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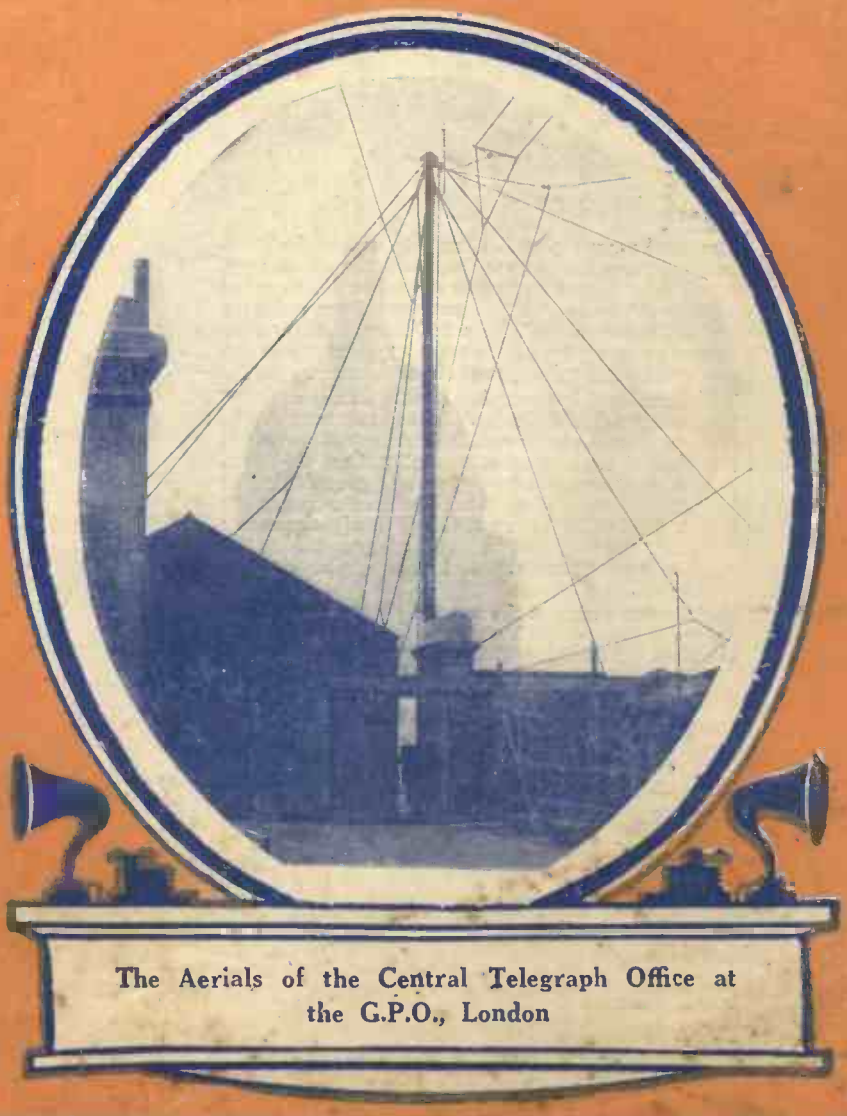

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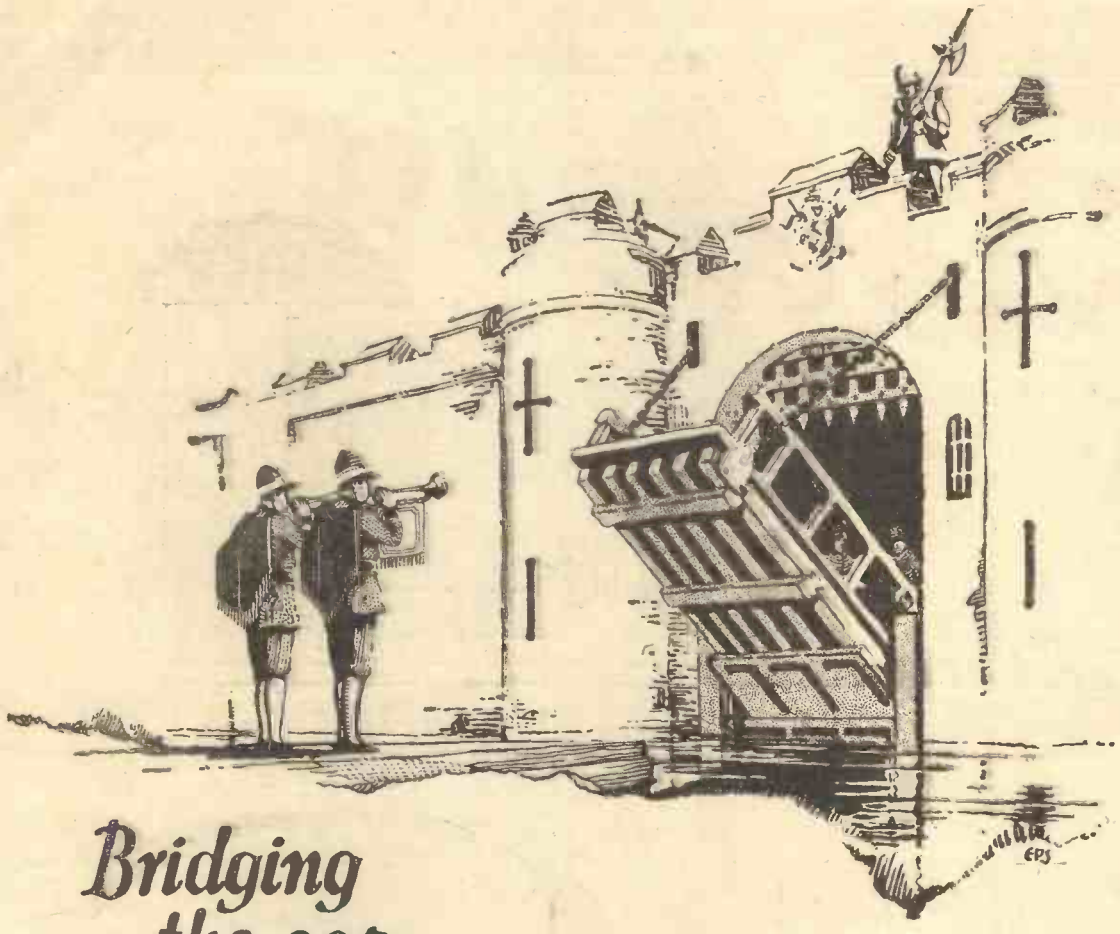

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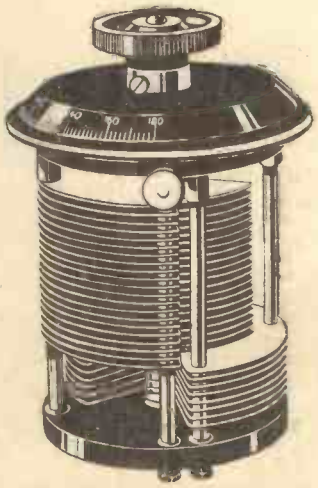

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Amateur Wireless and Electrics

The Leading Radio Weekly for the Constructor, Listener and Experimenter

Edited by BERNARD E. JONES
Technical Adviser: SYDNEY BRYDON, D.Sc., M.I.E.E.

Vol. VIII. No. 191 — JANUARY 30, 1926

Chief Contents

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THE TRUTH ABOUT THE H.F. AMPLIFIER

A RATHER remarkable feature about the feats of ultra-long-distance reception that are reported from time to time is that a very large number of them are accomplished either with single-valve sets or with two-valve receivers consisting of a rectifier and a note magnifier. This might seem at first sight to show that the use of high-frequency amplification in any form has been found unnecessary or even undesirable by our most experienced amateurs; but, as we shall see in a moment, this is not actually the case. There can be no doubt that with a properly constructed single-valve set with or without an added note magnifier enormous distances can be covered.

The purpose of the reaction coil is to feed into the grid circuit of the rectifier energy sufficient to neutralise the damping introduced by the aerial and earth system, by the inductance and by other parts of the set. The single-valve set with reaction—provided that the set is so designed that full use can be made of reaction—is therefore one of the most sensitive forms of receiver that we have.

Note that I make the proviso that the set must be such that *full* use can be made of reaction. In many receiving sets owing largely to the effects of stray couplings the valve does not go quite smoothly into oscillation, but jumps into that condition with a loud "plock" long before the point of maximum sensitiveness is reached.

As regards long-distance reception with the single-valve set, an examination of reports will show that the majority of outstanding feats were accomplished upon continuous-wave signals, to receive which the set must be oscillating so as to produce the necessary heterodyne. It is quite possible to receive telephony from across the Atlantic with one valve, but when one does so the set must be operated so close to the point of oscillation that distortion and indistinctness are bound to occur. Further, when the receiver is near the oscillating point its extraordinary sensitiveness causes it to bring in a great deal of interfering noises in the form of tiny atmospherics.

When we use high-frequency amplification we are treating the rectifying valve in quite a different way. We no longer attempt, to anything like the same extent at all events, to eliminate damping by feed-back methods; we obtain our results by applying to the grid of the detector valve bigger voltage variations. It is a peculiarity of the thermionic valve that its efficiency is raised enormously if the magnitude of the voltage changes applied to the grid is increased. In fact if we double the amplitude of the incoming waves we obtain four times the rectified current

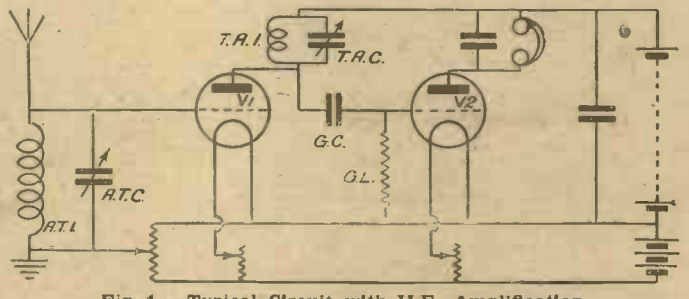


Fig. 1.—Typical Circuit with H.F. Amplification.

One stage of efficient high-frequency amplification will just about double the amplitude of the waves brought in by the aerial before they are passed on to the rectifier. A second stage will not produce a further doubling, for when they are used in cascade, the efficiency of H.F. amplifying stages falls off considerably; still, a second stage will give a further increase in amplitude. Thus by making use of high-frequency amplification we can greatly increase the efficiency of the recti-

fier and produce a large rise in the current variations delivered to the telephones.

A Typical Circuit

Fig. 1 shows a popular circuit using a single stage of high-frequency amplification. Here the coupling between the high-frequency valve V1 and the rectifier V2 is by means of the tuned-anode method. If the two inductances, that tuning the aerial and that tuning the anode of the first valve, are so placed that interaction between them is reduced to a minimum, this circuit may be stabilised completely with the potentiometer slider almost at the negative end of its travel. Such an arrangement of valves has a very great deal to recommend it since, though no magnetic reaction is used, the set is extremely sensitive and can be relied upon to bring in long-distance telephony without distortion and with much less mush than comes in in the case of a single-valve set with reaction pushed almost to its limit.

Reaction effects may be obtained when required by the use of the potentiometer which regulates the potential of the grid of the high-frequency valve. Owing to the capacity between the grid and plate of this valve there is a coupling between the anode and grid circuits which can be regulated by means of the potentiometer.

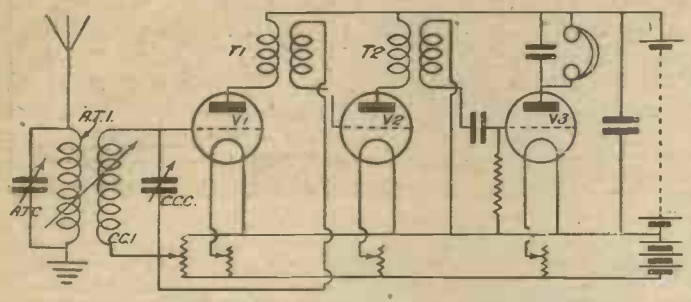


Fig. 2.—Circuit with Two Stages of H.F. Amplification.

A Common Objection

One of the objections commonly urged against the use of high-frequency amplification is that it produces instability. It is certainly true that a receiving set containing two or more stages of H.F. amplification may be very much harder to handle in certain ways than a single-valver; but it is quite possible to build a perfectly stable receiving set with two high-frequency stages, and such a set is, so far as my experience goes, not harder but easier to handle than the average single-valver. No one, however skilled he may be, can tune in a very weak signal with a single-valve set without a chirp or two, though the experienced wireless man will confine the interference caused to others to a matter of a second or two. With a circuit such as that shown in Fig. 2, in which two stages of high-frequency amplification are used, any signal within the range of the receiving set may be tuned in without its carrier wave being heard at all. The couplings used after the two H.F. valves V1 and V2 in this case are transformers of the aperiodic type. These are wound with resistance wire so as to "flatten" their tuning.

Aperiodic transformers of good design which will give a very respectable degree of amplification over the whole broadcast waveband are obtainable at quite reasonable prices. When using them it must be remembered that it is essential to mount them in such a way that there is no interaction between them and that stray couplings between them and the aerial and secondary inductances are reduced to a minimum. Such a set is delightfully easy to handle, since there are only two controls, and it brings in telephony with wonderful purity. At the same time it is not nearly so efficient as one employing sharply-tuned high-frequency couplings. If you desire perfect stability you must sacrifice efficiency to some extent.

Conclusions

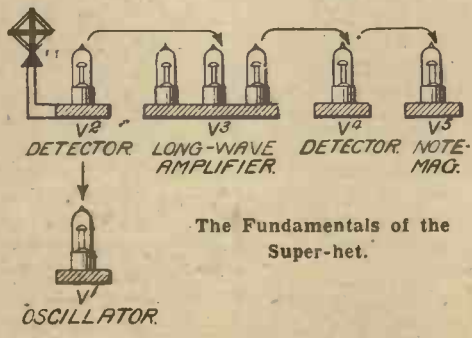
My own view is that for reception of long-distance morse signals the single valve, with or without the addition of a note magnifier, is the best thing to use. For short-wave work, too, that is, for reception below about 180 metres, high-frequency amplification is quite out of place; short-wave signals come through as a rule with extraordinary strength, and no form of high-frequency coupling can be made stable enough to be satisfactory with very high frequencies. For telephonic reception upon the broadcast waveband and the higher wavelengths I would strongly recommend the use of high-frequency amplification where great range is desired. The beginner should make his first attempts with aperiodic or semi-aperiodic couplings, and as he becomes more skilled he can progress to tuned-anode or transformer systems. J. H. R.

THE SUPER-HET SIMPLY EXPLAINED

PERHAPS the chief reason for the comparative scarcity of super-heterodyne receivers in this country is because many amateurs think that they are two complicated for everyday use. There seems to be a widespread idea that the super-het is quite different to other types of receiver and that it is rather too difficult for the average listener.

This is quite a mistaken idea, because the super-het is not particularly complicated or mysterious. A glance at the diagram will make things tolerably clear; the minute oscillations circulating in the frame aerial are applied to the grid of the first detector valve and rectified. The wavelength is then increased by means of the separate oscillator and "pick-up" coil to 10,000 metres or so; the currents are then passed through a three-valve amplifier and finally rectified by the second detector. After this the signals may be amplified at low-frequency in the usual way.

Once the fundamental principle of the super-het is properly understood there is no reason why the construction and operation of the set should present any special difficulty. The amateur should be careful



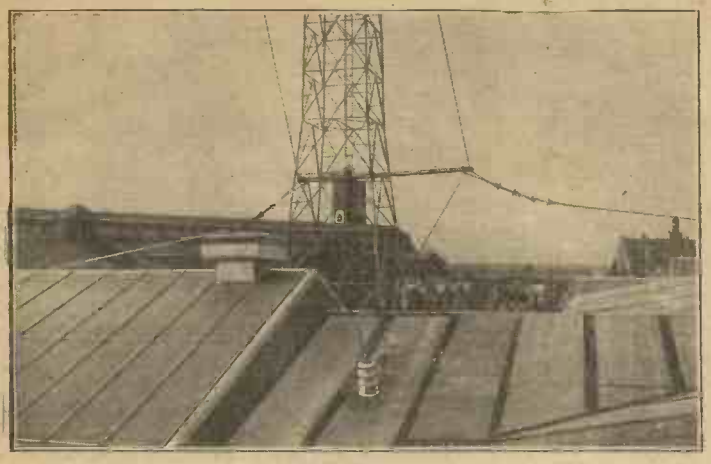
The Fundamentals of the Super-het.

to purchase high-quality parts and should pay the fullest attention to the choice of the transformer "kit." A glance at the advertisement columns of "A.W." will reveal many excellent kits for the super-het.

The tuning is rather difficult at first. The same station will come in on two settings of the oscillator coupler; it is a matter for experiment to find out which of these settings give the best results.

The tuning is highly critical, and the amateur would be well advised to incorporate a vernier device with the main variable condenser. For this purpose either the geared dials now on the market or a neutrodyne condenser will be found equally satisfactory.

In conclusion, choose the type of super-het which most appeals to you. Follow the directions given as carefully as possible and invest in the best components you can afford. Take plenty of time on the construction of the set and pay special attention to the wiring. Test the connections thoroughly before using the receiver, and do not be disappointed if at first the results are not what you expected. After a few days' experience you will be thoroughly satisfied with results. G. J. M.



Aerial Base of 10 Kw. Lorenz Machine Broadcast Transmitter.

Dr. Schmidt in his Laboratory.

A RIVAL OF THE VALVE!

High-frequency Machines as Broadcast Transmitters. By Dr. ALFRED GRADENWITZ

AMATEURS listening in to the Berlin broadcasting station a short time ago were surprised to hear the following announcement: "Hallo, hallo. This is the C. Lorenz Company, of Berlin-Tempelhof. We are making tests with the new Lorenz-Schmidt high-frequency machine transmitter on 280 metres."

The early type of radio transmitter, of course, was based on the use of sparks emitting trains of electric waves. This was, after a number of years, superseded by the electric arc transmitter, and eventually by the valve, which by those interested in wireless engineering is generally considered the sole and ideal means of generating short waves as used in broadcasting. Much ingenuity has been expended in order to show that no machine transmitter could ever hope to reach results at all comparable with those recorded by the valve.

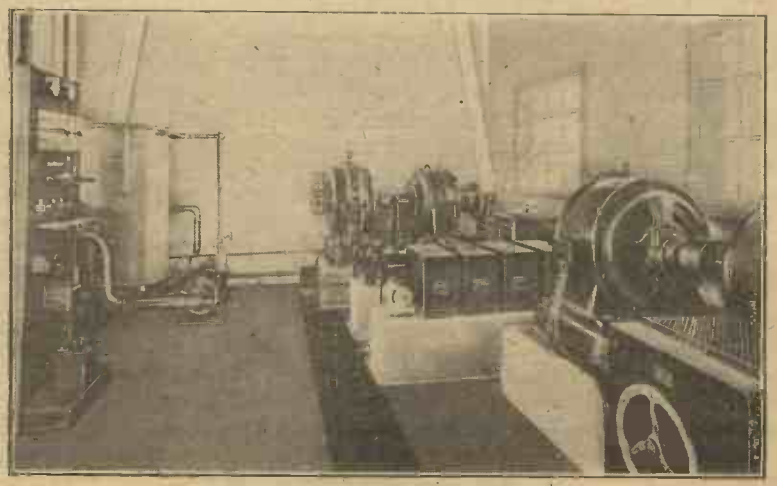
The frequency of currents generated by a machine is dependent on the number of poles and the speed of rotation of the rotor, which cannot be increased beyond a certain maximum lest the centrifugal forces exceed the internal forces keeping its structure together. The diameter of the rotor must accordingly be kept within certain limits, so that the stator ring can only accommodate a certain number of poles insulated in accordance with the requirements of safety. This is why a special arrangement for manifolding the fundamental frequency of the machine had to be provided. However, this by no means disposed of all the problems connected with the design of a machine transmitter for broadcasting purposes, another requirement being the keeping of the speed of the rotor, in spite of any fluctuations in load and voltage, at absolutely constant figures, any fluctuation of the number of revolutions being tantamount to an alteration of the wavelength, which would make the wave emission entirely unsuitable for broadcasting purposes.

