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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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COMPOSITION OF THE PROGRAMMES.

A CORRESPONDENT whose letter is published elsewhere in this issue criticises the programmes and programme policy of the B.B.C., and in one respect at least we are entirely with him in his contention that the programmes as at present compiled are usually a series of short snatches of widely diverse matter, so that even the listener with the most varied interests possible could not be expected to sit through an evening's programme without constantly switching his receiver off and on.

Programmes are Too "Scrappy."

It has always been difficult for us to understand the mentality of those who are responsible for compiling the programmes. We do not want to criticise the material which is broadcast, as it must be generally accepted that a large proportion of the material is really first-class; but what we do object to is the effort which seems to be behind the arrangement of the programmes guiding the compiler so that he endeavours to make

every evening's programme in some respect or other make an appeal to every class of listener—in fact, he adopts the same attitude towards every day's programme as the producer of a variety entertainment who aims at producing a show suitable to run probably for many weeks without much alteration in the detail of compilation.

The "My Programme" Idea.

We have always contended that the B.B.C. is not right in assuming that it must entertain or interest every listener every day. Some considerable time back the B.B.C. instituted a very commendable idea in inviting various individuals to compile what was termed "My Programme," and, provided that the compiler was given freedom to select matter which would be of personal interest to himself instead of trying to map out an ideal programme on present B.B.C. lines, the plan was a complete success. Now, if only the B.B.C. would be prepared to extend that idea and let their performances be a series of programmes compiled from the personal choice of single individuals, we believe that it would do much to popularise listening and would be a reply to the present criticisms of "scrappiness" of the evening transmissions. We have repeatedly pointed out in the past that a comparatively small percentage of the listeners in this country make a habit of listening-in every evening. They treat listening to broadcasting on much the same lines as they do their other forms of recreation or entertainment, and would normally reserve one or two nights a week for listening-in; but at present, if one looks through the programmes for a week, it is usual to find that there are several items which one would like to listen to, but these are scattered at odd hours right through the week. Programmes made up on the basis of the choice of one individual each night would mean that that evening would be one of real interest and entertainment for all listeners of kindred tastes; other evenings being similarly compiled so as to make an appeal to different groups of listeners. We might even concede to the B.B.C. a special "educational night," which we venture to believe would, if so labelled, and provided it did not recur too frequently, prove extremely popular. The objection to educational matter as broadcast at present is generally considered to be that it is sandwiched in amongst items of pronounced contrast, the B.B.C. seeming to resent any opportunity being given to listeners to settle down into one frame of mind or atmosphere and enjoy reception of kindred matter for more than a few minutes on end.



Natural Oscillations of Loud Speaker Diaphragms.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

THE subject of transients is very comprehensive and more difficult than that of sustained effects. Strictly speaking, in the reproduction of speech

and music, transients form the greater proportion of the result. The nuances, sforzandos, alterations in this and that, which imbue a musical composition with creative artistic appeal, are all the result of transients. The loud report of a gun, the clapping of hands, the drum with its regimental rhythm, the staccato of the kettle-drum or the pianoforte, one and all of them belong to the category of transients.

At this stage the reader ejaculates—well, what is a transient? A transient is something fleeting, something which arrives quickly and is gone in a trice, i.e., there is nothing sustained or lasting about it. In an academic sense this can be applied to anything upon our planet, or, in fact, to the entire universe. Music consists of

transients, since it is forever changing in tempo, in expression, in colour and tone. If one strikes a note on the pianoforte the sound is suddenly called into existence, but quickly dies away. It moves and has its being metaphorically in the twinkling of an eye. It passes from us with celerity, and is, therefore, a transient.

A simple form of transient is illustrated in Fig. 1. This is the waveform of an electric oscillation which grows from nothing to a definite current value,

after which it decays to nothing. The oscillation is something like that caused by impulsing a tuned circuit as in a buzzer wavemeter.

When a speaker stands before a microphone in the broadcasting studio his speech creates sound waves in the air. These cause the microphone to respond in such a manner that its resistance varies. This variation in resistance causes a current to flow in the primary winding of a transformer. After amplification the current is used to modulate the radio transmitter as shown in Fig. 2. Here we have a device—the microphone—which converts the sound waves into electric waves. Both waves should have the same shape if there is no distortion. With sustained sounds, such as the steady bowing of a violin or the continuous note of a whistle, it is

Probably no one in this country has had a longer experience of the design of modern types of loud speakers than Dr. McLachlan, nor would it be easy to find anyone with so thorough a familiarity with the theory of the subject. The problem of transients is one which is by no means familiar to students of wireless and it is a distinctly complex subject. It is significant that Dr. McLachlan himself has waited until now to disclose the results of experimental work on the problem, although he has made reference to it from time to time in earlier writings even so far back as 1923. The present article, including as it does experimental evidence in the form of records, will, we feel sure, be read with great interest.

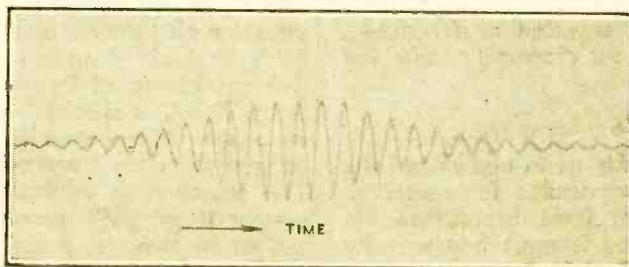
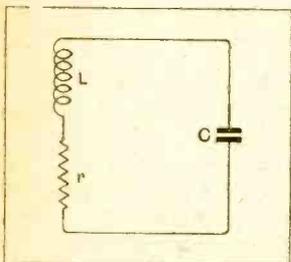


Fig. 1.—Diagram illustrating a simple transient. The frequency of the oscillation is 600 cycles per second. The waveform is that of the growth and decay of the natural oscillation of a simple tuned circuit consisting of an inductance, resistance and condenser as shown.

Transients alias "Attack."—

known that the distortion due to microphone, amplifiers, etc., is small. But when the sounds are very complex, when they start abruptly and terminate suddenly, what happens in the amplifier then? As Shakespeare says, Ay, there's the rub! In this particular article I do not wish to deal with the problem of transients in amplifiers. This will come later on. The issue at the moment concerns the performance of loud speakers when reproducing transients. In certain quarters this has been termed "attack." In a strictly musical sense, the term attack (French—*attaque*) means the entry of a soloist, or a group of instruments at any stage of a musical composition. A good attack means a brisk, clear-cut entry. For general purposes I prefer to use the scientific word *transient*, since it embodies all stages, whether entries, middle sections, or exits.

Loud Speaker Response at about 12,000 Cycles.

A comprehensive treatment of the subject is impossible in a short article, so that one must be content to describe certain experiments which indicate the results obtained with transients. The problem can be presented in various ways, but the simplest would appear to be that in which the natural oscillations of the loud speaker play the leading rôle. Is there a reader who

the corridor between the two rooms, the *natural* noise and that reproduced from the loud speaker could be compared. There was in effect no comparison, the reproduction being an absolute travesty of the original. The loud speakers, one and all, gave forth a dull thud

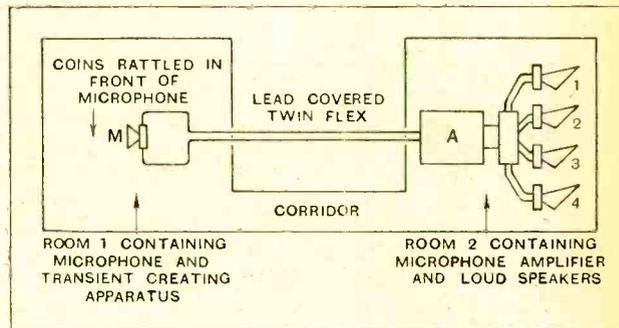


Fig. 3.—Diagram illustrating layout of apparatus for experiments on the reproduction of transients due to rattling of coins or ringing of electric bell.

with just a suspicion of something metallic. The pitch of the thud altered from speaker to speaker, and was somewhat similar in effect to that obtained when tapping the speaker by hand. It looked particularly possible that the chink of the coins—if reproduced at all—was dwarfed by the natural frequencies of the diaphragm. It is doubtful even in the absence of the diaphragm oscillations if much would have been heard of the metallic ring of the coins, since loud speakers are not noted for fecundity of output at frequencies of the order 12,000 to 20,000 cycles per second.

Speech Transients and the Loud Speaker.

Another interesting experiment was to ring an electric bell and listen to the original and to the reproduction.

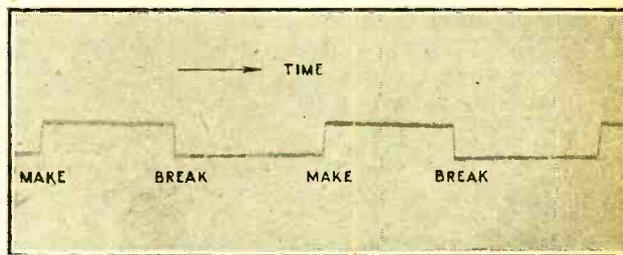


Fig. 4.—Diagram showing waveform of transient applied to loud speaker. Actually this is the waveform of the e.m.f. applied to the grid of the LS5A power valve in whose anode circuit the loud speaker was situated.

The latter was dulled due to a dearth of upper frequencies, whilst diaphragm oscillations added a tinge of acoustic colouration.

Speech—in electrical form—was then put through the system, and again there appeared to be a diaphragm colouration, particularly when reproducing sudden sounds. Further, the colouration varied from loud speaker to loud speaker, and tallied—as far as could be discerned by aural perception—with the class of sound obtained by tapping the diaphragm. It is the sudden explosive nature of speech, concomitant with rapid rises

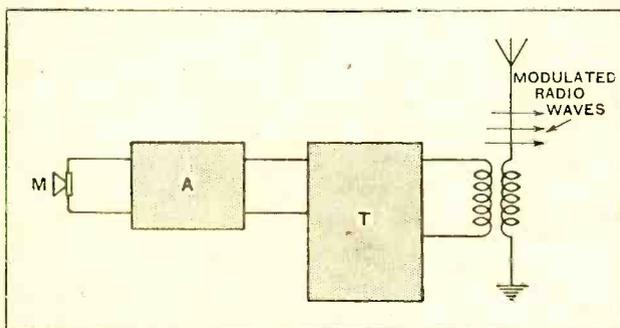


Fig. 2.—Diagram illustrating broadly how sound waves are ultimately converted into radio waves. M = microphone, A = microphone amplifier, T = radio-broadcasting transmitter.

has not tapped the apex of his loud-speaker diaphragm? If so, let him rise and do it now! Yes, I agree, the sound is anything but musical. It does not charm, rather does it irritate. Now when the current suddenly starts in the loud speaker the corresponding force is equivalent to tapping it by hand. It seems, therefore, that this dull thud obtained by tapping will also be obtained when the sounds to be reproduced are sufficiently sudden. To test the validity of this argument the following experiment was arranged. A high-quality microphone in one room was connected to a speech or audio-frequency amplifier whose output was taken to a change-over switch in another room. By means of the switch any one of several loud speakers could be connected to the amplifier (see Fig. 3). A number of coins of the realm, silver and copper, were put in a glass bottle and shaken violently. The *natural* noise or chink of the coins is well known and needs no description. The pitch is very high, since the natural frequencies are from 12,000 cycles upwards. By standing in

Transients alias "Attack."—

in the air pressure applied to the microphone, which causes the diaphragm colouration to be conspicuous. For this reason, a loud speaker must be really good to give pleasing speech. When the reproduction is of

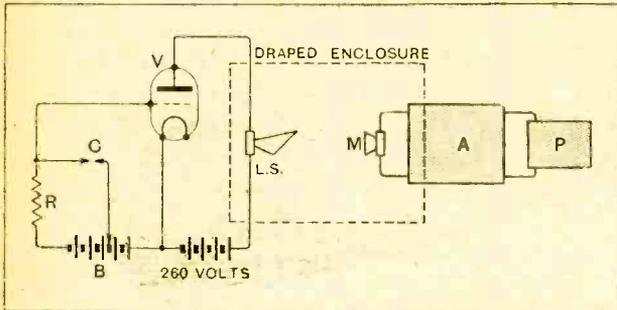


Fig. 5.—Diagram illustrating disposition of apparatus for applying square topped transient to loud speaker, and obtaining a record of the resulting acoustic waveform on the axis of the speaker. R = non-inductive high resistance, B = grid bias battery. The bias voltage is reduced when the relay contacts C are closed. L.S. = speaker under examination, M = microphone, A = resistance-capacity microphone amplifier fed direct to P the recorder.

moderate loudness—weaker than the original voice—the acoustic colouration is hardly noticeable. This is due to the insensitivity of the ear to low frequencies. But as the reproduction is increased to or beyond natural loudness, the bass becomes more assertive aurally and the colouration is then conspicuous. In the reproduction of certain classes of music the transients are less sudden than in speech, and the acoustic colouration is, therefore, less pronounced if at all aurally detectable. There is more than one natural frequency of the diaphragm with which we have to contend. To illustrate this point, a number of records of the acoustic output from several loud speakers have been taken, when a really severe transient was applied electrically to the operating coil.

The wave form of the electrical transient is shown in Fig. 4, and is nothing more or less than a series of regular Morse dots from the contacts of a special relay. In other words, the loud speaker was supplied with an interrupted direct current. Transient effects occurred (a) when the current was made, i.e., it sud-

denly rose from a small value to a large value; (b) when the reverse of (a) occurred, i.e., the value of the current was suddenly reduced. The apparatus in question is illustrated diagrammatically in Fig. 5. To secure the desired transient, the relay contacts were used to vary the grid bias on a valve by a definite amount. The loud speaker was situated direct in the anode circuit of the valve unless otherwise stated, and its acoustic output was collected—so to speak—by a microphone, the two being situated in a heavily draped enclosure. After amplification by a thermionic valve amplifier the output was taken to a recording instrument, where the waveform was delineated. The amplifier is shown diagrammatically in Fig. 6. It is an ordinary resistance-capacity coupled arrangement with battery filter circuits. Unless otherwise stated in connection with the records,

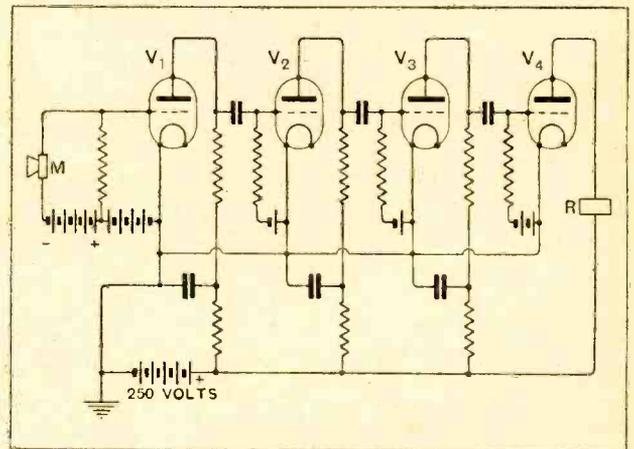


Fig. 6.—Circuitual arrangement of microphone and its associated amplifier. V₁, V₂, V₃ = L55B valves, V₄ = L55A R = recorder. M = microphone.

there was neither an input transformer nor an output choke-condenser combination. The object of this was to eliminate any effects these might have on the loud speaker transients.

The concluding instalment of this article will give the results obtained in carrying through these experiments. (To be concluded.)

New QSL Service.

We are asked to state that arrangements have been made for forwarding QSL cards to or from amateurs in Great Britain who are not members of the R.S.G.B.

The address to which such cards should be sent is "B.R.R.L.," 2, Chepstow Road, Croydon, Surrey.

Amateurs wishing to avail themselves of the service should send 2d. in postage stamps with every dozen cards that they wish to have forwarded, and provide a supply of stamped addressed envelopes for the free delivery of cards received from other amateurs for forwarding to them.

We understand also that the organisers of this service will welcome any suggestions for its improvement and extension.

TRANSMITTERS' NOTES AND QUERIES.

The QSL section of the R.S.G.B. is still in operation, but cannot undertake to deal with cards to and from non-members.

Japanese Amateurs

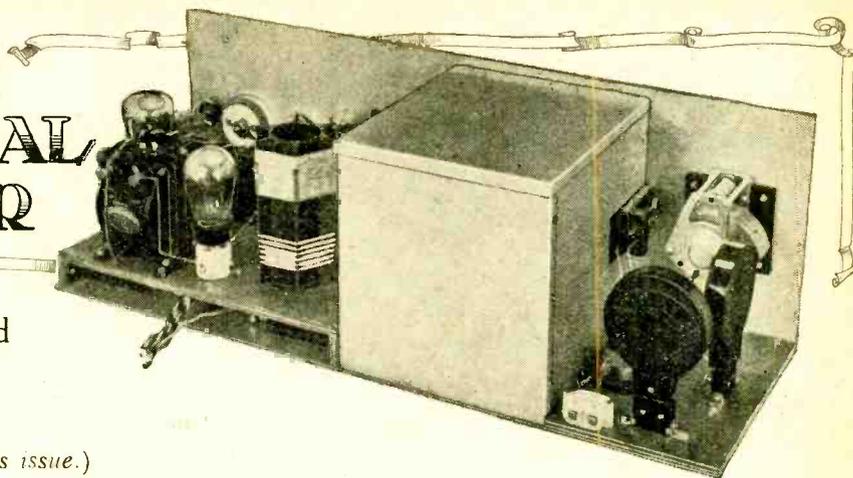
Japan has altered the call-signs of her experimental stations to conform with the Radiotelegraph Regulations of the Washington Convention, and we acknowledge our indebtedness to our Californian contemporary *Radio* for the following re-

vised list of stations operated by members of the Japanese Amateur Radio League.

- J 1AG Hiraio Radio Laboratory, Ibaragiken.
- J 1CT Tokyo Electric Co., Radio Laboratory, Kawasaki.
- J 1CW H. Takeuchi, 419, Ikebukuro, near Tokyo.
- J 1CX H. Horikita, 597, Shimohehikubo, Ebaramachi, near Tokyo.
- J 1CZ N. Eimura, c/o Mr. Sayama, 3495, Magome-machi, near Tokyo.
- J 1DA T. Senba, 680, Shimonumabe, Denen-Chofu, Tokyo.
- J 1DB M. Sumi, 85 Mukoyama, Shibuya-machi, near Tokyo.
- J 1DC T. Seki, 33, Sakusabe, near Chiba.
- J 3CB K. Kusama, 1581, Mikage-cho, near Kobe.
- J 3CC K. Kajii, 100, Torishima-cho, Osaka.
- J 3CD Y. Tanigawa, 4, Yamamoto-dori, Kobe.
- J 3CE M. Takebe, 306, Sakuragi-cho, Tonodan, Kyoto.
- J 3CF Y. Kikuchi, 35, Naka, 2, Dojima, Osaka.
- J 3CG G. Kikuchi, 2249, Koroen-hama, near Kobe.
- J 3CH T. Hayashi, Hibirigaoka, Kawabe-gun, Hyogo-ken.
- J 3DD K. Kasahara, 880, Tennoji-cho, Osaka.

QSL cards may be sent via J 3DD.

The
Wireless
World
**S.G. REGIONAL
RECEIVER**



Constructional Details and
Operating Instructions.

By H. F. SMITH.

(Concluded from last week's issue.)

REFERRING back to Fig. 4, it will be seen that the ribbed ebonite grid coil former is slotted to take the long-wave winding L_1 , which is wound in sections. Each of the six slots is roughly $\frac{1}{2}$ in. deep and nearly $\frac{3}{8}$ in. wide, spaced $\frac{1}{16}$ in. between centres; they can be cut with a fine saw. Approximate dimensions are given advisedly, as different specimens of wire vary in overall thickness, and the space required depends to some extent on the tension applied in winding. Exact dimensions can best be determined by trial; what is required is that each section should consist of a single layer helix of 37 turns of No. 32 D.S.C. wire in slots of the same width as the covered wire. Starting operations at the end connected to tag *c*, a tapping point should be brought out at the sixth turn, after which the winding proceeds normally from the end of one slot to the beginning of the next until all are filled.

The medium-wave winding, L_2 , spaced from L_1 by a distance of $1\frac{1}{2}$ in., is a simple closely wound coil having 65 turns of No. 9/40 Lewcos Litz wire (S.S.C. and D.S.C. overall), tapped at the second turn from the starting point at tag *b*. This coil is wound in the same direction as L_1 . It will be noticed that each of the windings is shown in Fig. 4 as having three tappings; actually, this addition is a refinement not ordinarily needed, which will be discussed later.

Details of the H.F. transformers, also built as a single assembly, are shown in Fig. 4, and an enlarged section of the long-wave windings T_2 is given in Fig. 6. A series of six slots, nearly $\frac{1}{16}$ in. wide, must be cut in each of the ribs, the first three being of greater depth than the remainder, as they have to accommodate the primary, which is wound under the secondary. Again, approximate dimensions of the slots are given; they

may be cut in a lathe, or with a suitable saw or file. The primary long-wave coil should first be wound: it consists of three sections of 38 turns each of No. 40 D.C.C. wire. Separated from it by small pieces of insulating material $\frac{1}{16}$ in. thick, inserted in each slot, is the secondary, with 35 turns of No. 32 D.S.C. in each section.

