregnate with Ohmaline varnish and bake out as before.—A. H. A.

EARTH CONTACT!

NEXT WEEK AT 2LO

By THE LISTENER

ON Sunday afternoon, May 30, we are promised a relay from Hyde Park by the Royal Parks Band. Studio interludes will also be given, the soloists being Edward Isaacs, the famous Manchester pianist; Harry Solloway, the new violinist; Herbert Cave, tenor; and Helen Henschel.

A carillon recital will be broadcast from Loughborough at 8 p.m., followed by an organ recital by J. Edgar Humphreys relayed from St. Mary-le-Bow. The late evening programme consists of a light symphony concert, conducted by Geoffrey Toye.

The week's pianist for the special recitals is Mrs. Norman O'Neill, who will give excerpts from Mozart's compositions.

Francesco Ticciati.

On Monday chamber music will be given in the evening by the well-known Æolian Players (Constance Izard, Rebecca Clarke, Gordon Bryan and Joseph Slater), and Anne Thursfield as vocalist. A variety programme is promised at 8 o'clock, the artistes announced being the Two Bobs, C. W. Thwaite, Will Hay the Schoolmaster Comedian, Carlton, Lawrence Bascomb, Ann Stephens and Alan Macbeth, and the Fayre Sisters in a concertina quartet.

Vladimir Vladimoff.

On Tuesday Emilio Colombo's orchestra will be heard again with Signor Colombo himself, just recently returned from Italy. Later will follow Act II of *Othello* (Verdi), relayed from Covent Garden. At 10 p.m. will follow the first part of the new mystery competition play entitled *Wolf, Wolf!* written by Ernest Hope.

A lighter atmosphere is to prevail on Wednesday, when, in addition to the orchestras of Camille Couturier, the New Gallery and the Rialto during the day, at 8 p.m. John Henry's concert party programme will be relayed from Ramsgate. As this date also marks the birthday of Thomas Hardy, a special feature programme will be given at 10 p.m.

Listeners will be glad to hear once more the J. H. Squire Celeste Octet on Thursday, with Gaby Valle as vocalist. At 10 p.m. follows part two of the mystery serial *Wolf, Wolf!*

Some popular artistes will appear on Friday. Episode V of *That Child* includes, in addition to Lorna Hubbard, the child in question, Mabel Constanduros, Michael Hogan and Ena Grossmith.

Interludes will be provided by Ronald Gourlay, and later a short programme by the Wireless Symphony Orchestra.

Friday, June 4, being the anniversary of Weber's death, a programme will be given of some of his works, with Rachel Morton, soprano, and Francesco Ticciati, the Italian pianist,

Anne Thursfield.

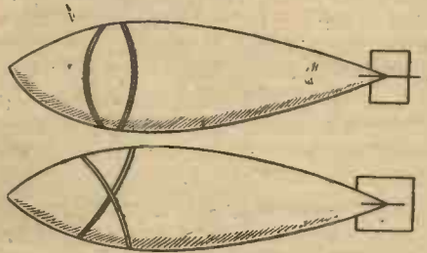
On Saturday Trooping the Colours will be given at 11 a.m. At 7.40 there will be a performance by Vladimir Vladimoff and his famous Balalaika Orchestra. The singer is Mdme. Oksarova, soprano.

THE WIRELESS EQUIPMENT OF THE *NORGE*

WIRELESS played an extremely important part in the latest expedition under Amundsen to the North Pole. The rigid airship *Norge* was very thoroughly equipped with wireless apparatus and in addition to the normal plant there is a direction-finder. The installation was undertaken by the Marconi Co.

The generating plant for power supply to the transmitter is a machine giving 133 milliamperes at 3,000 volts for H.T. and 14 amperes at 14 volts for L.T. This generator is driven by an air screw which develops 3 h.p., and arrangements are made for regulating the speed of this screw, while in addition to the air-screw drive, a 2¾-h.p. petrol engine is installed in case of breakdown. Power is taken from the generator and fed into a Marconi-type-U transmitter of .5-kilowatt input. Type T250 valves are employed, and the set is suitable for C.W. or tonic train, the latter being produced by a rotary interrupter. The wavelength range is from 559 to 1,500 metres.

For reception the ship is equipped with



Plan and Elevation showing Arrangement of Aerial.

a Marconi short-wave receiver which has a wavelength range of 10 to 100 metres. The purpose of this instrument was for communication with Point Barrow, where a short-wave transmitter is in operation. The standard receiver is arranged so as to be suitable for direction-finding or ordinary reception. For direction-finding a radiogionometer is used.

Low-tension current for the receivers is provided by an accumulator "floating" across the L.T. side of the generator. When the generator is running the accumulator is charging, so a constant source of L.T. is always ready for service. The main aerial of the *Norge* is 300 ft. long, but the most interesting aerials are the direction-finding loops. It must be borne in mind that the compass, when actually at the Pole, is useless, since all bearings are due south, so the direction-finding equipment is really one of the most important pieces of apparatus on board. The loops are forward and are wrapped round the envelope diagonally. The drawing will make the arrangement obvious. Each loop has two turns 9 in. apart.

D. B.

TWO further broadcasts of opera from Covent Garden have been fixed. An act of *Jewels of the Madonna* will be given on June 18, and another from *Manon* on June 25.

The efficiency of radio communication between Mexico and the rest of the world will be greatly increased by the installation of the new 500-watt equipment for trans-oceanic service. The station is located in Chapultepec Park, Mexico City.

The Australian "beam" wireless station will probably be ready for a trial service with Great Britain about September, and will be opened for traffic during the year.

The final lecture of the series which have been given from the London School of Economics is announced. On June 1 the subject chosen is, "Is the House of Commons of Any Use?" and the speakers will be Mr. J. H. Thomas and Mr. G. K. Chesterton. Mr. Lloyd George will be in the chair.

Bootle Education Committee have decided not to allow schools to use their wireless installations during school hours without special permission.

Experimental transmissions on a wavelength of 395.8 metres are being made by the Prague station.

The Breslau broadcasting station is now transmitting nightly with a power of 4 kilowatts. A wavelength of 418 metres is employed.

The Czecho-Slovakian Ministry of Railways has installed loud-speakers in the Wilson railway station at Prague in order to inform passengers of the arrival and departure of trains.

It is stated that wireless amateurs in Cairo are proposing to erect a transmitting aerial on the top of the Pyramid of Chephren, a height of 472 ft. The transmitter itself would be installed in the Rameses Tomb.

The Ravag Broadcasting Co. of Vienna proposes to install a microphone in St. Stephen's Cathedral to relay all organ recitals and for the transmission of midnight chimes of the Grosse Pummerin carillon.

Two new wavelengths have been suggested for the Vienna station, namely, for the high-power transmitter at Rosenhuegel, 517.2 metres, and for the old plant at the Stubenring 588.2 metres. When the change is made the Graz station will broadcast on 363.8 metres.