500 Kw. Machine for Telegraphy.

Dr. K. Schmidt, chief engineer to the C. Lorenz Company, of Berlin-Tempelhof, has designed a speed controller affording a perfect solution of the problem, which is based on the following principle.

As the number of revolutions of the motor grows beyond its normal figure, it can be slowed down by short-circuiting the resistance inserted into the magnetic field. This, however, occurs at too late a moment, when the wave generated by the high-frequency machine has already undergone an alteration (shortening). The Schmidt speed controller, therefore, short-circuits this resistance once during each revolution of the rotor, the duration of the short-circuiting period being exclusively dependent on the number of revolutions of the motor.

A flat spring of a frequency of vibration exceeding the number of revolutions of the machine is used as speed controller. At the point where this spring has its maximum amplitude of vibration (that is, in connection with springs fixed at both ends in the centre, and in connection with springs fixed at one side at the end actually fixed) there is placed a silver contact having another contact placed opposite.



500 Kw. High-frequency Transmitter.

This spring, which is fixed on the disc of the rotor of the high-frequency machine, bends outwards, under the action of centrifugal force, though by various amounts at the various points of its course. In addition to the centrifugal force, the flat spring is submitted to the action of gravity. As it reaches the uppermost point of its course gravity will counteract the centrifugal force, whereas at the lowermost point both forces are acting in the same sense. This, accordingly, is where the spring makes contact. When the speed of rotation of the machine is growing, the centrifugal force increases, bending the spring more strongly, so that contact is made earlier, and the resistance in the magnetic field is short-circuited at an earlier moment.

Automatic Adjustment

The magnetic field of the motor under the action of this controller will adjust itself to an average figure, responding to any outward action without any lag. In fact, the number of revolutions is thus kept constant to nearly a hundred-thousandth of a revolution.

The machine is inserted into an oscillatory circuit tuned to the fundamental frequency, so that this may assert itself better. Machines are generally designed with a fundamental frequency of about 7,500 cycles per second, though higher frequencies—up to 10,000 cycles—may as well be adopted.

In order next to multiply the fundamental frequency generated by the machine a frequency-changer is resorted to, which is fed by the alternating currents of the high-frequency machine, and which at the same time, as exciter of vibrations, is inserted in a tuned oscillatory circuit.

The Frequency-changer

The mode of operation of the frequency-changer is based on the fact that iron under the action of electric currents is magnetised up to a given maximum, beyond which no further increase is possible. Now, the alternating currents generated by the machine will flow into the iron of the frequency changer, saturating the iron with magnetism by jerks; and while this is occurring the voltage increases abruptly, loading up the condenser of the oscillatory circuit, which is discharged across the self-induction, thus giving rise to the well-known fluctuations of electrical energy between the condenser poles. If no further charging impulse were supplied these fluctuations would soon be dying down. This, of course, is made impossible by the condenser being always charged at each impulse.

In addition, however, there is the following reason. Dimensions have been so chosen as to cause any new impulse exactly to coincide with the phase of vibration, the wave amplitude thus being increased over again by each new impulse in the rhythm of vibration, just like a pendulum struck at given intervals in the direction of vibration. Moreover, the sequence of impulses is so rapid (double the frequency of the machine, impulses occurring once during each half-wave) that the amplitude in the intervals between consecutive impulses can only fall off slightly, being restored to its previous figure in a minimum of time.

This method of multiplying the fundamental frequency of the machine has likewise been devised by Dr. Schmidt. The multiplied frequency can, of course, by means of another frequency changer and circuit be once more multiplied, thus reaching waves of remarkable shortness. It may be said that the frequency changer is built up of iron sheets only six to seven-thousandths of a millimetre in thickness, thus avoiding any eddy currents liable to interfere with the rapid increase of magnetism.

Modulation

While the high-frequency currents generated by valves can be modulated in the valve, those set up by high-frequency machine transmitters must be modulated in the aerial system. This can be done by means of the iron choking coils developed by Pungs and Gerth; that is, by causing the high-frequency currents to flow through an iron choking coil pre-magnetised by continuous current, and the magnetic intensity of which is controlled by the speech input, so that high-frequency currents are only allowed to pass in accordance with the sounds converted into electrical energy which they are expected to transmit.

The first 10-kilowatt broadcast machine transmitter designed on this system has recently been installed at Munich.

IS THE CRYSTAL OBSOLETE?

ONE of the most significant features of wireless to-day is the growing popularity of valve receivers. The number of valve owners is becoming much greater than before, and the crystal seems to be regarded as out of date. The reason for this is not so much the weaker volume of the crystal set as the lack of sufficient choice of programmes.

When the valve set was open to such charges as distortion and bad reproduction, music lovers generally were inclined to keep to the crystal. In past years the crystal has more than held its own, but during the last few months tremendous improvements have taken place in valve receivers; distortion has almost been abolished by the use of valves specially designed for rectification and resistance-capacity L.F. amplification. Great ranges may be covered with the help of the neutrodyne and super-heterodyne systems of H.F. amplification. Tuning difficulties have been reduced to a minimum, and on many up-to-date receivers only two tuning dials are used.

Consequently many of the former drawbacks to valve sets do not now exist, and the only real objection still remaining is the important question of expense. There is a great gap between the thirty shillings or so necessary for a good crystal set and the ten or twelve pounds for a multi-valve receiver. The neutrodyne and super-heterodyne type of receiver may cost anything up to £100.

The crystal set will always remain a firm favourite with those whose purse is limited and with those who live close to a broadcasting station, but the ever-increasing army of wireless experimenters will be satisfied only with the latest and most up-to-date type of set. M. J.

DUST AND PANEL LEAKAGE

DURING the winter, moisture is only too apt to collect on the ebonite panel of the wireless set, and this, combined with the dust which settles on panels and components at all seasons of the year, forms an effective and troublesome "short" between terminals.

An increase in signal strength will often be noticed if the panel is placed for an hour or so near a warm fire (not too near, however, to cause warping) and afterwards carefully dusted with a fine brush. M. W.

BROADCASTING IN SWEDEN

ALTHOUGH but quite recently relay stations have been erected in Sweden at Orebro and Varborg, such is the enthusiasm for broadcasting in that country that it has been decided to put up in the very near future further relay stations in the towns of Umea, Karlskrona, Kalmar, Kristinehamm, Upsala, Hernosand and Kiruna.

Although these small transmitters would cover quite a fair area of the country, there are many districts which are not within crystal range of a broadcasting station, and it is to this effect that the Government has decided, in view of recent experiments made at Karlsborg, to transmit, if necessary, with a power of 60 kilowatts. The actual site of the new station has not yet been fixed, but it is likely that it will be placed at some point approximately half-way between Stockholm and Gothenburg. Although the wavelength of 1,350 metres is being considered, there is a possibility that a higher one may be chosen. It is hardly expected that this high-power station will be in operation before the middle or even the end of this year, but it is hoped to effect transmisions on a minimum power of about 20 kilowatts. GRIDDA.

MAKING PAPER-DIAPHRAGM LOUD-SPEAKERS

An article describing how the difficulties commonly met with may be surmounted

Cone-type Loud-speaker.

THIS article will assist readers in obtaining a better understanding of the principles of diaphragm-making which is apparently not fully comprehended by the home constructor of paper-diaphragm loud-speakers.

With reference to pleated-paper diaphragms comparatively little need be said. When cutting the material to be pleated the worker should remember that the length of the material to be cut can be determined by a simple mathematical calculation involving the well-known symbol π. For the uninitiated it must be explained that the circumference of a circle has a "length" corresponding to 3.142 times its diameter. In mathematical parlance the constant 3.142 is referred to as Pi and indicated by the symbol π. Hence if the diameter of the diaphragm to be made is known, the circumference can be determined.

The figure obtained indicates the length of material necessary, less the amount required for the seam. A suitable addition would be equal to twice the depth of a pleat. It is as well also to arrange for the length to be a whole multiple of the depth of a pleat. Hence if calculations indicate (assuming pleats ½ in. deep) the length to be, say, 29.25 in., arrange for a length of 29.5 in. Of course the strip is also cut a little wider than the radius of the diaphragm under construction, to allow for the material gripped between the rims forming the supporting frame. It should be clearly understood that the *effective diameter* of the diaphragm is not twice the width of the strip cut.

Referring now to Figs. 1 and 2, which illustrate the above-mentioned facts, we may take as an example a diaphragm 8 in. in diameter having pleats ½ in. in depth and proceed to determine the dimensions of the strip to be cut in the following manner:

In the calculations—

d represents effective diameter of diaphragm.
g represents amount gripped at rim.
p represents depth of pleat.
x represents "convenient" addition.

$$\text{Length of strip} = 3.142 \times \text{diameter} + 2 \times \text{depth of pleat} + x$$
$$= 3.142\,d + 2\,p + x$$
$$= 3.142 \times 8 + 2 \times 0.5 + x$$
$$= 26.136 + x$$
$$= 26.5 \text{ in.}$$

$$\text{Width of strip} = \frac{\text{diameter}}{2} + \text{amount gripped between bands at rim, say, } \tfrac{3}{8} \text{ in.}$$
$$= \frac{d}{2} + g$$
$$= \frac{8}{2} + 0.375$$
$$= 4.375 \text{ in.}$$

Now we will consider cone-shaped diaphragms, but in passing note that pleated diaphragms appear in cross-section as a disc of varying thickness and their stiffness at the centre is greater than at the periphery. As readers know, reproduction from this type of loud-speaker is often better than those of horn models. Without going too deeply into technicalities, attention is called to the fact that the pleated diaphragm is practically "floating" at its periphery. This fact raises the question as to whether a floating diaphragm is a *sine qua non* to perfect reproduction. Experiment has shown that a floating diaphragm reduces resonance to a marked degree and that a cone loud-speaker 8 in. in diameter, with a comparatively free edge, can give a reproduction in which speech is audible and understandable all over the average suburban villa providing a resistance-capacity-coupled amplifier is used. Transformer-coupled amplifiers are not so satisfactory.

The easiest way to make a cone is to cut a sector from a disc of the material used and cause the newly-formed edges on the disc to unite and adhere. Difficulty is often experienced in that it is not known how to produce a cone of particular dimensions or the size of sector to be cut.

There are no hard-and-fast rules regarding the dimensions of the cone required for loud-speaker reproductions, but it is usual to arrange for the angle at the apex to be between the limits of 90 to 130 degrees. The particular cone shown diagrammatically in Fig. 3 is one of 120

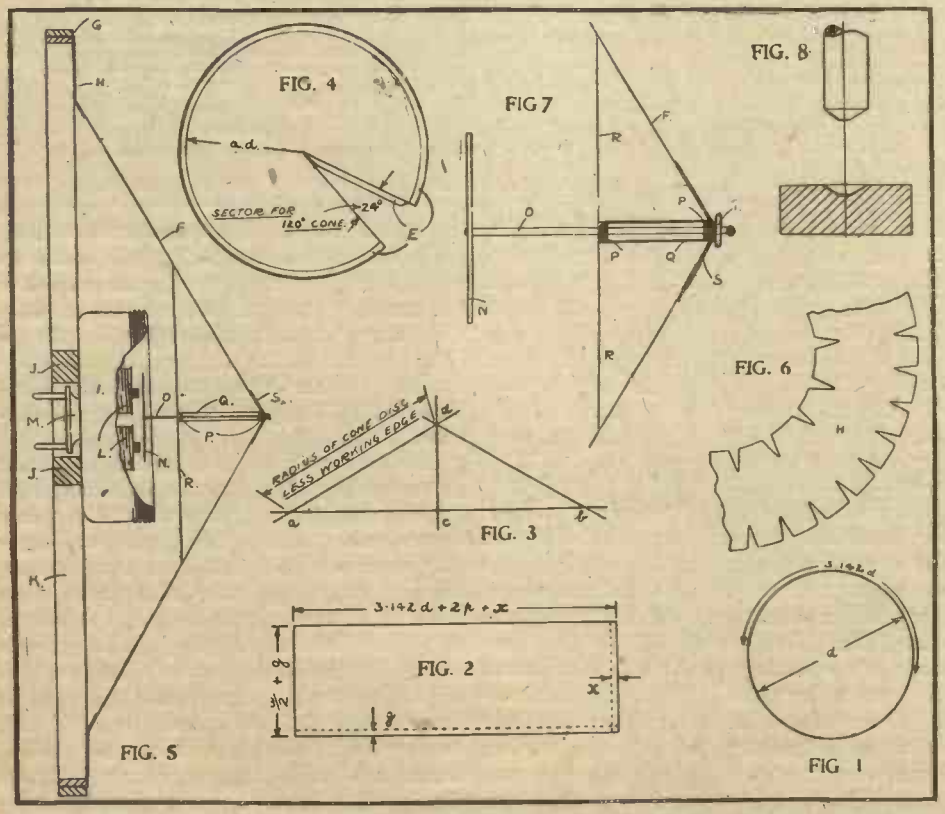


Fig. 1.—Relation between Diameter and Circumference of a Circle. Fig. 2.—Pattern for Pleated Strip. Fig. 3.—Method of Determining Radius of Disc for Cone. Fig. 4.—Pattern for Disc of Cone. Fig. 5.—Section of Cone Loud-speaker. Fig. 6.—Detail of "Flexible" Edge. Fig. 7.—Detail of Diaphragm Adjusting Device. Fig. 8.—Tool for Making Metal Nose.

degrees; this has been found a satisfactory standard section to adopt.

To determine the characteristic dimensions of the cut material from which the cone should be formed, first draw the conical section required in the manner shown in Fig. 3 by drawing a line a c b and another, c d, perpendicular to a b. The radius of the cone is represented by a c and c b. The depth is represented by c d.

Then proceed to determine the length of a d, which is the radius of the disc from which the cone is produced. This may be accomplished by measurement or by calculation. The former method is satisfactory for all practical purposes if the graphic representation of the cone has been accurately drawn.

Mathematically the radius of the disc may be determined from the formula

$$a\,d = \sqrt{ac^2 + cd^2}.$$

By way of example, consider a cone 8 in. in diameter and 2¼ in. deep. By measurement a d is approximately 4⅝ in. long.

A disc of this radius has a definite periphery, but only a part of the "length" of that periphery is required (equivalent to the "length" of the circumference of an 8-in. diameter circle).

Hence the size of sector to be cut away can be determined as follows, using a book of mathematical tables if desired:

Actual diameter of finished cone = 8 in.

Circumference of finished cone

$= 8 \times 3.142 = 25.133$ in.

Diameter of disc from which cone is cut

$= 4\frac{5}{8} \times 2 = 9.25$ in.

Circumference of disc $= 9.25 \times 3.142$

$= 29.060$ in.

Then by proportion.

Operating on circle 9.25 in. diameter a "length" of 20.060 in. is equivalent to 360°.

Operating on circle 9.25 in. diameter a "length" of 25.133 in. is equivalent to

$$\frac{360 \times 25.133^\circ}{29.060}$$

$= 335.88^\circ = 336^\circ$ approximately.

Sector to be removed is one of $360^\circ - 336^\circ = 24^\circ$.

It should be noted that whatever the diameter of a cone of 120°, the sector to be removed from the disc will always be one of 24°.

Constructional Details

Having made the necessary calculations, obtain the material to be used in forming the cone and mark it out as shown in Fig. 4, arranging the working edges E for the kind of seam intended and method of attachment to the frame or other support.

It is advisable to roll the pattern to "break" the material thoroughly and thus avoid creases.

A cone speaker having a floating diaphragm is illustrated by the photograph and Fig. 5. This cone was constructed exactly as described above. It will be noted that the cone F (Fig. 5) is not directly attached to the frame G, but is supported by an annular member H, which comprises a "ring" of paper of suitable width having serrated inner and outer edges for attachment to the cone and frame respectively. A section of this annular member is diagrammatically illustrated by Fig. 6. The operating element is a phone ear-piece I carried upon two struts J supported within the inner band K of the rim. If the position of the magnets L is adjustable, the struts J must be adapted to accommodate the adjusting means M. An adjustable earpiece is not essential for this type of speaker, as other means of adjustment are provided.

It will be observed that the cap and diaphragm have been removed from the earpiece and that a small metallic diaphragm N has been substituted for the original diaphragm. The small metallic diaphragm is of convenient diameter and is carried at the end of a No. 10 B.A. rod O, to which it is soldered. The rod passes through two No. 10 B.A. nuts P (Fig. 7) rigidly fixed within a tubular member Q constructed of paper. Its inner end is retained concentrically within the cone F by means of the paper disc R. A metallic cone S, formed with a simple tool of the kind shown in Fig. 8, is used to stiffen the nose of the cone 9 and support the outer end of the tubular member Q. A lock-nut T is provided on the rod O for retaining the metallic diaphragm N in its relative position.

When the various components have been assembled the position of the small diaphragm is adjusted by slackening off the lock-nut T and rotating the rod O in the desired direction, subsequently retaining it in position by means of the said lock-nut.

This type of diaphragm adjustment described is adaptable to speakers of the pleated-diaphragm type. H. J. H.

WHY THE AMATEUR WENT DOWN IN WAVELENGTH

I HAVE been asked to relate my experiences since the war as an amateur transmitter.

When one looks back on the past (the good old days) when the experimenter was looked upon to fill the air with the necessary dope for the experimental receiver to "monkey" with, one cannot help feeling sorry that those times are past and gone. To those of my readers who remember the early days of wireless just after the war, when the experimenter was confined to the 1,000-metre wavelength, such stations as 2 F Q, 2 O N and 2 K V used to fill the air with music and witty comments, both technical and otherwise, regarding the transmisions and the *pros* and *cons* thereof. In those days these stations were eagerly searched for. The "star" turns usually came on on Sunday evenings, when in a deep stentorious voice we heard: "2 F Q calling. Hullo, 2 K Vic, Weybridge."

After communication had been established and detail adjustments made, a series of well-known gramophone records were churned out by 2 F Q and 2 K V, and these were eagerly listened to by the enthusiast who had ample time to juggle with all sorts of "hook-ups" and amplifiers.

All went well for a time until it was found that the 1,000-metre wave was too close to the aircraft one (900 metres) and caused at times some little trouble through heterodyning.

The First Drop

It was then decided by "the powers that be" that the experimenter should be put down a peg. However, before dropping to the next stage, I should like to say a few words about our old 1,000-metre friend the Dutchman, P C G G. How many of our earlier enthusiasts' ambitions were to receive this station and, after having been successful in picking him up, to amplify him for loud-speaker work? I used to get quite a lot of callers at my station desirous of hearing for themselves what the Dutchman was really like.