High-gain H.F. Coupling.

The medium-wave H.F. transformer is of the type with which the majority of readers are familiar: its secondary, with 60 closely wound turns of Litz of the same gauge as the grid coil, is wound directly on the ribs, and over it is the primary, having 40 turns of No. 40 wire, spaced out to occupy a winding length of 1 in. It is separated from the secondary by six narrow strips of ebonite, grooved on their undersides to fit over the ribs, and of such a thickness that the spacing between the two windings is between $\frac{1}{32}$ in. and $\frac{1}{16}$ in. The four coils are all wound in the same direction.

Each of the three variable condensers is mounted on a piece of $\frac{1}{4}$ in. ebonite sheet, 3 in. square, which is in turn secured to the panel by means of four screws. In mounting C_3 and C_1 , large holes are drilled through the metal to provide a clearance for the "one-hole fixing" nut, as it is essential that these condensers should be insulated from earth, but the framework of C_2

must be in contact with the panel, so the ebonite sheet serves no other purpose than that of a distance-piece to compensate for the thinness of the metal. Of course, suitable bushes or washers may be substituted. Similarly, the body of the Clarostat resistance is insulated by a bush or otherwise, and the spindle of the Igranite rheostat is prevented from making

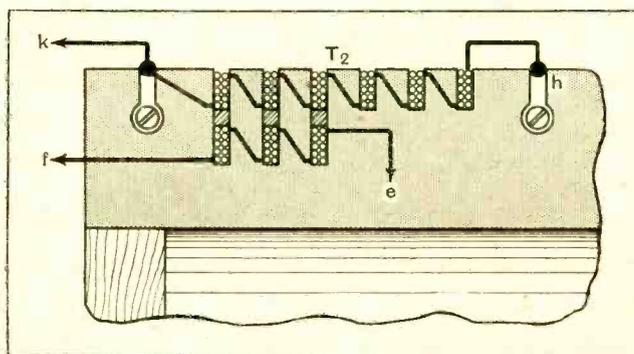


Fig. 6.—Enlarged section through long-wave transformer windings. Lettering of terminal points corresponds with that given in other diagrams.

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contact with the metal panel by drilling an amply large clearance hole to pass it.

Components are mounted on the baseboards in the positions shown in Fig. 7, after which as much of the

No. 20 tinned copper wire is suitable for the majority of the connections, but in some instances—which will be obvious—it is better to use insulated flexible wire. When the baseboard inside the screening box has been mounted, it will be necessary to pass out twin flexible

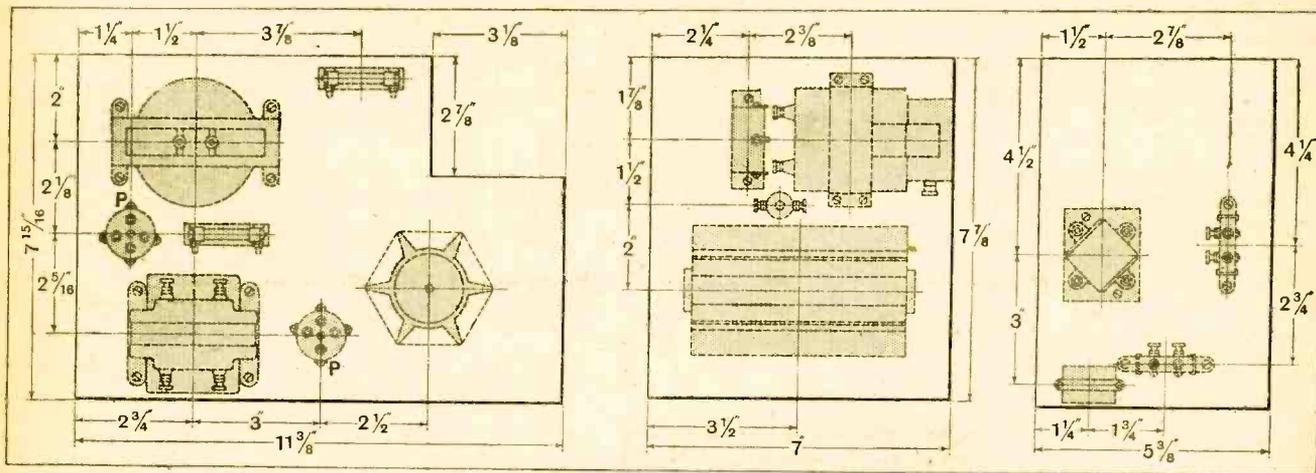


Fig. 7.—Disposition of components on baseboard and platform: under the latter are mounted condensers C_1 , C_2 , C_3 , C_4 , and decoupling resistance R_2 , in relative positions as shown in Fig. 8.

wiring as possible should be carried out before mounting the units in position. It is inevitable in making a set including a good deal of screening that some of the terminals should be difficult of access; hence the need for following a definite plan. It would be wearisome to the reader—and generally quite unnecessary—to describe each step in detail, but a few general hints will save delays.

The "aerial" section is quite straightforward, and may be wired with the baseboard *in situ*; the earth terminal is joined to any convenient and adjacent point on the metal frame. Before mounting the switch S_1 , its second and third middle contacts should be joined together, and, similarly, the necessary diagonal connections should be soldered to S_2 while it is easily accessible.

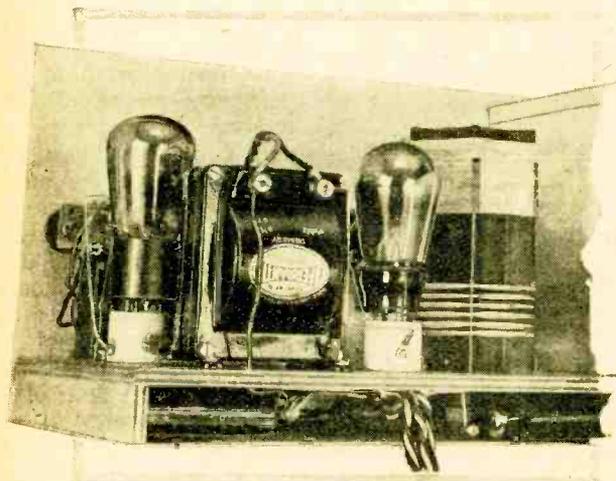
leads for the H.F. valve filament connections, for the lead which supplies screen grid voltage, and another wire for joining to C_6 through holes in the side of the box before screwing down the main platform.

To avoid congestion of the wiring to the wave-changing switch S_2 , care should be taken to begin with the lower connections, which would otherwise be inaccessible, remembering at the same time not to run wires in such a way as to prevent insertion of the H.F. valve in its holder.

The high-frequency circuits are intended for working with average screen grid valves, and there is a reasonable margin of safety in the matter of stability. Tests were carried out with Mullard P.M.14 and Osram S.215 types. Choice of a detector valve should be carefully made; those actually used were Mazda G.P.407, Marconi D.E.L.210, Mullard P.M.4DX and P.M.6D, and Osram D.E.L.410. What is required is a steep-slope valve of not more than some 10,000 or 12,000 ohms impedance. For the L.F. position, any good power or super-power valve will do, although it may be pointed out that the advantages of the modern high-conductance type become evident when receiving distant stations.

Simplified H.T. Connections.

A single anode voltage supply (with, of course, a separate feed lead for the screen grid) is provided for all the valves; within the usual limits of between 120 and 150 volts, this is perfectly satisfactory; but in cases where abnormal volume is required, it is a simple matter to provide a separate connection for feeding the L.F. amplifier; the set is capable of loading a "super-super" power valve with some 200 volts or more on its plate. In the matter of screen grid and bias voltages, the user must be guided by the makers' figures; these are not always given with respect to anode bend detection, but



Condensers mounted below the platform are screwed to the battens. Mounts of L.F. transformer are reversed (optional).

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it will be found that the valves mentioned above will need something between $7\frac{1}{2}$ and $10\frac{1}{2}$ volts applied through the connection marked G.B. - 1; normal anode voltage is assumed.

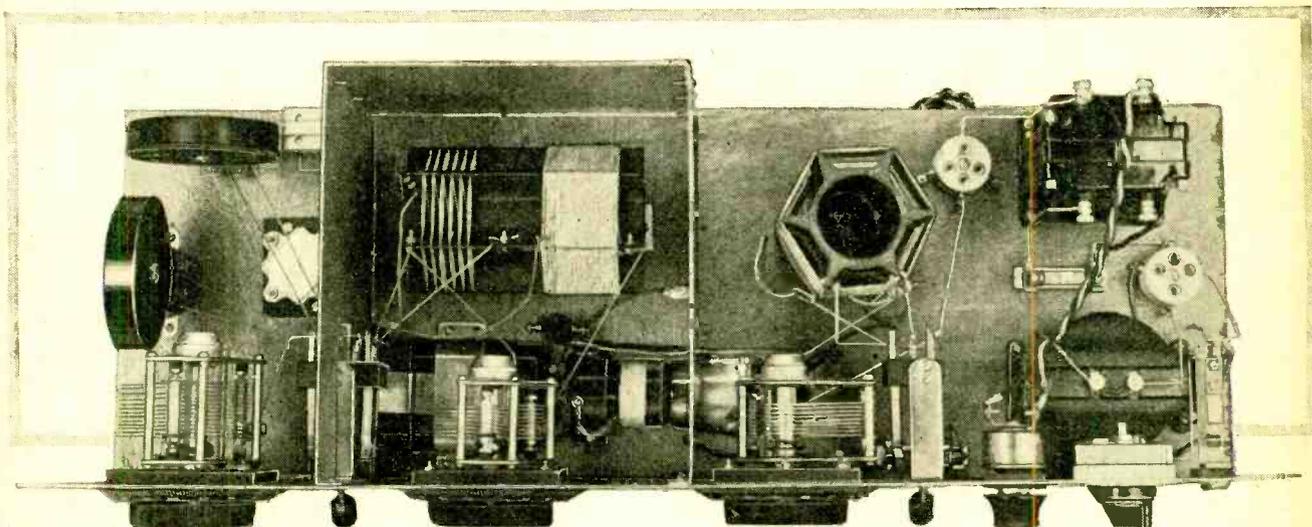
The loading coils L_1 and L_2 , which are of the commercial plug-in type, should have an inductance of such a value that the wave-range of the tuned aerial system is as nearly as possible equal to that of the other two circuits; otherwise we forfeit the full benefits of a wave-band switching scheme. Thanks to the use of a larger tuning condenser and of a series aerial capacity C_1 , it is not difficult to bring about this state of affairs, but hard-and-fast rules cannot be laid down. In most cases, coils No. 50 and No. 200 respectively will meet the case; a few plates may be removed if necessary from the fixed air-dielectric condenser. A reduction of its capacity will have the effect of increasing selec-

being audible at two condenser settings, while weak signals and very sharp tuning of the secondary circuit will suggest that coupling is too loose.

In operating the receiver, it will be found that the condensers C_3 and C_4 run approximately in step; and, provided they are tuned to the desired wavelength, the signal will generally be at least faintly audible even though the condenser C_2 setting may be considerably "off tune." Consequently, in spite of its three tuning dials, the set is not difficult to operate; probably it is easier to work than a receiver without a tuned aerial circuit, but of the type depending on fairly close reaction coupling for its sensitivity.

Signal Strength Adjustments.

By proper adjustment of the volume-control resistance connected across the L.F. transformer primary, it is possible to ensure that the anode-bend detector shall



Plan view of receiver. Single bias cell for H.F. valve and by-pass condenser C_1 are secured to the baseboard by light metal clips.

tivity, and thus a ready means of reducing the band of interference due to a powerful local station is available, but it should be borne in mind that an excessive reduction will decrease signal strength.

Loose Coupling without Complications.

Operation of a set with a coupled aerial tuner is likely to prove difficult to the beginner only when matters are complicated by variable coupling between the circuits. In this case, transference of energy from primary to secondary is determined by the position of the aerial tapping on the secondary coil; if it is arranged to include a comparatively large number of turns common to both circuits, coupling will be tight, and *vice versa*. As already stated, provision for extra tappings may be made—at, say, the first and fourth turns on the medium-wave grid coil and in similar proportion on the long-wave winding—but, after careful tests on several typical aerials it can be asserted that the tapping positions specified represent the best coupling for average conditions. As a guide to those who wish to experiment in this direction, it may be stated briefly that too tight a coupling is indicated by flat and indefinite tuning, a transmission

work at its best—with a large but not excessive H.F. input—and at the same time to throttle down the output from this stage to a value within the capabilities of whatever L.F. valve may be used. A milliammeter in the rectifier plate circuit is a refinement that can be recommended; its many advantages and the method of its application are treated at length in the article on "The Valve as an Anode Bend Detector," to which reference has already been made. In the absence of an indicating instrument, the following course of procedure will yield the desired results; it is applicable except in localities where input from the aerial is sufficiently great to overload the H.F. valve; in such cases, a pre-detector volume control may sometimes be necessary, especially when the "Regional" scheme comes into operation. With the volume control R_1 at maximum resistance, tune in the local station accurately ("local" here means at distances up to 50 miles or even much more in the case of exceptionally powerful transmitters) and, if volume is found to be excessive, reduce the value of R_1 till intensity is at the desired level. If reproduction is now lacking in quality, particularly on deeply modulated passages, it can reasonably be assumed that

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the detector is being overloaded, and accordingly input to it must be reduced by operating the H.F. filament rheostat; or, at short ranges, by detuning. Signals

or three programmes. This statement may possibly be misleading; although the combination of anode bend detector and single stage transformer-coupled L.F. amplifier gives of its best when input to it is large, several

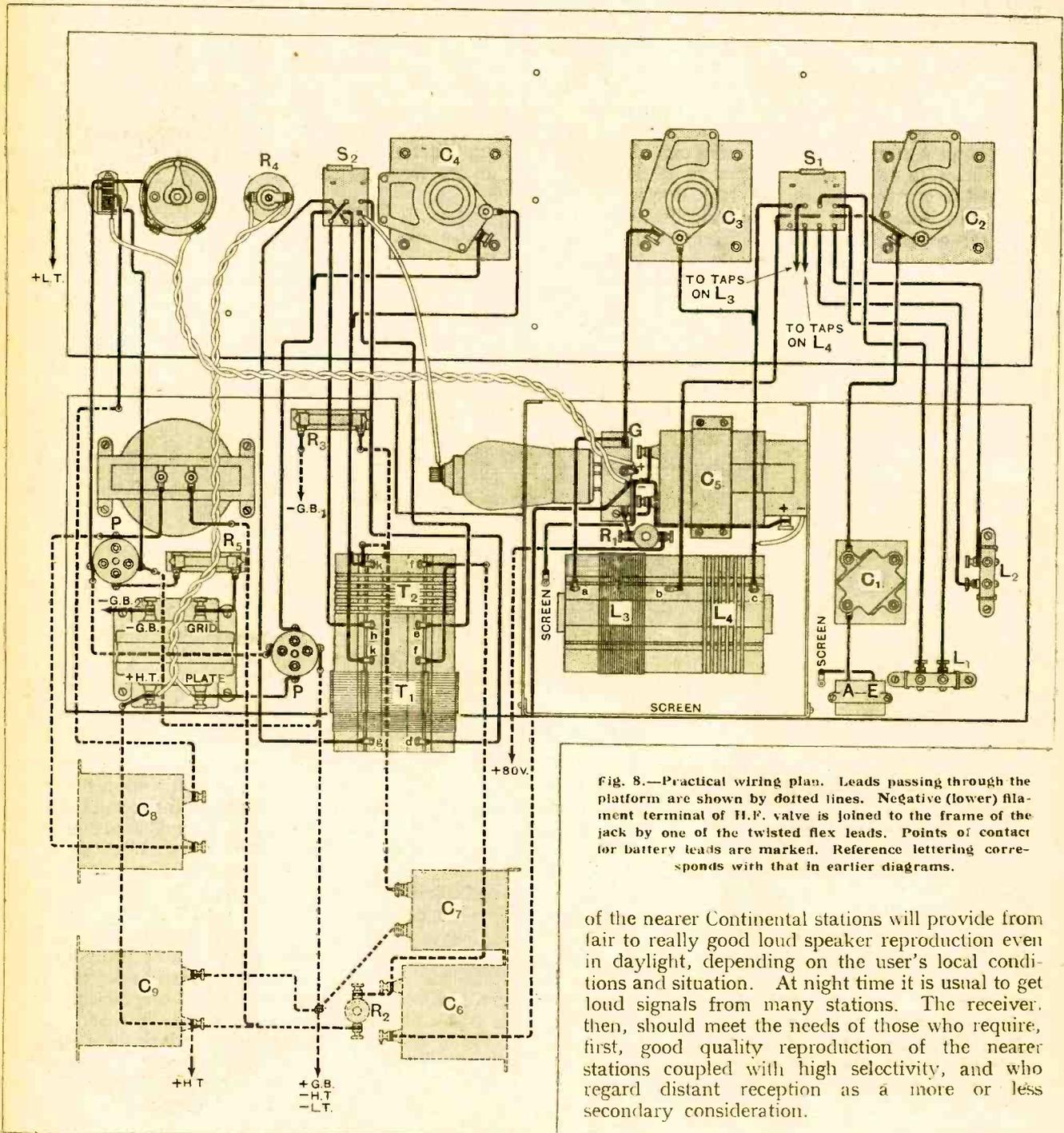
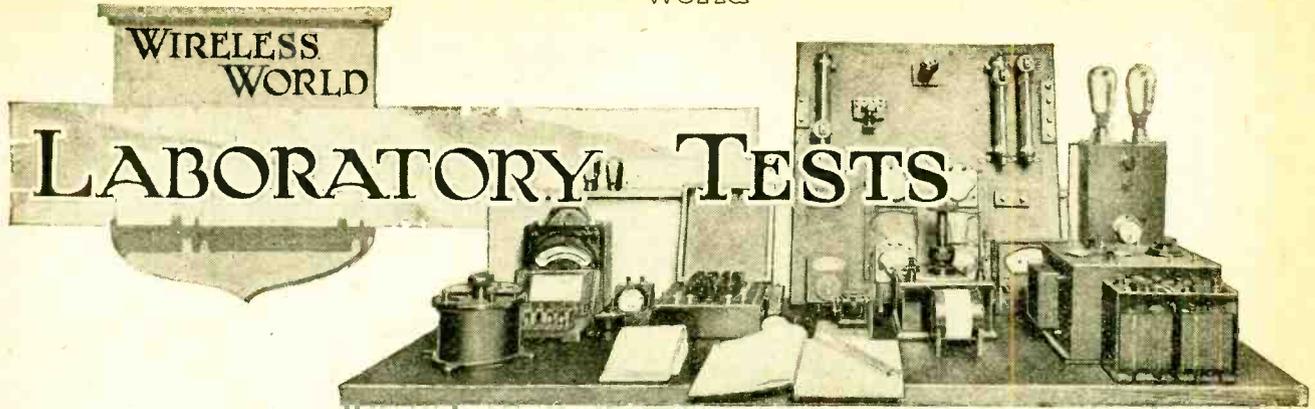


Fig. 8.—Practical wiring plan. Leads passing through the platform are shown by dotted lines. Negative (lower) filament terminal of H.F. valve is joined to the frame of the jack by one of the twisted flex leads. Points of contact for battery leads are marked. Reference lettering corresponds with that in earlier diagrams.

of the nearer Continental stations will provide from fair to really good loud speaker reproduction even in daylight, depending on the user's local conditions and situation. At night time it is usual to get loud signals from many stations. The receiver, then, should meet the needs of those who require, first, good quality reproduction of the nearer stations coupled with high selectivity, and who regard distant reception as a more or less secondary consideration.

should now be restored to the desired volume by increasing the value of the transformer shunting resistance. In the opening paragraph of this article it was stated that the set is intended for consistent reception of two

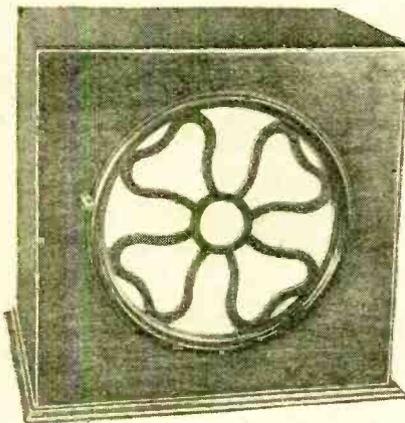
(This set is available for inspection by readers at the Editorial Offices, 116-117, Fleet Street, E.C.4.)



A Review of Manufacturers' Recent Products.

COLATO LOUD SPEAKER.