In deference to the wishes of listeners, the Prague station has ceased to broadcast advertisements.

The Chicago Federation of Labour has obtained permission to erect a broadcasting station at the Municipal Pier, which was formerly used as a wireless station by the American navy. The Labour movement will finance and control the station, which is intended to transmit messages to labour centres in the United States of America and abroad.

Loud-speakers have been erected in St. Peter's Cathedral at Rome. For many centuries sermons could only be heard by a comparatively small circle of listeners in the immediate vicinity of the minister. Reports from Rome now confirm that by means of an amplifying unit and loud-speakers, every word of the sermon is clear in all parts of the cathedral.

Radio-Toulouse regularly relays operatic and other performances from the Capitol Theatre and others in that city.

By means of the new system of photo-transmission by wireless, a portrait of Mr. Baldwin has been sent to New York in one hour 45 minutes.

The Radio Club de Liége is running a small telephony transmitter, and concerts are broadcast on Mondays, Wednesdays and Fridays at 9.30 p.m. B.S.T. A wavelength of 185 metres is employed.

The Egyptian Government has granted Marconi's Wireless Telegraph Co., Ltd., a thirty years' concession for wireless purposes.

Radio Belgique (Brussels) is making experimental transmissions on a wavelength of about 550 metres.

Norway will shortly bring into operation a further three small relay stations, namely: Rjukan (100 watts), Porsgrund (700 watts), and Notodden (50 watts).

Time signals, emanating from the Neuchâtel Observatory are daily broadcast by the Berne station at 13.00, 16.00 and 20.00 B.S.T.

The power of the new Radio-Zoologie broadcasting station at Antwerp is only 100 watts; it takes the bulk of its programmes by land-line relay from Radio Belgique, Brussels.

During the last few months the wireless telegraphy station established at Theodosia, a port on the South-eastern coast of Crimea (Russia) has daily transmitted a weather forecast and time signal at 12.29 B.S.T. on a wavelength of 600 metres. The call-sign of the station is REK. A further forecast, including storm warnings, is sent out at 11.40 a.m. on 1,800 metres, and at 23.00 B.S.T. on a 600-metre wavelength.

A new broadcasting station has been erected at Agram (Zagreb), in Hungary. For the present it will be operated by the local wireless association, who will be solely responsible for the general programmes. The concerts are broadcast on a wavelength of 350 metres with a power of 350 to 500 watts.

The new Salamanca (Spain) broadcasting station EAJ 22 has now resumed transmissions on a wavelength of 405 metres. Concerts are given from 17.00 to 18.00 and 21.00 to 23.00 B.S.T. daily.

Since April 1, the cost of wireless receiving licences in Czecho-Slovakia has been reduced from fifteen to ten kroner, or roughly 1s. 2d. per annum.

In Jugo-Slavia a high-power broadcasting station is being erected by the State in the neighbourhood of Agram (Groatia). Broadcasting in Jugo-Slavia is still in its infancy, and it is stated there are only about 700 wireless receivers in Belgrade.

It is intended to install a microphone on the tower of Glasgow University so that the chimes may be broadcast.

Sheffield listeners are complaining bitterly that their local relay station is being badly heterodyned. It is practically impossible to follow the station's transmission and it is generally thought that more than one station is heterodyning 6 F.L.'s programme. Repeated requests have been made for the station to lower its wavelength.

The use of wavelength-governing crystals is being seriously considered by German broadcasting authorities, and tests are to be carried out extensively next month to determine whether it is possible by their use to reduce the number of wavelengths in Germany from the present twenty to some nine or ten.

Early works of great composers are the basis of a programme from Glasgow, to be relayed to Daventry, Edinburgh and Dundee, on June 10. The principal vocalists are Mavis Bennett, Herbert Thorpe and Joseph Farrington, while the station orchestra and choir will contribute the major portion of the programme.

Band music is very popular with Scottish listeners, and interest is being shown in the northern visit of the Marsden Colliery Band, which will broadcast from Glasgow on June 8.

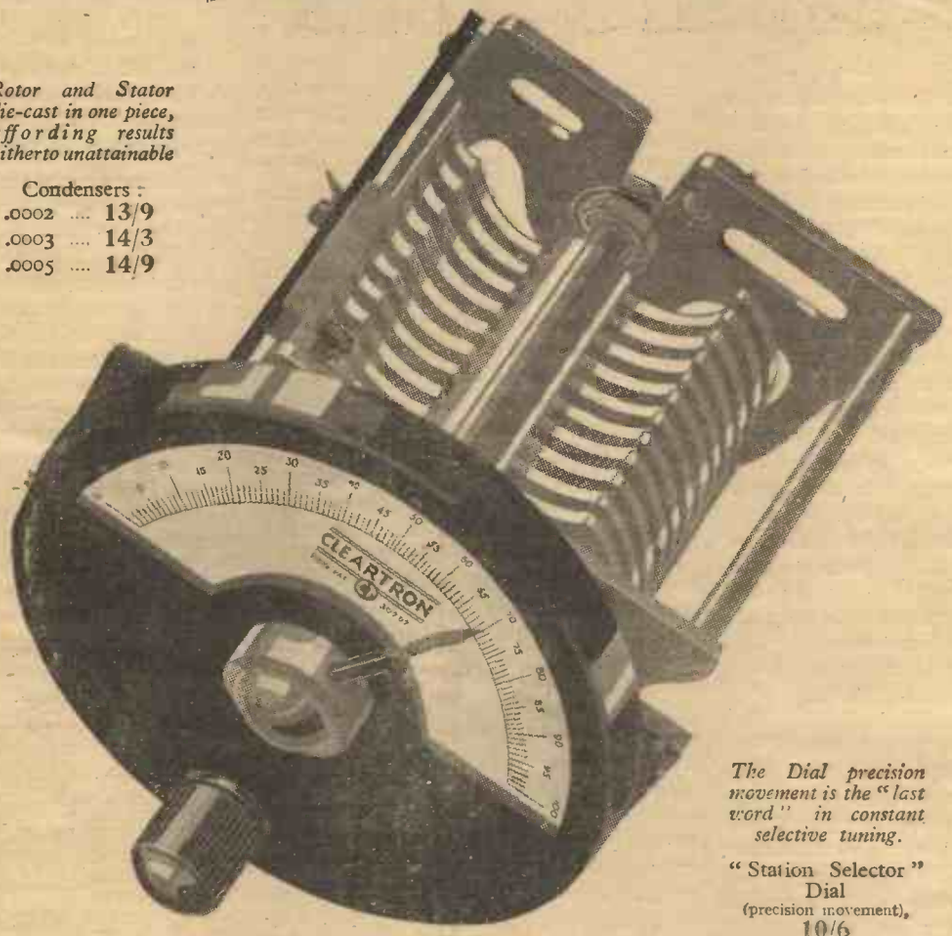
Under the title of *Whiffs*, a series of revues is to be given from the Glasgow station, commencing June 7. In addition to the usual musical interludes and topical sketches, a novel competition is to be run.