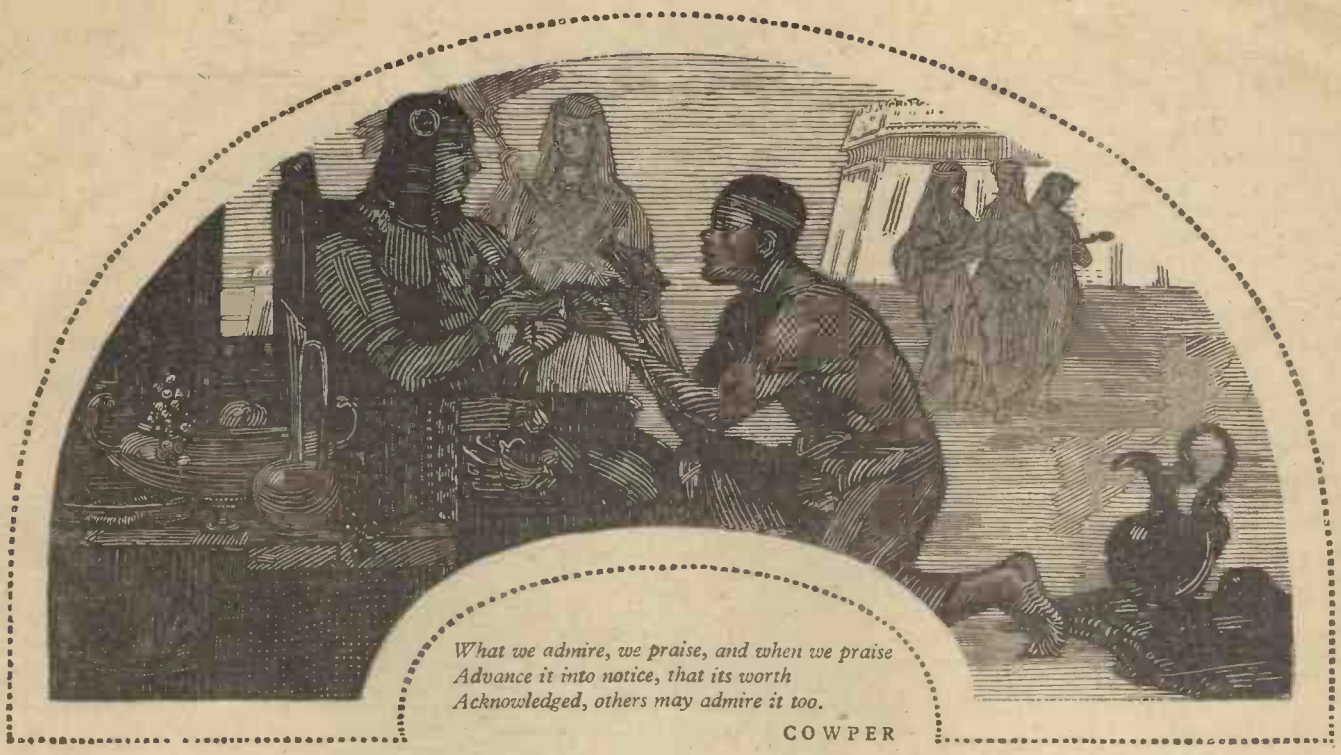
I remember on one occasion visiting an enthusiastic experimenter whose results on this station were very indifferent, the cause being that the amplifier was at the wrong end—at least, as far as signals from the Dutchman were concerned. The amplifier in use consisted of six stages of low-frequency, transformer-coupled. As a single-phase A.C. supply adjoined the station, the result was colossal amplification of A.C. ripple and exit any Dutchman!

It is interesting to note at this stage that it was quite possible to use three stages of high-frequency amplification on the 1,000-metre waveband. The type of high-frequency amplification I used was transformer coupling, and with this more amplification was possible per valve than any other form of coupling. Three stages of high-frequency transformer-coupled high frequency were used with great success on P C G G; in fact it was possible to receive this station using six valves almost as loudly as one receives 2 L O at the present time.

1,000 to 440

We now come to the time when the

(*Concluded at foot of page* 186)



What we admire, we praise, and when we praise
Advance it into notice, that its worth
Acknowledged, others may admire it too.

COWPER

"That its worth acknowledged . . . . . "

JUST how strong is the wireless public's loyalty to the Wuncell Dull Emitter is demonstrated by the fact that the year just passed was easily the most successful in the history of the Cossor Valve.

A very large proportion of Wuncell users are those who first became acquainted with the peculiar merits of Cossor Valves through the original P.1—the most popular Bright Emitter ever placed upon the British market.

During the past two and a half years the public have had ample opportunity to test out the Cossor Valve under every possible condition. Invariably they have found it supersensitive to a degree, productive of a beautiful fullness of tone and exceptionally trustworthy. They have proved that the arched filament combined with the electron-retaining hood-shaped Grid and Anode is responsible for a standard of efficiency which cannot be duplicated by any other make of Valve. Consequently once they have chosen their valves, Cossor users are not to be weaned from them.

Month by month this circle of enthusiasts is widened by those discerning men who are desirous of obtaining the finest possible valve service. With the Wuncell they are realising that the working costs of a Valve Set are reduced to a level never before believed possible.

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W.1. For Detector and L.F. use - 14/-
Consumption: ·3 amps.
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Consumption: ·3 amps.
W.3. The Loud Speaker Valve - 18/6
Consumption: ·5 amps.

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On Your Wavelength!

"Snowspherics"

THE snow, of which we have had plenty of late, was responsible for some rather curious effects upon wireless reception at my station, and I expect that many of my readers had similar experiences. The first of these occurred when the snowfall began. In previous years when we have had any snow I have nearly always noticed that atmospherics became very pronounced during a fall, especially if the snow was heavy and was being driven by a high wind. On one occasion I remember noticing during a storm that actual sparking was taking place across the vanes of the aerial tuning condenser. You may imagine that I disconnected pretty quickly. Falling snow, and sometimes fine rain, is often highly charged; hence the effects produced by its contact with one's aerial.

This year "snowspherics" were not so pronounced, except at the very beginning of the fall. But there were other results, which were distinctly interesting. My own range and signal strength declined to an extraordinary extent. On looking out of the window I found that my insulators were covered with great masses of snow, and as I use wire halliards this meant that the aerial was to all intents and purposes earthed at both ends. A vigorous shake of the halliards and of the lead-in dislodged most of the accumulation, and there was an immediate improvement.

On trying round I found that I could not get quite a number of the stations that are usually within easy range of my set. On the following evening, when the roofs of buildings and the surface of the garden had a covering of snow about 4 in. thick, I had a further surprise. Before switching on I had freed the insulators and the aerial wire from snow, so that a short was probably not taking place, unless, possibly, there was a thin film of frozen moisture on the insulators. Signal strength, however, was worse than ever, and when I tried for other stations I found that I could hear nothing of any except the most powerful.

Mystery

I wondered first of all whether the snow was having an adverse effect upon transmitting stations. To test this, I fixed up a crystal set to an indoor aerial and found 2 L O, 5 X X and Radio-Paris coming in at their normal strength. The trouble, then, was at the receiving end, and it was limited to the outdoor collector system. I am not quite sure what the solution of the mystery is, but it seems to me that what happened may have been something like this: My outdoor aerial is rather badly screened by buildings on the south, east and west and by a large tree on the north. The wire itself points almost due north and south, the lead-in being at the south end. All of the roofs and the tree were covered by a thick mantle of snow. The former were connected direct to earth by columns of ice in the rain-pipes, whilst the trunk of the tree had on one side a thick covering of driven snow.

Variable Earths

Buildings and trees are always regarded as "earth" in the ordinary way. The extent, however, to which buildings are earthed in normal circumstances depends upon the conducting nature of the materials used in their construction, and it must not be forgotten that slate is a pretty effective insulator. Trees again are thoroughly earthed in summer-time owing to the sap in their trunks, branches and leaves; but in dry winter weather they are quite poor conductors. You may prove this last statement for yourself by a simple experiment. Drive a large nail into the trunk of a tree close to the ground. You will find that when the tree is sapless it makes a very poor earth connection, though in summer-time it answers nearly as well as an actual ground connection. It seems to me that the covering of snow had the effect of producing large perfectly earthed surfaces many feet above ground level, thus reducing the electrical height of my aerial. The net result would be the same as that produced either by raising the ground level 20 ft. or so, or by lowering the aerial wires until they were only a few feet above the surface of the soil. If I am right, then snow effects will have been noticed much more by those who live in towns than by those who dwell in the heart of the country and whose aerials are well away from buildings. Will anyone who kept a record please let me know if his experiences bear out my theory?

A Special Announcement regarding this week's FREE GIFT appears on page 200

Screening

It is quite possible that the adverse effects upon reception were also due to the effects of screening caused by the presence of large conducting surfaces in the neighbourhood of the aerial. Apropos of screening, only the other day I read an exceedingly interesting article describing some experiments recently made at the National Physical Laboratory. The results obtained in the course of these seem to show that a wireless "shadow" can be thrown only by a very large object in close proximity to a receiving aerial. The writer of the article holds that it is quite incorrect to state that an aerial can be screened from any particular direction by buildings, trees and so on; if it is screened at all it must be screened from all directions. This is certainly not my experience, for I have always found that though in winter the northern stations come in very well indeed, I can hear nothing at all of them in the summer-time. Stations whose transmissions come from other directions are not nearly so seriously affected by seasonal changes.

My own feeling is rather that the effects of screening are not particularly noticeable upon a near-by transmission of big strength, but that they make themselves felt much more when one is dealing with distant signals, which anyhow require a certain amount of high-frequency amplification for satisfactory reception. Wireless is full of problems that are only partially solved at present, and there are many aspects of the subject of which we know very little indeed. Curiously enough, I have another account of some experiments with regard to screening made in America about two years ago. In these it was found that a near-by concrete tower did most effectively screen an aerial from transmissions coming from one direction.

Unfortunate!

"It was, I think, most unfortunate that the 'spoof' news bulletin, purporting to give an account of a revolutionary rising in London, should have been broadcast the other night," says a note just to hand from a friend. I suppose it was—but what fools these mortals be! It was stated emphatically at the beginning of the item that it was merely a skit. Every line was ridiculous in the peculiar Knoxian vein, but I suppose the trouble was that listeners switched on in the middle and just a few of them—surely, only a few—did not see the absurdity of such statements as that a mob was attacking the water-fowl in St. James's Park with bottles, that the National Gallery was being sacked, and so on. One listener told me he thought that the B.B.C. was trying to belittle the seriousness of a terrible situation by making facetious comments at the end of each fresh item with the idea of helping the country not to give way to despondency! The B.B.C. must remember in future that its position is very much the same as that of a great newspaper—and broadcast

On Your Wavelength! (continued)

"humour" (in the form of "spoof" news) in sparing doses.

It must not be forgotten that however ridiculous "spoof" announcements may be there will always be large numbers of simple-minded people who will take them seriously. Another point to be borne in mind is that thousands of users of crystal sets are only just within range of certain stations, and while they can hear music fairly well, they often find speech difficult to follow; hence they jump at conclusions—and land badly!

Wavelength Piracy

I see that the United States Government is about to bring an action to test its powers in the matter of the regulation of wavelengths. It appears that a Chicago broadcasting concern, finding its allotted wave unsatisfactory, has been adopting, without permission, one that belongs not to the United States, but to Canada. They are a good deal more strict in the States over the wavelength business than we are on this side of the Atlantic. If a station is given, for example, a wavelength of 400 metres, a check is kept upon its transmissions to see that it sticks to that wavelength and does not wander at times several metres above or below it. Wavelength regulations of this kind have become very necessary over there owing to the large number of broadcasting stations that exist. The Government has also done a great deal towards clearing up the broadcast waveband by suppressing coastal and other spark stations and substituting valve transmitters for the old inefficient gear.

A Necessity

It is expected that the powers of the Government will be confirmed when the case is heard, though at the present moment the condition of affairs is rather curious, since the United States Government is not in quite the same strong position with regard to wireless as is our own by virtue of the Wireless Telegraphy and other Acts. It would be a very good thing if our own authorities would pay closer attention to the wavelength question and would sit heavily upon those stations, commercial and others, which did not abide by their stated wavelengths. There are certain amateurs, too, who appear to have at times a fine disregard for the wavelength regulations.

A Warning

If you have youngsters, take my tip and be chary about the bedside crystal set that they are so fond of rigging up. One of mine has a set of this kind which works very well off an indoor aerial rigged up round his room. The other night I looked in when I went to bed to see that all was well, and found that it emphatically was not. The boy had gone to sleep with the headphones on and must have turned over several times after doing so, for the cord was wound tightly twice round his neck. Luckily I was just in time to disentangle him, though in a few minutes it would have been too late, for he was already well on the way towards suffocation. I know not a few grown-ups who have bedside sets, and the warning not to go to sleep with the headphones on applies just as much to them.

Wireless "Pops"

From the end of the present month onwards the B.B.C. is to institute Saturday afternoon concerts between five and seven o'clock, the Children's Hour being moved forward to 4.15 on that day to make room for them. This will, I am sure, be a very welcome innovation, for a great many people at present who have the half-day off on Saturday find that there is little to interest them by wireless until seven o'clock comes along. The new concerts are aptly named "Pops," and I am sure that they will be really popular. The Saturday service will now be practically continuous from 4.15 until midnight, which is pretty good, as most people must admit. Like Oliver Twist, however, listeners want more, and I am sure that a lunch-time concert on Saturday, or one between two o'clock and three in the afternoon, would be welcomed generally.

Simultaneous Reception

I tried an interesting experiment in simultaneous reception of a number of stations in one and the same house the other night. I have at present three aerials, one out of doors and two installed in rooms in the house. Rather wondering what would happen, I connected a valve receiver to the outdoor, a crystal set with two note magnifiers to the first indoor wire and a plain crystal set to the second. I tuned in Birmingham on the valve set at good loud-speaker strength. The valve-crystal combination was soon bringing in Daventry, also on the loud-speaker, whilst the plain crystal set was tuned to 2 L O. There was not the slightest interference of one set with another even when the tuning was changed and all three were receiving either 2 L O or 5 X X. Of course if the valve set had been allowed to oscillate it would probably have affected the reception of both crystal sets, but it was *not* permitted to do so.

Weird Effects

One does get, though, a few rather weird effects. If the catwhisker of one of the crystals is adjusted, scratching and scraping noises are heard very loudly from the loud-speaker of the valve set. Further, if one speaks into the loud-speaker attached to the valve-crystal combination or into the receivers of the plain crystal set, the words can sometimes be heard issuing from the loud-speaker of the valve set. There is one more interesting result from this experiment. When the development foreshadowed by Lord Gainford and others is brought about and there are at least two alternative programmes within the range of any receiving set, it will be quite possible to receive either at will in the same house, or to turn on both in different rooms.

Bound to Come

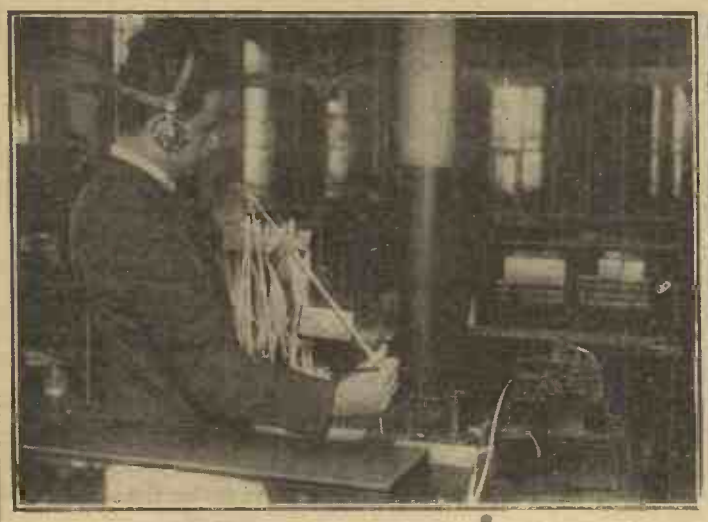
When I am doing experiments in reception during the afternoons I not infrequently find the Children's Hour coming in. I am always most careful not to howl on these occasions, and I wish I could say the same of some of my neighbours, who do not show much consideration for the youngsters. An interesting feature is the variety of the hiding places chosen for the presents brought by the wireless fairy on birthdays. There is one I have been waiting for for some time, and not until just the other day did I hear it: "Go and look in mother's Russian boots, Willie"!

Watch Your H.T.B.

I had been noticing for some days that my set was not passing quite the normal amount of plate current. Like many other people, I always put off fiddling jobs to the last possible moment, and that is why my high-tension battery was not tested out until the milliamps. had grown small by degrees and beautifully less. My H.T.B. consists of eight large-sized slab units, each of which gives about 16 volts when new. These have been in use for seven months, the average discharge rate being about 8 milliamps. On going through them unit by unit I found an extraordinary difference in their present voltages. Those which had the hardest work to do, that is, those which are common to all three kinds of valve, had stood up pretty well, none of them being below 13 volts. But right in the middle of the battery was a slab which, though it never had a drain of more than 6 milliamperes or so, since it supplied only the rectifier and the note magnifier, was down to nothing at all. The presence of this "dead" unit must have set up a very high resistance, with the result that the voltage supplied to the plates of the rectifier and the note magnifier had dropped right off. This kind of thing can happen in any battery, and it is always as well to be on the look-out for it. Test your high-tension battery carefully, but when you do so use a high-resistance voltmeter, otherwise you will do more harm than good. A cheap moving-iron voltmeter often passes as much as 250 milliamperes, so that when you use it you practically short-circuit your battery, doing it a great deal of damage, besides getting an incorrect reading.

THERMION.

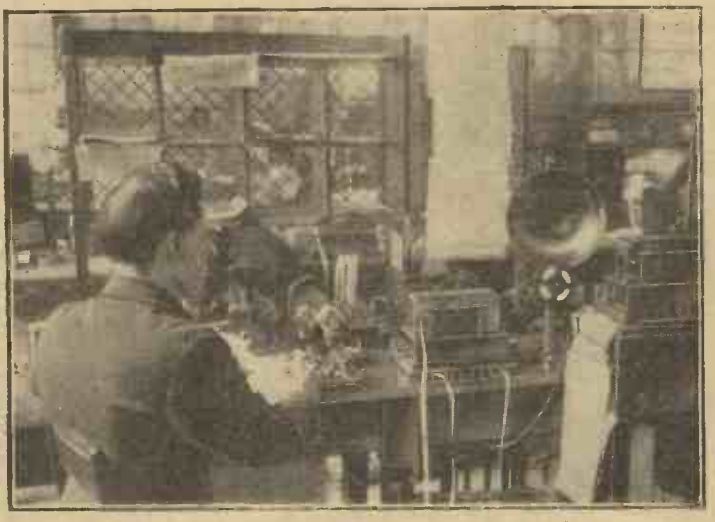
WIRELESS AT THE G.P.O.



Receiving telegrams from Milan at 45 words per minute.