This loud speaker incorporates a reed type movement of conventional design, to which is attached a cone diaphragm mounted on chamois leather and clamped between two wood rims fixed to the front of the cabinet. The movement will handle sufficient volume without chatter, or other signs of distress, to meet the requirements of the average sized room. Quality is reasonably good, although a slight falling-off in the responses was noticed at either end of the musical scale, particularly below 200 cycles and above 2,500 cycles per second. Between these limits the response appears to be fairly even. Although the back of the cabinet is acoustically open, allowing free egress for the sound waves, there is occasionally a slight trace of cabinet resonance. This may be due to the method of mounting the unit, which is carried on transverse battens of rather small cross section. However, it is only on deeply modulated passages that this effect is noticed, and it can be eliminated by careful adjustment of the volume.



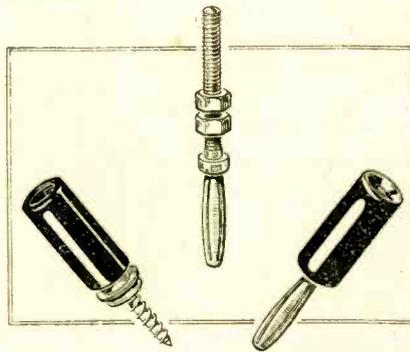
Colato cabinet loud speaker.

The loud speaker is housed in a handsomely polished mahogany cabinet, the price being £5 10s., and the makers are Messrs. C. A. Colato, 33, Edgware Road, London, W 2.

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CLIX WOOD-SCREW SOCKETS AND PARALLEL PIN PLUGS.

To meet the requirements of those who find it more convenient to fix wander plug sockets to a wooden baseboard than to mount these on insulating material, The Electro-Linx, Ltd., have added to their



Clix wood-screw socket, parallel pin plug and coil pins.

range of "Clix" products a new socket fitted with a shank of familiar wood screw pattern. To facilitate fixing, grooves have been cut in the walls of the socket to take the blade of a screwdriver. Insulating sleeves are fitted, and these can be obtained in red or black. They cost 2d. each.

If this fitment is used in H.F. circuits, consideration should be given to the nature of the wood base, and only well-seasoned wood should be employed; otherwise serious leakage may ensue.

The internal diameter of the socket is 3/16 in., and it is intended to take the parallel pin type plug of this size. These plugs are fitted with a hollow stem divided into longitudinal segments, four vertical grooves being cut in the stem from tip to base. The grooves, however, do not reach to the extreme tip, but terminate just short of this, leaving a complete ring of metal to impart stiffening to the plug. The tip is reduced slightly in diameter to facilitate easy entry into the socket.

The method of anchoring the lead is the same as adopted in all Clix plugs, and has been described fully in previous reviews. Insulating sleeves are fitted, and

are available in black or red. The price of these plugs is 2d. each.

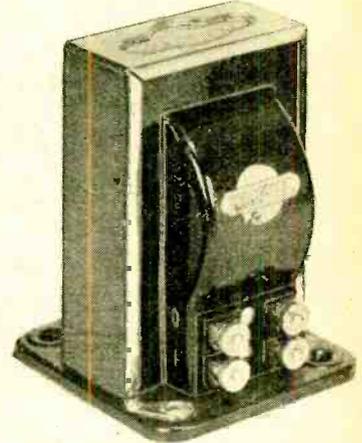
Clix coil pins consist of a 3/16 in. long shank screwed to take 6BA nuts and terminating in a parallel plug similar to that described above. A small collar is provided at the base of the screwed shank for fixing purposes, and the pin is held in position by a lock nut run down the screwed portion. These pins are admirably suited for use on the bases of interchangeable coils of the type described from time to time in this journal, and they cost only 2d. each with two lock nuts.

The makers are The Electro-Linx, Ltd., 254, Vauxhall Bridge Road, London, S.W.1.

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IGRANIC PENTOFORMER.

This transformer has been designed especially for use as an output transformer when a pentode valve is employed in the last stage of a receiver. The primary inductance must necessarily be large in view of the high A.C. resistance of the



Igranic Pentoformer.

valve, and in order to obtain a satisfactory balance of impedances between the secondary and the loud speaker a step-down ratio must be used.

The Pentoformer is fitted with two

secondary coils, and these can be arranged either in series or parallel by suitably connecting the four output terminals. When the series connection is adopted, a step-down ratio of 2:1 is obtained, the parallel arrangement giving a ratio of 4:1. This enables the most suitable ratio to be used to suit the impedance of the particular loud speaker employed.

The measured impedance of the primary without D.C. flowing was found to be 623,000 ohms at 920 cycles.

The makers are the Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.4, and the price is 30s.

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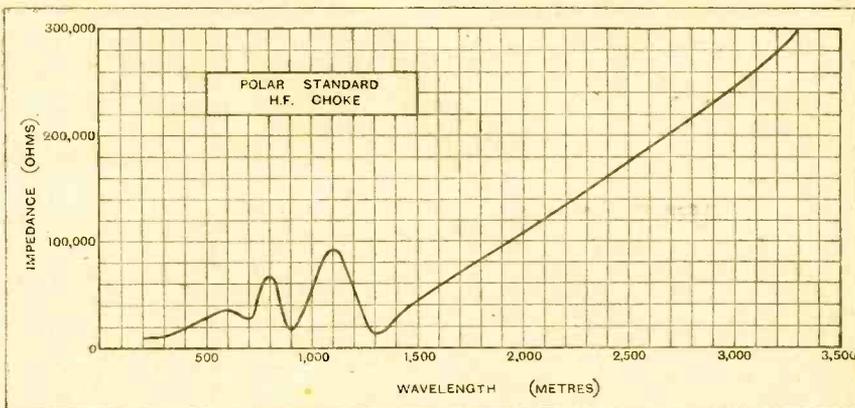
POLAR H.F. CHOKES.

The H.F. chokes marketed by Messrs. Wingrove and Rogers, Ltd., 188-189, Strand, London, W.C.2, are made in two distinct types, one for general use on all broadcast wavelengths and the other for short waves from 10 to 200 metres.

Standard Choke.—Having regard to the high inductance of this choke, the overall dimensions are unusually small, the sides of the square base and the overall height being only 1½ in. The slotted former is moulded integral with the base, and the winding consists of five sections wound with fine enamelled wire. The number of turns appears to be well above the average, and this gives a fairly high D.C. resistance, namely, 810 ohms

The impedance curve is unusual. It shows maxima at 600, 800 and 1,100 metres and at 1,300 metres falls almost to its original value at 200 metres. From 1,300 metres it then commences to rise steadily up to the maximum wavelength measured (3,300 metres). The indications are that the choke should function up to 5,000 metres, the upper limit claimed by the makers. Due to the two humps at 800 and 1,100 metres, there is a possibility of

self-oscillation over the wavebands 800-900 metres, and 1,100-1,500 metres, where the slope of the curve is negative. Also, due to the minimum at 1,300 metres the impedance at 1,600 metres is somewhat below the average. Over the 200-500 metre band, however, the impedance is up to standard. The actual impedance values at these salient points are as follow:—



Impedance curve of Polar Standard H.F. choke; external capacity 8 micro-mfd.

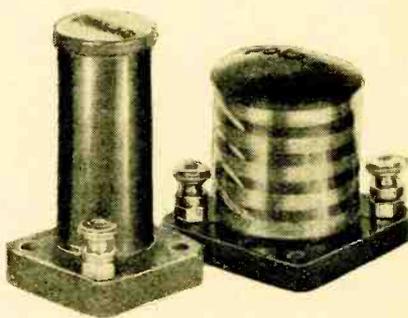
Wavelength (metres).	Impedance (ohms).
200	8,200
500	27,900
1,600	58,800

It is fortunate that the subsidiary resonances occur in the waveband between 600 and 1,300 metres, and the choke will be perfectly stable in any receiver designed for the reception of B.B.C. stations.

Short-Wave Choke.—The waveband for which this choke has been designed is 10-200 metres. The winding consists of a single layer of enamelled wire on a

cylindrical former 5/8 in. in diameter and 1½ in. long. The former is a one-piece moulding provided with a square base with 1 in. sides and fitted with terminals.

Like all short-wave chokes, the impedance curve shows a marked resonance. With an external capacity of 8 micro-mfd., resonance occurs at 170 metres, so that unless the capacity of the circuit into



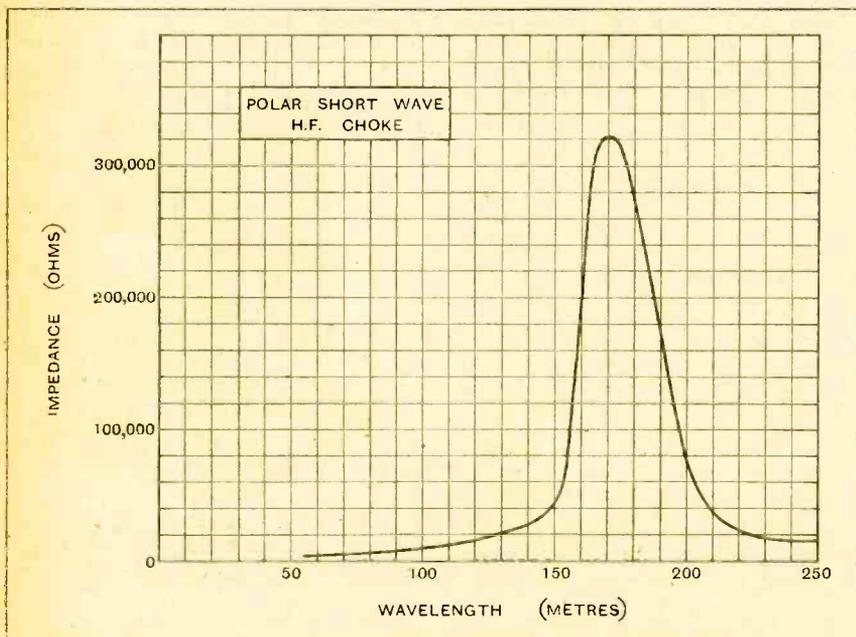
Polar Standard and Short Wave H.F. chokes.

upon from 170 metres downwards. At 55 metres, the lowest wavelength measured, the impedance is 3,280 ohms, and at resonance 322,000 ohms. The D.C. resistance is 41 ohms.

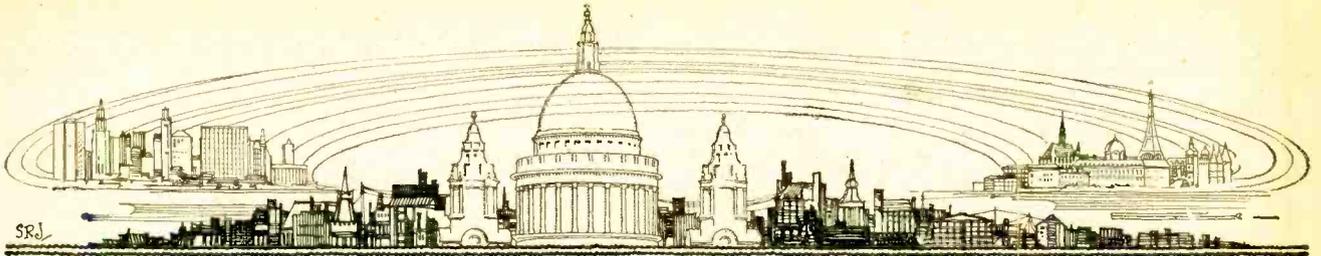
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R.I. AND VARLEY STRAIGHT LINE TRANSFORMER.

In our issue of March 13th last, under "Laboratory Tests," we gave the inductance of the primary on this transformer as 18 henrys. To obviate any misunderstanding regarding the "goodness" of the components, we consider it advisable to state that the effective impedance of the winding under working conditions will be considerably higher than the inductance value given would seem to indicate, since at mean speech frequency this will be mainly capacitative. Between 50 and 500 cycles, however, the inductance of the primary is of the order of 100 henrys.



Impedance curve of Polar Short Wave H.F. choke; external capacity 8 micro-mfd.



CURRENT TOPICS

Events of the Week in Brief Review.

NEW WAVELENGTH DECISIONS PENDING?

The International Wireless Conference opens to-morrow at Prague, and will continue until April 13th. Government delegates will attend from 26 countries. Six broadcasting concerns will be represented, including the B.B.C. One of the most important questions on the agenda will be the allocation of broadcast wavelengths.

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THE SEVENTY MILLION.

According to Dr. Joseph Raber, President of the International Telegraph Union, there are 70,000,000 persons possessing wireless sets throughout the world. The estimate does not include France, Spain, Belgium, and Holland, where precise figures are not available.

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60 KILOWATTS FROM PRAGUE.

The Radio Journal Broadcasting Company of Czecho-Slovakia has signed a contract for the purchase of a 60-kilowatt transmitter for the Prague station, and it is hoped that the power increase will be effected by the end of the current year.

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HEAT AND COLD BY RADIO.

The daily Press is discussing the possibility of heating Paris by wireless. To judge from broadcasting criticisms in some of the French journals, the opposite process can be achieved by keeping the broadcast programmes at their present standard.

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"SHORT WAVES."

Mr. T. L. Eckesley, B.A., B.Sc., will read a paper with the above title at a meeting of the Wireless Section of the Institution of Electrical Engineers on Wednesday, April 10th.

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ULTRA SHORT WAVE COMPETITION.

Mr. E. T. Somerset, of Inholmes Park, Burgess Hill, Sussex, has inaugurated a competition, "complete with prizes," for members of the Radio Society of Great Britain for the first communication of over 10 miles on 5 metres.

This is probably one of the few competitions of which it may not be said: "A large entry is expected."

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ZOFFEN.

Zoffen will be a name to conjure with if the Austrian Broadcasting Company can realise its ambitions. The general manager, Herr Oskar Czeija, in a lecture before the Vienna Scientific Club a few days ago, stated the constructors of the Zoffen station were aiming at the transmission of a programme which could be received at any point on the earth's surface.

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BROADCASTING RELIGION.

Under the heading "To-morrow will be Sunday," our Catholic contemporary *The Tablet* prints a weekly list of religious broadcasts from the principal stations on the Continent.

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WIRELESS AND THE GRAMOPHONE.

Another stage in the wedding march of wireless and the gramophone is indicated by the recent announcement that Senatore Marconi and Mr. David Sarnoff have been elected to the board of the Gramophone Company, Ltd. Senatore

Marconi needs no introduction, while Mr. Sarnoff's name is a household word in the United States. His technical knowledge and business ability have greatly contributed to the building up of the Radio Corporation of America.

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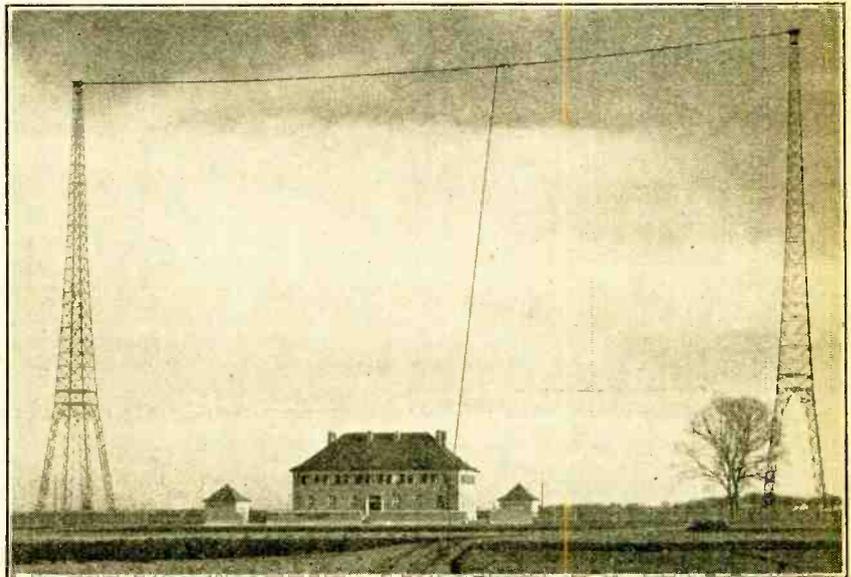
"FULTOGRAPH" PICTURES BY TELEPHONE.

To enable *The Evening Standard* to publish photographs of the Grand National, Wireless Pictures, Ltd., connected a "Fultograph" transmitter to the Post Office telephone at Aintree. Pictures sent by this means a few minutes after the conclusion of the race were published in London on the same afternoon.

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ITALIAN IDENTIFICATION SIGNALS.

Following a plebiscite taken by the Italian broadcasting authorities amongst their listeners, it has been decided to introduce a mechanical interval signal between items in order to assist in the identification of the individual trans-



HEARD TOO EASILY? The well-known Nürnberg broadcasting station which recently created a "wipe out" effect in the Newcastle service area. Nürnberg relays the programme of Munich and is now working on 240 metres.

matters. For the present, as a test, two stations only, Milan and Naples, have adopted the method, the former transmitting the morse symbol T (—), the letter E (.) at intervals of seven seconds. Should the experiment meet with general approval, further distinctive signals will be allotted to Rome, Turin, Genoa and Bolzano.

NEW CZECHO-SLOVAKIAN STATION.

The construction of the new 12-kilowatt Pressburg (Bratislava) broadcasting transmitter is nearing completion, and within a day or two initial tests will be carried out on a wavelength of 277.78 metres. A start has already been made on the installation of the 10-kilowatt transmitter at Mährisch Ostrau; this station will work on 254.2 metres.

AN AFTER-DINNER STORY.

At a gathering of The Wireless Dinner Club a few evenings ago, Lt.-Col. Edgecumbe told the story of an American widow who, being anxious to conceal the fact that her late husband had been electrocuted as a murderer, used to explain that "he occupied the chair of applied electricity at one of our public institutions."

ALL ABOUT TWO-STROKES.

"The handy two-stroke" has long been a byword in the motor cycling fraternity. In "Two-stroke Motor Cycles," the fourth edition of which has just been issued, the staff of *The Motor Cycle* contribute an encyclopædia of facts, with illustrations, concerning the simplest form of mechanically propelled road vehicle. The book is obtainable from our publishers, price 2s., or 2s. 3d. post free.

FORESTALLING THE JEREMIAHS.

Anticipating the annual lamentation that broadcasting is responsible for bad weather, the Royal Meteorological Society has produced statistics to show that any effect of wireless upon weather would be due to "sub-homeopathic doses" of less than one in a thousand million. To produce a year's rain for a suburban tennis court by means of an electric kettle would cost £800 or more.

SINGLE WAVELENGTH WORKING IN U.S.A.

The news that broadcasting station KYW at Chicago has been licensed to erect a "supplemental" 3.5-kilowatt transmitter to cover "dead spots" is a reminder that America has employed a form of single wavelength working for a number of years. The stations WBZ, at Springfield, Mass., and WBZA at Boston, owned by the Westinghouse Company, have transmitted the same programme on the same wavelength for three years past.

BETS ON THE ETHER.

Bookmakers in the North are seriously considering a scheme for wireless communication with racecourses, says a Leeds correspondent. It appears that the intention is to dispense with tape machines and to allot a secret wavelength for subscribers. The transmitting stations would be mounted on lorries

which would travel from one race meeting to the next.

The early pioneers of wireless can hardly have guessed that their researches would prove so valuable.

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BLACK DAYS FOR INDIAN BROADCASTING.

"The general opinion nowadays appears to be that the Indian Broadcasting Company's stations are not worth listening to, and the licence-holder either packs his apparatus away in the box-room, or confines his leisure hours to the "short wavers."

Thus speaks the Radio Club of Bengal in its official organ *Radio Jottings*. Since the above paragraph was written the I.B.C. has issued its annual report, showing a loss of £16,125 on one year's

radio sales in 1928 is estimated at \$650,000,000, as compared with \$425,000,000 in 1927. And in the opinion of the Radio Manufacturers' Association of America, sales in 1929 should exceed \$800,000,000.

The contributing factor to recent successes is held to be the arrival of the mains-driven receiver.

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"THE YACHTING WORLD."

A new journal has been added to the range published by Iiffe & Sons Limited. *The Yachting World*, one of the oldest yachting papers in the British Isles, has been acquired and will appear in new and improved form on Friday, April 5th, and each succeeding Friday, under the title of *The Yachting World and Motor Boating Journal*. Major B. Heckstall Smith, who is the leading writer on yachting subjects, has been appointed Editor.

The Yachting World and Motor Boating Journal will have a striking pictorial cover, and the aim will be to cater for yachtsmen who go afloat upon the sea or inland waters in yachts and boats of all types and tonnages. Reports from yachting stations and motor boating and sailing clubs will appear throughout the season, and a feature will be made of illustrations.

The Yachting World and Motor Boating Journal, price 6d., will be obtainable from booksellers and bookstalls every Friday, or direct from the Publishers, Iiffe & Sons Limited, Dorset House, Tudor Street, London, E.C.4.

HAVE YOU HEARD BELGRADE?

The new broadcasting transmitter at Belgrade (Yugo-Slavia), a Marconi 9 kW installation, began regular daily transmission on Sunday, March 24th.

HOLLAND—JAVA TELEPHONY.

In the article entitled "World-Wide Telephony" in our issue of March 20th it should have been stated that the title picture on p. 313, and the two photographs on p. 315, depicted Station PHOHI, Huizen, built by Messrs. Philips. The station engaged in the Holland-Java service is PCLL, Kootwijk, owned by the Government.