The Air Ministry is erecting a number of short-wave stations in the British Empire for communication with aircraft.

ANOTHER CLEARTRON PRODUCT

Rotor and Stator die-cast in one piece, affording results hitherto unattainable

Condensers :
.0002 .... 13/9
.0003 .... 14/3
.0005 .... 14/9



The Dial precision movement is the "last word" in constant selective tuning.

"Station Selector" Dial
(precision movement),
10/6

THE DI-KAST CONDENSER

A distinct innovation in Condenser design. Avoids the contact resistance losses experienced with separately assembled condensers. Rotor and Stator are die-cast in one, which means positive connection and perfectly matched characteristics. The specially designed vanes provide straight line reading, greater range, easy short wave tuning and very low minimum capacity. Another feature of unusual interest is the MICRO STATION SELECTOR, a newly designed dial precision movement, allowing completely selective tuning and ten or more different adjustments between each degree. Play and back-lash entirely eliminated.

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Cleartron Radio Valves, Standard prices, 12/6 and 15/-

48/577 A.

Condenser Faults

SIR,—At the present time one hears and reads a good deal regarding variable condenser efficiency and faults, and in this respect perhaps some of my own experiences would be of assistance to other readers.

Of course, any slight fault or point of inefficiency is very much more pronounced on the higher frequencies, and the condenser I am going to mention was perfect in operation on the broadcasting band.

I built a short-wave receiver with a range of from 10 to 100 metres, and took great care in selecting good components. On completion the set functioned fairly satisfactorily, but there was one great drawback which made tuning of weak signals difficult. This fault was that, as the condenser was rotated, a continuous rustling sound was heard. At first this was thought to be due to dust between the plates, but inspection disproved this. The contact to the moving spindle was secured by a pigtail of four turns. As these turns were of bare copper and since they touched as the condenser plates were turned, it was thought that this might be partly the cause of the trouble. Two of these turns were removed so that those remaining could not touch, and although this improved matters slightly, there was still the rustling sound. Careful scrutiny showed that the pigtail was fastened to the spindle by fitting into a cut in the latter, the joint being covered with solder. On testing this connection, however, the real cause of the trouble was found; the pigtail was in the groove all right, but the soldering had not been properly done, with the consequence that the connection was *slightly* loose. This appears to be a rather obscure fault, but a similar thing might cause annoyance to many others. On soldering the connection carefully the receiver worked quite silently and is now giving splendid results.—F. P. (Keighley).

The Wavelengths Problem

SIR,—I read with interest your article in No. 204 regarding the probable rearrangement of the wavelengths of the broadcasting stations in Great Britain. The new wavelengths suggested appear to be a considerable advance on those at present in use, and should certainly improve conditions in our own country, where wavelength problems of a domestic nature have been rather overlooked of late owing to the greater attention given to the general European situation.

At the present time it is something to boast about if one can cut out a near-by station in favour of another B.B.C. transmission. In allocating the existing wavelengths, the separation of stations serving adjacent areas was not, in my opinion, given due consideration. Until recently the large and enthusiastic wireless population of Fife spent many weary nights in trying to separate Dundee on 331 metres from Edinburgh on 324 metres. These wavelengths have now, fortunately, been altered so as to allow a greater margin. Another case is provided by the difficulty experienced by Glasgow listeners in receiving Belfast when the local station is working. On well-separated wavelengths these stations would be useful in providing alternative programmes for listeners in their respective areas, but with only 18 metres between them I find that intelligible reception is easier from Königswusterhausen than from Belfast during Glasgow's transmissions! This crowding of our own stations also gives rise to interference by oscillation, as by the use of excessive reaction (in endeavouring to obtain greater selectivity in order to receive a transmission on a wavelength not far removed from that of the local station) the operator of a valve set may cause howls which interfere with the neighbouring receivers tuned to the local station. Under such conditions the one- or two-valve man is tied to the local station during broadcasting hours.

The "two programmes for everyone" slogan appears to have been abandoned, and though the advent of Daventry was hailed as the forerunner of a new era in which every listener would be able to choose his programme, nothing farther has been done, and though English listeners who are centrally situated are now well catered for, crystal and single-valve operators in Scotland still have to rely on one programme. It appears to me that the only satisfactory solution of the alternative programmes and wavelengths problems is the erection of stations outside the city areas, transmitting on two widely separated wavelengths and with greatly increased power. A smaller number of stations would then suffice to cover the whole of Great Britain; each area would have at least two programmes, and the jamming of city dwellers' sets would be avoided. Oscillation caused by station-searchers would be greatly reduced, and the only people who would be worse off would be the very small minority who would then be situated under the shadow of the stations, which, being located in country districts, would not affect a large number by the blotting-out of other transmissions.—G. S. (Glasgow).

Read ROBERT HICHENS' The Spinster in The ARGOSY 1s.

Other Correspondence Summarised

W. R. Lough (27, Norfolk Road, S.W.19) has numerous copies of the early issues of "A.W.," and will be pleased to forward them to any reader.

"DO YOU UNDERSTAND THE TROPADYNE?"

(*continued from page* 756)

side being connected to the moving arm of the potentiometer shunted across the main low-tension accumulator.

Although it is not absolutely necessary, the writer has made metal covers of zinc to fit over the two duolateral coils and the three H.F. transformers and connected the covers to L.T. negative. This helps to prevent the set from picking up long-wave Morse and also to avoid stray capacity coupling between the transformers.

The three H.F. valves should be brought near to oscillation point by means of the filament rheostat and potentiometer for maximum sensitivity.

The set is easy to build and simpler to operate than the conventional tuned-anode set, and the results are a revelation.

About 25 volts to the Wecovalve and about 50 volts to the .06 valves are suitable H.T. values, and about 50 volts to the last valve if a DE6 or B.T.H. B6 is used.