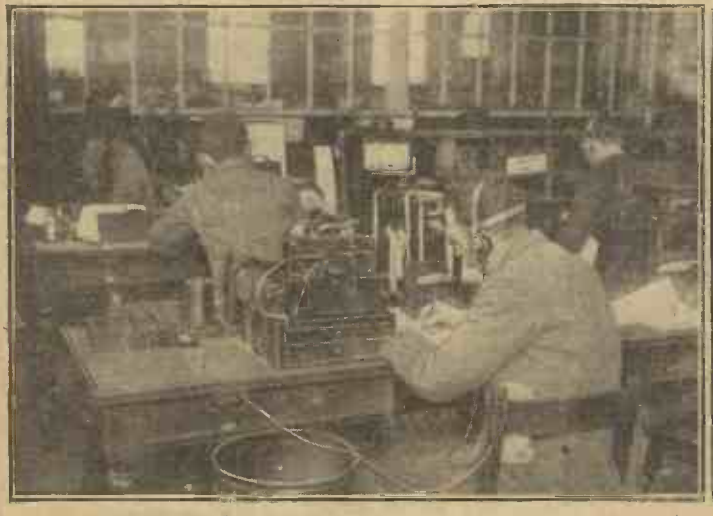
Aural reception from Prague at hand speed.

WIRELESS is used at the Post Office to a much greater extent than is realised by wireless enthusiasts. A visit to the Central Radio Office at the G. P. O. is very interesting to all amateurs, as in this one room all messages are sent and received. Most of the automatic transmitters and receivers are connected by land-line to the outlying receiving stations and to the transmitters, such as Leafield (Oxford Radio). Numerous wavelengths are employed; for example, one machine



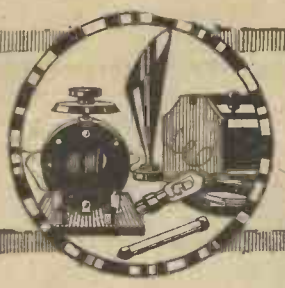
The operator is here seen checking the emitted signals by means of a loud-speaker.

illustrated on this page transmits to Halifax (Nova Scotia) on a wavelength of 40 to 50 metres, while another transmits from Leafield to the same station on a wavelength of thousands of metres. Communication is effected at all speeds, either by hand or machine. In certain cases signals are checked over on a loud-speaker, as is shown herewith. One of the aerials used in the system is illustrated in the photograph on our cover.



Receiving and transmitting from and to Warsaw.

Transmitting to Halifax on 50 metres.

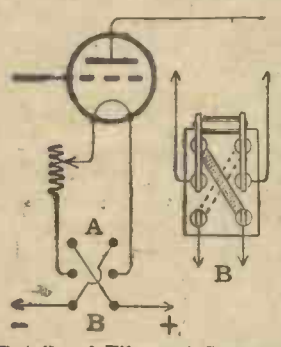


PRACTICAL ODDS AND ENDS

Reversing the Rheostat

THE reader is often at a loss to know just where the rheostat should be placed, since so much depends upon circuit arrangements and valve characteristics. Obviously the best thing to do is to try both arrangements, and the most convenient way of doing this is to use a simple reversing switch in each valve filament circuit and connect it as shown in the accompanying sketch.

An ordinary D.P.D.T. knife switch will be found quite suitable. The two lower contacts B are connected to the positive and negative L.T. leads at any convenient point, the rheostat coil and one filament valve leg being connected to the two central contacts or blades. The two upper contacts A are joined to the two lower contacts B in the manner shown on the right of the sketch where copper-tape links are used for making the cross connections, one being clamped under the shoulders of the contacts on the upper side of the switch and the other (shown dotted) under the nuts on the base of the switch. It will be seen that when the switch blades engage the contacts A the rheostat is in the positive lead, and when thrown over to position B, it is immediately placed in the negative lead. R.



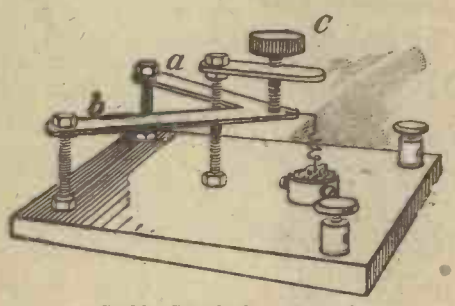
Details of Filament Control.

A Stable Crystal Detector

THE catwhisker of the crystal detector described below and illustrated in the accompanying diagram, when set on a sensitive spot will not move even if the table or bench is knocked or the set is jolted in any way.

The contacts can be light or heavy without interfering with the ease of adjustment. The brass springs A and B have a tendency to press upwards, while the control screw C affords just the right amount of downward pressure. The double springs prevent any jolting in a sideways direction.

Adjustment of the catwhisker can further be simplified if the crystal cup be mounted on an eccentric support, so that for "searching," the crystal and not the catwhisker, is moved. L. C.

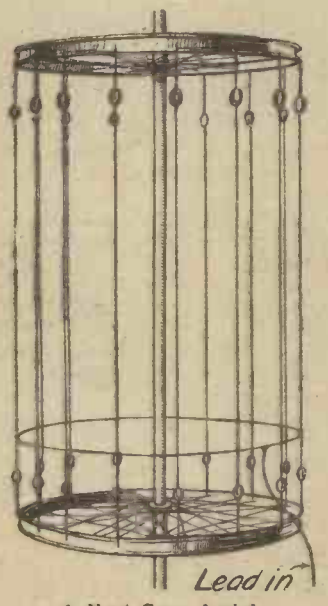


A Stable Catwhisker Mounting.

A Neat Cage Aerial

WHEN but little space is available for the erection of an aerial, one of the cage type (as shown in diagram) will be found extremely useful, and the strength of the incoming signals is not appreciably below that of a full open aerial system. The cage aerial has the advantage of being immune, when used out-of-doors, from the effects of high winds and heavy storms, which often wreck ordinary aerials.

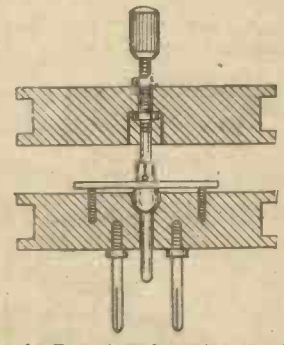
The type of cage aerial illustrated consists of two old bicycle wheels bolted at their centres to a wooden pole of sufficient thickness to guarantee stability. The wheels should be mounted about 6 or 8 ft. apart. The method of fixing the wire is clearly shown. Small shell insulators should be fastened at regular intervals along the rim of each wheel, and the wires suspended between them. The lead-in is taken from the lower portion of the aerial. F. L.



A Neat Cage Aerial.

Simple Reaction Coupling

THE sketch shows a very simple method of coupling a small reaction bobbin to an ordinary H.F. plug-in transformer, the two components being drawn in section, so that the reader should experience no difficulty in following the idea.



Simple Reaction Coupling Device.

The movement consists of a sliding spindle, which is clamped to the centre of the reaction bobbin and passed through a ball socket (taken from an old crystal detector), which is very firmly attached to the top of the transformer bobbin by means of a brass clamping link and two screws as shown. The small holes drilled through the centres of the two bobbins should be a size larger than the diameter of the spindle.

A fairly deep recess is made in the lower portion of the reaction bobbin in order to accommodate the protruding neck of the ball socket when a very tight coupling is desired. The top portion of the transformer bobbin is similarly recessed to take the round end of the ball socket which should be sunk in as far as possible. The coupling is varied by simply raising or lowering the spindle, care being taken to see that the spindle does not slide too freely in the ball socket and that the valve legs of the transformer fit very tightly into their sockets. A very fine adjustment of reaction is possible. J. R.

The Call for Better Radio Components

THE increasing demand for components of quality is the surest indication that constructors realize the importance of building radio receivers and amplifiers with reliable parts if they wish to obtain the best results from their outlay and their work. A.J.S. specialize in well made components.

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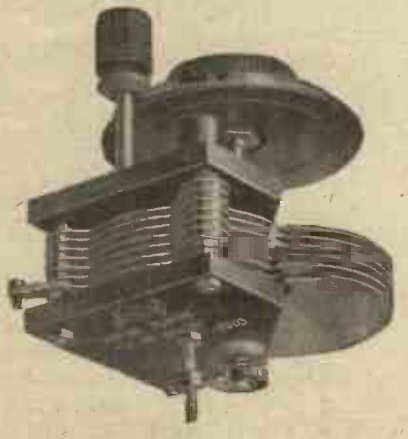
The set 20 to 400 inclusive, **£2.10.0.** List price bought single **£2.15.9.**



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A machine with which it is possible to see by wireless.

Mr. Baird Viewing the Transmitted Image in the Receiver.

NEARLY twelve months ago we gave an account of the researches made by Mr. Baird, of London, in the subject of television, and it was then indicated that Mr. Baird had met with a fair measure of success, inasmuch as at that date he was able to transmit an outline of an object or "shadowgraph." Since that time Mr. Baird has made such progress that he is now able to transmit the image of a living face with such clarity that the expression and personality are clearly defined; a demonstration of this was recently given to a representative of "A.W." The picture is in tone similar to a photograph, with a pinkish colouring, and its presentation is similar to what one experiences when using a pair of glasses not quite suited to one's eyes; additionally, a succession of black bands are constantly passing across the picture, though these are not of such account as to detract from it to any real extent; but in any case the elimination of these is not regarded as a difficulty.

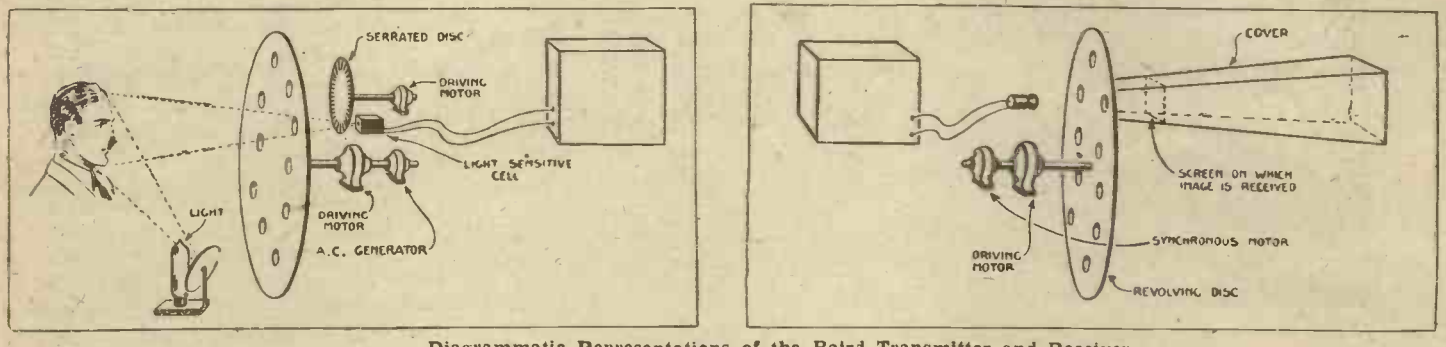
It is not proposed to describe Mr. Baird's apparatus, which he names the Televisor, in detail, for by a study of the diagrams on this page and the brief outline given below of the problem of television, the principle upon which he is working will be apparent. Fundamentally the apparatus is the same as was described in the earlier issue referred to, and the great success that he has obtained is largely due to increased efficiency in the light-sensitive cell.

At the present time it is not possible to prophesy what course the development of Mr. Baird's invention will take, but it may be mentioned that a company has been formed with the name of Television, Ltd., and in an interview Capt. Hutchinson, the business manager, stated that an initial 500 receivers are being constructed which it is hoped can be retailed for about £30 each, it being understood that the purchasers of these would be enthusiasts who did not demand perfection at this stage and who would be more or less willing to act as pioneers in the development of the science. Incidentally it may be mentioned that the receiving apparatus is little larger or more complicated than a five- or six-valve broadcast receiver. We understand that the application has been made to broadcast, and that the proposal is to install a television transmitter in London at an early date.

The difficulties that Mr. Baird has had to overcome may be judged by the following brief outline of the problem of television. After the discovery that the metallic element selenium possessed the property of varying its electrical resistance according to the intensity of light which was allowed to fall upon it, it was not long before it was suggested that in this lay the solution to television or "seeing by wire" as it was popularly termed. It seemed so easy—one had only to have a mosaic of "electric eyes"—or selenium cells to give them their proper name—on which a picture could be focused at the transmitting end and to cause the varying currents to operate a number of lamps at the receiving end and television was accomplished! Experimental apparatus constructed on these lines was actually tried, but it was realised that such a huge number of cells, lamps and connecting wires would have to be employed as to render the scheme impracticable.

It was next conceived that the image could be split up into minute parts in the same way as is done on the photographic reproductions in this journal, and then current impulses representing each part be sent in quick succession, the phenomenon of persistence of vision being relied upon for the presentation of the picture as a

(*Concluded in third column of page* 182)



Diagrammatic Representations of the Baird Transmitter and Receiver.

A Part View of the Transmitter.

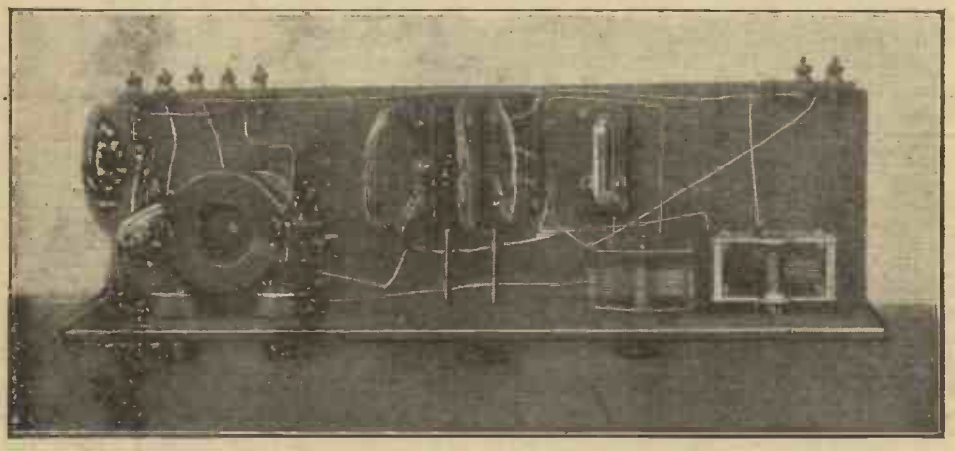
A SHORT-WAVE SET—

THE recent somewhat startling developments in British short-wave work, the gradual lowering of the broadcast wavelengths below the 300-metre line, and the activities of transmitting amateurs all over the world make the possession of a short-wave receiver a necessity to the man who would keep himself abreast of everything that is going on in the ether.

Fundamentally there is no reason at all why one set should not be made to cover all wavelengths from about 15 metres to 25,000 metres, for though methods that are good enough for waves above 300 metres will not always serve on the higher frequencies, a set designed for short-wave work should give remarkably good reception on the lower frequencies used for ordinary broadcasting.

The broadcast receiver is designed to give good reception on a loud-speaker, and the short-wave set does not usually answer with a loud-speaker. The broadcast receiver has to deal with radio frequencies that can be amplified with comparative ease before detection; the short-wave set handles frequencies that are so high that they can only be amplified before detection by taking extraordinary precautions.

The history of the set about to be described is rather interesting. It was originally made up about nine months ago and gave results that were thought to be so good that it was photographed with the idea that it would be useful to readers of "A.W." Then, whilst the writer was conducting further experiments with it, having in mind the necessity for giving a very complete description of "how it works," he became dissatisfied and decided to put off writing about it until satisfaction was achieved. As a consequence, the set is not now quite in the same form as it is shown in the photographs. The alterations made in the general layout and wiring were not great, but they will be detailed and the reasons given. They will probably prove rather instructive to would-be constructors of short-wave sets.



Plan View of Baseboard.

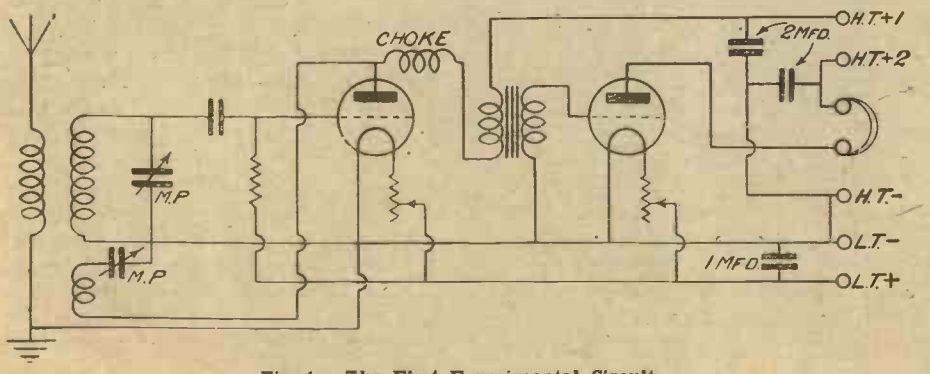
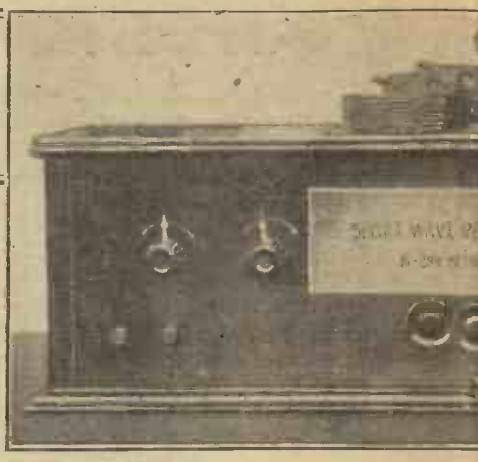


Fig. 1.—The First Experimental Circuit.

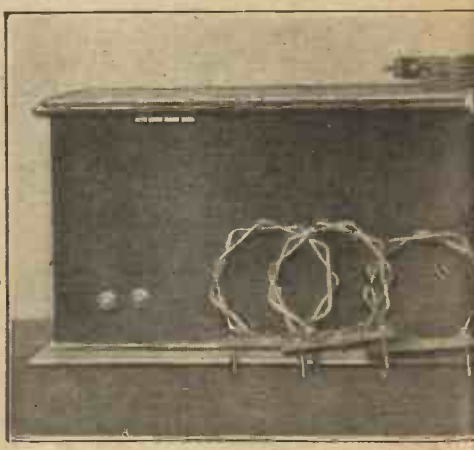


The Com

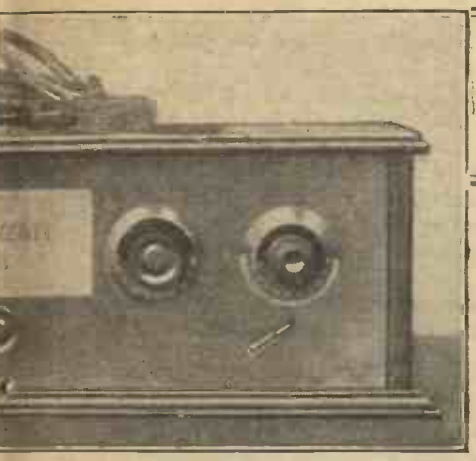
First Experiments

The original desire was to have a set covering, comfortably, all wavelengths used by amateur transmitters, that is, from 20 to 200 metres. Because it was to receive both long-distance low-power telegraphy, and low-power telephony as well, a delicate control of reaction was necessary with provisions for fine tuning, without which a short-wave set is useless. For the reception of continuous-wave morse it is necessary to have the set just gently oscillating, when it is in the most delicate condition for the purpose. For the reception of low-power telephony the set must be just not oscillating. To get these two conditions it is necessary that the circuit shall go in and out of oscillation very smoothly, without any "plop." That is to say, it must come out of oscillation with exactly the same setting of the reaction condenser as it goes into oscillation.