WHO'S WHO IN THE ETHER.

Answers to Correspondents.

E. V. (Yeovil).—Cassel relaying Frankfurt-on-Main. These were only gramophone selections from the opera *Tristan and Isolde* (Wagner), not a complete performance. **F. J. P. (St. Anne's).**—Yes, Motala relaying Stockholm. A relay from the St. Saviour's Church at Oslo of the wedding of H.R.H. Prince Olaf of Norway and H.R.H. Princess Martha of Sweden. Possibly the other station you heard giving the same transmission was Bergen (relaying through Oslo), but cannot confirm. **H. B. M. (Margate).**—The WL of Eiffel Tower has fluctuated considerably lately; the station may broadcast shortly on 1,470 metres. In order to carry out alterations to the aerial, mid-day concerts have been suspended for eight days. **J. P. (Bournemouth).**—On this WL would tally with Stamboul, which broadcasts Turkish music nightly at 7 p.m. A Western programme follows at 10 p.m. G.M.T. **C. V. D. (Havant).**—These French transmission (Radio Paris and Toulouse) were heard through Radio Maroc (March 10) as the Rabat station, for some twenty minutes relayed foreign broadcasts. **R. L. (E.14).**—Lille, which has reduced its WL to about 245 metres; call is, *Radio PTT du Nord. Lille*.

FORTHCOMING EVENTS.

WEDNESDAY, APRIL 3rd.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, Business meeting. Edinburgh and District Radio Society.—At 8 p.m. At 117, George Street. "Lectures."

MONDAY, APRIL 8th.

Institute of Wireless Technology.—At 7 p.m. At the Engineers' Club, Coventry Street, W. Lecture: "Wireless Receiver Design from Pre-Broadcasting Days to the Present Time," by Mr. M. A. Hutchins.

TUESDAY, APRIL 9th.

The Television Society.—At 8 p.m. At the Engineers' Club, Coventry Street, W. Lecture: "Some Notes on Exploring," by Mr. J. Cameron Rennie, B.Sc., M.I.E.E.

WEDNESDAY, APRIL 10th.

Institution of Electrical Engineers, Wireless Section.—At 6 p.m. (light refreshments at 5.30). At the Institution, Savoy Place, London, W.C.2. "Short Waves," a paper by Mr. T. L. Eckersley, B.A., B.Sc. Wigan Technical College Radio Society.—Members' night. Queen's Park Radio Society.—At 8 p.m. At St. Jude's Hall, Lancefield Street. Lecture by Prof. A. M. Low.

working and a total loss of £28,650 since the company was started.

The directors attribute their troubles to the prevalence of "piracy" and to difficulties in collecting sums due as a 10 per cent. tax on wireless imports.

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SUPPLY AND DEMAND.

In the *Indian Radio Times*, which is the official organ of the Indian Broadcasting Company, a writer agrees with the recent dictum in *The Wireless World* ("Broadcast Brevities") that "the I.B.C. will have to learn the hard lesson that in matters of broadcasting the demand follows the supply," but denies that the supply in India has been followed by a demand, the I.B.C. having lost one and a half times its income every month.

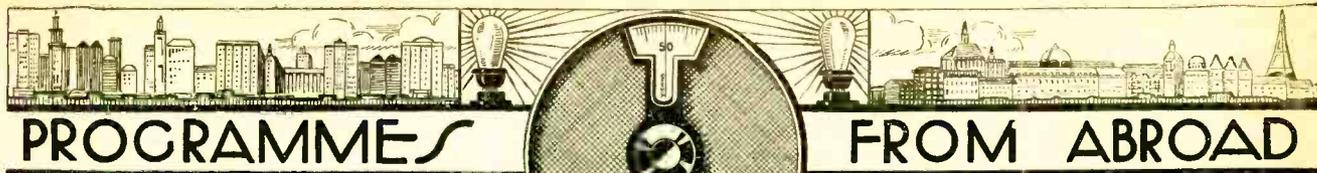
It would appear that a "supply" which produces such a tardy response on the public's part is not the sort of supply that is needed. Has the I.B.C. considered a change in the menu?

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HAVE MAINS SETS SAVED U.S.

RADIO?

Fears that the American wireless industry had reached saturation point have been shattered by record figures achieved in 1928. According to *Radio Retailing* (New York), the retail value of



SATURDAY, April 6th.

All Times are reduced to Greenwich
Mean Time and are p.m. except
where otherwise stated.

BARCELONA (Radio Barcelona), Call EAJ1 (350.5 metres); 1.5 kW.—6.0, International Market Prices and Exchange Quotations. 6.10, Sextet Selections. 8.30, Elementary French Lesson. 9.5, Exchange Closing Prices. 9.10 (approx.), Orchestral Concert: March, Fidèle et hardi (Rust-Lotter); Selection from La Bayadère (Kálmán); Waltz Jota, El confitero (Escalás); Prelude, Madrid in 1808 (Juncá Soler); Waltz from Der Rosenkavalier (R. Strauss); Polonaise militaire (Chopin). 10.0, News and Announcements. 10.5, Programme (to be announced).

BERGEN (365.9 metres); 1.5 kW.—6.0, Programme for Girls. 7.0, Orchestral Music. 7.20, Concertina Recital. 7.50, Topical Talk. 8.0, Talk: Nils Henrik Abel. 8.30, Orchestral Concert. 9.0, Weather Report, News and Time Signal. 9.15, Dance Music. 11.0 (approx.), Close Down.

BERLIN (Königswusterhausen) (1,649 metres); 40 kW.—4.0, Programme relayed from Hamburg. 5.0, A Debate between Workers. 5.30, Elementary French Lesson. 5.55, Prof. Landsberger, Talk: Nationality in Plastic Art—the Character of Art in Italy and France. 7.0, "Rural" Programme: Overture to Der Wildschütz (Lortzing); Tenor Solo from Czar and Carpenter (Lortzing); Humorous Recitations by Gustav Hermann; Recitative and Tenor Solo from Undine (Lortzing); Selection from Die Puppenfee (Bayer). 8.0, Soloist Concert: Tenor Solos, (a) Recitative and Air from Aida (Verdi), (b) Air from Dobrynia Nikititsch (Gretchaninoff); Soprano Solos, (a) Ich möchte schweben über Talund Hügel, (b) Du schaust mich an mit stummen Fragen, (c) Jahrelang möcht ich so dich halten (Sjögren); Piano-orte Solos (a) Improptu in F Sharp Major (Chopin), (b) Selection from Lucia di Lammermoor (Donizetti), Tenor Solos, (a) Die Nachtstille (Kaschewaroff), (b) Die Nacht (Moussorgsky), (c) Singe nicht, du schöne (Rachmaninoff); Soprano Solos, (a) Die Prinzessin, (b) Margareten Wiegenlied, (c) Im Kahne, (c) Ein Schwan, (d) Zickeltanz (Grieg); Pianoforte Solos (Delibes), (a) Valse lente from Coppélia, (b) Pizzicato from Sylvia; followed by News and Dance Music relayed from Voxhaus. 11.30 (approx.), Close Down.

BERLIN (Voxhaus), 475.4 metres); 4 kW.—9.10 a.m., Market Prices. 9.15 a.m., Time Signal, Weather Report and News. 10.0 a.m., Programme of Gramophone Records. In the Interval, Exchange Quotations. 11.55 a.m., Time Signal. 12.30, Time Signal, Weather Report and News. 1.0, Programme of Gramophone Records. 2.0, Exchange Quotations. 2.10, Agricultural Report and Time. 2.30, Dr. Paul Frank, Talk: Medical Hygiene. 3.0, Prof. Adolf Marcuse, Astronomical Talk: The Heavens in April. 3.30, Light Anecdotes. 4.0, Orchestral Concert: Little Concert Suite (Coleridge Taylor); Tango-Serenade, Blanca (Geisler); Selections from Friederike (Lehár); Selection from "As you like it" (Wetzlar); Waltz, Verlorenes Glück (Schmalstich); Song, Zwei Märchenagen (Kálmán), followed by Advertising Notes. 5.10, Dr. Fritz Seidler, Talk: The Cultivation of Waste and Moor Land. 5.35, Norbert Meyer, Talk: Voices over the Ocean. 6.0, Oswald Riedel, Talk: Eastern Frontier Lands. 6.30, Albert Voss, Talk: Young People and Professions. 7.0, Programme of Sketches in Celebration of the Foundation Festival of the Hochantenne Wireless Association, followed by Time Signal, Weather Report, News, Sports Notes and Dance Music. 11.30 (approx.), Close Down.

BERN (406 metres); 1.5 kW.—6.29, Time Signal and Weather Report. 6.30, Dr. Erich Fischer, Talk: The German Gift for Folk Song, followed by Programme of Songs, Duets and Quartet Selections. 7.30, Orchestral Concert. 8.0, "Dr. Ybrueh," Play in Dialect (Paul Frima), relayed from Basle (1,010 metres). 9.0, News and Weather Report. 9.15, Selections by the Kursaal Orchestra. 9.40, Dance Music. 11.0 (approx.), Close Down.

BRESLAU (321.2 metres); 4 kW.—3.15, Orchestral Concert: March, Heil Europa (von Bion); Overture to Banditenstriebe (Suppé); Selection from La clochette de l'ermite (Mailart); Waltz, Die Hydro-pathen (Gungl); Selection from Show Boat (Kern); Idylle passionnelle (Kazizade); Humorous March, Baby spielt Soldat (de Micheli); Waltz from Die Landstreicher (Ziehrer); Selections from Friederike (Lehár). 4.45, Weekly Film Review. 5.25, Reading in Esperanto by Margarete Polier. 5.35, Georg Lichey,

Talk: The French Revolution. 6.20, Lesson in Shorthand. 6.50, Four Young Men glance at Matters of the Moment. 7.15, Light Variety Programme by Senff-Georgi and the Station Orchestra. 9.0, News and Announcements. 9.30, Dance Music from Voxhaus. 11.0 (approx.), Close Down.

BRUSSELS (511.9 metres); 1.5 kW.—After 7.30, Experimental Transmission on a High Power.—5.0, Trio Concert: Selection from Le Roi d'Ys (Lalo); Minuet for Pianoforte (de Boeck); Intermezzo (Zilcher); Mattinata (Leoncavallo); Sirène blonde (Scassola); Violin Solo, Sérénade à Lisette (Caludi); Selection from Ma non (Massenet); 'Cello Solo, Litanei (Schubert); Loin du bal (Gillet); Garden of Love (Haydn Wood); Selection from The Dollar Princess (Fall). 5.45, Elementary and Intermediate English Lessons. 6.30, Columbia Gramophone Records. 7.30, "La Radio-Chronique." 8.15, Concert arranged by La Meuse, L'Antenne and Hebdio-Radio-Vision. In the Interval at 9.0, Topical Talk. 10.10, News and Esperanto Bulletin. 10.15, Dance Music from the Palace Hotel Restaurant. 11.0 (approx.), Close Down.

BUDAPEST (545 metres); 20 kW.—4.40, Instrumental Concert. 5.40, Recital of Songs. 6.30, Concert of Tzigane Music. 7.30, Pianoforte Recital by the Sisters Kotányi on Three Pianos. 8.30, Talk in English. 9.0, Time, Weather, News, Sports and Racing Notes. 9.25, Orchestral Concert: Selection from The Mute of Portici (Anber); Intermezzo and Barcarolle from The Tales of Hoffmann (Offenbach); Ballet Suite (Tchakovsky); Waltz Souvenir de Herkulesbad, (Pazeller); A la hongroise (Gillet); Traum durch die Dämmerung (R. Strauss); Siamese Prudic Procession (Szóhrnt); Variations on a German Folk Song after Various Composers (Ochs).

CRACOW (314.1 metres); 1.5 kW.—6.10, Talk on Exchanges. 6.56, Time Signal and Chimes. 7.5, Talk: A Glance at the Foreign Politics of the Past Week. 7.30, Programme relayed from Warsaw. 9.30, Concert from a Restaurant. 10.30 (approx.), Close Down.

DUBLIN, Call 2RN (411 metres); 1.5 kW.—1.30, Weather Report and Gramophone Records. 7.20, News. 7.30, Val Vouden (Entertainer). 7.45, Irish Lesson by Seamus O'Duinnin; 8.0, Pianoforte Selections by Carmel Turner. 8.15, Soprano Solos by Violet Pearson. 8.30, Recitations by Dr. J. B. Magennis. 8.45, Tenor Solos by Andy Dunne. 8.55, Selections by the Station Celeste Orchestra. 9.15, Variety Programme by Dorothy Day and Company. 9.45, "Gone to the Dogs," One-Act Comedy, by the Brooklyn Players. 10.15, Baritone Solos by Robert Irwin. 10.25, Selections by the Station Orchestra. 10.30, News, Weather Report and Close Down.

FRANKFURT (421.3 metres); 4 kW.—2.5, Programme for Children: Songs by a Children's Choir. 2.55, Talk for the Housewife by Fini Pfannes. 3.35, Orchestral Concert of Modern Dance Music; in the Intervals: News and Announcements. 5.10, Reading by O. W. Studtmann from The Lives of the Caesars (Suetonius). 5.30, Answers to Correspondents. 5.55, Lesson in Esperanto by W. Wischhoff. 6.15, Herr Flach, Talk: Extension of the Connections of the German Railways. 6.35, Herr Sauer, Talk: Insurance Societies and Banking Houses. 6.55, Prof. E. Sittig, Astronomical Talk: The Heavens in April—the apparent size of the

stars. 7.15, Variety Programme, followed by Dance Music from Voxhaus. 11.30 (approx.), Close Down.

HAMBURG, Call HA (in Morse) (392 metres); 4 kW.—9.15 a.m., News. 10.0 a.m., Programme of Gramophone Records. 11.10 a.m., Weather Report. 11.15 a.m., Exchange Quotations. 11.40 a.m., Concert, relayed from Hanover (566 metres); in the Intervals: Time Signal, Tide Reports, News and Snow Report. 1.40, Exchange Quotations. 2.30, Review of Books. 3.0, Prof. Fritz Brüggemann, Talk: Man Throughout the Ages—In the Nineteenth Century, relayed from Kiel (250 metres). 4.0, Concert of Old Italian Opera Music: Symphony, Jean d'Arc (Verdi); Selection from The Puritans (Bellini); Selection from L'Elisir d'amore (Donizetti); La Sonnambula (Bellini); Overture to The Barber of Seville (Rossini); Selection from Lucia di Lammermoor (Donizetti). 5.0, Orchestral Concert of Request Items. 6.0, Relay from a Live-stock Dealer's, Hanover. 6.30, Prof. Blumenstock, Talk: The Chinaman and his Doctor. 6.55, Weather Report. 7.0, "Die komponierte Liebeserklärung," Musical Programme. 9.30, Talks extraneous to the Programme. News, Weather Report, Sports Notes, Snow Report and Announcements. 10.0, Dance Music. 10.50, North Sea and Baltic Weather Report.

HILVERSUM (1,071 metres); 5 kW.—9.40 a.m., Time Signal and Daily Service. 11.40 a.m., Police Announcements. 11.55 a.m., Concert of Trio Music. 1.40, Musical Programme relayed from the Tuschinski Theatre, Amsterdam. 3.40, Italian Lesson by Mr. Giovanni Rizzini. 4.40, French Lesson by Mr. Raymond Lafont. 5.40, Concert by the Wireless Trio. 6.25, German Lesson by Mr. Edgar Grün. 7.25, Police Announcements. 7.45, Programme arranged by the Workers' Radio Society: Concert and Talk. 11.10 (approx.), Close Down.

HUIZEN (336.8 metres); 4 kW.—Transmits on 1,852 metres from 5.40 p.m.—11.10 a.m., Divine Service. 11.55 a.m., Trio Concert. 12.55, Gramophone Records. 2.40, Programme for Children. 5.10, Gramophone Records. 6.20, Talk by Max K. Gerisch. 6.30, Gramophone Records. 6.40, Elementary English Lesson. 7.10, Talk by M. Blom, Mayor of Angerlo. 7.40, Concert.

KALUNDBORG (1,153 metres); 7 kW.—Programme also for Copenhagen (331.8 metres).—6.30 a.m., Morning Gymnastics. 10.0 a.m., Weather Report. 2.0, Programme for Children. 2.30, Orchestral Concert: Overture to La Dame blanche (Boieldieu); Waltz from Der Rosenkavalier (R. Strauss); Chanson Louis XIII and Pavane (Couperin); Selection from Die toien Augen (Albert); Havannaise, Chanson pour Pepa (Valverde); Selections from Nantoua (Lalo); Old Songs: Overture (Lehár); Waltz from Hansel and Gretel (Humperdinck); Vesterthoughts (Herbert); Panamerica (Herbert); Ernst und Scherz für's Wiener Herz (Konczak); Ea badinant (l'Anabrosio); Folies-Bergère (Lincke). 4.40, Exchange Quotations. 4.50, Talk. 5.20, Talk by E. M. Thomsen. 5.50, Weather Report. 6.0, News and Time Signal. 6.30, Talk: Modern Authors of Other Lands. 7.0, Chimes from the Town Hall. 7.2, Concert of Old Dance Music: Fatinitza March (Suppé); Waltz, Til Svendsen (Svendsen); Spanish Mazurka, Madrilena (Svendsen); Polka Mazurka, Brennende Liebe (Jos. Strauss); Polka, Wiener Kreuz (Jos. Strauss); Spitzentuch-Quadrille (Joh. Strauss); Laura Waltz (Müllöcker); London Polka (Métrá); Pas de quatre (Lutz); Elena (Ivanovici); Vera-Galop (Michaelis). 8.0, Reading, followed by News. 8.45, Vocal and Orchestral Concert of Light Music. 10.0, Dance Music from the Industri Restaurant. 11.0 (approx.), Chimes from the Town Hall. 11.15 (approx.), Close Down.

KATTOWITZ (416.1 metres); 10 kW.—3.0 Music Lesson by Prof. F. Sachse. 3.25, Children's Letter Box. 4.0, Divine Service relayed from the Ostra Brama Church, Vilna (456 metres). 5.0, Programme for Young People. 6.10, Talk by Prof. K. Simm. 7.0, Art Talk by K. Rutkovsky. 7.30, Programme relayed from Warsaw. 9.0, Weather Report and News. 9.30, Dance Music.

KAUNAS (2,000 metres); 7 kW.—5.0, Time Signal and Weather Report. 5.5, Agricultural Talk. 5.33, Aviation Report. 6.0, News and Announcements. 6.30, Popular Concert. 7.15, Peasant Dialogue. 8.5, Concert.

Programmes from Abroad.—

KÖNIGSBERG (280.4 metres); 4 kW.—5.35, Talk: China To-day and in the Past. 6.0, Programme Announcements in Esperanto, followed by Topical Talk. 6.35, See **Königs-wusterhausen**. 7.10, "Grotesques and Lyrics." 8.0, Recital for Two Pianos: Sonata in D Major (Mozart); Concerto pathétique in E Minor (Liszt); Two Sonatas in B Flat Major (Clementi); En blanc et noir (Debussy). 9.10, Weather Report, News and Sports Notes. 9.30, Orchestral Concert. 11.0 (approx.), Close Down.

LAHTI (1522.8 metres); 35 kW.—5.35, Mandoline Selections by I. Putilin and G. Grossberg. 6.0, Dance Music by Suomi's Orchestra. 6.30, Songs. 6.50, Talk. 7.0, Dance Music. 7.45, News in Finnish and Swedish and Close Down.

LANGENBERG (462.2 metres); 20 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Cologne (263.2 metres), and Münster (267.8 metres).—12.5, Orchestral Concert: March, Feurig Blut (Wiedermann); Waltz, Ball bei Hof (Ziehrer); Overture to Donna Juanita (Suppé); Selections from The Girl of the Golden West (Puccini); O lass dich halten, gold'ne Stunde (Jensen); Noch sind die Tage der Rosen (Baumgartner); Suite, Wedding Scenes (Smetana); Boston, Ania (Ettinger); Nur bu bist der Traum meiner Nächte (Ettinger); Potpourri Bitte, recht freundlich—(Ralph). 1.30, Hints for the Housewife. 2.0, Programme for Children by Els Vordemberge. 2.30, Economic Report. 2.40, Dr. Wiedenhoff, Talk: The Technical Organisation of the Westdeutscher Rundfunk. 3.5, Programme for Women. 3.30, Dr. Stein, Talk on World Politics: The Reparations Question. 3.55, Dr. Otto Peltzer, Talk for Young People: Sport, Intellectuality and Youth. 4.20, English Lesson by Prof. Hase. 4.45, Orchestral Concert: Overture to Cosonay (Kéler-Béla); Suite, Der Minnesänger (Amadei); Angelus (Micheli); Waltz, Marienklänge (Strauss); March, Unter Hindenburg (Schulze-Stolle). 5.30, Dr. Stulz, Talk: How can I reach an Understanding of History. 5.50, Instruction in Morse. 6.15, Talk for Workers by Hans Schmitt. 6.40, Dr. Lips, Talk: The Development of Human Culture. 7.0, Variety Programme, followed by News, Sports Notes, Commercial Announcements, Concert and Dance Music. 12.0 Midnight (approx.), Close Down.