Operation

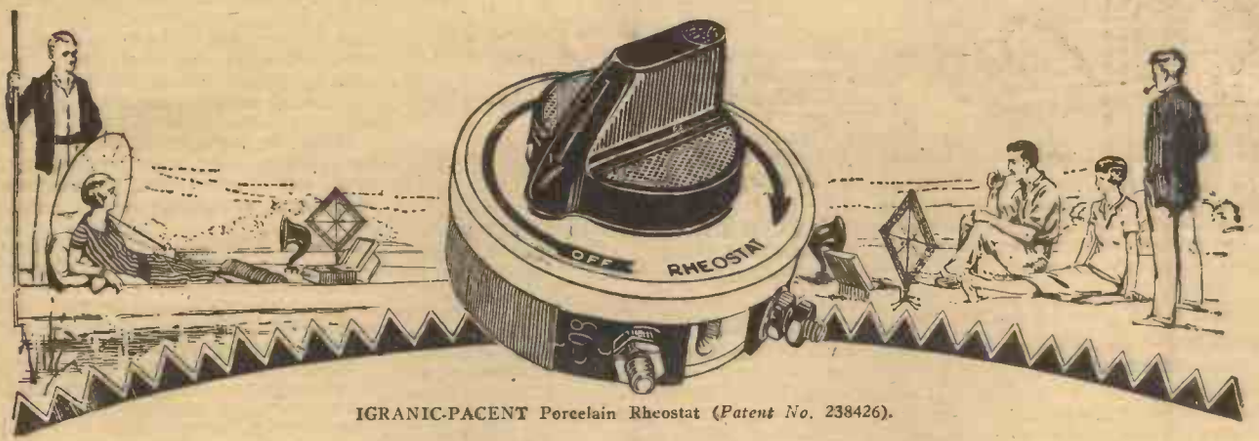
To operate the set, tune in the local station by adjusting the condensers across the wound formers, C1 and C2, and then vary the condenser, C3, across the 600 coil until signals are at a maximum, then tune in a distant station and make a final adjustment of the condenser, C3. This need not be touched again, and all tuning is now done on condensers, C1 and C2. The tuning of C2 is very sharp, and a vernier is essential, but it is not necessary to use a vernier in conjunction with C1.

Once a station is logged it will always come in at the same settings of the condensers, and if the wavelength of one station is close to another, only the vernier of C2 may need altering to go from the one station to the other.

No L.F. valves need be incorporated in the set, as every wise amateur should make up an efficient low-frequency amplifier which can be used with any type of receiver.

If a frame is used, the first former will not be required, and the connections go direct to the position occupied by the 60 turns of the former in the diagram.

F. G. S.



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Why is the Igranic-Pacent Porcelain Rheostat so particularly suitable? The reason is obvious as soon as you examine it. The Igranic-Pacent Rheostat is thoroughly dependable—any amount of rough travelling will not put it out of adjustment.

Users of the Igranic-Pacent Rheostat appreciate it as a well-made component, designed to do its job well and to keep on doing it under all sorts and conditions of service. It is compact too—it takes up very little space in a portable set.

Smoothness of control and quiet operation are additional advantages appreciated by users of all types of sets, portable or otherwise. The highly finished Bakelite knob and the attractive dial improve the appearance of any receiver.

Rheostats of 6, 10, 20, 30 and 50 ohms. or a Potentiometer of 400 ohms. are obtainable, and the price is the same for each—half-a-crown.

Ask your dealer to show you this and all Igranic-Pacent Radio Essentials.

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The IGRANIC Instructional Carton
contains a comprehensive, fully illustrated descriptive handbook, full-size general arrangement drawings, wiring diagrams and drilling template for constructing a six-valve Supersonic Heterodyne Receiver according to the Igranic design. Obtain a copy from your dealer.
PRICE 2/6.

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THE
Igranic-Pacent Rheostat
is also obtainable with Bakelite base, as illustrated above — in the same resistances at 4/- each.

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NOTE.—*In the following list of transmissions these abbreviations are observed: con. for concert; lec. for lecture; orch. for orchestral concert; irr. for irregular; m. for metres; and sig. for signal.*

GREAT BRITAIN

The times given are according to British Summer Time.

London (2LO), 364 m. 1-2 p.m., con. (Tues., Thurs, Fri.); 3.15-3.45, transmission to schools; 3.30-5.30, con. (Sun.); 4-5 p.m., con.; 5.15-5.55, children; 6 p.m., light music; 7-8 p.m., time sig., news, music, talk; 8.10-10 p.m., music; 9.0, news (Sun.); 9.30 p.m., time sig., news, talk; 10 p.m., special feature (Mon., Wed., Fri.). Tues. and Thurs. the Savoy Bands are relayed until 11.30 p.m., and on Sat. until midnight.

Aberdeen (2BD), 495 m. **Belfast** (2BE), 440 m. **Birmingham** (5IT), 479 m. **Bournemouth** (6BM), 386 m. **Cardiff** (5WA), 353 m. **Glasgow** (5SC), 422 m. **Manchester** (2ZY), 378 m. **Newcastle** (5NO), 404 m. Much the same as London times.

Bradford (2LS), 310 m. **Dundee** (2DE), 315 m. **Edinburgh** (2EH), 328 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 321.5 m. **Liverpool** (6LV), 331 m. **Nottingham** (5NG), 326 m. **Plymouth** (5PY), 338 m. **Sheffield** (6FL), 301 m. **Stoke-on-Trent** (6ST), 306 m. **Swansea** (5SX), 482 m. **Daventry** (25 kw.), high-power station, 1,600 m. Special weather report 10.30 a.m. and 10.25 p.m. (weekdays), 9.10 p.m. (Sun.); 11.0 a.m., light music (exc. Sat. and Sun.); relays 2LO from 4 p.m. onwards, own con. on Mon. Dance music daily (exc. Sun.) till midnight; on first Friday in each month until 2 a.m.

IRISH FREE STATE.

Dublin (2RN), 397 m. Daily, 7.30 p.m. Sundays, 8.30 p.m. until 10.30 p.m.

CONTINENT

The Times are according to the Continental system; for example, 16.30 *is* 4.30 *p.m., and* 08.00 *is* 8 *a.m. B.S.T.*

AUSTRIA.

Vienna (Radio Wien), 582.5 m. and 531 m. (temp.) (10 kw.). 11.00, con. (almost daily); 15.30, con.; 19.25, news, weather, time sig.; con., lec., news; 20.00, con.; 22.00, dance (Wed., Sat.).

Graz, 402 m. (1 kw.). Relay from Vienna. Also own con. (Tues., Wed., Fri.), 20.10.

BELGIUM.

Antwerp, 265 m. (100 w.). Relays Brussels.

Brussels, 482 m. (1½ kw.). 17.00, orch. (Tues., Thurs., Sat. only), news; 20.00, lec., con., news (opera, Mon. and Wed.).

CZECHO-SLOVAKIA.

Prague, 368 m. (5 kw.). Con., 20.00-23.00, daily. Also tests on 398.5 m.

Brunn (OKB), 521 m. (2.4 kw.). 10.00, con., news (Sun.); 19.00, lec., con. or dance (daily).

DENMARK.

Copenhagen (Radioraadet), 347.5 m. (2 kw.). Sundays: 15.30, lec.; 17.30, children; 20.00, play; 21.15, news, con.; 21.15, news, Esperanto (Mon.), silent night. Weekdays (Tues., Fri., Sat.); 20.00, lec., con., news, con.; 21.30, dance (Sat.).

Ryvang, 1,150 m. (1 kw.). Sundays: 09.00, sacred service.

Odense, 810 m. Relays Copenhagen.

Sorö,* 1,150 m. (1½ kw.). Relays Copenhagen. Also broadcasts at times on 1,500 m.

FINLAND.