The first circuit tried was the ordinary Reinartz arrangement, shown by Fig. 1. A Hammerlund (American) variable condenser of .00025 microfarad maximum capacity was used for tuning the grid coil G, and a Bowyer-Lowe variable "square-law" of the same capacity was used for reaction control. This set gave very good results on all waves from 20 metres up to



View of Bac



plete Receiver.

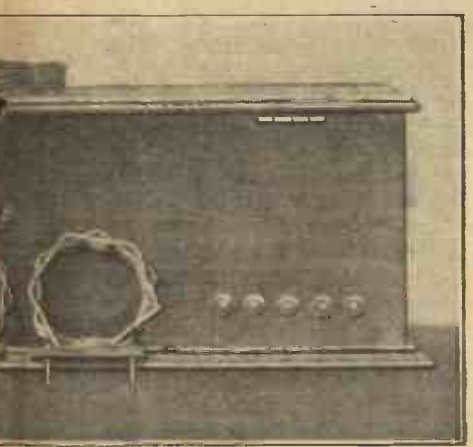
15-290 METRES: By 5YM

the limit desired, and oscillation could be obtained down to 15 metres. Experience in handling the set, however, led to the conclusion that it could be improved upon and that improvements were necessary. In the first place, the condenser, excellent though it was, developed a nasty habit of making scratchy noises because the pick-up to the moving plates was of the rubbing-contact type. Also hand-capacity effects were apparent when working below 40 metres, due to the fact that the frame of the reaction condenser could not be earthed. The moving plates of both variable condensers were connected to the low-potential (earth) side of the circuit; but this was not enough.

Necessary Improvements

Another thing was that reaction control was not considered fine enough.

Another part of the set that did not give entire satisfaction was the note magnification. The excellent Lissen T1 transformer originally put in was not found to be giving all the desired amplification, and since the very finest quality on telephony could be sacrificed for the sake of additional amplification, a transformer of a larger step-up ratio was decided on. The Lissen was taken out and a Marconiphone



s of Cabinet.

Ideal transformer of 8-1 ratio was put in its place, resulting in a 30 per cent. increase in the volume of the signals.

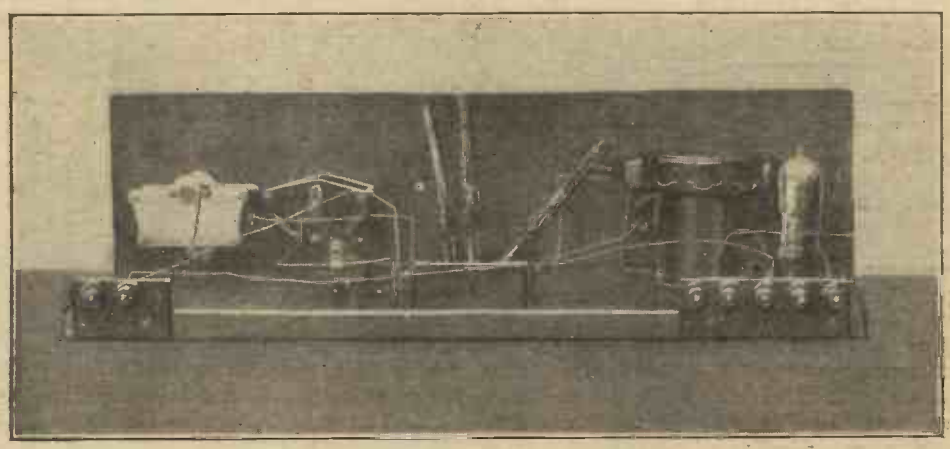
Experiments also showed that the radio-frequency choke coil in the plate circuit of the detector (ch) was too big. This had been a 300-turn Igranic coil, as usually recommended. It was found that a much smaller coil gave far better results.

Modifications

Having got so far with small but steady improvements, a complete overhaul of the circuit was deemed necessary, and a slight alteration in the reaction coil was made in order to give smoother control. The

means that an ordinary aerial as used for broadcast reception can be used without any series condenser, which always cuts down signal strength. Strong signals have been heard as low as 18 metres.

In the photographs will be noticed at the extreme end of the bottom board, against the L.F. amplifying valve, a twin basket-wound coil. These are the two choke coils in the phone leads, put in to minimise body capacity by isolating the head-set. They are shown in Fig. 1. In rebuilding they were found to be unnecessary when the H.T. tappings, and the L.T. as well, were shunted with large-capacity condensers as shown in Fig. 2.



Rear View of Receiver Out of Case.

circuit, which is an adaptation of the Reinartz circuit, is shown in Fig. 2. This is the circuit now in use and the one that is recommended above all others for this class of work. Its advantages are that the aerial coil is completely separated from the rest of the circuit, save that the negative side of the filament battery is earthed and acts as an untuned pick-up. This

The components necessary to build up the set in its improved form are as follows:

One best-quality panel, 24 in. by 8 in.; one baseboard, 24 in. by 6 in.; one cabinet, with lid, of correct dimensions to take baseboard and panel; two variable condensers, .00025 microfarad maximum (Hammerlund, Gecophone or Igranic are

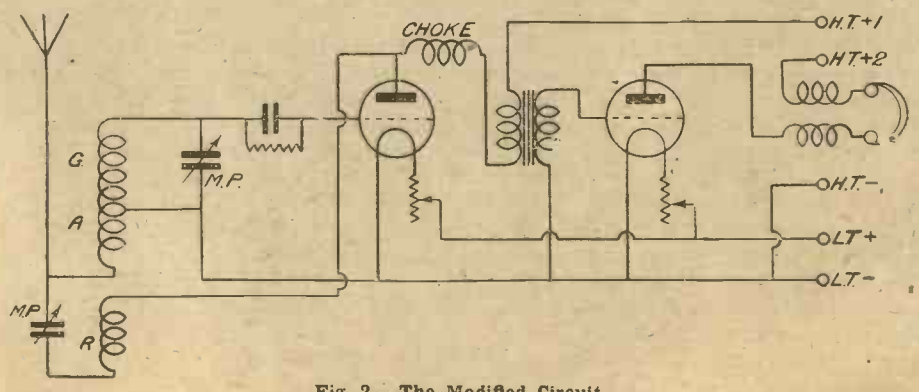


Fig. 2.—The Modified Circuit.

recommended); choose condensers, for preference, having pigtail connections to the moving plates; one Webber short-wave three-coil holder; one set of Webber short-wave coils (N. V. Webber and Co., Oatlands Park, Weybridge, Surrey); one intervalve transformer, 6-1 or 8-1 ratio; one D.E.V. valve and set of mounting clips; one D.E.3 or similar 3-volt valve; one Woodhall Universal valve-holder; one grid condenser, .0002 microfarad; one grid leak (5 megohms) and clips for same; two filament resistances for dull-emitter valves; two 2-microfarad Mansbridge fixed condensers; one 1-microfarad Mansbridge fixed condenser; nine terminals; twelve lengths of Radioduct (Autoveyors, Ltd.) for connections; one 4-in. length of ebonite tube or rod; about 30 ft. No. 24 d.c.c. wire; odds and ends of ebonite to make terminal-strips and supports for the long wave coil; about ½ lb. of No. 18 gauge enamel-covered copper wire (this is only necessary if a coil is required to take broadcasting stations up to 290 metres); in addition, the usual 4-volt accumulator and 66-volt H.T. battery are necessary.

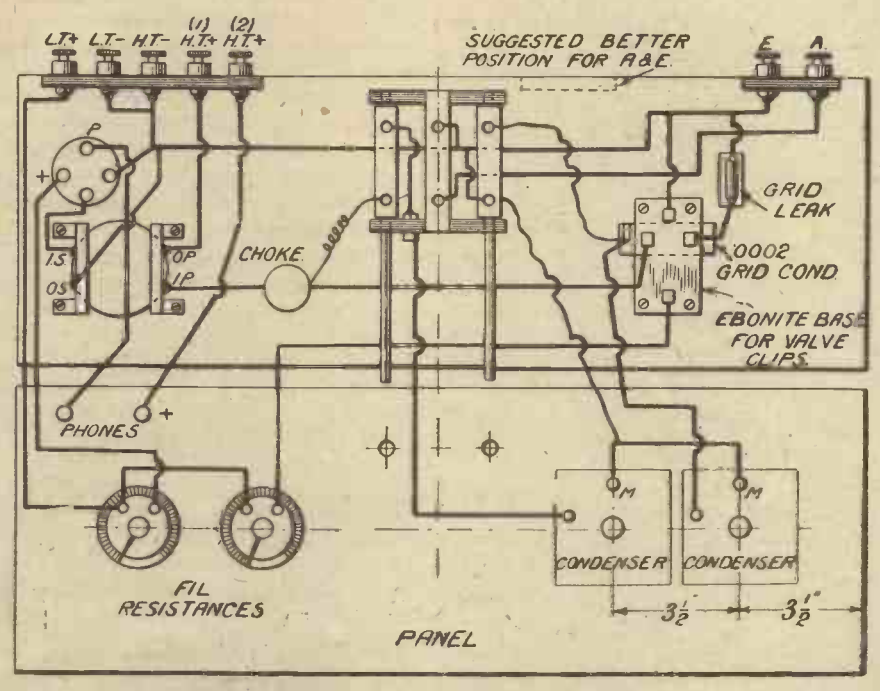


Fig. 3.—The Panel Layout.

The Layout

As the selection of the components has been left, more or less, to the discretion of the constructor, no attempt has been made to give an actual dimensioned wiring diagram. Fig. 3 shows a suggested layout of the set. As can be clearly seen, the coil-holder is in the middle of the baseboard, with the two variable condensers to the right of the panel. The tuning and detector part is widely spaced, but the L.F. amplifier is crowded in as small a space as possible on the left. In this layout, with the baseboard and panel shown on one plane, the leads look longer than they actually are. The main idea has been to keep the tuning inductances as far as possible from the condensers and other metallic bodies and, at the same time, to allow room for both moving coils to be very loosely coupled. If the set were being made up again the aerial and earth terminal strip would be moved nearer to the coil-holder to allow of shorter leads being taken to the coil. The position suggested is indicated by dotted lines in the diagram.

As will be seen in the photographs, the detector valve is mounted on a small strip of thin ebonite supported on small feet 1 in. high; under the mount is the grid condenser. The grid leak, also mounted in its clips on a small strip of ebonite, should be placed as close as possible to the valve so that the connections to this part shall be reduced to a minimum in length.

Connections

In the photographs a small terminal strip is shown mounted on small feet close to the grid coil. This was intended to shorten, as much as possible, the flex leads; but this plan was subsequently abandoned, as the short flex leads to the moving coils were not found to be supple enough and were inclined to work loose and to break, with a consequent development of undesirable noises.

The better plan is to have flex leads at least 3 or 4 in. long, tin and solder the ends, and make the connection to the nearest possible point. The connections actually adopted and found to give every satisfaction are indicated in the wiring diagram. There is a flex lead of about 4 in. from the earth connection (back) of the aerial coil to the diagonally opposite (front) socket of the grid coil. This is connected, still with flex, to the moving-plate connection of the variable condensers. A stiff wire lead is taken from the fixed-plate side of the grid-coil tuning condenser to the grid condenser under the valve mounting. From here a flex lead is taken to the back socket of the grid coil-holder.

The reaction coil connections are made by means of flex from the front, or inside, socket to the choke coil, which is also connected by stiff wire to the plate of the detector valve. In order to get rid of a long and straggling flex lead for the other connection a small terminal has been inserted in the coil-holder mounting. The flex is taken to this and a stiff wire lead taken from it to the reaction-coil fixed-plate connection.

Important Points

The low-wave limit of tuning will be more or less fixed by the amount of capacity there is in the wiring and components of the set, apart from the intended capacity of the condensers. Therefore all wires should be kept as short as possible. But shortness must not be gained by running wires close together. We are, in fact, engaged in a perpetual fight in designing and wiring up a short-wave set. It is most necessary to have all components well spaced.

The best plan is to lay our components out with as much room as possible, as indicated in Fig. 3, and then take each lead by its shortest possible path. To prevent the generation of unwanted noises by connections working loose, every connection should be soldered. 5 Y M.

(To be concluded.)

"THE TELEVISOR" (*continued from page 179*)

whole. To put this idea into effect various methods of splitting the picture up have been devised, such as by means of vibrating and revolving mirrors, revolving prisms and revolving lenses, and mostly they were of a successful nature, for that part of the problem was simply mechanical and optical; the success obtained, however, made apparent another difficulty and a very real one—the selenium cell would not respond sufficiently quickly to the light impulses, and, worse still, having responded it took an appreciable time to come back to its original condition, which meant that in the short space of time allowable it never actually reverted to its first state.

The Real Difficulty

A little arithmetic will show that in the case of such a small picture as one 2 in. square, assuming this to be divided by 100 vertical lines and 100 horizontal lines, these will divide the picture into 10,000 parts, each of which must be transmitted in one-sixteenth of a second or, in other words, there must be 160,000 current impulses, each of correct value, per second. Small wonder, then, that difficulty is met in securing correct responsiveness of the light-sensitive cell. In its solution lies the secret of television, as it is readily demonstrated that the rest can be accomplished by mechanical and optical means.

"A.W." TESTS OF APPARATUS

Conducted in the "Amateur Wireless" Research and Test Department

Ella Varic Rheostats

MESSRS. LIONEL ROBINSON AND CO., of 3, Staple Inn, Holborn, are the manufacturers of the Ella Varic rheostats, a sample of which we have tested. The resistance wire of this rheostat is wound on a flat annular former of fibre, to which is attached a metal strip which supports the rotating contact arm. One-hole fixing for the attachment of this component to a panel is provided, a good point being the provision made for fixing to panels up to ⅜ in. in thickness. A substantial knob and pointer, together with a graduated metal scale, give the component a very pleasing appearance.

On test the 5-ohm rheostat model was found to have a pleasant "feel," and the control of filament temperature was quite satisfactory. Still smoother contact between arm and wire could be obtained by lessening the spacing between each turn of wire. The maximum resistance is approximately 5½ ohms. A 15-ohm model is made by the same firm.

Ella Varic Rheostats.

Radion Loud-speaker Horn

WE have received for test purposes a small loud-speaker horn manufactured by Messrs. The American Hard Rubber Co., of 13A, Fore Street, London, E.C.4. This horn is made of the same material as that of the well-known Radion panels, and its black glossy finish presents a pleasing appearance. The height of the horn is 10 in. and the diameter of the flare 3½ in. The attachment consists of two parts, the horn itself and a phone cap, the latter being so moulded that it fits tightly into the horn, so avoiding the usual rubber connection.

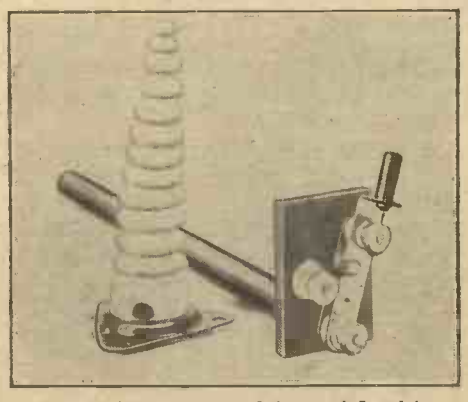
The horn has been designed to work in conjunction with a Brown A.Q. type of phone for the reason that the ordinary iron diaphragm type of phone will produce a rattle effect when used with powerful signals. Its use is therefore limited to owners of the A.Q. type of phones who do not wish to go to the expense of a proper loud-speaker.

On test, in conjunction with the type of phone mentioned, the instrument gave fair loud-speaker results on a straight detector and one low-frequency amplifier set.

Radion Loud-speaker Horn.

Igranic Insulators

MESSRS. IGRANIC ELECTRIC CO., LTD., have sent us for test a sample of their stand-off insulator, which has been specially designed to provide a convenient method of supporting and insulating indoor aerials, although it has numerous other applications where a stand-off insulator is required.



Igranic Stand-off Insulator and Lead-in.

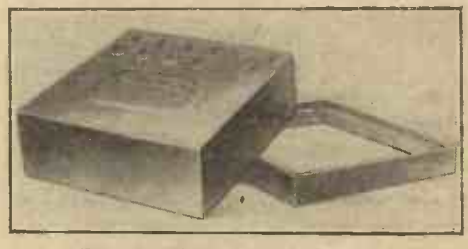
The insulator is 5 in. long, and is provided with deep corrugations which materially increase the leakage path, thus reducing any possibility of "creep" along the surface of the insulator. The end of the insulator is slotted to hold the wire, which, by an ingenious arrangement, may be fixed and held very firmly in position.

On test we found the insulator very useful for insulating and supporting indoor aerials, while its insulation resistance was found to be adequate for all ordinary wireless purposes.

The same firm produce a very neat and efficient combined lead-in tube and earthing switch, which is also shown in the same photograph. The ebonite tube is 10 in. long, through which a metal rod passes and to which a substantial wing-nut for securing the aerial wire is fitted. At the other end of the tube is a small rectangular piece of ebonite on which is mounted a nickel-plated earthing switch, consisting of three terminals mounted on short springs, one acting as a pivot for the metal arm, the others forming the contacts. Between the pivot and one terminal is connected a lightning arrester, so that when the set is not earthed it is still protected from static discharges by the arrester. The component is well made and finished.

Burndept Super Radio Battery

WE have received from Messrs. Burndept, Ltd., of Aldine House, Bedford Street, Strand, W.C.2, a sample of their new Super Radio Battery. This battery consists of thirty-six very large dry cells, which are manufactured with drawn zinc



Burndept Super Radio Battery.

seamless containers. It is intended that the battery be employed as a 45-volt unit, the extra cells only being used when the voltage begins to drop. Thus, after some few months' use, when normally the voltage would be a few volts lower than nominal, by bringing into action these extra cells the full 45 volts are obtainable.

Another advantage of this battery is that, owing to the large size of the plates of the cells (and consequently their lower resistance), the current furnished by this battery is ample for a four-valve set. The battery is contained in a square imitation wood box and is of a substantial weight. The top of the container is covered with a red wax composition, into which are mounted five tapping points in the form of small brass terminals. One is, of course, the negative end of the battery, while the other four are positive tappings for 20 volts, 45 volts, 48 volts and 50 volts. Thus for H.F. and detector work, when the battery is new, the 45-volt terminal will be right, this being changed to 48 or

(*Concluded in third column of next page*)

THE "OUTSIDE" PROGRAMME

IMPROVEMENT in programmes and more dance music are the desires most frequently expressed by listeners to British broadcasting. True it is that the followers of these two schools do not see eye to eye in all matters; indeed, fratricidal tendencies are sometimes expressed, but each in their way desire the betterment of wireless with the hope that in that betterment a large percentage of their desires will be represented.

From a review of broadcast programmes it is sometimes difficult to believe that all these desires are known and attempts made to satisfy all and sundry. Why is it, then, that sweeping changes are not made conducive to an atmosphere of peace.

In the following notes points of interest will be found for the listener who would like to possess the power of being able to switch on his favourite dance music whenever the mood prompted.