LEIPZIG (361.9 metres); 4 kW.—2.0, Programme for Children. 3.0, Talk on Chess-playing. 3.30, Orchestral Concert: Overture to The Two Hussars; Suite, Jeux d'enfants (Bizet); Selections from L'Amico Fritz (Mascagni); Norwegian Dances (Grieg); Waltz, Frühlingskinder (Waldteufel); Wiener Spaziergänge (Komzák). 4.45, Wireless News and Talk. 5.20, Weather Report and Time Signal. 5.30, See **Königs-wusterhausen**. 5.55, Labour Market Report. 6.0, Dialogue between a Librarian and a Library-member. 6.30, Ernst Krohn, Talk: German Taxation. 7.0, Selection from "Karneval in Rom"—Operetta (J. Strauss). 8.30, Juvalian Landau reads from his own Works. 9.0, Time Signal, Snow Reports, Weather, News, Programme Announcements and Sports Notes. 10.30, Dance Music relayed from **Voxhaus**. 11.30 (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 (426.7 metres); 3 kW.—7.0, Chimes and Programme of Dance Music. 8.25, News and Announcements. 9.45, Weekly Agricultural Report and Market Prices. 10.0, Chimes and Time Signal, followed by Programme (to be announced). 12.0 Midnight, Chimes and News, followed by Dance Music from the Alkazar. 12.30 a.m. (approx.), (Sunday), Close Down.

MOTALA (1,351 metres); 30 kW.—Programme also for Stockholm (438 metres), Boden (1,200 metres), Göteborg (348.3 metres), Hörby (260.9 metres), Östersund (720 metres) and Sundsvall (545.5 metres).—4.0, Concert for Light Music relayed from Göteborg. 5.0, Programme for Children. 5.30, Cabaret Programme relayed from Göteborg. 6.45, Sonata for Violin and Pianoforte No. 3 in D Major (Mozart), (a) Allegro con spirito, (b) Andante cantabile, (c) Allegretto, (d) Allegro. 7.10, "Flitting"—Play (Fastbom). 7.35, Programme of Folk Music. 8.0, Topical Talk, followed by News and Weather Report. 8.45, Dance Music relayed from the Sphinx. 11.0 (approx.), Close Down.

MÜNICH (536.7 metres); 4 kW.—Programme relayed by Augsburg (566 metres), Kaiserslautern (272.7 metres), and Nuremberg (240 metres).—2.30, Legal Talk. 3.0, Trio Concert: Overture to The Daughter of the Regiment (Donizetti); Fantasia, Erinnerungen an Grieg (Urbach); Three Songs (Engelthier), (a) Glaude, Liebe, Hoffnung, (b) Was bin denn ich? (c) Die Gatten; Jota aragonesa for Violin (Albéniz); Serenade (Piercé); Gavotte Madrigal (Thomé); Selections from the Song Cycle, Falterseelchen (Engelthier); Serenata amorosa (Beccé); Vogelstelletier (Künnecke); Syncopation (Kreisler). 4.30, F. Behringer, Talk: Modern Wireless Stations. 5.0,

Saturday, April 6th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

Zither Recital: Stimmungsbilder (Grünwald); Fantasia in B Flat Major (Haustein); Celesta (Kollmaneck). 5.35, Labour Market Report. 6.0, Answer to Queries. 6.30, Recital from the Works of Brahms, relayed from **Nürnberg**: Rhapsody No. 1 in B Minor Op. 79 for Pianoforte; Soprano Solos, (a) Sonntag, (b) Gang zum Liebchen, (c) Ständchen, (d) An die Nachtigall, (e) Sapphische Ode; Ballade in D Major Op. 10 No. 3 for Pianoforte. 7.5, Variety Programme. 9.0, Relay of a Concert. In the Interval, at 9.20, News. 11.0 (approx.), Close Down.

NAPLES, Call INA (333 metres); 1.5 kW.—4.0, Concert: Orchestral Selections, (a) Intermezzo, Tout simplement (Monestes), (b) Intermezzo, Il piccolo buttero (Barbieri); Soprano Solo, Vorrei morire (Tosti); Orchestral Selection, Intermezzo, Canzone perduta (Corti); Soprano Solo, Nel mistero della sera (Cerchia); Orchestral Selection, Potpourri, In Flemerlanda (Pietri); Soprano Solo, Ballata medioevale (De Lucia); Orchestral Selection, Intermezzo, Maniaca (Travisi); Soprano Solo from L'Amico Fritz (Mascagni); Orchestral Selections, (a) Intermezzo, Baby Parade (Manfred), (b) Tarantella marinara (Lama). 4.30, Time Signal. 4.35, Talk. 7.30, Time Signal, Talk, Wireless Notes, Announcements, News and Harbour Notes. 7.45, Relay of an Opera from the **Sau Carlo Royal Theatre**. 9.50, News. 9.55, Calendar and Programme Announcements. 10.0 (approx.), Close Down.

OSLO (496.7 metres); 1.5 kW.—Programme relayed by **Fredrikstad** (387 metres), **Hamar** (577 metres), **Notodden** (297 metres), **Porsgrund** (455 metres), and **Rjukan** (444 metres).—6.15, Weather Report and News. 6.30, Mlle. Elisa Ulvig tells of Iceland and of Knut. 7.0, Time Signal and Orchestral Concert: Intermezzo and Barcarolle from The Tales of Hoffmann (Offenbach); Selection (Grieg); Selection from The Merry Wives of Windsor (Nicolaï); Overture to Flotte Burschen (Suppé); Selection from Der Bettelstudent (Müllöcker); Waldteufeleien (Kling); Selection (Geisler); The Siberian Post (Renner); Behüt Dich Gott from Trompeter von Säckingen. 8.30, Weather Report, News and Topical Talk. 9.0, Accordion Recital. 9.30, Dance Music. 11.0 (approx.) Close Down.

PARIS (Ecole Supérieure), Call FPTT (458 metres); 0.5 kW.—5.30, Radio Journal de France. 7.0, Talk on Literature. 7.15, Chronique des combattants. 7.30, Scientific Talk. 7.45, Concert arranged by the Union des Grandes Associations, followed by Time Signal, News, Weather Report and Dance Music. 11.0 (approx.), Close Down.

PARIS (Eiffel Tower), Call FL (1,485 metres); 5 kW.—4.0, Pasdeloup Concert. 6.10, Weather Report. 6.20, "Le Journal Parlé"—Programme of Talks, (a) M. Marc Faysinet—The Postilion, (b) Dr. Pierre Vachet: Health; (c) Mlle. Jacqueline Bertillon: Social Works; and Talks by other contributors.

PARIS (Petit Parisien) (336.3 metres); 0.5 kW.—7.45, Gramophone Records, Talk and News. 8.0, Concert: Overture to Ossian (Gade); Selection from La Juive (Halévy); Clarinet Solo, Larghetto from the Quintet (Mozart); Third Slavonic Rhapsody (Dvorák); Fantasia, Les deux Aveugles (Offenbach); Scènes foraines (Mignan); Goudounia (Casadesu); In the Intervals at 8.25 and 9.0, News.

PARIS (Radio-Paris), Call CFR (1,744 metres); 15 kW.—11.30 a.m., Selections from Les Cloches de Corneville (Planquette). In the Interval at 12.0 Noon, Exchange Quotations and News. 1.0, Market Prices Report. 2.30, Exchange Quotations. 2.45, Programme for Children. 3.15, Dance Music. 3.45, Exchange Quotations and News. 5.30, New York Exchange Quotations and Agricultural Report. 5.45, Gramophone Concert: Pompanola (De Sylva); Petite Lisette (Goublier); Tango, Good-bye Boys (Sanders); Selection from I Pagliacci (Leoncavallo); Selection from Werther (Massenet); Introduction to Tristan and Iseult (Wagner); Le Héron (La Fontaine); Elle est à vous (Vvain); Bohemia (Polla). 6.30, First Lesson in Modern French Music, arranged by the Mainsion Durand. 6.45, Metal Prices and News. 7.0, Talk: The Educational Value of the Family. 7.15, Orchestral Concert: Suite from L'Arlesienne (Bizet); Au crépuscule (Feret); Moment Musical (Schubert); May Night (Rimsky-Korsakoff); Hungarian Dance (Brahms). 8.0, Programme of Dance Music. In the Intervals, News.

POSEN (336 metres); 1.5 kW.—5.50, Miscellaneous Items. 6.15, Sonata in G Minor for Violin and Pianoforte (Sjögren). 6.45, Recitations. 7.10, Talk for Women by Mme. Sabina Swidzinska. 7.30, Programme relayed from **Warsaw**. In the Intervals: Theatre and Cinema Notes and News. 9.0, Time and News. 9.30, Cabaret Programme. 11.0, Concert arranged by Maison Philips. 1.0 a.m. (approx.) (Sunday), Close Down.

PRAGUE (343.2 metres); 5 kW.—6.0, Chimes and News. 6.5, Wireless Notes. 6.15, Operetta relayed from **Brünn** (432.3 metres). 9.0, Time Signal, News, Sports Notes and Theatre Review. 9.25, Popular Music relayed from the Hotel Redouta, **Bratislava** (299.8 metres). 10.0, Chimes.

ROME, Call IRO (443.8 metres); 3 kW.—7.29, Time Signal, News and Report of the International Labour Office at Geneva. 7.45, Concert of Band Music: March from Macbeth (Verdi); Selection from Nerone (Boito); Danza abruzzese (Melchiorre); "Dozule"—Comedy in One Act (Andrea Picard, Translated by Amerigo Guasti); Sulla piana della Melia (Manente); Indian March and Procession from L'Africaine (Meyerbeer); Literary and Art Review by Lucio d'Ambrà; Nocturne (Martucci); Polonaise in A Flat (Chopin); Forlana from La Gioconda (Ponchielli). 9.50, Giornata parlato and News. 10.0 (approx.), Close Down.

SCHENECTADY, Call 2XAF (31.48 metres); 30 kW.—11.30, White House Coffee Programme relayed from **New York**. 12.0 Midnight, Phil Spitalny's Music relayed from **New York**. 12.30 a.m. (Sunday), Musical Programme relayed from **Rochester**. 1.0 a.m., Orchestral Music from the Hotel van Curler. 1.30 to 4.0 a.m., **New York Relay**. 1.30 a.m., Programme by Mildred Hunt and the Marimba Orchestra. 2.0 a.m., General Electric Hour. 3.0 a.m., Lucky Strike Programme. 4.0 a.m., Special Programme to Commander Byrd at Little America. 5.0 a.m., (approx.) Close Down.

STUTTGART (374.1 metres); 4 kW.—5.15, Talk, relayed from **Freiburg** (577 metres). 5.45, Concert of Alsatian Music, from the Works of Josef Erb: Introduction; Pianoforte Solos. (a) Ländler am Abend, (b) Nordisches Menuett; Songs, (a) Sehnsucht, (b) Es regnet sich langsam ein, (c) Glaube; Violin Solo, Berceuse, Op. 4; Songs, (a) Der Garten, (b) Rosenglut; Violin and Organ Selection, Unser täglich Brot gib uns heute, Op. 71; Three Songs, Violin Solo, Minuet and Allegro con fuoco from the Sonata in E Minor, Op. 21; Pianoforte Solos, (a) Mazurka à la hongroise, (b) Caprice, Polkette. 6.45, "Cosi fan tutte", Opera-comique (Mozart), relayed from the Municipal Theatre, **Freiburg**. 9.50, News. 10.0, Humorous Programme by Carl Wilczynsky, "Drunter und Draüber". 11.0, Gramophone Dance Music. 12.0 Midnight (approx.), Close Down.

TOULOUSE (Radiophonie du Midi) (389.6 metres); 8 kW.—11.45 a.m., Vocal and Instrumental Concert. 7.0, Market Prices and News. 7.30, Concert by a Viennese Orchestra: Waltz, The Blue Danube (Strauss); Waltz from Faust (Gounod); Waltz, Frühlingsstimmen (Strauss); Waltz Potpourri (Rocher). 7.50, Melodies, (a) Rencontre (Fauré), (b) Pour un seul mot d'amour (Rully). 8.0, Chimes, followed by Concert arranged by La Dépêche: Choral Selections, Vocal Solos and Recitations. 9.15, North African News. 9.30 (approx.), Close Down.

VIENNA (519.9 metres); 15 kW.—4.15, Programme for Children. 4.45, Concert: Violin Solos, (a) Adagio (Kodaly), (b) Satyr and Dryads—A Fairy Tale (Zsolt), (c) Czardas from Hejre Kati (Hubay); Songs, (a) Air from Stabat Mater (Pergolesi), (b) Selection from St. Paul (Mendelssohn), (c) Selections from The Creation (Haydn); Pianoforte Solos, (a) Slovakian Suite (Felber), (b) Prelude and Fugue (Kohn). 5.30, Dr. R. F. Arnold, Talk: The Individual and Society. 6.0, Topical Talk. 6.25, Time Signal and Weather Report. 6.30, Relay from the Vienna Opera House, followed by Concert and Phototelegraphy Transmission.

WARSAW (1,385.7 metres); 10 kW.—5.50, Miscellaneous Items. 6.10, Wireless Review by Dr. M. Stepovsky. 6.56, Time Signal. 7.0, Prof. S. Niewiadomsky, Talk: The History of Polish Music. 7.30, "The Enemy of Women," Operetta in Three Acts (Eysler); in the Interval, Theatre Notes. 9.0 (approx.), Aviation Notes, Weather Report, News, Police Announcements and Sports Notes. 9.30, Dance Music relayed from the Hotel Bristol.

ZÜRICH (489.4 metres); 1 kW.—6.0, Chimes from the Zürich Churches. 6.15, Time Signal and Weather Report. 6.17, Concert by the Station Quintet. 7.0, Popular Programme by Yodel Double Quartet and the Zürich Mandoline Orchestra. 8.0 (approx.), Folk Song Recital by Leopold Höhn. 9.0, Weather Report and News. 9.10, Gramophone Selections of Dance Music.

SUNDAY, April 7th.

Programmes from Abroad.—

BARCELONA (Radio Barcelona), Call EAJ1 (350.5 metres); 1.5 kW.—11.0 a.m., Relay of Chimes from Barcelona Cathedral. 11.5 a.m., Meteorological Report and Forecast for Europe and North-East Spain and Route Notes for Aviators. 1.30, Selections by the Iberia Trio. 2.45 to 6.0, No Transmission. 6.0, Weekly Agricultural and Commercial Bulletin and Information. 6.10, Programme of Dance Music by the Station Orchestra. 6.30, Recital of Songs. 7.0, Weekly Agricultural Talk arranged by the San Isidro Catalonian Agricultural Institute. 7.20, Orchestral Selections. 7.50 (approx.), Vocal Recital. 8.20, Concert by the Station Orchestra. Selections from El puñao de rosas (R. Chapi). 8.40, Sports Results. 9.0 (approx.), Close Down.

BERGEN (365.9 metres); 1.5 kW.—9.30 a.m., Church Service and Sermon. 11.30 a.m., Weather Report and Forecast and General News Bulletin. 7.0, Orchestral Concert. 7.50, Talk on a Topical Subject. 7.20, Lecture by Br. Just Brig: "Harold Haarfagre: the 'Battle of Hapsford.'" 8.30, Musical Programme. 9.0, Weather Report and Forecast, followed by General News Bulletin and Time Signal. 9.15, Programme of Dance Music. 11.0 (approx.), Close Down.

BERLIN (Königswusterhausen) (1,649 metres); 40 kW.—7.55 a.m., Relay of Church Chimes from the Garrison Church at Potsdam. 8.0 a.m., Sacred Recital of Vocal and Instrumental Music and Sermon from Voxhaus, followed by Chimes relayed from Berlin Cathedral. 10.30 a.m., Orchestral Concert. 12.15, Talk by E. Nebermann on the Modern Chess Game. 12.45 to 1.15, Experimental Transmission of Pictures. 1.30 to 2.30, Three Talks for Farmers. 2.30, Reading of Fairy Stories. 5.30, Talk. 6.45 (approx.), Concert or Play, followed by Late News and Announcements and Dance Music Programme. 11.30 (approx.), Close Down.

BERLIN (Voxhaus) (475.4 metres); 4 kW.—7.55 a.m., Relay of Chimes from the Potsdam Garrison Church. 8.0 a.m., Morning Recital of Soloist and Choral Religious Music with Sermon followed by Relay of Chimes from the Cathedral. 10.30 a.m., Orchestral Concert. 12.15, Chess Talk by E. Nebermann. 1.30, Announcements and Practical Hints for Agriculturists. 1.45, Review of Market Prices of the Week and Weather Report and Forecast. 1.55, Talk for Farmers. 2.30, Reading of Fairy Tales. 5.30, Talk. 6.45 (approx.), Musical or Dramatic Programme, followed by Meteorological Report and Late News of the Day, Sports Notes and Results and Programme of Dance Music. 11.30 (approx.), Close Down.

BERN (406 metres); 1.5 kW.—9.30 a.m. to 10.30 a.m., Religious Address. 12.0 Noon, Time Signal and Weather Report and Forecast. 12.5, Concert of Light Music. 2.30, Popular Concert by the Bern Kursaal Orchestra. 6.29, Time Signal, Weather Report and Forecast. 6.32, Talk by Herr Georg Schaeffner: "Gudolf's Shakespeare." 7.0, Musical or Dramatic Programme. 9.0 (approx.), Late News and Announcements, Weather Report and Forecast and Concert. 9.40 (approx.), Close Down.

BRESLAU (321.2 metres); 4 kW.—Programme relayed by Gleiwitz (326.4 metres). 8.15 a.m., Chimes relayed from Christ Church. 10.0 a.m., Evangelical Morning Festival, with Musical Items and Sermon. 11.0 a.m., Concert. 2.0, Fairy Story. 5.0, Talk. 7.15, Concert by the Station Orchestra and Soloists arranged by Herbert Brunar. Cello Solo: Romance in E Minor (C. Goltermann). 9.0, Late News and Announcements.

BRUSSELS (511.9 metres); 1.5 kW.—6.0, Matinée for Children, arranged by the Children's Theatre, under the direction of Léon Leroy. 6.30, Selections by the Station Trio. 7.30, "La Radio-Chronique." 8.15, Concert by the Station Orchestra. 10.15, General News Bulletin from the Evening Press. 11.0 (approx.), Close Down.

BUDAPEST (545 metres); 20 kW.—8.0 a.m., General News and Announcements and Beauty Hints. 9.0 a.m., Church Service and Sermon. 11.30 a.m. (approx.), Time and Meteorological Report followed by Concert of Symphony Music. 2.30, Agricultural Talk. 3.0, Wireless High School: Vocal Recital and Talk. In the interval at 3.45, Time Signal. 4.25, Musical Programme. 6.25, Transmission of The Bird-fancier—Operetta in Three Acts (Zeller).

COLOGNE (283.2 metres); 4 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Langenberg (462.2 metres) and Münster (267.8 metres).—6.45 a.m., Lesson in Self-Defence. 7.5 a.m., German Shorthand Lesson, arranged by Hans Molitor. 7.25 a.m. to 7.55 a.m., Esperanto Lesson and Survey of Programmes of the Week in Esperanto. 8.5 a.m. to 9.0 a.m., Catholic Morning Recital of Vocal and Instrumental

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

Music with Sermon. 10.35 a.m., Talk. 12.0 Noon, Concert of Light Music conducted by Eysoldt. 1.30, Talk. 1.50, Talk. 2.10 (approx.), Talk or Reading. 3.30, Concert of Light Music. 5.0, Talk. 7.0, The Czarevitch—Operetta by Franz Lehár, followed by Late News and Announcements, Sports Results and Orchestral Concert and Programme of Dance Music. 11.0 (approx.), Close Down.

CORK, Call 6CK (222 metres); 1.5 kW.—8.30 to 11.0, Programme of Vocal and Instrumental Music. 9.40, Selections by the Grossi Trio (Piano, Violin and Cello). 11.0, National Anthem followed by Weather Report and Forecast. 11.15 (approx.), Close Down.

CRACOW (314.1 metres); 1.5 kW.—9.15 a.m. to 10.45 a.m., Relay of Morning Service from a Cathedral. 10.56 a.m., Fantasia relayed from the Church of Notre Dame followed by Time Signal. 11.5 a.m., Meteorological Report. 11.10 a.m., Concert by the Philharmonic Orchestra relayed from Warsaw. 1.0 and 1.20, Talks for Agriculturists. 1.40, Agricultural Chronicle by Mr. Wasnievsky. 2.0, Weather Report and Forecast. 2.15, Concert by the Warsaw Philharmonic Orchestra. 4.20, Talk. 5.20, Concert relayed from Warsaw. 6.0, Miscellaneous Items. 6.56, Time Signal from the Astronomical Observatory. 7.0, Panfare from the Church of Notre Dame, followed by Sports Notes. 7.30, Concert of Vocal and Instrumental Music: Mazurka (Wieniawski) rendered by Mr. Mikuszewsky (Violinist). Followed by News and Announcements and Dance Music relayed from Warsaw.