Helsingfors (Skyddskar), 504 m. (500 w.). Temporarily closed down.

Helsingfors, 440 m. Con., 18.00 (Tues., Thurs., Sat., Sun.).

***Tamafors**, 368 m.

***Jyvaskyla**, 561 m. (200 w.).

***Uleaborg**, 233 m. (200 w.).

* Relay Helsingfors.

GRAND DUCHY OF LUXEMBURG.

Radio Luxemburg (LOAA), 1,200 m. Con.: 14.00 (Sun.), 21.00 (Thurs.).

FRANCE.

Eiffel Tower, 2,650 m. (5 kw.). 06.40, weather (exc. Sun.); 11.00, markets (exc. Sun. and Mon.); 11.20, time sig., weather; 15.00, 16.45, Stock Ex. (exc. Sun. and Mon.); 18.00, talk, con., news; 19.00 and 23.10, weather; 21.00, con. (daily).

Radio-Paris (CFR), 1,750 m. (about 3 kw.). Sundays: 12.45, con., news; 16.30, Stock Ex., con.; 20.15, news, con. or dance. Weekdays: 10.40, news; 12.30, con., markets, weather, news; 16.30, markets, con.; 20.15, news, con. or dance.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 458 m. (800 w.). 07.00, physical exercises; 14.00 or 15,00, studio con. or outside relay; 20.30, lec. (almost daily); 21.00, con. (daily).

Le Petit Parisien, 333 m. (temp.) (1 kw.). 21.15, con. (Tues., Thurs., Sat., Sun.).

Radio L.L. (Paris), 350 m. (250 w.). Con. (Mon., Wed., Thurs.), 20.30.

Radio-Toulouse, 430 m. (2 kw.). 12.30, con., time sig. (daily); 17.30, news (exc. Sun.); 20.45, con.; 21.25, dance (daily). Also operatic relays on 500 m., occasionally.

Radio-Lyon, 280 m. (2 kw.). 20.20, con. (daily).

Radio Agen, 318 m. (250 w.). 12.40, weather, Stock Ex.; 20.00, weather, Stock Ex.; 20.30, con. (Tues., Fri.).

***Lyon-la-Doua**, 488 m. Own con., 20.00 (Mon., Wed., Sat.).

***Marseilles**, 351 m. (500 w.).

***Toulouse**, 280 m. (2 kw.).

***Bordeaux**, 411 m.

* Relays of PTT Paris.

Montpelier, 220 m. (1 kw.). Relays Radio Toulouse.

Angers (Radio Anjou), 300 m. (500 w.). Daily: 20.30, news, lec., con.

Bordeaux (Radio Sud-Ouest), 330 m Con., 22.00 (Mon., Fri.).

Mont de Marsan, 390 m. (300 w.). Con. (weekdays only), 20.30.

GERMANY.

Berlin, on both 504 and 571.5 m. (4 kw.). 06.30, con. (Sun.); 09.00, sacred con. (Sun.); 11.00, con. and tests; 12.55, time sig., news, weather; 15.00, educ. hour (Sun.), markets, time sig.; 17.30, orch.; 20.30, con., weather, news, time sig., dance music until 24.00 (exc. Tues. and Fri.). Relayed on 1,300 m. by Königswusterhausen and Stettin (241 m.).

Königswusterhausen (LP), 1,300 m. (8 kw.). 11.30-12.50, relays Berlin (Sun.); 15.00, lec. (daily); 18.30, relay of Berlin (Vox Haus) con. (daily). 2,525 m. (5 kw.), Wolff's Buro Press Service: 06.45-20.10. 2,880 m., Telegraphen Union: 08.30-19.45, news. 4,000 m. (10 kw.), 07.00-21.00, news.

Breslau, 418 m. (4 kw.). 12.00, con. (daily), Divine service (Sun.); 12.55, time sig. (Sun.), weather, Stock Ex., news; 16.00, children (Sun.); 17.00, con.; 19.00, lec.; 20.30, con., weather, time sig., news, dance (relays Berlin). Relay: Gleiwitz, 251 m.

Frankfort-on-Main, 470 m. (1½ kw.). 08.00, sacred con. (Sun.); 11.55, time sig., news; 12.55, Nauen time sig.; 16.00, con. (Sun.); 16.30, con.; 18.00, markets, lec.; 20.00, lec., con., weather. Dance: relays Berlin. Relay: Cassel, 273.5 m.

Hamburg, 392 m. (4 kw.). Relayed by Bremen (279 m.), Hanover (294 m.), Kiel (233 m.) Sundays: 07.25, time sig., weather, news, lec.; 09.15, sacred con.; 13.15, con.; 18.00, con.; 19.15, sports, weather, con. or opera, dance. Weekdays: 05.45, time sig., weather; 07.00 and 07.30, news, weather; 12.55, Nauen time sig., news; 14.00, weather, con.; 16.15 and 18.00, con.; 19.00, lec.; 19.55, weather and con.; 22.00, dance (daily, exc. Tues.).

Königsberg, 462 m. (1 kw.). 09.00, sacred con. (Sun.); 12.55, time sig., weather, news; 16.30, con.; 17.00, con. (Sun.); 19.30, lec.; 20.00, con. or opera, weather, news, dance (irr.).

Leipzig, 452 m. (700 w.). Relayed by Dresden (294 m.). 08.30, sacred con. (Sun.); 11.00, educ. hour (Sun.); 12.00, con. (daily); 12.55, Nauen time sig., news; 16.30, con., children (Wed.); 20.15, con. or opera, weather, news, cabaret or dance (not daily).

Munich, 487.5 m. (3 kw.). Relayed by Nuremberg (340 m.). 11.30, lec., con. (Sun.); 14.00, time sig., news, weather; 16.00, orch. (Sun.); 16.30, con. (weekdays); 18.30, con. (weekdays); 19.15, lec.; 19.30, con. (Sun.).

Munster, 412 m. (1 kw.). Relayed by Elberfeld (259 m.), Dortmund (283 m.). 11.45, radio talk, Divine service; 12.00, news (Sun.); 12.30, news (weekdays); 12.55, Nauen time sig.; 15.30, news, time sig.; 16.00, con.; 17.00, children (Sat.); 19.40, news, weather, time sig., lec., con.

Norddeich (KAV), 1,800 m. 24.00 and 04.00, weather and news.

Stuttgart, 447 m. (1½ kw.). 11.30, con. (Sun.); 16.30, con. (weekdays); 17.00, con. (Sun.); 18.30, time sig., news, lec., con. (daily); 21.15, time sig., late con. or cabaret.

HOLLAND.

Amsterdam (PCFF), 1,955 m. (1 kw.). Daily: 06.35-15.30 (exc. Mon. and Sat., when 12.30-13.30), news, Stock Ex.

Hilversum (HDO), 1,050 m. (2½ kw.). 09.00, sacred service (Sun.); 19.10, con.; 21.00, news, etc. Testing on 25 kw.