How Dance Music is Obtained

The outside broadcast department who carry out the B.B.C.'s external (as opposed to studio) programmes are daily responsible for three or four distinct groups of dance-music transmissions. Their method of procedure in obtaining these interludes is interesting. After preliminary negotiations with the hotel or dance club have been made, a representative of this department is detailed to listen to the band in question and tender advice calculated to improve the quality of the music from the broadcasting standpoint.

The next step is the installation of telephone lines by the G.P.O. and the holding of a full-dress rehearsal—the important point being that on this occasion the band will be controlled from Savoy Hill and judged purely by that unmerciful instrument the microphone.

The rehearsals progress with a series of checks, during which time the positions of various musicians are frequently changed—a trumpet is perhaps subdued, the banjos are moved forward, or the whole band more widely dispersed until perfection, so far as this particular combination is concerned, is obtained. Some five weeks later devotees of Terpsichore are dancing to the strains of a recruit to the army of broadcasters.

In obtaining this all-important "balance" the bandmasters listen on headphones, and it is interesting to note that the leaders of famous bands are always the most painstaking in this respect.

Cost of Wireless Dance Music

For the individual, dancing nowadays is far from being a cheap form of recreation, neither is the supply of dance music a cheap undertaking. In addition to the expenses involved by such necessary details as wireless equipment—telephone lines and engineers—dance music involves a heavy copyright charge. On every tune broadcast a charge of varying amount is paid. This is quite rational, but the cost of these transmissions can be gauged by the public when it is realised that this charge is proportionately increased according to the number of stations relaying the transmission.

To add to the reader's perplexity, a parallel might be stated by saying that were a dance band to play a tune in a hall, copyright would be paid once, but were the proprietor of the hall to open six large doors so that an overflow of guests might hear the music, he would be obliged to pay the copyright fee six times. In view of the above, the advantage of a few high-power stations compared with the present system can be appreciated.

The recent extension at Daventry of dance music until 2 a.m. has proved so popular that this innovation is being carried to 2 L O, but here the hand of finance creeps in, limiting the Londoner's Friday dance to midnight. The voice of the provinces will soon be raised claiming an equal privilege, so that the B.B.C. with its hydra-headed system will shortly be involved in a charge of approximately one-thousand-five-hundred extra hours of dance music per year on this one score alone.

What of the Non-dancer?

The average listener of to-day is possessed of infinite patience and a large amount of tact, due no doubt to his intimate knowledge of the technical difficulties inherent in the present system of broadcasting; but the day is fast approaching when allowances will be out of vogue and each group of listeners will expect their cherished desires to be satisfied. The wireless receiving set of to-morrow, as far as Britain is concerned, can be looked upon as possessing three taps to be turned on at will and labelled "highbrow," "middle brow" and "dance music."

Programmes for All

How can this delightfully independent prospect be achieved. As has been shown above, the present multi-station system, carrying with it its bill of overhead charges and adding in a hundred ways to programme costs, is about to give way to the scheme recently announced by the B.B.C. Let us hope that it will wipe away the present bones of contention by giving to London three stations transmitting classical, popular and dance programmes from aerials situated outside the metropolis and so arranged that the London listener can receive all three should he so desire.

The provinces would be served by the "regional high-power stations," as foreshadowed by the B.B.C.'s recent announcement, but each "region" should receive the triple London bill, thus giving the provincial listener his three taps. Costly as these stations will be, the enormous saving in overhead and programme charges can at once be seen. The present system involves a squander of programme material. Having only two programmes to supply, it can at once be recognised to what a standard the B.B.C. transmissions will attain.

The provincial listener may resent the loss of local autonomy, but he need indulge in little apprehension on this score, while, on the other hand, his profit should be obvious. The B.B.C. in their pronouncement made no reference to the dismantling of local studios, and it is conceivable that these will be used in the same manner as those recently erected at Oxford and Cambridge.

All systems of broadcasting are evolutionary, but in the near future Britain can look forward to a great advance in the system of unified broadcasting. Development will yet again make these changes obsolete, but they are likely to be a permanency until the possibility arrives of adequately radiating several programmes simultaneously from one aerial. It would be interesting to know how far the above suggestions cover the programme requirements of the readers of this journal.

ROBERT GLENDINING.

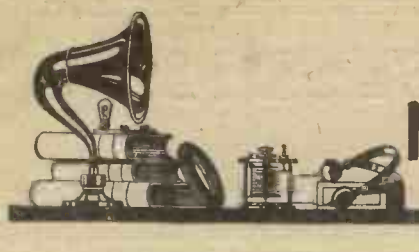
"'A.W.' TESTS OF APPARATUS" (*continued from preceding page*)

50 volts as the voltage drops. For low-frequency and power valves two of these batteries in series will furnish an ample current at 90 volts.

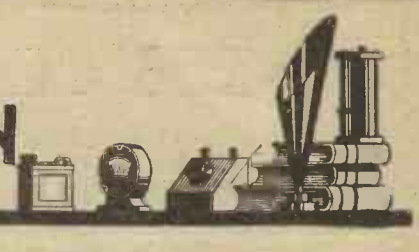
On test, this battery was found to be very silent in action and very free from the crackling and "frying" noises usually inseparable from the small-sized battery. The voltage remained up to the nominal for a considerable time, and the battery proved itself to be fully capable of substantiating the maker's claims.

The extension of the service of dance music from Daventry has proved very popular, and the B.B.C. has received a general request for similar facilities for London. Beginning the first week in February, therefore, dance music will be transmitted from London every Friday until midnight.

Wireless stations are rapidly increasing in the Belgian Congo. Stations will soon be opened at Elisabethville, Stanleyville, Coquilhatville, Lisala and Albertville.



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. 200).

Wood's Metal

Q.—*What is Wood's metal, and for what is it used?—L. A. (Blackburn).*

A.—Wood's metal is a kind of solder with a very low melting point. Its principal use for wireless purposes is to fix crystals in their cups securely, at the same time allowing contact to be made with a large area of the crystals. Most crystals are damaged by heat so that ordinary solder would be unsuitable for the purpose. Wood's metal is not suitable for making connections in the set itself, as joints made by it are not strong enough to withstand vibration.—M. C.

Sal-ammoniac Solution

Q.—*I have experienced some difficulty with the electrolyte of the H.T. batteries described in No. 159. Can you tell me what is a correct solution and also how to prevent crystallisation?—F. S. (Bradford).*

A.—The article states that a saturated solution is necessary, which is about 7 oz. dissolved in 1 pt. of water. Dissolve two fairly-heaped tablespoonfuls of sal-ammoniac in a tumbler of water. To avoid the formation of crystals on the zinc, keep the water level up so as to stop the solution from getting too strong.—M. L.

Condenser Plates

Q.—*An article appeared in No. 178 giving particulars of the construction of a condenser unit for improving the tone of the loud-speaker. It was stated that each condenser consisted of twelve pieces of copper-foil, and, further on, that the foils were arranged three on each side, which of course would only make six altogether. Can you tell me which is the correct figure?—H. P. (Llanelly).*

A.—The word "three" in the article is a misprint. It should read "Six on each side," making twelve foils in all for the condenser.—E. K.

Milliammeter

Q.—*Can you suggest a few uses for a milliammeter reading from 0 to 10, in conjunction with a four-valve set?—P. S. (Eltham).*

A.—Such a meter will be extremely useful. If it is connected in series with the H.T. battery, the exact amount of the total current being drawn from the battery may be readily ascertained. If it is connected in series with the plate circuit of the detector valve the needle will be seen to drop as signals are tuned in. When the needle shows the lowest reading the set has been tuned exactly to the wavelength of the transmitting station. This method is more accurate than tuning by ear and in addition it can be seen whether any alteration to the set has made an improvement or not by observing whether the signals decrease the reading or not after the alteration has been made. (It should be remembered that the effect of signals on a detector valve is to decrease the anode current.) When the meter is placed in the plate circuit of one of the amplifying valves it will show whether the valve is amplifying perfectly. If so the needle will remain perfectly steady as the average anode current will not be varied. If the needle flickers rectification is taking place. An upward movement of the needle shows rectification on the lower bend of the curve and a downward movement shows that the valve is being worked near saturation point. The grid potential should then be altered accordingly. Several other uses for the instrument will occur when experimenting.—M.

Toroidal Coils

Q.—*I have read the article on toroidal coils which appeared in a recent issue, but I am not quite sure how the coil is connected as an H.F. transformer without short-circuiting the H.T. side. It is mentioned as being tapped.—R. A. B. (Manchester).*

OUR WEEKLY NOTE

LOW-LOSS COILS.

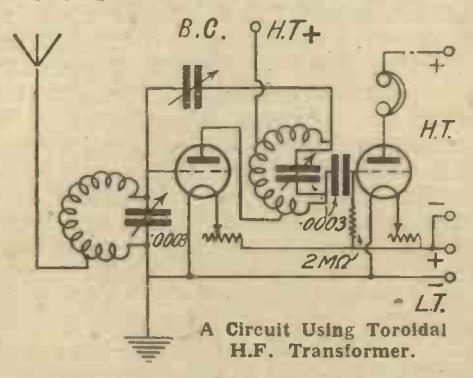
The theoretical advantages of low-loss coils are now well known. Such a coil is wound with thick wire and therefore has a low resistance; it has wide spacing between the turns and consequently low self-capacity, the little insulating material in its field ensures low dielectric losses, and the coil is therefore the very last word in efficiency.

It might be expected that the substitution of a low-loss coil for one of the ordinary type would result in an immediate and considerable increase in the strength of reception. But often it doesn't.

The reason for this is that the tuning coil is only a portion of the aerial circuit. If the losses in the rest of the aerial circuit are high it will make very little difference whether a "high-loss" or low-loss coil is used. In such a case reducing the losses of the coil may make only a slight difference to the total losses of the circuit. Whenever the use of a low-loss coil effects no appreciable improvement get to work right away to trace and eliminate the greater losses in the rest of the aerial circuit.

THE BUREAU.

A.—The circuit diagram shown herewith illustrates a two-valve set (H.F. and detector) employing toroidal coils, and the method of



A Circuit Using Toroidal H.F. Transformer.

using coils of this description for the H.F. stage should be quite clear. B.C. is a small balancing condenser; all the components have the usual values. There is, of course, another kind of toroidal in which the primary and secondary are separate windings, either wound with one another or arranged on "opposite sides" of the ring. The primary and secondary coils should, of course, be wound in the same direction and comprise, for broadcast wavelengths, about 100 turns each. A coil of this description may be substituted for an ordinary H.F. transformer without trouble.—H. J. H.

H.T. Battery

Q.—*I have started to construct a permanent H.T. battery as described in No. 159, but I have found some difficulty in removing the old zincs and sal-ammoniac paste, which has hardened around the cells. Can the cells be put in the tubes as they come from the old battery, and does it increase the resistance or decrease the amperage of the high-tension battery?—M. (Whitley Bay).*

A.—For this type of battery you should not use old and hard-crusted inner cells; they are nearly always unsatisfactory and very troublesome to clean. Use only those which are still somewhat moist, and clean by rubbing gently with an old tooth-brush in warm water. Don't break the paper or cloth, for the black powder will then escape and spoil the cell. To remove the zinc, cut it with a knife at the top edge near the soldered joint, and then roll it back from the joint. This lays open the interior and the cell can be lifted out undamaged.—W.

Calculating Transformer Impedance

Q.—*Can you tell me how to find the impedance of a low-frequency transformer? I have particulars of the resistance, core size and number of turns in the winding.—M. A. H. (Tottonham).*

A.—The impedance or apparent resistance in an alternating circuit is obtained by dividing the applied voltage by the current produced. If Z = impedance, E = volts, and I = current,

$$Z = \frac{E}{I} \text{ ohms}$$

The impedance of a circuit will be greater than its ohmic resistance on account of the inductance possessed by the windings when passing an alternating current. Two elements combine to form the total impedance, namely, the resistance and the reactance or inductance. Reactance is the counter E.M.F., set up by the opposition to changes in the alternating current value. Its numerical value is $2\pi fL$, f being the frequency and L the self-inductance in henries, the usual symbol for the reactance being X. Impedance is therefore expressed $Z^2 = R^2 + X^2$, therefore $Z = \sqrt{R^2 + X^2}$. The voltages spent in overcoming the two elements of impedance differ in phase by an angle of 90 degrees, that due to resistance being in phase with the current and that due to reactance being 90 degrees in advance. The actual phase angle of the total applied volts will therefore be the resultant of these two sector quantities and will take up an angle dependent upon their relative magnitudes. The reactance volts of a transformer can be measured simply by a voltmeter applied across the terminals of its primary or secondary winding when a known value of current is passing. The resistance of the windings multiplied by the current then passing gives the resistance volts or volt-drop (C × R) due to resistance, which subtracted from the total applied volts leaves reactance volts. To arrive at the permeability of the core under these conditions the formula may be used:

$$N \text{ (total flux)} = \frac{E \times 10^8}{T \times 4.44\ f},$$

T being the turns of wire and f the frequency. Dividing N by the cross-sectional area of iron in the core will give the induction value B per square inch, from which the permeability can at once be obtained.—H. H. A.

BIRMINGHAM'S NEW STUDIO

THE LARGEST IN THE COUNTRY

FURTHER progress on the part of the B.B.C. was marked by the opening on Wednesday, January 20, of the new Birmingham station at Broad Street, Birmingham.

The First Station

First inaugurated on November 22, the Birmingham station for several months broadcast from temporary premises at Witton, and then in August of the following year removed to far more commodious premises in the centre of Birmingham at New Street, with the transmitting plant at the Summer Lane Corporation Power Station.

Even the larger studio provided at New Street, and more particularly the offices, were inefficient, and it is only in the latest move to Broad Street that 5 I T can be said to have ever been adequately housed.

The new home, however, was built for the express purpose of broadcasting, with the result that there are features which make the new Birmingham station notable among the broadcasting stations of the country.

A huge building provides accommodation on two floors, and on the first the principal chamber is the studio, which, measuring 45 ft. by 50 ft., is now the largest studio in the country. It has been furnished with gold and blue drapings, which are hung on ropes and pulleys so that the degree of echo can be controlled, and there is thus provided great facilities for the experiments which will do so much to improve both studio work and the quality of transmissions.

There is ample office accommodation for the whole staff, and on the second floor there is provided a second and far smaller studio from which talks and individual items will be broadcast.

The Opening Ceremony

The opening ceremony was performed by Mr. P. J. Hannon, M.P., who was introduced by Lord Gainford (chairman of the B.B.C.).

Lord Gainford stated that one of the main objects which the B.B.C. had at the present time was to secure to as many listeners as possible throughout Great Britain an alternative programme. His board, he continued, was very anxious also to improve their programmes. Unfortunately at the present moment they were limited in the amount of their income during the period that the Broadcasting Inquiry Committee was sitting. They were, however, doing their best to improve their programmes. He saw in broadcasting increasing usefulness, not only bringing peace on earth, but goodwill among men.

Mr. P. J. Hannon claimed for broadcasting that it elevated the qualities of the home. From the time 5 I T moved to New Street there had been accomplished 4,995 hours of transmission. That was 160 hours each month, or 5½ hours per day, and during the whole of that time there had only been .12 per cent. breakdowns, or twelve hours loss of transmission in every thousand hours of broadcasting.

In formally declaring the station open, he paid a tribute to Mr. Percy Edgar, the station director, who has done so much towards making the Birmingham transmissions such a success.

"WHY THE AMATEUR WENT DOWN IN WAVE LENGTH" (*continued from page* 168)

amateur wavelength was altered from 1,000 to 440 metres. It was at first thought that a great deal of trouble would be occasioned in getting the transmitter to work satisfactorily on this wavelength, also that some interference would be caused to reception by ship spark stations, but this was not the case; things seemed to go well and very little trouble was caused on this account. The question of capacity losses was not so important in these days as in the present time, and most sets were wired with covered conductors and shellacked.

On this wavelength many very useful tests and experiments were carried out and remarkable results obtained; for instance, with an input of 10 watts it was found possible to carry on telephonic conversation with stations as far north as Aberdeen. I have no doubt many of my readers will remember the tests carried out by 2 O N, the writer and 2 J Z.

Early Difficulties

The experimenter in those days was not in the happy position of being able to obtain the components now available; one had to resort to ex-Government parts, if you were lucky enough to obtain them. In many cases he had to manufacture his own parts, such as filament resistances, valve sockets and even low-frequency transformers.

Enthusiasm grew very rapidly, and the want of a recognised experimental transmitting station on this wavelength was felt. The Marconi station, 2 M T, was opened and worked by Capt. Eckersley, now chief engineer to the B.B.C. This marks the first real step to what ultimately led to present-day broadcasting.

When the first official broadcasting station in this country was opened, the amateur experimenter's troubles started in earnest. It was found that interference was caused to broadcast listeners by their transmissions. In nearly every case the complaints were received from persons using crude forms of crystal set; valve users were not troubled except by very near stations. Although amateur permits entitled experimenters to work during broadcasting hours, a mutual agreement was arrived at not to make any tests during broadcast transmissions. This, of course, made it necessary for the experimenter to carry out his tests at a very late hour of the night, and in many cases until the small hours of the next morning, which was a tax on the vitality of the persons engaged and many suffered in consequence.

Still Lower

As many complaints still came in both to the P.M.G. and the B.B.C., it was decided to allot a still lower wavelength of 200 metres to the experimenter, but even on this wave it was found impossible to carry on tests without causing some interference. This wave was found a very useful one in some directions, more especially for C.W. signals, and I believe the first British signals received in America were on this wavelength.

Organised tests were arranged at this stage between this country and America, a great many British amateurs being successful in getting through. Judging from the reports received on telephony by myself, I would venture to suggest that the 440-metre wave was more successful; this, of course, may be due to the fact that the receivers used then were not so efficient on the 200-metre band.

As it was found that long-distance low-power work was possible on the shorter wavelength, the authorities were approached with a view to obtaining permission to transmit on very short waves.

Interference

In conclusion, I should like to add that I hope those who listen to the broadcast programmes will sympathise with the amateur experimenter, and be quite sure before making any complaints of interference that such interference does really emanate from an amateur.

"Good night, everybody! 2 K T switching off and closing down."

J. E. NICKLESS.

The Rumanian postal authorities are organising a permanent exhibition of radio apparatus in the head office in Bucharest with the object of encouraging interest in radio matters in Rumania.

RADIOGRAMS

NOW that a system of wired wireless telephony is being successfully operated on an express train travelling daily between Berlin and Hamburg, a further five trains on the same section will be equipped with transmitting and receiving apparatus. In the near future the services will be extended to Munich, Leipzig, Frankfort-on-Main, Cologne and other important cities. Experiments are now in progress at the Norddeich station with a view to establishing two-way communication between steamers in the Baltic and North Seas and German cities.

As a result of the great floods, the yacht *Commandant Tissot,* which was utilised as a wireless laboratory by the Sté. Française d'Etudes de T S F, sank at its moorings in the river Seine on January 8.

In conjunction with the Dutch Ministry of Education, a committee has been formed with a view to examining the possibilities of broadcasting educational courses.

The next play to be broadcast will be *Betty of Mayfair,* and an excerpt from this musical comedy will be given on January 29.

A new revue by Kenneth and George Western, of "The Roosters'" concert party will be broadcast from the high-power station on February 1. It is entitled *Out of the Hat,* in twelve "dips."

By special request, a microphone has been permanently installed at Croyland Abbey, and the bells will be broadcast again on February 7.