DUBLIN, Call 2RN (411 metres); 1.5 kW.—8.30 to 11.0, Concert of Vocal and Instrumental Music relayed from Cork. 10.5, Vocal Selections rendered by Doreen Thornton (Soprano). 11.0, National Anthem and Weather Conditions and Forecast. 11.15 (approx.), Close Down.

GENOA, Call JGE (386.9 metres); 1.2 kW.—7.0, Opening Signal followed by "Il Radiogiornale." 7.25, News and Announcements supplied by the Stefani Agency and Sports Results. 7.20, Official Announcements by the Station. 7.25 (approx.), Talk; Sporting Events of the Day by Leandro Vaccari. 7.40, Concert of Vocal and Instrumental Light Music by the Wireless Orchestra, conducted by Fortunato Russo: Per me è giunto il di supremo from Don Carlos—Opera (Verdi) rendered by Pier Maria Zennaro (Baritone) with pianoforte accompaniment. 9.45 (approx.), Late News Bulletin supplied by the "Giornale di Genova" and Close Down.

HAMBURG, Call HA (in Morse) (392 metres); 4 kW.—Programme relayed by Bremen (273 metres), Flensburg (219 metres), Hanover (566 metres) and Kiel (250 metres).—7.20 a.m., Ice Report. 7.25 a.m., Weather Report and Forecast and General News Bulletin. 7.40 a.m., Talk: Contemporary Economic Questions. 8.0 a.m., Weekly Legal Talk. 8.15 a.m., Morning Recital. 9.55 a.m., Relay of Church Service. 11.55 a.m., Nauen Time Signal. 12.5 (for Hamburg, Kiel and Flensburg), Concert of Orchestral Music. 12.5 (for Hanover), Latest Gramophone Records. 12.5 (for Bremen), Concert by the Station Orchestra. 1.0, Programme for Children by Funkheinzelmann. 5.0, Talk. 6.30, Lecture for Athletes. 6.40, Sports Chronicle. 6.55, Meteorological Report. 7.0, Musical or Dramatic Programme, followed by Weather Report and Forecast, General News Bulletin, Sports Results and Concert of Orchestral Music. 10.50 (for Bremen, Flensburg, Hamburg and Kiel), Meteorological Report for North Sea and Baltic. 11.0 (approx.), Close Down.

HILVERSUM (1,071 metres); 5 kW.—11.40 a.m., Talk: How to Play Bridge, by Mr. J. J. A. de Ridder. 12.10, Selection by the Wireless Orchestra, conducted by Nico Treep. 1.40, Talk by a Dramatic Critic. 2.10, Musical Programme. 7.40, Time Signal and Press News and Announcements. 7.55 (approx.), Musical Selections. 8.10, Concert by the Augmented Station Orchestra and Soloists: Selections of Operatic Music. 11.10 (approx.), Close Down.

HUIZEN (336.3 metres); 4 kW.—Transmits from 5.40 on 1,852 metres.—8.5 a.m., Divine Service with Address. 9.30 a.m., Relay of Morning Service. 12.10, Recital by the Station Trio. 1.10, Talk. 1.40, Talk. 5.30, Relay of Church Service (on 1,852 metres) from the Evangelical Lutheran Church at Rotterdam: Preacher, J. W. Brass; Organist, J. T. Schaafdele;

Instrumental and Choral Musical Numbers. 7.10, Talk by Prof. Alph. Mulders van Hoeven. 7.55 (approx.), Concert of Popular Music. 9.10, Press News and Announcements. 10.25, Epilogue by the Choir, conducted by Mr. Jos. Pickkers. 10.40 (approx.), Close Down.

KALUNDBORG (1153 metres); 7 kW.—Programme also for Copenhagen (339.8 metres).—9.0 a.m., Morning Service, relayed from Copenhagen. 10.30 a.m. to 10.40 a.m. (Kalundborg only), Weather Report and Forecast from the Meteorological Institute at Copenhagen. 11.0 a.m., Time Signal and Chimes. 11.5 a.m., News and Announcements. 12.0 Noon, German Lesson. 12.30, French Lesson. 5.50 (Kalundborg only), Weather Conditions and Forecast from the Meteorological Institute at Copenhagen. 6.0, Press News and Announcements. 6.15, Time Signal. 6.16, Sports Notes. 6.30, Talk. 8.0, Pianoforte Recital of the Works of Chopin, by Ole Willumsen: Fantasia in F Minor, Opus 49.

KATTOWITZ (416.1 metres); 10 kW.—9.15 a.m., Relay of Morning Service. 10.56 a.m., Time Signal, followed by Meteorological Report. 11.10 a.m., Concert by the Philharmonic Orchestra, relayed from Warsaw: Scottish Symphony in A Minor (Mendelssohn). 1.0, Talk: The Silesian Gardener. 3.0, Concert of Popular Music. 6.0, Various Announcements. 6.56, Time Signal. 7.0, Talk. 7.30, Evening Concert. 9.0, Weather Report and Forecast, News and Announcements and Sports Results. 11.0 (approx.), Close Down.

KÖNIGSBERG (280.4 metres); 4 kW.—Programme relayed by Danzig (455.1 metres).—8.0 a.m., Morning Recital of Religious Music. 9.56 a.m. (Danzig only), Weather Report and Forecast. 10.0 a.m. (Königsberg only), Meteorological Report. 10.30 a.m., Selections of Light Music. 10.55 a.m., Time Signal from Nauen. 12.0 Noon, Musical Programme. 3.30, Concert of Light Music, conducted by Walter Kelch: East Asian Suite (Yoshitomo). 7.5 (approx.), Concert of Orchestral Music, followed by General News Bulletin and Sports Results. 9.30, Programme of Dance Music, relayed from Berlin (Voxhaus).

LAHTI (1,522.8 metres); 35 kW.—Programme also for Helsingfors (375 metres).—7.0 a.m., Relay of Church Service in Finnish. 9.50 a.m., General News Bulletin. 10.5 a.m., Programme of Orchestral Music. 10.25 a.m., Musical Selections. 10.50 a.m., Meteorological Report and Time Signal. 11.0 a.m., Relay of Divine Service in Swedish. 3.0, Concert of Light Music by the Station Orchestra, conducted by Erkki Linko. 4.57, Time Signal and Weather Report and Forecast. 7.20, Concert by the Wireless Orchestra. 7.45, Late News Bulletin in the Finnish and Swedish Languages. 8.15 (approx.), Close Down.

LANGENBERG (462.2 metres); 20 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Cologne (263.2 metres) and Münster (267.8 metres).—6.45 a.m., Self-defence Lesson, by Dr. L. Bach. 7.5 a.m., Lesson in German Shorthand. 7.25 a.m., Esperanto Lesson: Alfred Dornmann. 7.45 a.m., Review of Forthcoming Programmes in Esperanto. 8.5 a.m. to 9.0 a.m., Catholic Morning Festival with Address and Vocal and Instrumental Numbers. 10.35 a.m., Talk. 12.0 Noon, Concert of Popular Music, conducted by Eysoldt. 1.30, Literary Talk. 1.50, Chess Talk. 2.10 (approx.), Talk or Reading. 3.30, Musical Selections. 5.0, Talk. 7.0, Relay of "The Czarevitch," Operetta, by Franz Lehár, followed by Late News Bulletin, Sports Intelligence and Concert of Light and Dance Music. 11.0 (approx.), Close Down.

LEIPZIG (361.9 metres); 4 kW.—Programme relayed by Dresden (317 metres).—7.30 a.m., Selections of Organ Music from a Church in Leipzig. 8.0 a.m., Morning Recital of Vocal and Orchestral Music. 2.0, Musical Programme. 8.0, Transmissiou of Salome: Drama in One Act by Oscar Wilde, translated into German by Dr. Kieser, produced by Hans Peter Schmiedel, incidental Music by Wilhelm Rettich; followed by Time Signal, Press News and Announcements, Sports Bulletin and Programme of Dance Music. 11.30 (approx.), Close Down.

LYONS (Radio Lyon) (291 metres); 1.5 kW.—10.0 a.m., Orchestral Concert. 6.30, "Le Journal Parlé," containing Press News and Announcements, Programme of Entertainments and Agricultural Bulletin. 7.0, Selections of Vocal and Instrumental Music. Variations sur un thème à deux claviers (Saint-Saëns). 9.0 (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 (426.7 metres); 3 kW.—2.0, Relay of Chimes, followed by Time Signal. 2.5, Musical Selections rendered by the Station Orchestra: L'Arlesienne—Second Suite (Bizet). (a) Pastorale, (b) Intermezzo, (c) Minuet, (d) Farandola. 3.30 to 7.0, No Transmission. 7.0, Relay of Chimes, followed by Dance Music Selections. 8.0, Talk: Famous Travels. 8.30 to 10.0, No Transmission.

Programmes from Abroad.—

10.0, Chimes relayed from the Gobernacion and Time Signal. 10.5, Evening Concert by the Orchestra of the Station. 10.30, Concert of Band Music relayed from the Hotel Nacional. 12.0 Midnight, Relay of Chimes. 12.5 a.m. (Monday), Continuation of the Concert. 12.30 a.m. (approx.) Close Down.

MILAN (JMI (534.2 metres) ; 7 kW.—9.0 a.m., Opening Call Signal, followed by English Language Lesson. 11.30 a.m. Time Signal. 11.32 a.m. Musical Selections by the Station Quartet. 12.30 to 3.0, No Transmission. 3.0, Opening Signal. 3.2, Relay of a Comedy from the Arcimboli Theatre. 3.45, Concert of Light Music by the Station Quintet and Soloists. Mezzo-soprano Selections: La tregua (Sinigaglia) rendered by Gina Gottlieb. 7.25, Opening Signal. 7.30, Official Communications by the Station. 7.40, Lecture on a Historical Subject by C. A. Blanche. 8.0, Relay of an Opera from the Scala Theatre. In the intervals: Talk: Town and Country, by Ulderico Tegani. Sports Intelligence and Late News and Announcements supplied by the Stefani Agency. 10.30 (approx.), Close Down.

MOTALA (1351 metres) ; 30 kW.—Programme also for Stockholm (438 metres), Boden (1,200 metres), Göteborg (346.8 metres), Hörby (260.9 metres), Östersund (720 metres), and Sundsvall (645.5 metres).—10.0 a.m., Relay of Divine Service from Stockholm. 3.30 Literary Reading. 4.0, Children's Corner. 4.55, Carillon relayed from the Town Hall at Stockholm. 6.15, Dramatic Programme. 8.15, General News Bulletin and Weather Report and Forecast. 8.45, Concert Programme. 9.45 (approx.), Close Down.

MUNICH (536.7 metres) ; 4 kW.—Programme relayed by Augsburg (506 metres), Kaiserslautern (272.7 metres), and Nürnberg (240 metres).—9.0 a.m., Evangelical Festival of Church Music with Address. 10.0 a.m., Chimes relayed from Munich Town Hall. 10.10 a.m., Transmission of the Bavarian Weather Chart. 10.50 a.m., Time Signal, followed by Weather Report and Forecast. 11.0 a.m., Concert of Light Music. 12.5, Time, Meteorological Report and Review of Forthcoming Programmes. 7.0, Musical Programme. 8.0, Relay of Suor Angelica—Opera by G. Puccini. 9.20 (approx.), Evening News Bulletin.

NAPLES, Call INA (333 metres) ; 1.5 kW.—8.30 a.m., Lesson in French by Professor Etienne Verdier. 9.0 a.m., Selections of Sacred Music. 3.45, Programme for Children. 4.0, Selections of Vocal and Orchestral Music. 4.30, Time Signal. 7.32, Il Radiogiornale. 7.50, Chronicle of the Naples Harbour Authorities. 8.0, Time Signal. 8.02, Popular Programme of Vocal and Orchestral Operatic Music and Recitations: Duet from Act II of André Chénier (Giordano), rendered by E. Blandi (Soprano) and G. Ferrero (Tenor). In the interval: Prose and Verse Recitations by E. Murolo. 9.0, Sports Results. 9.55, Calendar and Survey of Programmes of the Week. 10.0 (approx.), Close Down.

OSLO (496.7 metres) ; 1.5 kW.—Programme relayed by Fredrikstad (387 metres), Hamar (577 metres), Notodden (297 metres), Porsgrunn (455 metres), and Rjukan (448 metres).—6.15, Weather Conditions and Forecast, followed by News and Announcements. 6.30, Talk. 7.0, Time Signal. 7.2, Concert by the Station Orchestra, conducted by M. Hugo Kram. 8.30, Meteorological Report and General News Bulletin. 8.45, Talk by a Journalist on a Topical Subject.

PARIS (Ecole Supérieure), Call FPTT (458 metres) ; 0.5 kW.—Programme relayed at intervals by the following stations: Bordeaux PTT (275 metres), Eiffel Tower (1,485 metres), Grenoble (416 metres), Lille (267 metres), Limoges (285 metres), Lyons PTT (478.2 metres), Marseilles (303 metres), Rennes (280 metres), Toulouse PTT (260 metres).—7.0 a.m., General News Bulletin and Time. 8.25 a.m., International Time Signals and Weather Report and Forecast. 12.0 Noon, Concert of Popular Music arranged by the General Association of French Wireless Listeners. 1.0, (approx.) Concert of Symphony Music relayed from the Assembly Hall of "Le Journal." La chaise à porteurs (Chaminade) 5.30, "Le Radio Journal de France économique" 7.30, Concert arranged by the General Association of Wireless Listeners, followed by Late News Bulletin, Time and Weather Report and Forecast. 12.0 Midnight, Close Down.

PARIS (Eiffel Tower), Call FL (1,485 metres) ; 5 kW.—7.56 a.m., Time Signal on 32.5 metres. 9.26 a.m., Time Signal on 2,650 metres. 6.10, Weather Report and Forecast. 6.20, Le Journal Parlé, including Police History, Sports Chronicle, General News Bulletin and Racing Results supplied by "Paris Sport." 7.0 to 8.0, Literary or Dramatic Programme.

Sunday, April 7th.

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7.56, Time Signal on 32.5 metres. 10.26, Time Signal on 2,650 metres.

PARIS (Petit Parisien) (336.3 metres) ; 0.5 kW.—7.45, Gramophone Selections. 7.50, Lecture. 7.55, General News Bulletin. 8.0, Orchestral Concert with the assistance of artistes of the Opéra and the Opéra-comique: Selections from Les Diamants de la couronne—Opera (Auber). 8.25, Press News and Announcements. 8.30, Concert of Symphony Music conducted by Prof. Estyle of the Paris Conservatoire. 9.0, Late News and Announcements. 9.10, Concert of Symphony Music continued. 10.0 (approx.), Close Down.

PARIS (Radio Paris), Call CFR (1,744 metres) ; 15 kW.—7.0 a.m., General News Bulletin and Review of the Press. 7.30 a.m., Doctor Diffe gives his Daily Physical Culture Lesson. 11.0 a.m., Sermon by the Révérend Père Lhande, followed by Sacred Recital of Religious Music. 11.30 a.m., News from the Press. 11.45 a.m., Programme of Orchestral Selections. In the interval: Humorous Selection by Bilboquet. 3.30, The "Odéon" Programme of Gramophone Records organised by "L'Industrie Musicale." In the intervals: News and Announcements. 5.30, The Pathe Half-Hour of Gramophone Selections. 6.0, Agricultural Report. 6.30, News and Announcements. 6.45, Radio Paris Circus. 7.15, Radio Paris Concert. In the intervals: Late News from the Evening Press. 9.30 (approx.), Close Down.

POSEN (336 metres) ; 1.5 kW.—9.15 a.m. to 10.45 a.m., Relay of Religious Service. 11.10 a.m., Time Signal. 11.15 a.m. and 11.35 a.m., Two Talks for Agriculturists. 11.55 a.m., Talk for Housewives. 4.30, Talk. 5.20, Vocal Selections rendered by Anne Kripowicz (Soprano), Pierre Ivanicky (Tenor) and Jean Novak (Bass). 6.20, Talk relayed from Warsaw. 6.45, Talk: Silva rerum by Mr. B. Busiakiewicz. 7.5, Miscellaneous Items. 7.30, Musical Programme. During the intervals: Literary Talk, relayed from Warsaw, Theatre and Cinema Programmes and News. 9.0, Time Signal followed by Sports Notes. 9.20, Programme of Dance Music relayed from the Café Wielkopolanka. 11.0 (approx.), Close Down.

PRAGUE (343.2 metres) ; 5 kW.—8.0 a.m., Morning Recital of Church Music. 3.30, Concert of Popular Music. 4.30, Programme for Workers: Talk. 5.0, Programme of News and Music for German Listeners. 6.0, Sports Bulletin. 9.0, Time Signal and General News Bulletin. 9.15, Notes on Theatre Programmes. 9.20, Concert of Light Music. 10.30 (approx.), Close Down.

RABAT, Call PTT (414 metres) ; 2 kW.—12.30 to 2.0, Selections by the Station Orchestra. 4.0 to 5.0, Musical Selections. 8.0, Le Journal Parlé, consisting of General News Bulletin and Various Announcements. 8.15, Relay of European Broadcasting Stations. 8.30, Selections of Vocal and Instrumental Music by the Station Orchestra: Midsummer Night's Dream; Overture (Mendelssohn). In the interval at 9.30 (approx.), Sports Notes and Results. 10.30 (approx.), Relay of European Broadcasting Stations. 11.0 (approx.), Close Down.

ROME, Call IRO (443.8 metres) ; 3 kW.—8.30 a.m., Opening Signal. 8.32 a.m., German Language Lesson. 9.0 a.m. to 9.45 a.m., Festival of Religious Music with Vocal and Instrumental Numbers. 10.0 a.m., Transmission from the "Casa di Dante": Talk on "Il Purgatorio." 12.0 Noon, Opening Signal. 12.5 to 1.0, Selections by the Station Trio. 1.0 to 4.0, No Transmission. 4.0, Opening Signal. 4.5 to 5.30, Concert of Popular Music. 6.50, Press News and Announcements and Agricultural Talk. 7.15, Sports Bulletin and Various Announcements. 7.29, Time Signal followed by Official Announcements from the Station. 7.45, Selections from Old and New Italian Comic Opera. Il Signor Bruschino—Comic Opera in One Act (Rossini). During the intervals: Reading. 9.50, Late News and Communications. 10.0 (approx.), Close Down.

SCHENECTADY, Call 2XAD (19.56 metres) ; 30 kW.—7.0, Relay of Biblical Drama from New York. 8.30, Recital of Organ Music by Elmer A. Tidmarsh. 9.0, Sermon for Men by Doctor S. Parkes Cadman relayed

from New York. 11.0, Relay of Stetson Parade and the American Legion Band Programme from Boston, Mass. 11.30, Relay of Dictograph Programme from New York. 12.0 Midnight, Vocal Selections. Old Company's Programme relayed from New York. 12.30 a.m. (Monday), Relay of Programme from the Capitol Theatre, New York. 2.0 a.m., Relay of Talk on "Our Government," by David Lawrence, Editor of "The United States Daily" from Washington D.C. 2.15 a.m., Atwater Kent Hour relayed from New York. 3.15 a.m., Relay of Studebaker Champions from New York. 3.45 a.m. (approx.), Close Down.

SEVILLE (Union Radio), Call EA15 (369.9 metres) ; 2 kW.—2.0, Musical Selections by the Wireless Orchestra, followed by Programme of Gramophone Music and Variety Concert of Spanish Numbers. 3.0 to 9.30, No Transmission. 9.30, Programme of Light Music by the Orchestra of the Station, followed by Festival of Flamenco Songs; Overture to The Marriage of Figaro—Opera (Mozart). 11.30 (approx.), Close Down.

STAMBOUL (1,200 metres) ; 5 kW.—5.0, Selections of Turkish Music. 6.45, Weather Report and Forecast and Time Signal. 7.0, Concert of Light Music by the Station Orchestra: Selections from La belle Hélène—Opera (Jacques Offenbach). 8.30, Late News and Announcements. 9.45 (approx.), Close Down.

TOULOUSE (Radiophonie du Midi) (389.8 metres) ; 8 kW.—11.45 a.m., Concert of Orchestral Music. 12.0 Noon, Time Signal. 12.5, Concert (continued). 12.45, News and Announcements supplied by "Le Télégramme," "L'Express" and "Le Midi Socialiste." 1.0, Sermon. 7.0, Stock Exchange Quotations and Cereal Market Prices from Paris and Press News and Announcements. 7.30, Concert of Instrumental Music. 8.0, Time Signal. 8.1, Concert, arranged by L'Association des Commerçants Radio-electriciens du Midi: Vocal Selections from Manon—Opera (Massenet) (a) Allons, Maïnon, plus de chimères, (b) Le marche sur tous les chemins. 9.15, News Bulletin from North Africa, followed by News and Announcements. 9.33 (approx.), Close Down.