HUNGARY.

Buda-Pesth (Csepel), 560 m. (2 kw.). 09.00, news; 12.00 and 15.00, weather, news; 17.00, dance music; 20.00, con. or opera, dance.

Kosice, 2,020 m. (2½ kw.). 19.00, con.

ICELAND.

Reykjavik, 327 m. (700 w.). Tests: 22.30, 24.30.

ITALY.

Rome (1RO), 425 m. (3 kw.). 10.30, sacred con.; 13.15, official communique; 17.00, children; 17.30, relay of orch from Hotel di Russia; 17.55, news, Stock Ex., jazz band; 20.30, news, weather, con.; 22.15, late news.

Milan, 320 m. (2 kw.). 20.00-01.00, con., jazz band. Testing on 425 to 430 m.

JUGO-SLAVIA.

Belgrade (Rakovitza) (HFF), 1,650 m. (2 kw.). 17.00, news (daily), con. (Tues., Thurs., Sat.).

Agram (Zagreb), 350 m. (500 w.).

LETTLAND.

Riga, 488 m. (2 kw.). Con. daily, 21.00-22.00.

NORWAY.

Oslo, 382 m. (1.2 kw.). 11.00, Divine service (Sun.), Stock Ex. (weekdays); 13.15, markets; 19.15, news, time, lec., con.; 22.00, time, weather, news, dance relayed from Hotel Bristol, Oslo (not daily).

Bergen, 358 m. (1½ kw.). 19.30, news, con., etc.

POLAND.

Warsaw, 480 m. (6 kw.). Daily: con., 11.00-13.00; 15.00-23.00, daily.

RUSSIA.

Moscow (RDW), 1,450 m. (12 kw.). Weekdays: 12.30 and 17.55, news and con.; 23.00, chimes from Kremlin.

(Popoff Station), 1,010 m. (2 kw.). 10.00, 11.00, lec.; 13.00, 19.00, con. (Tues., Thurs., Fri.).

Radio Peredacha, 410 m. (6 kw.).

(*Concluded on page* 770)

To 6-Volt Users—

BETTER RESULTS AT A SIXTH OF UPKEEP COSTS

Osram D.E.8.

(H.F.) for 6-Volt Accumulators (L.F.)

Only 0·12 Amp. Filament current consumption at 5·6 Volts

THE introduction of the D.E.8, H.F. and L.F. OSRAM VALVES is a big advance in 6-volt valve construction. As D.E.2 OSRAM VALVES have established an unassailable reputation for better 2-volt reception, the D.E.8 types now come to the aid of 6-volt accumulator users.

D.E.8. OSRAM VALVES enable you to change over from extravagant bright emitter valves to dull emitter 6-volt valves consuming one-sixth of the current consumption *with no alteration* to your filament rheostat. They provide better characteristics which make for louder and clearer reception, and the maximum sensitivity for getting distant stations. Accumulator expenses are reduced to a fraction of what they ordinarily are with definitely a big increase in efficiency. It is NOT now necessary to maintain a bulky 6-volt accumulator to operate satisfactorily a 6-volt valve.

As a sensitive Detector the D.E.8. H.F. OSRAM VALVE is unsurpassed, and the addition of a "Neutrodyned" H.F. Amplifier brings in the most elusive and distant stations with remarkable ease and volume.

For more volume, greater purity and lower running costs, use the D.E.8. L.F. as a low-frequency amplifier. It may also be used as an exceedingly economical small power valve.

From the time D.E.8 OSRAM VALVES are first put into service until their veteran days, they give the same satisfying volume and tone. By using OSRAM Dull Emitter Valves you are assured of a constant unvarying electron emission throughout a long and useful life. Behind them is the longest experience in the manufacture of dull emitter valves in the country.

Characteristics: H.F. Type.

Filament Volts	5·6—6.
Filament Current	0·12 *amps.*
Anode Volts	40—120.
Impedance	25,000 *ohms.*
Amplification Factor	16.

Characteristics: L.F. Type.

Filament Volts	5·6—6.
Filament Current	0·12 *amps.*
Anode Volts	20—100.
Impedance	8,000 *ohms.*
Amplification Factor	7.

PRICE 22/6 EACH

GET THE BEST OUT OF YOUR SET

With a 6-volt accumulator, use D.E.8 OSRAM VALVES (D.E.8 H.F. as Detector).

Use an OSRAM D.E.5 Power Valve in the last stage:

Osram Valves

for Broadcasting

The G.E.C.- your guarantee

Advt. of The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

"BROADCAST TELEPHONY" (*cont. from page 768*)

Trades Union Council Station, 450 m. (2 kw.). 18.00, con. (Mon., Wed.).

Leningrad, 940 m. (2 kw.). Weekdays: 16.00.

Nijni Novgorod, 1,400 m. (1.2 kw.). 21.30, con.

SPAIN.

Madrid (EAJ6), 392 m. (1½ kw.). Daily: con. (times vary daily). Closes at 24.00 on Sun., Wed., Sat.

Madrid (EAJ7), 373 m. (4½ kw.). 17.30-24.00, con. (almost daily).

Madrid (EAJ4), 340 m. (3 kw.). 16.00, con.

Barcelona (EAJ1), 324 m. (3 kw.). 17.00-21.00, news, lec., con. (Sun.); 18.00-23.00 (daily).

Barcelona (Radio Catalana) (EAJ13), 462 m. (4½ kw.). 19.00-24,00, con., weather, news.

Bilbao (EAJ9), 415 m. (1 kw.). 19.00, news, weather, con. Close down 22.00.

Bilbao (Radio Vizcaya) (EAJ11), 418 m. (2 kw.). 22.00-24.00, con. (daily).

Cadiz (EAJ3), 357 m. (550 w.). 19.00-21.00, con., news. Tests daily (Mon., Tues., Wed., Sat.), 24.00.

Cartagena (EAJ15), 335 m. 19.00-22.00, con. (daily).

Seville (EAJ5), 357 m. (1½ w.). 21.00, con., news, weather. Close down 23.00.

Seville (EAJ17), 300 m. 19.00-22.00, con. (daily).

San Sebastian (EAJ8), 343 m. (500 w.). 17.00-19.00, 21.00-23.00 (daily).

Salamanca (EAJ22), 405 m. (1 kw.). 17.00 and 21.00, con. (daily).

Saragossa, about 325 m. Testing.

SWEDEN.

Stockholm (SASA), 430 m. (1 kw.). 11.00, sacred service (Sun.); 12.30, weather; 14.00, con. (Sun.); 17.00, children (Sun.); 18.00, sacred service; 19.00, lec.; 21.15, news, con., weather. Dance (Wed., Sat.).