The B.B.C. have secured the services of two new artistes, namely, Hatch and Carpenter, who are somewhat similar to the Layton and Johnston turn who scored such a success in the United Kingdom. Their first performance will be given at the 2 L O studio on February 10.

An excerpt from the *Blue Kitten,* as performed at the Gaiety Theatre, will be relayed to the London station on February 12. It will include the sketch *Breakfast in Bed*, with W. H. Berry in the cast.

Sir Frederic Cowan will accompany a recital of his own songs at the London studio on February 12.

On the occasion of the Civil Service Dinner, which takes place on February 12, the speeches of H.R.H. Prince Henry and the Prime Minister will be S.B. to all stations.

On February 13 the Cardiff station will celebrate its third anniversary, and a special programme will be given in which Mr. Rex Palmer, who opened the station in 1923, will take a prominent part.

For the week beginning February 1, the 7.25 p.m. period will be devoted to the works of various foreign composers, including Scarlatti, Couperin and Rameau. They will be given by Mrs. Norman O'Neill.

On Wednesday, February 3, the B.B.C. hope to relay a portion of a well-known cabaret show.

Mr. Reginald Berkeley, author of the *White Château,* has written another short play for broadcasting. Under the title of *The Quest of Elizabeth,* it will be performed at the London station on Friday, February 5.

Albert Sandler and his orchestra will be relayed from the Grand Hotel, Eastbourne, on Saturday evening, February 6.

A special relay of Continental programmes will be made from the Keston station at 9.30 p.m. on Friday, February 5.

A club of wireless experimental amateurs in Vienna has erected a small wireless telegraphy and telephony transmitter, which broadcasts on 270 metres every night, Sundays included, from 22.00 to 22.15 (telephony) and 22.30 to 22.45 (telegraphy).

According to recent statistics published by the German Ministry of Education, it would appear that in all cities where a broadcasting service has been established the attendance at evening classes of continuation schools has appreciably fallen off. This, it is said, is due to the educational lectures transmitted daily by the Reichsfunk.

The Lausanne broadcasting station is, for the present, in a state of flux, and it is possible that listeners may pick up the transmissions on various wavelengths. A new 1½-kilowatt Marconi transmitter is being installed, and it is expected that, in future, the concerts will be broadcast on a wavelength chosen between 310 and 330 metres.

The Geneva broadcasting station, seeking freedom from interference, has now altered its wavelength to 760 metres.

The new 1½-kilowatt Bergen broadcasting station is testing almost every evening on 350 metres. It gives its call-sign in many languages, including English. Apart from its own local transmissions, it will also, at regular intervals, relay the Oslo programmes.

It is expected that the new high-power Frankfort-on-Main station will start its preliminary tests at the end of February. When completed, the studio will be the largest possessed by any broadcasting station in Europe.

Sir William Mitchell-Thomson, the Postmaster-General, paid his first official visit to the Rugby station on January 11, and was shown round by Mr. Edward Shaughnessy, the assistant engineer-in-chief.

At the exhibition to be held at Cologne on January 31, the German Reichspost, in conjunction with the officials of the Munster broadcasting station, will instal a studio fitted with amplifying plant. By this means speeches, lectures and concerts given in the exhibition building will be conveyed by land-line and re-broadcast through Munster, Elberfeld and Dortmund transmitters.

France is following in the footsteps of Great Britain, and many hospitals are now equipped with receiving sets for the benefit of the patients.

Under the title of the Empresa Venedolana de Radio Telefonia, a company has been formed in Venezuela with a view to erecting a central broadcasting station at Caracas or La Guaira, to operate on a wavelength of about 400 metres. It is hoped that this station will be in full operation by the end of February.

The Manchester station is arranging an original feature, consisting of interviews in the studio with representatives of various trades, callings and professions.

On Sunday, January 17, the Ancient Society of College Youths rang Bow Bells. Records show a continuous list of its members who have rung the bells of the city churches since the society was formed in 1637.

Wireless telegraph services have now been inaugurated between Great Britain, Yugo-Slavia and Bulgaria.

Within the last few weeks a revolution has been effected in the lives of the lighthouse-keepers at Sule Skerry, a solitary rock about 35 miles from Stromness, by the installation of wireless. Owing to the frequent bad weather the watchers are often cut off from the outside world for weeks at a time, but when off duty the keepers can now listen to a number of the B.B.C. programmes. Similar facilities have been provided at Flannan Isles, which are situated about 20 miles from Lewis.

On a recent train journey between Scotland and the Border a Reinartz set was taken in a hat-box and set up in the train. A few yards of wire between the racks of the compartment formed the aerial, and, with a counterpoise earth on the floor, several stations could be heard between Glasgow and Carlisle, the loudest being Bournemouth.

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 Greenwich Mean 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.); 10.0-10.30 p.m., time sig., news, talk; 10.30-11 p.m., special feature (Mon., Wed., Thurs., 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), 308 m. **Dundee** (2DE), 331 m. **Edinburgh** (2EH), 324.5 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 321.5 m. **Liverpool** (6LV), 311 m. **Nottingham** (5NG), 323.5 m. **Plymouth** (5PY), 338 m. **Sheffield** (6FL), 301 m. **Stoke-on-Trent** (6ST), 304 m. **Swansea** (5SX), 482 m. **Daventry** (25 kw.), high-power station, 1,600 m. Special weather report 10.30 a.m. daily; 11.0 a.m., light music (exc. Sat. and Sun.); relays 2LO from 4 p.m. onwards, own con. on Thurs. Dance music daily (exc. Sun.) till midnight; on Fridays until 2 a.m.

IRISH FREE STATE

Dublin (2RN), 390 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. G.M.T.

AUSTRIA.

Vienna (Radio Wien), 530 m. (5 kw.). 10.00, con. (almost daily); 14.30, con.; 18.25, news, weather, time sig., con., lec., news; 19.00, con.; 21.00, dance (Wed., Sat.).

Graz, 397 m. (1 kw.). Relay from Vienna. Also own con. (Tues., Wed., Fri.), 19.10.

BELGIUM.

Brussels, 262 m. (1½ kw.). 17.00, orch. (Tues., Thurs., Sat. only), news; 20.00, lec., con., news (opera, Mon. and Wed.).

Liége (Radio Wallonie), 285 m. (Con. (irr.).

Liége (Radio Central), 205 m. 20.00, con. (Mon., Thurs., Sat.).

Seraing, 195 m. 20.00, con. (Thurs. only).

CZECHO-SLOVAKIA.

Prague, 368 m. (5 kw.). Con., 19.00-21.00 daily.

Brunn (OKB), 750 m. (1 kw.). 09.00, con., news (Sun.); 18.00, lec., con. or dance (daily).

DENMARK.

Copenhagen (Radioraadet), 340 m. (2 kw.). Sundays: 14.30, lec.; 16.30, children; 19.00, play; 20.15, news, con.; 20.45, news, Esperanto (Mon.), silent night. Weekdays (Tues., Fri., Sat.): 19.00, lec., con., news, con.; 20.30, dance (Sat.).

Ryvang, 1,160 m. (1 kw.). Sundays: 08.00, sacred service; 16.30-20.30, same as Copenhagen; 19.00 (Wed., Thurs.), lec., con., news, orch.

Hjoerring, 1,250 m. (1.5 kw.).*

Odense, 950 m. (200 w.).*

* Relay Copenhagen.

FINLAND.

Helsingfors (Skyddskar), 522 m. (500 w.). 17.30-20.00, con. (Tues., Thurs., Sat.).

Helsingfors, 318 m. Con. 17.00 (Tues., Thurs., Sat., Sun.).

Tamafors, 360 m. Relays Helsingfors.

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; 20.10, con. (2,740 m.) (daily).

Radio-Paris (CFR), 1,750 m. (about 3 kw.). Sundays: 12.45, con., news; 16.30, Stock Ex., con.; 20.15, news, Esperanto, con. or dance. Weekdays: 12.30, con., markets, weather, news; 16.30, markets, con. (Mon., Tues., Thurs., Sat.); 20.15, news., con. or dance. *Le Matin* gala con. every Sat., 20.30.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 458 m. (800 w.). 14.00 or 15.00, studio con. or outside relay; 20.00, Esperanto (Thurs.); 20.30, lec. (almost daily); 21.00, con. (daily).

"Le Petit Parisien," 358 m. (500 w.). 21.15, con. (Tues., Thurs., Sat., Sun.).

Radio-Toulouse, 443 m. (2 kw.). 12.30, con., time sig. (daily); 17.30, news (exc. Sun.); 20.45, con.; 21.25, dance (daily). Tests on 180 m.

Radio-Lyon, 280 m. (2 kw.). 20.15, con. (daily).

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

***Lyon-la-Doua**, 480 m.

***Marseilles**, 351 m.

***Toulouse** (PTT), 280 m.

***Bordeaux**, 410 m.

* Relays of PTT Paris.

GERMANY.

Berlin, on both 505 and 576 m. (4 kw.). 08.00, sacred con. (Sun.); 10.00, con. and tests; 11.55, time sig., news, weather; 14.00, educ. hour (Sun.), markets, time sig.; 15.30, children (Tues.); 16.00, orch.; 19.30, con., weather, news, time sig.; 21.30, dance (Thurs., Sat., Sun.). * Relayed on 1,300 m. by Königswusterhausen and Stettin (241 m.).

Königswusterhausen (LP), 1,300 m. (20 kw.). 10.30-11.50, con. (Sun.); 14.00, lec. (daily); 19.30, relay of Berlin (Vox Haus) con. (daily); 2,525 m. (5 kw.), Wolff's Buro Press Service: 05.45-19.10; 2,900 m.: Telegraphen Union: 07.30-18.45, news. 4,000 m. (10 kw.): 06.00-20.00, news.

Breslau, 416 m. (1½ kw.). 11.00, con. (daily); Divine Service (Sun.); 11.55, time sig. (Sun.), weather, Stock Ex., news; 15.00, children (Sun.); 16.00, con.; 18.00, lec.; 19.30, con., weather, time sig., news; 20.45, dance (Sun., Thurs.). Relay: Gleiwitz, 251 m.

Frankfort-on-Main, 470 m. (1½ kw.). Relay by Cassel (275 m.). 07.00, sacred con. (Sun.); 10.55, time sig., news; 11.55, Nauen time sig.; 15.00, con. (Sun.); 15.30, con.; 16.00, children (Sun.); 17.00, markets, lec.; 19.00, lec., con., weather, dance. Relay: Cassel, 273.5 m.

Hamburg, 392.5 m. (10 kw.). Relayed by Bremen (277 m.), Hanover (296 m.), Kiel 230 m.). Sundays: 06.25, time sig., weather, news, lec.; 08.15, sacred con.; 12.15, con.; 14.15, Esperanto, con.; 17.00, con.; 18.15, sports, weather, con. or opera, dance. Weekdays: 05.55, time sig., weather; 06.00 and 06.30, news, weather; 11.55, Nauen time sig., news; 13.00, weather, con.; 15.15 and 17.00, con.; 18.00, lec., English (Tues., Sat.), Spanish (Mon., Thurs.); 18.55, weather, con.; 21.00, dance.

Königsberg, 463 m. (1 kw.). 08.00, sacred con. Sun.); 11.55, time sig., weather, news; 15.30, con.; 16.00, con. (Sun.); 18.30, lec.; 19.00, con. or opera, weather, news, dance (irr.).

Leipzig, 452 m. (700 w.). Relayed by Dresden (294 m.). 07.30, sacred con. (Sun.); 10.00, educ. hour (Sun.); 11.00, con. (daily); 11.55, Nauen time sig., news; 15.30, con., children (Wed.); 19.15, con. or opera, weather, news, cabaret or dance (not daily).

Munich, 485 m. (3 kw.). Relayed by Nuremberg (340 m.). 10.30, lec., con. (Sun.); 13.00, time sig., news, weather; 15.00, orch. (Sun.); 15.30, con. (weekdays); 17.30, con. (weekdays); 18.15, lec.; 18.30, con. (Sun.); 19.30, con., news, weather, time sig.; 21.00, late con. (irr.).

Münster, 410 m. (2½ kw.). Relayed by Elberfeld (259 m.); Dortmund (283 m.). 10.45, Radio talk, Divine Serv.; 11.00, news (Sun.); 11.30, news (weekdays); 11.55, Nauen time sig.; 14.30, news, time sig.; 15.00, con.; 16.00, children (Sat.); 18.40, news, weather, time sig., lec., con.

Norddelch (KAV), 1,800 m. 23.00, weather and news.

Stuttgart, 446 m. (1½ kw.). 10.30, con (Sun.); 15.30, con. (weekdays); 16.00, con. (Sun.); 17.30, time sig., news, lec., con. (daily); 20.15, time sig., late con. or cabaret.

HOLLAND.

Amsterdam (PCFF), 1,955 m. (1 kw.). Daily: 07.15-16.10 (exc. Mon. and Sat., when 1.10-11.10), news, Stock Ex.

Hilversum (HDO), 1,050 m. (2½ kw.). 09.40, sacred service (Sun.); 19.50, con.; 21.40, news, etc.

HUNGARY.

Buda-Pesth (Csepel), 546 m. (2 kw.). 08.00, news; 11.00 and 14.00, weather, news; 16.00, dance music; 19.00, con. or opera.

ITALY.

Rome (1RO), 425 m. (2½ kw.). 09.30, sacred con.; 12.15, official communiqué; 16.00, children; 16.30, relay of orch. from Hotel di Russia; 16.55, news, Stock Ex., Jazz band; 19.30, news, weather, con.; 21.15, late news, Jazz band.

Milan, 320 m. (2 kw.). 22.00-24.00, con.

LETTLAND.

Riga, 475 m. (2 kw.). Con. daily, 20.00-21.00.

NORWAY.

Oslo, 382 m. (1.2 kw.). 10.00, Divine service (Sun.), Stock Ex. (weekdays); 12.15, markets; 18.15, news, time, lec., con.; 21.00, time, weather, news, dance relayed from Hotel Bristol, Oslo.

Aalesund, 515 m.

Bergen, 350 m. (1½ kw.). Testing.

POLAND.

Warsaw, 380 m. (700 w.). Daily: con., 17.00-19.00.

RUSSIA.

Moscow (RDW), 1,450 m. (12 kw.). Weekdays: 12.30 and 17.55, news and con.

(Popoff Station), 1,010 m. (2 kw.). 10.00, 11.00, lec.; 23.00, con. (Tues., Thurs., Fri.).

Radio Peredacha, 375 m. (6 kw.).

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

Leningrad, 940 m. (2 kw.). Weekdays: 15.00.

SPAIN.

Madrid (EAJ6), 392 m. (1½ kw.). Daily: 21.30-24.00, con.

Madrid (EAJ7), 373 m. (4½ kw.). Con.: 17.30-19.30 (Sun.); 15.30-17.30 (Mon.); 22.00-01.00 (Tues., Fri.); 16.00-18.00 (Wed., Sat.); 18.00-20.00 (Thurs.).

Madrid (EAJ4), 340 m. (1 kw.). Con.: 21.00-24.00 (Sun., Mon. and Thurs.); 15.30-17.00 (Tues., Fri.); 17.30-19.30 (Wed., Sat.).

Barcelona (EAJ1), 324 m. (650 w.). News, lec., con., 17.00-21.00 (Sun.), 18.00-23.00 (Mon., Tues., Fri., Sat.), 18.00-24.00 (Wed., Thurs.).

Barcelona (Radio Catalana) (EAJ13), 460 m. (4½ kw.). 19.00-24.00, weather, news., les., con., dance (weekdays); 21.00-24.00, con. (Sun.).

Bilbao (EAJ9), 300 m. (1 kw.). 19.00, news, weather, con. Close down 21.00 or 22.00.

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

Cadiz (EAJ3), 360 m. (550 w.). 19.00-21.00, con., news. Tests daily (Mon., Tues., Wed., Sat.), 24.00.

(*Concluded on page* 192)

"BROADCAST TELEPHONY" (cont. from page 190)

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

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

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

San Sebastian (EAJ8), 344 m. (500 w.). Daily: 18.00; con. Close down about 23.00.

Salamanca (EAJ22), 355 m. (500 w.). 21.00, con. daily.

SWEDEN.

Stockholm (SASA), 428 m. (1 kw.). 10.00, sacred service (Sun.); 11.30, weather; 13.00, con. (Sun.); 16.00, children (Sun.); 17.00, sacred service; 18.00, lec., con.; 20.15, news, con., weather. Dance (Wed., Sat.) S.B. from Stockholm to **Gothenburg** (SASB), 286 m.; **Malmo** (SASC), 270 m.; **Sundsvall** (SASD), 545 m.; **Boden** (SASE), 1,200 m. (1½ kw.); **Falun** (SMZK), 370 m.

Eskilstuna, 250 m. (250 w.).

Gefle, 325 m. (250 w.). **Joenkoeping** (SMZD), 265 m. (250 w.). **Linkoeping**, 467 m. (250 w.). **Norrkoeping** (SMVV), 260 m. (250 w.).

Karlstadt (SMXC), 221 m. (250 w.).

Trollaattan (SMXQ), 322 m. (250 w.).

Karlsborg, 1,250 m. (25 kw.). 19.00, news, weather (weekdays).

Varborg (340 m.). Testing.

Orebro (218 m.). Testing.

SWITZERLAND.

Lausanne (HB2), 850 m. (700 w.) (temp.). 19.00, lec., con. (daily). Tests on various wl.

Zurich (Höngg), 515 m. (500 w.). 10.00, con. (Sun.); 11.00, weather; 11.55, Nauen time sig., weather, news, Stock Ex.; 12.30, piano soli; 16.00, con. (exc. Sun.); 17.15, children, women; 19.15, lec., con., dance (Fri.); 20.45, news, weather.

Geneva (HB1), 760 m. (2 kw.). 19.15, con. (daily). Tests on 800 m.

Berne, 315 m. 09.30, organ music (except Sat.); 15.00, 19.30, con.

TRADE NOTES AND CATALOGUES

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., of Clifton Junction, Manchester, have issued an interesting folder giving valuable information regarding methods and apparatus for testing portable batteries.

A poster relative to the Sterling Dinkie loud-speaker and the Marconiphone Type 21 receiver has been issued by Messrs. The Marconiphone Co., Ltd., of 210, Tottenham Court Road, W.1.

The name of Messrs. Houghtons, Ltd., has been changed to Houghton-Butcher (Great Britain), Ltd. This alteration is due to the association of the Messrs. W. Butcher and Sons, Ltd., of Farringdon Avenue, E.C., with that of Messrs. Houghtons, Ltd.

An attractive calendar, representing a Mullard valve, has been sent us by Messrs. Mullard Wireless Service Co., Ltd.

"How to Get to Magnet House" is the title of an interesting booklet issued by Messrs. The General Electric Co., Ltd.

A booklet describing the Blackadda radio building system is published by Messrs. The Blackadda Radio Co., Ltd., of 48, Sadler Gate, Derby. In the Blackadda system all the components are standardised as regards terminal points so that they can be fitted to a "table" consisting of a moulded panel having 140 equally spaced holes. Wiring is effected by joining from point to point by means of special Blackadda connectors.

Sarbolt insulators are described in a leaflet issued by the Hatton Supply Co., of Hatton, Middlesex. The Sarbolt insulator incorporates an ingenious device for maintaining the porcelain covering in a vertical position, so that no leakage by damp can occur.