VIENNA (519.9 metres) ; 15 kW.—Programme relayed by Graz (354.2 metres), Innsbruck (455.9 metres), Klagenfurt (455.9 metres) and Linz (250 metres).—9.20 a.m., Recital by a Viennese Boys' Choir under the direction of Prof. H. Müller. 10.0 a.m., Concert of Popular Music by the Viennese Symphony Orchestra. 2.15 (approx.), Experimental Picture Transmission. 3.0, Afternoon Concert: Relay of the Operetta, "Josefine Gallunayer," by Paul Knepler, followed by Experimental Transmission of Pictures. 10.33 (approx.), Close Down.

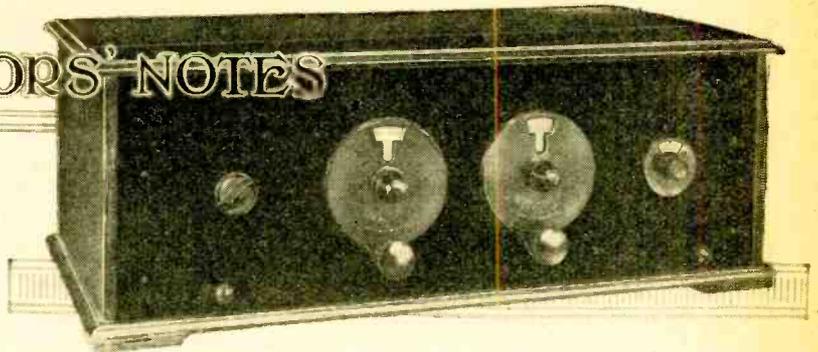
VILNA (456 metres) ; 1.5 kW.—9.15 a.m. to 10.50 a.m., Divine Service, relayed from a Cathedral. 10.56 a.m., Time Signal, followed by General News Bulletin. 11.10 a.m., Concert by the Philharmonic Orchestra. 1.0 to 2.0, Three Talks for Agriculturists. 2.0, Weather. 2.15, Concert by the Philharmonic Orchestra: Symphony in G Major (Dvorak). 4.30, Talk. 7.30, Relay of Concert from Warsaw, followed by Notes on Aerial Routes and Meteorological Report. 9.20, Police Communications and Sports Results. 11.0 (approx.), Close Down.

WARSAW (1,385.7 metres) ; 10 kW.—9.15 a.m., Divine Service, relayed from a Cathedral. 10.56 a.m., Time Signal and Fanfare, relayed from the Church of Notre Dame at Cracow, followed by Aerial Route Conditions and Weather Report and Forecast. 11.10 a.m., Symphony Concert, arranged by the Department of Education and Culture of the Magistracy of Warsaw: The Philharmonic Orchestra, conducted by J. Oziminsky: Mazepa, Symphonic Poem (Franz Liszt). 1.0, 1.20 and 1.40, Agricultural Talks. 2.0, Meteorological Report. 2.15, Orchestral Concert. 4.30, Talk for Graduates on Polish Literature. 5.20, Popular Programmes of Music and Literature. 6.20, Talk. 6.45, News and Announcements. 6.56, Time Signal. 7.0, Intellectual Diversions. 7.30, Concert of Orchestral Music: Theatre Notes in the intervals; in the interval at 8.0, Literary Talk. 9.0, Time Signal. 9.5, News, Aviation Notes, Weather, Police Communications and Sports Results. 9.20, Programme of Light Music from a Restaurant. 10.30 (approx.), Close Down.

ZÜRICH (489.4 metres) ; 1 kW.—10.0 a.m., Selections by the Station Orchestra. 11.29 a.m., Weather Report and Forecast. 11.30 a.m., Gramophone Selections. 3.0, Relay of Concert by the Carletti Orchestra from the Carlton-Elite Hotel. 6.30, Time Signal. 6.33, Religious Address. 7.0, Request Programme by the Station Orchestra: Hungarian Folk Songs of the 15th, 16th and 17th Centuries, collected by Bartok and Kodaly and rendered by Olga K. Kalliwoda, of Budapest. 9.0, Latest News Bulletin and Communications, supplied by the Neue Züricher Zeitung.

KIT CONSTRUCTORS' NOTES

The Six-Sixty "Mystery" Receiver: A Decoupled Four-valve Set.



THE sponsors of nearly every "kit" set claim that their products are suitable for long-distance loud speaker reception; it is strange that so few of them have taken advantage of the vast gain in overall magnification offered by the addition of a second L.F. stage to the almost ubiquitous H.F.-det.-L.F. three-valve combination. The matter is bound up in the fact that the amplification of an extra valve is multiplicative and not additive; if a single stage gives 10 times magnification, the addition of a second similar stage will result in an overall amplification of not 20 but 100 times. Possibly designers have been deterred by the L.F. interaction problem, but in view of recent developments this is no longer a completely valid reason, as the introduction of decoupling devices enables us to offset the ill effects of battery resistance.

Advantage has been taken of this scheme in the Six-Sixty "Mystery" Receiver, which, as the simplified circuit given in Fig. 1 will show, consists of an arrangement of transformer-coupled neutralised H.F. amplifier, leaky grid detector, and two L.F. stages, also linked by means of transformers. Anode circuits of the first three valves are decoupled by means of R.I.-Varley

"Anti-Mobo" units, which include a tapped resistance, useful in certain cases for breaking down the supply voltage when H.T. current is derived from a battery eliminator.

An Unorthodox Layout.

Aerial coupling is through an "aperiodic" double-wound transformer, with a primary tapped at three places so that selectivity may be adjusted. This coil assembly is built up as a unit consisting of two concentric windings on a moulded bakelite former, in the base of which is mounted a wave-range switch operated by a rod passed through the panel. The two coils are connected in parallel for short-wave reception. A similar description applies to the H.F. transformer, but its windings are, of course, differently arranged.

The layout of the set is unusual. Starting at the left-hand side, the first valve is the H.F. amplifier, and a long lead is passed from its anode to the H.F. transformer, on the extreme right of the baseboard. Adjacent to this coil assembly is the detector valve, followed by the two L.F. amplifiers, the last of which is next to the H.F. valve. This unusual arrangement makes for a more symmetrical panel layout, and, thanks to the wide spacing of grid and plate coils, screening is rendered unnecessary. The fact that the necessarily long plate lead does not cause any instability is probably due to a liberal application of the decoupling principle.

The loud speaker connection is picked up through a jack mounted on the terminal strip; contacts are so arranged that the filament circuit is closed by insertion of the plug. From the operating point of view it would be more convenient if the jack were mounted on the front panel.

It will be observed that the volume-control rheostat is connected in the negative

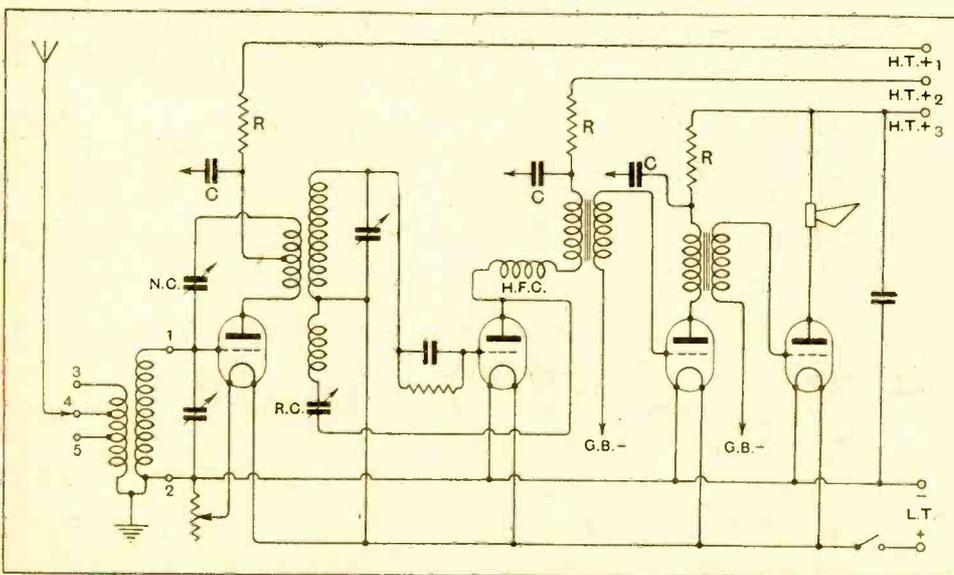


Fig. 1.—Theoretical circuit diagram, simplified by omission of waveband switch and output jack. Decoupling resistances and condensers are marked R and C; the low-potential sides of the latter are joined to the common negative bus-bar.

Kit Constructors' Notes.—

L.T. lead of the H.F. valve, and consequently it can be used to apply a slight negative bias to its grid, of course, by sacrificing some of the voltage applied to the filament. This method of reducing volume is particularly effective when dealing with overpoweringly loud signals.

Hints on Wiring.

As a ready-drilled panel is obtainable, the builder of the set is relieved of constructional work, his task being confined to assembly and wiring. A certain amount of care must be devoted to the latter operation, and reasonably stiff wire should be used in order to avoid risk of short-circuits between several of the longer leads. Wiring is made admirably clear by the large plan supplied, and as there is ample space, no excuse exists for misconnections.

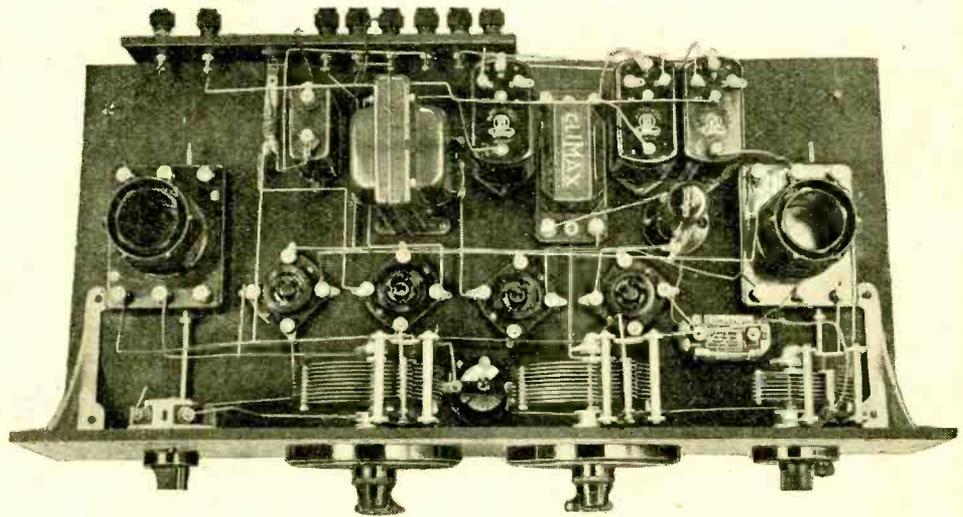
Small coils of the type included in this receiver are bound to have a fairly high H.F. resistance; it is in this direction that one has to pay for compactness and simple waveband changing. Results on test confirmed the accuracy of this statement; a fairly extensive use of reaction has to be made for reception of distant transmissions, but it cannot be said that H.F. resistance is excessively high. Of course, fairly flat circuits have the advantage that they do not introduce any loss of the higher audible frequencies through sideband "cutting."

It was found that there is a good deal of "spreading" of a powerful local transmission, but for those more fortunately situated selectivity is sufficient. An improvement may be made in this respect by altering the position of the aerial tap, remembering that the same connection is not necessarily the best on both wavebands, although a satisfactory compromise can generally be effected.

The neutralising adjustment is easily made; in fact, over the majority of the short-wave band and the whole of the long-wave band the actual set tested was stable without a balancing capacity.

In the matter of reaction control it is advisable to experiment with the H.T. voltage applied to the detector valve (*via* the terminal marked H.T. + 2). A common reaction winding is used for both wavebands; it is always a difficult matter to arrange both its inductance and its disposition with respect to the grid coils so that control is beyond reproach on both hands, but the problem seems to have been fairly successfully solved in this case. On the long waves there is hardly any overlap; on both bands reaction adjustment has little effect on tuning, but on the shorter wavelengths control is not quite so smooth.

As the circuit is essentially simple and straightforward



Plan view of the receiver. The neutralising condenser is mounted between the tuning condensers.

there is little likelihood that elusive faults will develop, and such troubles as may be encountered should be easily traced. Faulty switch contacts are often responsible for breakdowns, so particular attention was paid to those included in the coils; it seems most unlikely that they should fail in view of the robust nature of the contacts provided.

KIT CONSTRUCTORS' PROBLEMS.

The Information Department Service has been extended to deal with problems encountered by builders of "kit" sets discussed in these pages. Receivers already dealt with are the "New Cossor Melody Maker," G.E.C. "Music Magnet," and the Mullard "Master Three Star." The service is subject to the rules printed in the "Readers' Problems" section.

Too Much Magnification.

I have a Mullard "Master Three Star" set, and am thinking of using a pentode in the last stage instead of a P.M.2. Is this in order, and will any alteration to the wiring be necessary?

S. C. B.

We do not recommend your proposed alteration; your set as it stands already includes two L.F. stages, and the use of a pentode, with its enormous magnification, will result in alto-

gether excessive amplification. If you specially wish to use the valve, it would be best to abandon one of the stages.

o o o o

Ultra-short Waves.

You recently described a method of modifying a set for short-wave reception: would this plan be applicable to my "Music Magnet," and, if so, will you give me details? J. B. C.

Your set could be modified on the general lines of the arrangement to which you have referred; but, due to the use of fixed coils and wave-changing switches, the necessary alterations would be extensive, and you would run a risk of impairing the efficiency of the "ganged" tuning. We do not recommend this alteration, and fear that in any case the subject could not be treated adequately in the course of a letter.

USEFUL DATA CHARTS. (Nos. 24 (a) & 24 (b).)

The Design of Mains Transformers.

THE wireless amateur who is furnished with alternating current electric supply is interested in mains transformers either in connection with battery eliminators or with charging H.T. and L.T. batteries. The best form of transformer cannot be worked out mathematically: it can only be found by repeated trials, and a set of abacs is particularly useful for eliminating much of the arithmetical work involved.

In two recent issues of *The Wireless World* (No. 478, p. 569, No. 480, p. 630), H. B. Dent has given a design for a transformer to be used with a battery eliminator. In the course of the design he has assumed six turns per volt, and also that the wire gauge should be chosen so that the current density is 1,200 amps. per square inch. Experience has led him to adopt these figures, but they do not necessarily hold for transformers differing widely in size and function from the example, which he gives, and accordingly no such restrictions have been made in the abacs.

Design of a Battery Eliminator.

In the example which is chosen here to illustrate the abacs, H. B. Dent's design is followed fairly closely, and it will be seen that the greater part of the arithmetic disappears.

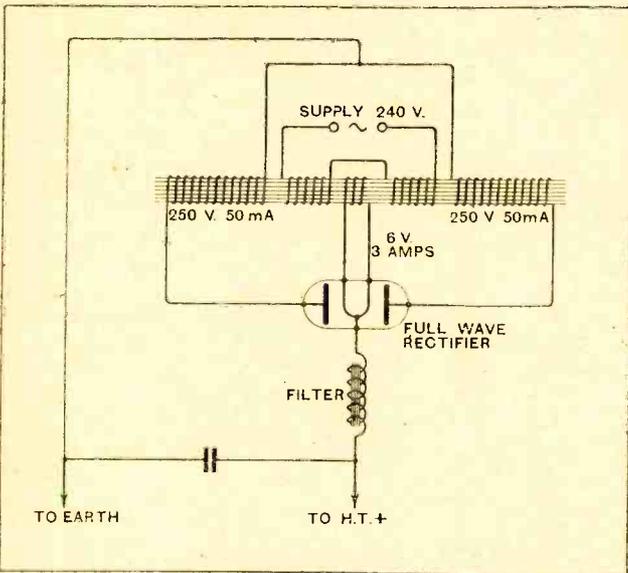


Fig. 1.—Transformer for supplying smoothed high-tension current. Note that the primary and secondary are split.

We wish to design a transformer (Fig. 1) for 240 v. 50-cycle mains which will deliver 250 v. at 0.1 amp. to the plates of two half-wave rectifiers (0.05 amp. to each plate alternately), and 6 v. at 3 amps. to the filaments.

The fundamental formula is $\frac{I}{\text{turns per volt}} = 4.44 \times$

$10^{-5} \times \text{cycles} \times \text{core section} \times \text{flux density}$ in kilo-lines per square inch. For stalloy it is usual to take 50 kilo-lines per square inch as the working flux density, and so, if we assume a core section of 1.5 sq. in., abac 24 (a) gives six turns per volt, or if we start with six turns per volt and work backwards, the core section

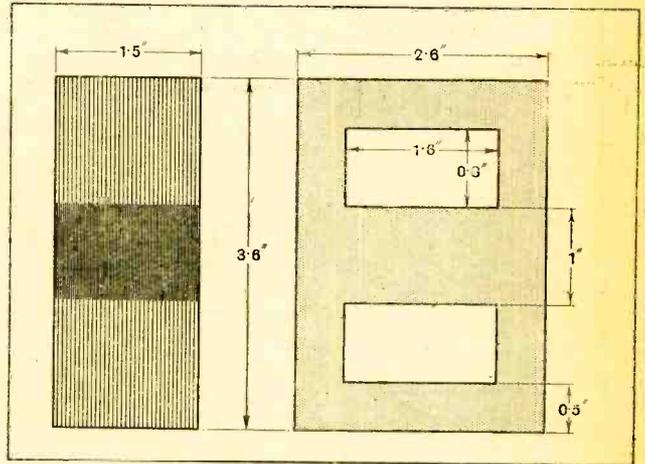


Fig. 2.—Transformer section giving dimensions.

will be 1.5 sq. in. Hence the total turns are as follows, remembering that the H.T. secondary is divided into two sections:—

- Primary turns = $240 \times 6 = 1,440$
- H.T. secondary turns = $260 \times 6 \times 2 = 3,000$
- L.T. secondary turns = $6 \times 6 = 36$

Now we turn to abac 24 (b). The primary amps. on full load are found as follows: The output load is $[250 \times 0.1] + [6 \times 3] = 43$ watts. Hence, assuming that the efficiency of the transformer is 80 per cent., the primary has to supply $43 \times \frac{100}{80} = 54$ watts, so that the primary current is $54 \text{ watts} / 240 \text{ volts} = 0.225$ amp.

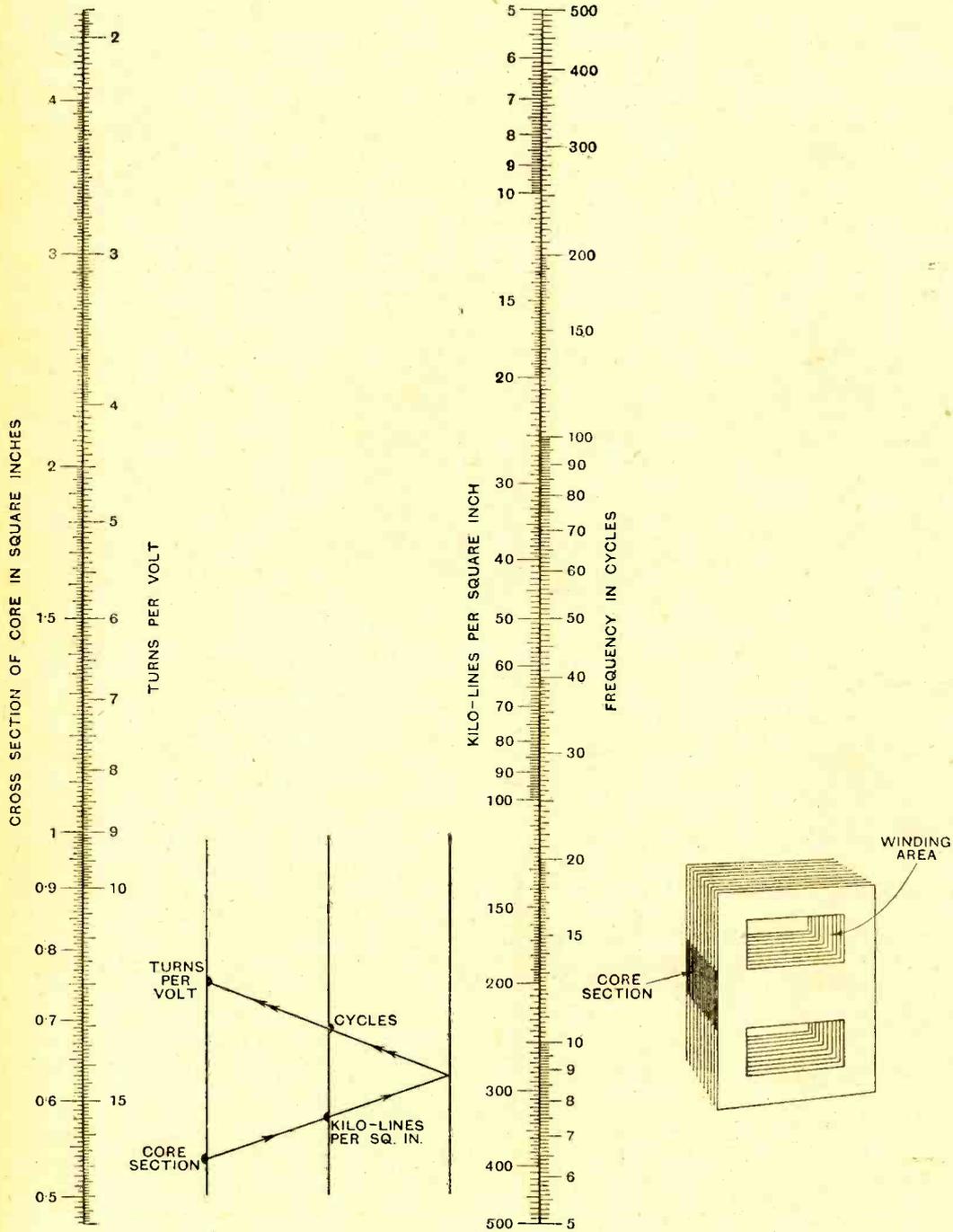
Hence we have:

- Primary current = 0.225 amp.
- H.T. secondary current = 0.05 amp. in each section
- L.T. secondary current = 3 amps.