Relays.—Boden (SASE), 1,200 m.; Eskilstuna, 250 m.; Falun (SMZK), 370 m.; Gothenburg (SASB), 288 m.; Gefle, 325 m.; Helsingborg, 235 m.; Joenkoeping (SMZD), 265 m.; Kalmar, 253 m.; Karlsborg, 1,250 m.; Karl-Sundsvall (SASD), 545 m.; Trollhattan scrona (SMSM3), 196 m.; Kristinehamm (SMTY), 202 m.; Karlstadt (SMXC), 221 m.; Linkoeping, 467 m.; Malmo (SASC), 270 m.; Norrkoeping (SMVV), 260 m.; Orebro, 218 m.; Ostersund, 720 m.; Säffle (SMTS), 245 m.; (SMXQ), 322 m.; Umea, 215 m.; Varborg, 340 m.

SWITZERLAND.

Lausanne (HB2), 850 m. (1½ kw.) (temp.). 20.00, lec., con. (daily).

Zurich (Hongg), 513 m. (temp.) (500 w.). 11.00, con. (Sun.); 12.00, weather; 12.55, Nauen time sig., weather, news, Stock Ex.; 13.30, piano solo; 17.00, con. (exc. Sun.); 18.15, children, women; 19.00, news, weather; 20.15, lec., con., dance (Fri.).

Geneva (HB1), 760 m. (2 kw.). 20.15, con. (daily).

Berne, 434 m. 10.30, organ music (exc. Sat.); 16.00, 20.30, con.

Basle. Testing.

CHIEF EVENTS OF THE WEEK

SUNDAY, MAY 30

London	Shakespeare's Heroines.
Cardiff	*Outpost* (A. G. Prys-Jones).

MONDAY

London	Burns' Songs and Poetry.
Aberdeen	"Jutland." A Sound Effect Cameo.
Birmingham	*The Wizard of Wireless.*
Newcastle	A Northumbrian Concert.

TUESDAY

London	*Wolf I. Wolf I* A Mystery Competition Play.
Belfast	Manx Music.

WEDNESDAY

London	John Henry's Concert Party.
Hull	Treasure Trove—From Past and Present.
Liverpool	Chamber Music.
Newcastle	The Wallsend Male Voice Quartet.
Nottingham	The St. Hilda Colliery Band.
Plymouth	A Joyous June Jumble.

THURSDAY

London	*Wolf I Wolf I* (Part 2).
Bournemouth	The King's Birthday—British Programme.

FRIDAY

London	Weber Centenary.
Cardiff	G.W.R. Staff Concert.
Manchester	*The Last.*

SATURDAY

Aberdeen	Aberdeen Musical Festival—Prizewinners Concert.
Cardiff	"Wit of the West."
Glasgow	"Round the Camp Fire."
Manchester	Masters of Opera—Verdi.

TRADE NOTES

We have received from the General Electric Co., Ltd., of Magnet House, Kingsway, the April issue of the *Osram Bulletin,* a monthly magazine of great interest to wireless dealers and traders.

A useful valve chart, showing the characteristics of Burndept, Mullard, B.T.H., Marconi and Osram, Cosmos, Cossor and Ediswan valves, has been issued by Burndept Wireless, Ltd., of Bedford Street, Strand, W.C.2.

An interesting relay, to take place on June 19, will be that from the Crystal Palace of the National Union of School Orchestras, numbering some 4,000 juvenile performers.

It is proposed to broadcast on June 20 the service held at Lincoln Cathedral, which will include an address by Archdeacon Blackie, Chaplain to the King.

"BANISH YOUR BATTERY TROUBLES!" (*continued from page 760*)

else a short-circuit of the mains may occur.

By inserting a Neon tube in the positive lead of the H.T. supply the ripple of D.C. mains will be still further reduced. This method, which is to be recommended, is shown diagrammatically in Fig. 11. With this smoothing system all hum is practically eliminated. The complete smoother may be mounted in a box, as has been done with the well-known commercial smoother seen in one of the photographs (Fig. 12) and which employs a Neon tube.

A. L. P.

Mains Voltage	*Primary Winding*		*Secondary Windings*		
	No. of Turns	*Gauge*	*12-volt Secondary*	*400-volt Secondary*	*30-volt Secondary*
100	400	20	48 turns of No. 20 d.c.c. wire tapped at the 24th turn.	1600 turns of No 36 d.s.c. wire tapped at the 800th turn.	120 turns of No. 18 d.c.c. wire.
110	440	22			
200	800	23			
210	840	23			
220	880	24			
230	920	24			
240	960	24			
250	1000	24			
260	1040	24			

CUT OUT THE CRACKLE

Fit C.E. Precision Rheostats throughout your set and be rid of those irritating crackling noises. Beautifully finished, fitted with a neat silvered dial and accurately calibrated, they greatly enhance the appearance of any set. One hole fixing makes their incorporation a simple matter.

	Retail Prices
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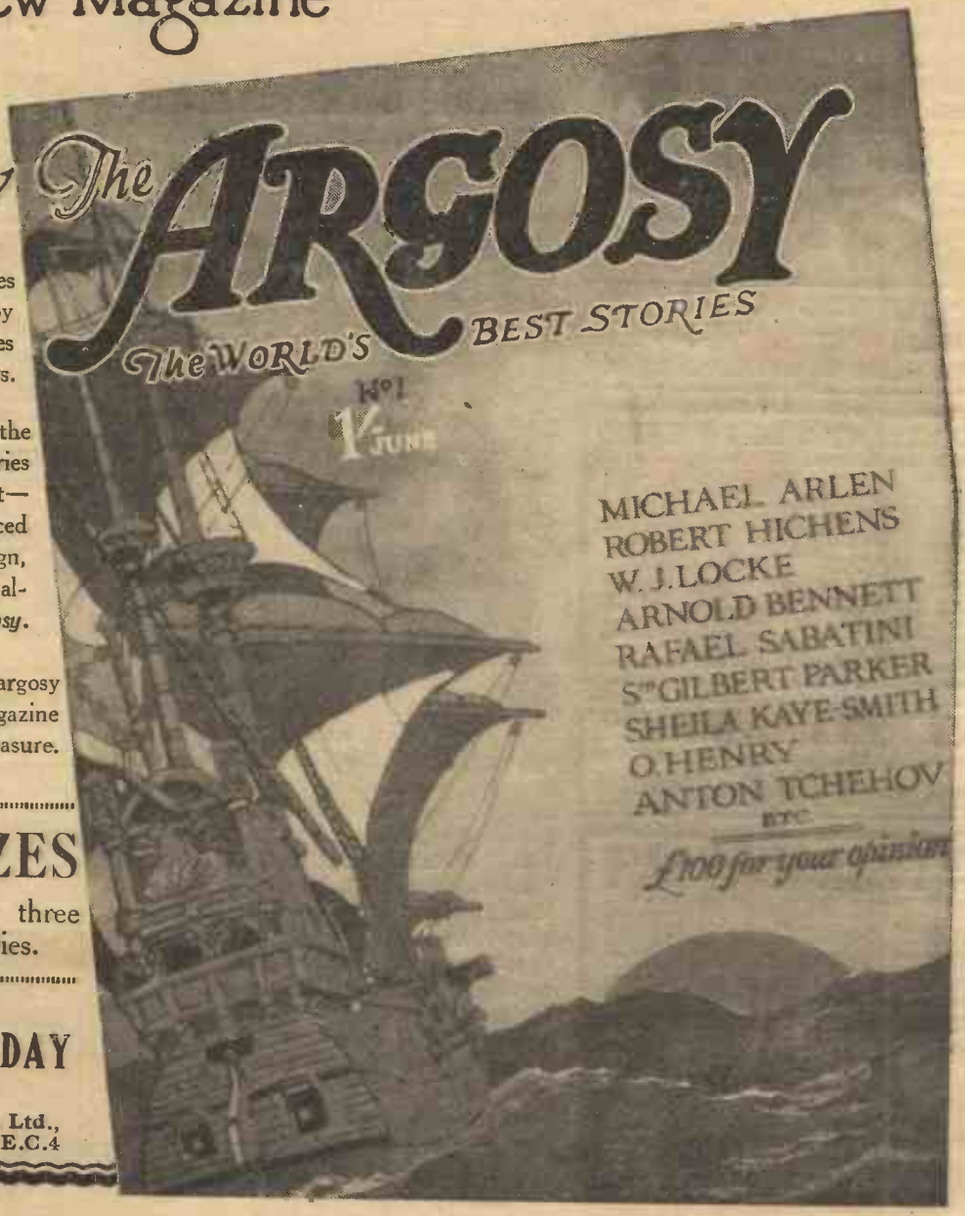