The new Dimic air-spaced coil, employing centre-tapped low-loss windings, is described in a pamphlet issued by L. McMichael, Ltd., of Hastings House, Norfolk Street, Strand, W.C.2.

"A Word Counter for the Typewriter" is illustrated and described in the current issue of "The Amateur Mechanic and Work" (3d.), and will be found to be very useful, as the device is entirely automatic in action and causes no distraction from the work in hand. Other articles in the same number are: "The Hawaiian Ukuleles or Guitars: Notes on Making"; "The 'A.M.' Reflecting Telescope"; "Automatic Pourer for Bottles, etc."; "Worm-thread Tool-setting Gauge"; "Fixing Aluminium Body to Two-seater Motor-car"; "An Enclosed Two-valver for Daventry or the Local Station"; "Building a Side-car Body"; "Practical Hints for the Motor-cyclist"; "How to Make a Moulding Plane"; "Some Very Cheap Telephone Receivers"; "Magnets: Natural, Temporary and Artificial"; "A Pen for Writer's Cramp."

Transformer Ratios

SIR,—With reference to the article "'If'-ficiency Tips" in No. 189, I think you ought to modify one statement, the one dealing with L.F. transformers.

The article specifies the first transformer of a series to be high ratio and the second one low ratio. Some well-known makers, including Marconi and Gecophone, work on exactly opposite lines and specify low ratio as No. 1 and high ratio as No. 2; but doesn't it really depend on the valve used as detector?—A. N. M. (Bedford).

"Dry Cells or Accumulators"

SIR,—Your correspondent P. R. B. appears to think that a dry cell capable of giving 174 ampere hours at 1½ volts is something miraculous. I therefore enclose the address of an old-established manufacturer of a cell in size exactly like the thiry-six installed by myself eighteen months ago. They state from tests that the cell has a capacity of 200 ampere hours at 1½ volts. Now thirty-six cells, coupled up in 3's in series, and twelve rows of these series coupled together in parallel, obviously have a capacity output of 2,400 ampere hours at 4½ volts, and in my article I state that I have drawn 2,088, over 300 less, so I have corroborated in practice the maker's statement—nothing more.

I cannot see what P. R. B. is puzzled about. If he does not listen-in six hours per day his battery will energise his set for a still longer term than mine, for we certainly use the set more than six hours per day.—GODFREY BAMBURG (London).

Telephone Extensions

SIR,—In No. 188 I noticed that a contributor described a one-wire method of telephone extension which, he said, was only suitable for use on crystal sets. This is not the case, as I have had a similar system working over 200 yd. in conjunction with a 3-valve set. The whole arrangement depends on the fact that most valve sets work very nearly as well with the earth lead attached to the + phone (or + HT) terminal, the cable being attached to the − phone terminal and connection being made as usual at the far end between the cable and ground.—J. B. I. (Hawick).

The Interference Problem

SIR,—I quite agree with THERMION'S remarks with regard to the disappearance of the B.B.C. stations. I use a four-valver, consisting of H.F. det. and two L.F., over which I have taken rather a lot of trouble in the way of spacing of components, low-capacity coils, condensers and valves, etc.

At Wimbledon, six miles from 2 L O in a straight line, London blots out everything forty metres either way, even with a series condenser. Using a series rejector circuit London disappears, to all intents and purposes, and I can just get faint traces of Cardiff, Bournemouth, and Birmingham, the last named fairly loud sometimes. No other British station can be heard, and, in fact, my only good stations are Brussels, Berne (what a wonderfully clear voice that lady announcer has!) and Toulouse. Zurich can usually be heard through deafening morse and a good many unidentified stations, also through bad morse.—G. E. B. (Wimbledon).

Those Examiners!

SIR,—A young friend of mine recently showed me the questions put by the examiners in this month's English Matriculation examination for the University of London. One of the subjects given for an essay was couched in the following terms: (IV) *Wireless telegraphy as a means of education and amusement.*

I must say that it puzzled me until I considered four alternatives, namely, (1) ignorance on the part of the examiners; (2) an intentional "catch"; (3) a poor understanding of what actually constitutes amusement; (4) a possible printer's error.

I presume that alternative (1) should not be contemplated, but outside legal circles it is not usual to classify the

(*Continued on page* 196)

CORRESPONDENCE (*continued from page 194*)

broadcast of concerts or other entertainments under the heading of wireless *telegraphy*; alternative (2) should not be countenanced if telephony was indicated; (3) if the examiners consider it both educational and amusing to listen to, say, Leafield or Northolt, they must lack a sense of humour, and lastly, (4) would be unpardonable.

Quite a number of candidates were unanimous in believing that the benefits of wireless telephony were to be expatiated upon.

Is it known to the examiners that under the ruling of Mr. Justice Stephen in the High Court (1910) it was made clear that all the Telegraph Acts passed since 1863 applied equally to telephony, and that in the same way the law relating to broadcast telephony is a part of the Wireless Telegraphy Act?

If, therefore, *telegraphy* was in the minds of the examiners, the candidates will have failed ignominiously, and it strikes me that the question as it was set was a misleading one. Surely it could have been put in more definite terms. Why not have used the words *Broadcast Telephony?*—J. G. A. (London, W.).

Other Correspondence Summarised

E. H. C. (Harrow) received Chilian 1 G W on his straight circuit detector and one low-frequency valve, using a standard coil-holder and plug-in coils. The wavelength was 36 metres.

A. E. G. (Sussex) received K D K A on a four-valve set, consisting of H.F. and two L.F. power valves in the last stage.

The British Journal Photographic Almanac, just published in its 61st issue, contains in its 880 pages much valuable information for the amateur photographer, together with numerous photogravure supplements. The "Almanac" costs 2s., and is published by Henry Greenwood and Co., Ltd., of 24, Wellington Street, W.C.2.

In a recent advertisement of the Radi-Arc Electrical Co., Ltd., the postal district was shown as W.1, whereas the correct address is Bennett Street, Chiswick, W.4, to which all communications should be sent.

A COMPREHENSIVE CATALOGUE

GECOPHONE receiving sets, components and accessories are described and illustrated in a 68-page catalogue received from the General Electric Co., Ltd. The receivers described cover the whole range from crystal sets to multi-valve super-heterodyne receivers, while the components illustrated are of special interest to the home constructor.

Other features of this complete list are pages of circuit diagrams, tables giving recommended Osram valve combinations, a glossary of wireless terms and definitions, a page of wireless symbols and a list of home and foreign transmitting stations, giving their call-signs and wavelengths.

A very fine receiving set and powerful transmitter were recently installed in the Vatican. For the time being they will only be used privately, but the idea is being considered of eventually using the Vatican station for broadcasting the Pope's announcements.

CHIEF EVENTS OF THE WEEK

SUNDAY, JANUARY 31

London	4.30	*La Chauve Souris.*
London	9.15	Schubert Programme.
Bournemouth	3.30	Wagner-Liszt Programme.
Bournemouth	9.15	Instrumental Feature and Art Songs.
Cardiff	9.15	*Out of the Depths.*
Glasgow	3.30	Orchestral Programme.

MONDAY

London	8.0	Chamber Music.
Birmingham	8.0	Classical Items.
Aberdeen	8.0	Scottish Song, Music and Drama.
Glasgow	8.30	Aspects of the East.
Belfast	8.58	Instrumental Solos.
Belfast	9.30	Two Scenes from Shakespeare.

TUESDAY

London	8.0	An Operatic Evening.
Bournemouth	8.0	Folk Lore in Song and Music.
Cardiff	8.0	A Pageant of the West—(1) Cardiff.
Manchester	8.0	*Daughters of Men.*
Aberdeen	8.0	English and Irish Music.

WEDNESDAY

London	8.0	Mendelssohn Programme.
Birmingham	7.30	Organ Recital.
Cardiff	8.0	"Runes of the Hebrides."
Manchester & 5XX	8.0	"John Peel" Programme.
Newcastle	8.0	Mendelssohn Programme.
Newcastle	9.15	Opera.
Glasgow	8.0	Symphony Concert.
Edinburgh	8.0	A Mendelssohn Night.

THURSDAY

Birmingham	8.0	Chamber Music Programme.
Manchester	8.0	Lancashire Talent Series.

FRIDAY

London	9.30	Special Relay from the Continent.
Manchester	8.0	A Popular Concert.
Belfast	8.0	Portion of Concert by the Belfast Philharmonic Society, relayed from the Ulster Hall.

SATURDAY

Newcastle	8.0	The Hatton Colliery Prize Band.
Aberdeen	9.0	Instrumental Programme.

PARS AND PERSONALITIES

By THE LISTENER

I LOOK forward to hearing Percy Heming again on Sunday night at 2LO. Mr. Heming went right through the run of *Lilac Time* at the Lyric Theatre. On Sunday he sings, amongst others, "Serenade," from the opera, and which is an aria from a lesser known opera, *Alfonso and Estrella.*

Mr. William Murdoch, the pianist, is an Australian who has made a great name over here for sonata playing, and has been associated with Albert Sammons, the violinist, both on the classical concert halls and before the microphone. The "Wanderer" fantasy, which he plays on Sunday, was based on Schubert's song of the same name and written by Liszt.

Miss Irene Scharrer, who is giving a recital on Monday from 2LO, is shortly leaving for a long American tour. She is a noted exponent of the Matthay system of pianoforte playing.

The operatic night of Tuesday will have as artistes some well-known members of the B.N.O.C.

On Monday at 2LO Mr. George Western, a popular member of "The Roosters'" Concert Party, produces his own revue entitled *Out of the Hat.* Words and music have been written by himself and his cousin, Mr. Kenneth Western. The two will also be remembered for a very amusing interlude when they were known as "The Perfectly Polite Pair."

When *Drake* is produced at 2LO it is hoped that Mr. Louis N. Parker will also broadcast. He has probably written, arranged and produced more plays and pageants than any other modern author. Best remembered are *The Man in the Street,* his arrangement of Jacobs' *The Monkey's Paw,* and *Beauty and the Barge,* also *Man and His Makers* and *Sacrament of Judas.*

Sir Frederick Cowen will accompany a recital of his own songs on Friday, February 12.

"A SUPER-HET RECEIVER WITH UNIT PANELS"

OWING to the demands upon our space this week we regret that we have been obliged to hold over the conclusion of the above article.

NO JOKES WITHOUT DUE WARNING!

(Not to be taken seriously)

THE great outcry which arose in the daily press on the day following the B.B.C.'s broadcast of a "Revolution in London," and the violent criticisms levelled at the heads of the organisation responsible for the stunt are, without doubt, fully justified and merited.

Surely if the B.B.C. up to the present have refrained from putting humorous items in their programmes, they should not be permitted to take undue advantage of unsophisticated listeners without giving due warning of such an intention.

To this end, it seems to me that in future a set of stringent rules should be drafted, and heavy penalties inflicted on all lecturers, announcers and officials of stations who do not conform to these regulations.

(1) Any joke to be broadcast should be published in detail in three consecutive issues of the official organ at least three weeks before the date on which the event is to take place, and full explanations should be given (*a*) in words of not more than three syllables, (*b*) in English, Gaelic, Erse, and a further five European languages, to be specified by a special committee appointed by H.M. Government. Esperanto and Ido will be optional.

(2) On the advertised evening previous to the perpetration of the lecture, sketch, comic song or simple flash of wit, a warning signal should be broadcast at intervals of ten seconds for a period of one-half hour by means of a powerful steam syren, and at every fifteenth, thirtieth, forty-fifth and sixtieth second of the minute during the performance the announcer's voice should be superimposed on the transmission and an official statement made to the effect that "*This is a joke.*"

(3) In the case where sufficient notice has not been given to the B.B.C. by the comedian or other artiste responsible for the said piece of humour, the joke should be followed by a continued and violent striking of a gong, after which an announcement should be made from the studio in these words: "The British Isles will now stand by for two minutes, during which period full explanations will be broadcast by all our main and relay stations." The high-power Daventry transmitter should also be brought into action, and should adopt an easily identifiable warning signal.

(4) On the evening following that on which the joke has been launched, the 2 L O broadcasting station should S.B. Handel's *Messiah,* or an equally soothing programme, to all stations in the United Kingdom.

Finally, special editions of evening papers, both in London and the provinces, should be published, each one to contain a description and full explanation of the joke together with lengthy comments by the editor, and should also include an official statement signed both by the B.B.C. authorities and the principal news agencies. All reference to the aforesaid joke should be printed in red ink, and the paragraphs framed in a suitable border.

By such means alone can anxiety and anguish to the British nation be avoided, and unless the B.B.C. comply with these simple rules, they should be restrained by Act of Parliament from including any humour in their programmes.

JAY COOTE.

WIRELESS IN HUNGARY

FOR some considerable time there has existed in Buda-Pesth a system by which telephone subscribers received at regular intervals musical concerts from a Tzigane orchestra, news bulletins, stock exchange quotations and sometimes were connected to the opera house and theatres. The company that worked the system, the Telefon Hiromondo A.G., recently concluded a contract with the Hungarian Posts and Telegraphs, and in conjunction with the wireless club attached to the Buda-Pesth Technical High School is now operating a 2-kilowatt transmitter erected by the Government Telegraph Department on the Island of Csepel. The transmitter is connected to the studio situated in the capital, a matter of some 8 kilometres distance by a land-line.

Broadcasting in Hungary is entirely under State control, but receiving licences are granted through the usual Post Office channels to Hungarian nationals, the monthly cost for private individuals being 30,000 kronen, whilst the tax for those using the public transmissions for public purposes has been fixed at 600,000 kronen in Buda-Pesth and at half that amount in the provinces for the same period of time.

Manufacturers and dealers pay from 200,000 to 400,000 kronen per month. All receiving apparatus used must bear the names of either the makers or the intermediaries by which it was sold, and these merchants are compelled to take out a certificate of technical efficiency and to guarantee that the sets placed by them on the market *do not radiate.* Concessions in the licensing tax are made for receivers used exclusively for experimental work, and a reduction is granted on the fees charged to invalid or blind people, or in instances where the apparatus is required for the use of hospitals or educational institutions.

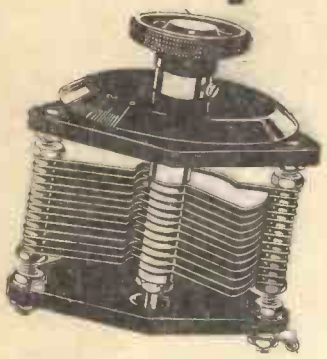
It is stated that the concession granted to the company is only of a temporary nature, but in the meantime concerts are given four times weekly on a wavelength of 546 metres and it is expected that the service will be extended in the near future.

J. G. A.

Multidyne Coils.—Owing to a typographical error it was stated in the test report on Multidyne tapped coils (on p. 137 of No. 190) that these coils are manufactured by Messrs. Multidyne, Ltd., whereas actually the manufacturers are Messrs. Lindalls, Ltd., of Lombard Street, Birmingham.

H.T. Accumulators, although entirely satisfactory for reception, often present some difficulty in the way of charging, as small garages and charging stations have no means of charging an accumulator above 12 volts. The Tungstone Accumulator Co., Ltd., of 3, St. Bride's House, Salisbury Square, Fleet Street, E.C.4, manufacture a series-parallel device whereby small-capacity batteries, from 24 volts upwards, can be charged from the ordinary 12-volt supply. This device is now fitted as standard to all Tungstone H.T. batteries.

STILL SETTING ITS OWN STANDARD



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of this condenser are so great that every set in which it is installed becomes a better, more efficient receiver. In many cases it makes all the difference between success and failure. Ask your dealer for it. Test it, use it regularly.

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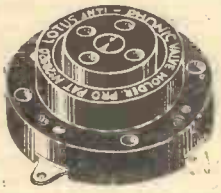

Price **2/3**

The delicacy of your Valve filaments are subject to microphonic elements from numerous sources. The LOTUS Buoyancy Valve Holder has been specially designed and constructed to counteract and dissipate these disturbances, and will, by its original and unique spring construction, absorb any shock, protect your valves, and eliminate all microphonic noises.

***The* LOTUS VALVE HOLDER is scientifically designed and made by the manufacturers of the LOTUS VERNIER COIL HOLDER.**

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GARNETT, WHITELEY & CO., Ltd.,

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The "Multistat" comes as a boon to the home constructor. Though occupying no more panel space than the ordinary type rheostat, it allows independent control of two (or three) valves. In addition, it considerably simplifies internal wiring.

Two or more resistance elements are fitted to a solid casting, having independent rotatable concentric spindles running through their centres. These spindles are provided with ebonite knobs by which they can be individually rotated. Contact arms attached to these spindles engage on the resistance windings, so that each element can be separately controlled by its respective knob.

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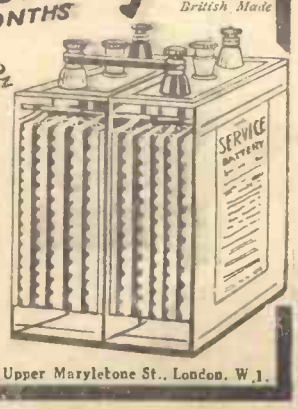
6-volt	24/-	30/-	36/-	45/-

Dispatched 1st charged CARR. PAID within 24 hours to your door on money back terms.

Single Cells, 2 Non-Corrosive Terminals per Cell. Ebonite Separators, Non-Frothing and Practically Unspillable.

H.T. 60 volt. Every Cell separately sealed and removable. Tapped every 6 volts, with Wander Plugs, post free. **7/6**

Adjustable carrier, takes all sizes, 2/6 each



SERVICE BATTERY CO., 8, Service House, 44a, Upper Marylebone St., London, W.1.

¶ *The illustration shows a simple but really effective loud speaker horn—that can be covered with fancy paper or painted so as to resemble a factory article—made for a few pence by following the easy directions supplied with every 'Lissen' Loud Speaking Unit, a new Lissen product yielding results equal to the most expensive instrument on the market and sold at the record low price of* **13/6**

A powerful loud speaker that costs less than headphones

The complete Unit with 'Lissen' Reed attached ready to receive a cone or any other diaphragm working on the reed principle.

The 'Lissen' Reed Attachment (patent pending) Price 1/-.

Showing method of attaching Reed to the 'Lissen' Loud Speaking Unit.

Hardly credible—but true. For less than the price of a pair of 'phones you can buy the 'Lissen' Loud Speaking Unit that only needs the addition of a horn to make it a powerful, full-sized instrument, equal in volume, purity and tone to the most costly on the market.

Any good horn will do. If you have a spare one in the house from a gramophone or a loud-speaker it will serve admirably. If not, there are directions with every 'Lissen' Loud Speaking Unit and full-sized patterns, telling you how to make a simple but attractive and really efficient horn for a few pence. Or, by using the Lissen Reed (price 1/- extra), a cone or any other diaphragm working on the reed principle can be quickly made and fitted, yielding results equal to an expensive speaker. By removing the sound-box and substituting the 'Lissen' Unit, any gramophone can instantly be converted into a loud speaker.

Make this test. Go to your nearest dealer and ask him to put on the most expensive loud speaker in his stock. Then put the same horn on the 'Lissen' Unit—keep the input voltage the same, no matter how high—and see if you can notice any difference.

Your Dealer will gladly demonstrate.

LISSEN LIMITED

Lissenium Works, 16-20, Friars Lane, Richmond, Surrey.

'Phone: Richmond 2285 (4 lines). 'Grams: "Lissenium, Phone, London."

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