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SUGGESTED NEW WAVELENGTHS

FOR EUROPEAN BROADCASTING STATIONS

AT the International Conference of European broadcasters, which was held at Geneva in March with the object of devising a scheme to avoid interference, the following table of altered wavelengths for the more important stations, based on tests made at various times, was put forward for consideration:

	Metres
Toulouse (P T T)	245.9
Brussels	265.5
Barcelona (E A J 1)	280.4
Dortmund	283
Birmingham	288.5
Münster	303
Bournemouth	306.1
Newcastle	312.5
Milan	315.8
Leipzig	322.6
Belfast	326.1
Prague	348.9
Breslau	357.1
London	361.4
Graz	363.8
Oslo	370.4
Stuttgart	379.7
Manchester	384.6
Radio-Toulouse	389.6
Frankfort	394.7
Glasgow	405.4
Berne	411
Stockholm	416.7
Rome	422.6
Hamburg	428.6
Brunn	441.2
Paris (P T T)	447.8
Lyons	476.2
Berlin (Witzleben)	483.9
Aberdeen	491.8
Zurich	500
Vienna (Rosenhuegel)	517.2
Munich	535.7
Buda-Pesth	555.6
Berlin (Magdeburgerplatz)	566
Madrid (E A J 6)	577
Vienna	588.2

Apart from the smaller relay stations to which a series of common wavelengths may be allotted, it would appear that but very slight alterations will be effected in the wavelengths of those stations not mentioned in this list. Of course, before these new wavelengths can be brought into operation, authority from the respective governments must be obtained. J. G. A.

SPARK INTERFERENCE

MUCH of the interference experienced by broadcast listeners situated near the coast-line arises from the increasing use of wireless direction-finding installations. The calls are morsed on a wavelength of 450 metres, which with spark transmission means an overlap up to 100 metres on each side. To make matters worse, coastal and sea-going vessels are also allotted wavelengths of 300 and 600 metres, either of which can be used at will.

Between the three wavelengths none of the short-wave B.B.C. stations are free from interference. The only effective remedy is to load up the set to receive Daventry, as ordinary selective tuning, or the use of wave-traps, seems quite unable to cope with this form of nuisance.

M. A. L.

"A Dovecote for the Garden" is the title of an article appearing in the current issue of "The Amateur Mechanic and Work" (3d.), and describes the construction of a house where birds may come and go at pleasure and live an unrestricted natural life. Other articles appearing in the same number are: "The War Against Rust," "Making a Lady's Work-table," "Accumulators: Their Action, Care and Maintenance," "In the Metalworker's Shop: Accurate Drilling," "Choosing a Speedometer for Motor-cycle," "A Convertible Wireless Three-valve Set," "Building a Poultry House," "A Beautiful Ship Model in Nickel," "The Reflecting Telescope and How to Use It," "Pendulums for Electric Clocks: A Convenient Suspension Bracket and Spring," etc.

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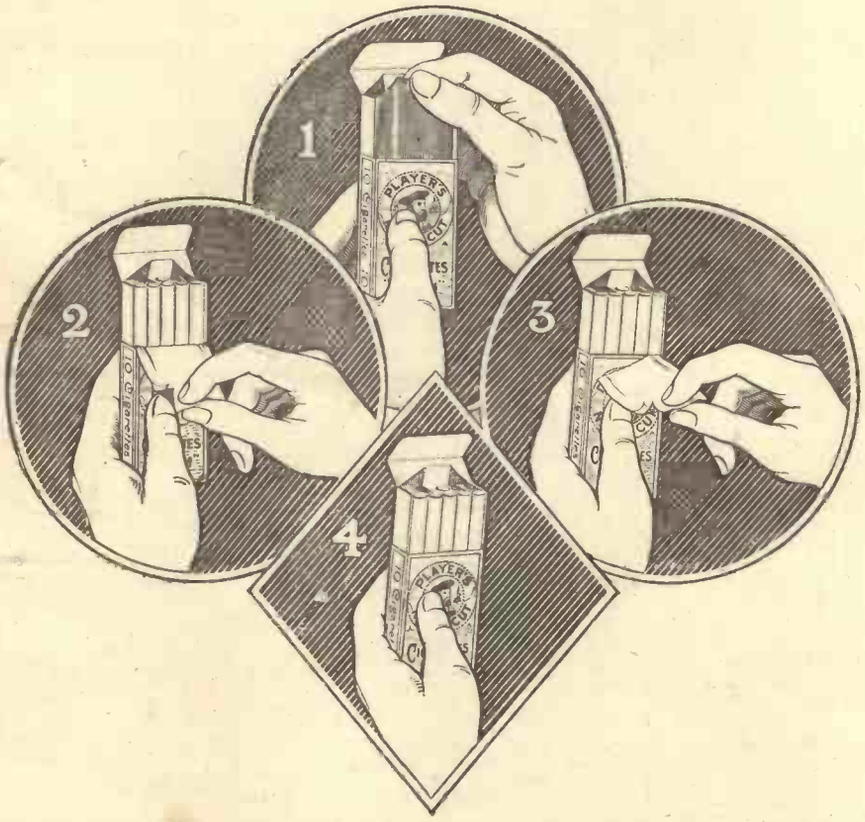

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