Then for each coil we go through abac 24 (b): the current density in each case is taken as 1,200 amps./sq. in., and when the corresponding wire diameter is found, the nearest available gauge is taken. For compactness, combined with safety, D.S.C. is used, and, since the number of turns is known, the winding area is found on the third journey across the abac.

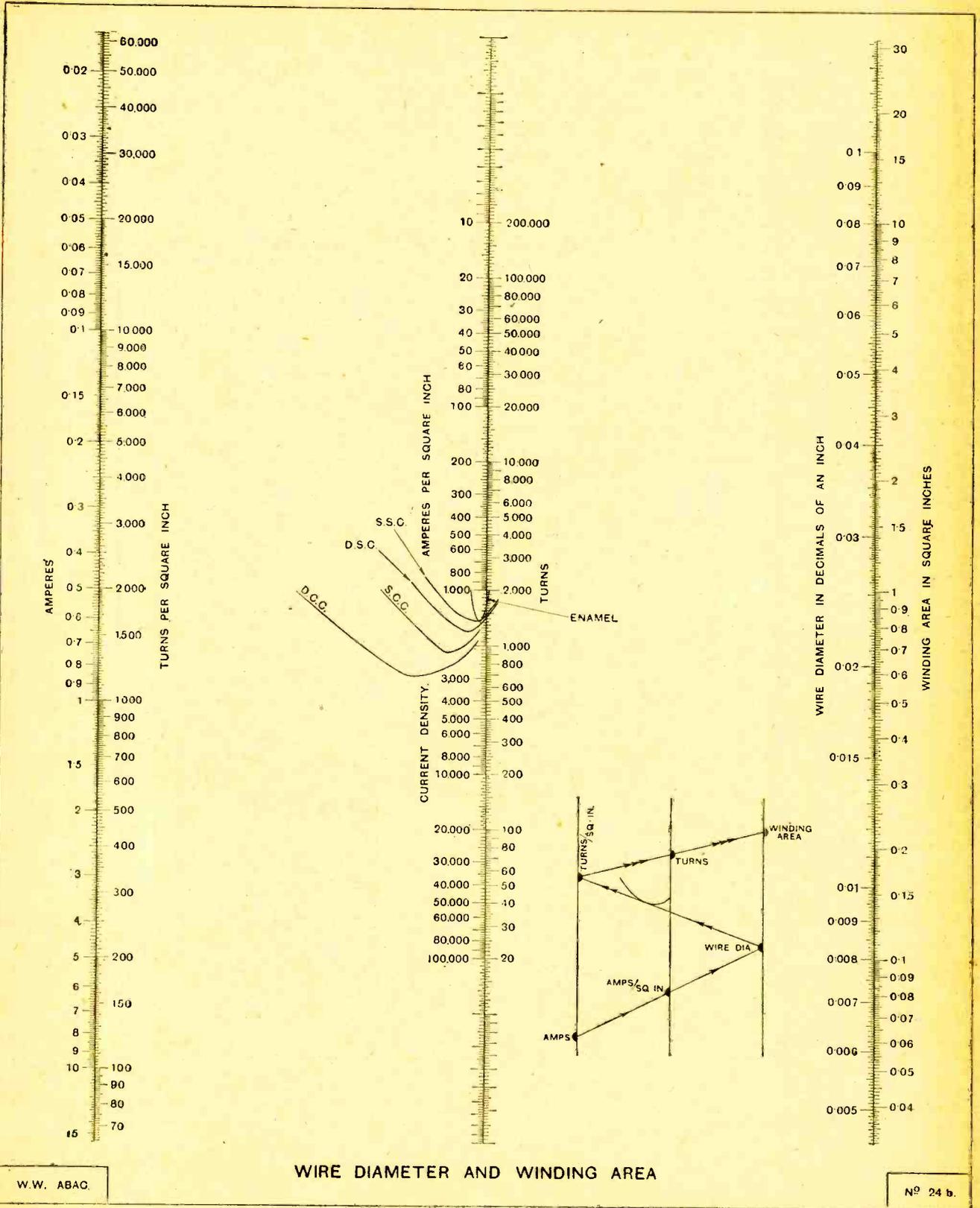
We tabulate the results below:

	Wire diameter.	Nearest S.W.G.	Nearest diameter.	Winding area D.S.C.
Primary	in. 0.01544	28	in. 0.0148	sq. in. 0.456
H.T. secondary	0.00729	36	0.0076	0.291
L.T. secondary	0.0564	16	0.064	0.169



W. W. ABAC

Nº 24 a.



WIRE DIAMETER AND WINDING AREA

W.W. ABAC.

Nº 24 b.

Useful Data Charts. (Nos. 24 (a) and 24 (b).)—

Hence the total winding area is 0.916 sq. in.

A section of the transformer is shown in Fig. 2. The height of the window is 0.8in. Since the coils are to be bound with silk or linen tape, which will be 0.03in. thick on the outer faces and 0.06in. on the inner face (where the tape is wound more closely), the effective height of the window is 0.8 - 0.09 = 0.71in.; accordingly the total coil length is 0.916/0.71 = 1.29in., to which must be added ten thicknesses of tape for the five coils, making 10 x 0.03 = 0.3in. This fixes the length of window at 1.29 + 0.3 = 1.59in.

Method of Winding.

A word of explanation is desirable as to how the curves connecting wire diameter with number of turns per sq. in. have been calculated. It has been assumed that the wires have been piled with no attempt to wind each layer in the grooves formed by the preceding layer, since such bedding would require very careful winding, especially with fine wire. Hence No. 24 s.w.g. wire, dia. 0.022in., covered with double silk 0.003in. thick, has an overall diameter of 0.025in., giving forty turns per linear inch, or 1,600 turns per sq. in.

Now, the thickness of covering varies by jumps as we pass through the series of wire gauges, and so the curves in abac 24 (b) would show discontinuities which might lead to confusion; accordingly, the curves have

been smoothed, and the maximum error so produced does not exceed 7 per cent.

It is recommended that the curves should be used when making the trial design, but that at the second attempt greater accuracy should be obtained by using the subjoined table instead of the curves.

Enamel.	TURNS PER SQUARE INCH.				Wire Diameter (Inches).	S.W.G.
	S.C.C.	D.C.C.	S.S.C.	D.S.C.		
—	54.1	49.6	58.3	57.0	0.128	10
—	79.7	71.8	87.3	85.0	0.104	12
—	129	113	145	140	0.080	14
226	198	173	223	213	0.064	16
392	343	297	400	377	0.048	18
685	567	472	692	641	0.036	20
1,110	865	692	1,110	1,010	0.028	22
1,770	1,280	977	1,770	1,600	0.022	24
2,560	1,710	1,280	2,560	2,270	0.018	26
3,760	2,310	1,630	3,650	3,160	0.0148	28
5,370	2,950	1,990	5,180	4,500	0.0124	30
6,890	4,010	2,550	6,610	5,650	0.0108	32
9,610	4,960	3,020	8,730	7,310	0.0092	34
13,500	7,430	4,110	12,100	10,300	0.0076	36
20,400	10,000	5,100	17,800	14,700	0.006	38
32,500	12,900	6,100	25,200	20,100	0.0048	40
44,300	—	—	36,300	27,800	0.0040	42
64,100	—	—	50,500	37,000	0.0032	44
—	—	—	75,100	51,600	0.0024	46
—	—	—	123,000	77,200	0.0016	48
—	—	—	198,000	111,000	0.001	50

(To be continued.)

LETTERS TO THE EDITOR.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

"EMPIRE BROADCASTING."

Sir,—“Empire Broadcasting” by 5SW as your correspondent “Radios” states in his letter to you (January 23rd) is most irregular and disappointing here of late. We always have to sit up until 12.30 a.m. (Ceylon time), and then very often have great difficulty in picking him up. Before the change of wavelength this was not so bad, and on a number of occasions the London programme came in well, though often subject to quick fading. Since the change, however, things are infinitely worse, and one can almost always be certain of trouble. I rely on our old friend PCJ for the European music, which practically always comes in at L.S. strength and excellent quality. It seems a great pity that 5SW is now such a wash-out. Nairobi comes in well. Some time ago 5SW put on an extra half hour (earlier) for India and Ceylon. They broadcast a talk on gardening—relay of London, of course—not much of a subject for a “special half hour.”

We here are grateful to you for fighting the case of Empire Broadcasting, and though it seems a thankless task, trust that you will carry on the war. E. E. BENEST.
Batticaloa, Ceylon.

B.B.C. POLICY AND PROGRAMMES.

Sir,—In reference to the paragraph “Are Listeners Really Satisfied?” on page 267 of your issue of March 6th, I would like to point out that the true inference to be drawn from the fact that of 1,613 letters to the B.B.C. Programmes Department during the week ended February 23rd only 70 letters were critical, is more likely to be that the great body of dissatisfied listeners have realised the futility of bashing their heads against a brick wall.

Since the Corporation got into its stride, its policy in regard

to criticism is to maintain an attitude of patronising superiority and almost god-like infallibility towards all correspondents who have the temerity to suggest that there is any room for improvement in programmes or policy. This is, of course, having the desired result—silencing adverse criticism.

For instance, I used to write occasionally to the “Programmes” concerning current programmes (and sometimes criticised pronunciation!), but the replies of the haughty being at Savoy Hill were always so devastatingly final, and conveyed the impression that this gentleman regarded the programmes and policy of the B.B.C. as irreproachable, that I long ago ceased to waste time writing letters, and turned to Continental transmissions instead. This brings me to another wrong impression that is fostered by the “self-glorification” experts at Savoy Hill. The B.B.C. often advance the fact of the steady increase in licence-holders as proof that their programmes are approved by the vast majority of listeners, which is pure conjecture and, in my opinion, is a fallacy. Actually, I do not think the number of new listeners, to the B.B.C. *only*, increases anything like in proportion to the number of new licence-holders, because there are as many who, sick of the mediocrity and lack of novelty of 80 per cent. of B.B.C. programmes, are seeking most of their broadcast entertainment from foreign transmissions (or from gramophone records). I think “set” sales, if divided into “distance” and “local” reception, would prove this contention.

The above statements are generalities, and difficult to prove or disprove, so I will give the B.B.C. the opportunity of replying to certain definite points, by appending the precise grounds for complaint, as I see them.

Policy.—Altogether too grandmotherly and departmental. In certain cases (as the Empire S.W. policy) far too insular. Officials in contact with the public need smaller hats.

Programmes.—The general criticism is that the usual programmes are mediocre and lack daring and vision. There are a certain number of artists who appear to be given preference at Savoy Hill, and as a result we have the same comedian on for four consecutive weeks, a choice of only two or three "small" orchestras week after week for several months, or a choice of two or three full orchestras and military bands transmitting far more poorly played music than they should (the remedy in the latter case is, of course, to transmit far less and have it better performed).

Special points of criticism are:—

(1) The effort to cater for the majority and almost every small minority in the space of about 10 hours has resulted in a programme composed of items averaging 15 to 30 minutes each, superficially treated most of them, sandwiched in between snatches of piano "dithering" miscalled musical interludes, which leave the listener the alternative of continually switching on and off, or else of getting such a varied smattering of entertainment and education that he is left with the same sort of acute mental indigestion that he would get if he tried to read consecutive 15-minute snatches of a newspaper, a technical essay, a dramatic criticism, a novel, a serious play, a comic paper and a travel story, etc., etc., with unfinished snatches of the newspaper in between each. A glance at any day's programme in the *Radio Times* will prove this contention, in regard to London (2LO). 5GB is not quite so "snatchy," hence its greater popularity.

(2) Times of transmission. The general programme from "2LO" is too late for business and working people, owing to the silly idea of putting the Second News in the middle of the evening's programme at 9 p.m. The B.B.C. have never given any sensible reason for altering the news bulletins from 7 p.m. and 10 p.m. to 6.15 and 9. It simply shortens the principal item of each evening to 1½ hours (from 2 hours) and annoys the average man in search of a little entertainment before going to bed when he finds he either has to miss something good or sit up from 9.35 till 11 p.m. to hear it.

L. PHILLIPS.

London, E.C.2.

PROGRAMMES.

Sir,—When people grouse about the B.B.C. I wish I could get them here, so that they might realise the chaos. For example, for a particular week we are given (i.e., according to the programmes; but they are never followed) the following items twice each, taking into consideration only the six local stations:—

Debussy "Petite Suite," Franck "Variations Symphoniques," Fauré "Pelleas et Melisande" Suite, Grumbach "Dances Arabes" (twice on same day), Mozart Symphony (39), Puccini "Tosca" and "Madame Butterfly" selections, Rabey "Romance sans Paroles," Vidal "Petite Suite Espagnole," Chabrier "Joyeuse Marche," Gillet "Lettres de Manon" (or, according to the other programme, "Lettre à Manon"), Glück March from "Alceste," Mascagni "Cavalleria Rusticana," Pierné "Bouton d'Or," Rossini "Barber of Seville," Schubert "Trout," Saint-Saëns' "Havanaise," his "Etienne Marcel" Ballet, and his "March Heroique," Wagner "Meistersinger" selection.

That is the least of it! The "Two Pigeons" Ballet (Messenger) we get three times, as also a selection from Offenbach's "Contes d'Hoffmann," and Havel's "Pavane."

Nor is it entirely due to the want of any central organisation; for example, the Eiffel Tower off its own bat gives us Couperin's "Concert Reval" (sic: ? "Royal"), P.T.T. gives us a selection from Rimsky-Korsakov's "Autar" twice, and Radio-Paris puts on Delibes' "Le Roi l'a dit" twice also.

And as to "control": grumblers might listen to the Tower transmitting the Padeloup concerts on Saturday and Sunday afternoons! The "controller" has no idea what is coming, and manages always to choose the wrong moment to switch (yes, it is a step-by-step control!), with the result that he spends all his time making the music blast.

As I write I am listening to a Radio-Paris concert: out of five items they have changed two already (and, of course, the two I had wanted to hear!); now he announces a third change, without explanation or apologies, of course.

Paris.

R. RAVEN-HART.

WHO'S WHO.

Sir,—Re "P. A. H.'s" query in the "Who's Who in the Ether" column in your issue of March 13th, the station he heard was probably Turin; this station put through an O.B. of Bizet's "Carmen" on February 26th from about 7.50 p.m. onwards, operating on 276 metres, as near as I could measure.

Beeston, Notts.

T. C. PARRY.

TELEVISION.

Sir,—Referring to your interesting and informative Editorial in *The Wireless World* for March 31st on Television, may I point out that "the present state of development" to which you refer is by no means limited to objects "located within a very short distance of the scanning disc." Nor, indeed, is it essential that the objects be "subjected to the presence of a flickering light in a darkened or semi-darkened room." On more than one occasion that I have had the opportunity of visiting the Baird laboratories I have witnessed the reception of images transmitted by ordinary daylight. These transmissions were not effected by the spot-light system at all, and not only was the head and shoulder image received which you so well describe, but full extended scenes embracing as many as four persons as well as a piano and the other musical instruments of the players. In company with others I have also witnessed the image of a boxing match received with remarkable fidelity, as was also a small stage performance put over on the ordinary commercial televisor.

Apart from the question of the entertainment value of television, there is the educational value of this new art, which is incalculable as compared with the still pictures which the broadcasting authorities are already transmitting, and I submit that at least half-an-hour nightly should be given to television transmissions, which would not in any way deprive the public of their entertainment, since these transmissions could be accompanied by speech from another station without interference.

There is, as is well known, a vast body of amateur experimenters anxiously awaiting the opportunity to proceed with this new development of applied physics, and progress in this, as in the whole field of wireless science, lies only along the road of patient experiment, which should be encouraged rather than hindered by any lack of appreciation on our part. It is in this field that we owe to the amateur experimenter more of our remarkable development that has ever yet been recognised.

The Television Society.

CLARENCE TIERNEY.

UNENTERPRISING BRITISH RADIO MANUFACTURERS.

Sir,—I would like to draw attention to the appalling lack of general enterprise shown by British radio manufacturers, and in particular the apathetic attitude towards what one day in the near future may be the means of fostering large sales; I refer to the ultra-high frequencies.

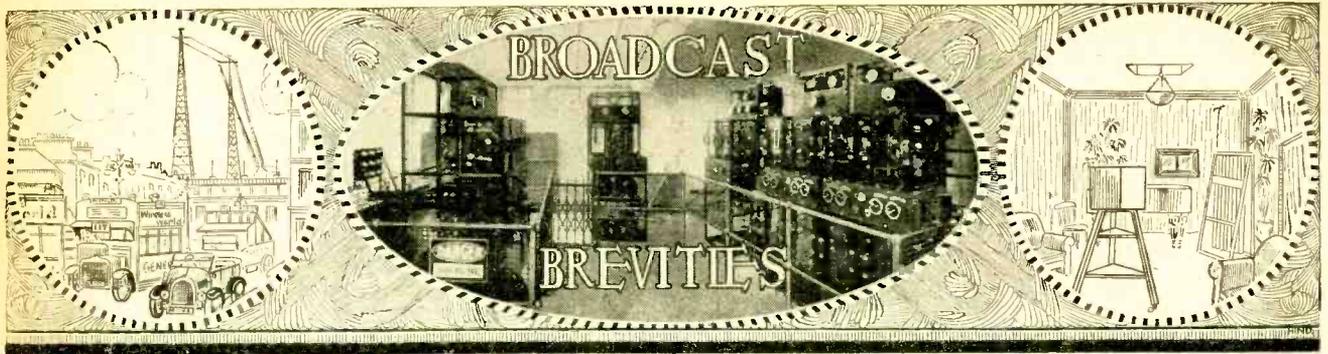
Why have I, for instance, to send to America for what I want in the course of my experiments in the 60 Megahertz band? The answer can be supplied by one illustration of fact which actually occurred. I wanted a 0.00005 taper plate variable S.L.F. condenser with double spaced (or nearly so) vanes and not possessing under any circumstances two bearings in metal end plates, but instead a single-bearing condenser with phosphor bronze "pigtail" shunting the bearing so as to keep it out of the argument as much as possible.

I approached two of our most famous firms giving full details of requirements. One did not have the courtesy to reply; the other did, but said that the managing director was away on holiday, but that when he returned the matter would be placed before him. Well he's having a mighty long holiday! Need I say more to give an idea of the callousness shown by our big firms towards the future?

Another point; when I was out in South Africa I was impressed with two things: complete lack of salesmanship and enterprise shown by British radio distributors, and the price of our articles is much too high for what they are—at least in the eyes of Colonials, who want short-wave factory receivers averaging £18 and dual control superheterodynes at about the American price of £45 for very fine jobs instead of our instruments with multitudinous controls selling for £75 or thereabouts.

Burgess Hill, Sussex.

E. T. SOMERSET.



News from All Quarters: By Our Special Correspondent.

Regional Scheme: The Next Step.—B.B.C.'s Acoustic Tests.—Licences.

"Northern Regional."

The shouting and the tumult over the fugitive appearances of the B.B.C. mobile transmitter in the Midlands seem to have died down of late, but this is no indication that the search for a suitable site for the Northern Regional has been abandoned. I understand that an interesting announcement may be expected very shortly.

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More About the Organ.

Mr. Henry Willis, the famous organ builder whose best-known instrument—at Liverpool—is the largest cathedral organ in the world, has collaborated with Captain West and the B.B.C. research department in the construction of the "organ" to which I referred a fortnight ago. Some further details may be of interest.

The pipes range in length from 8ft. to 1in., and are each designed to yield the purest note possible with a maximum of fundamental. The longest pipes are of wood, the others being of metal.

The keyboard is detachable to allow of remote control.

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Tests at Savoy Hill.

The instrument will first be used in the studios at Savoy Hill. When the sound characteristics of each of the studios have been measured, the organ will continue its travels with a tour of certain selected halls which have been proved exceptionally good for broadcasting purposes. By a comparison of the various characteristics, the engineers hope to arrive at a suitable formula for the construction of the studios in the new Broadcasting House.

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Sound-measuring Apparatus.

The organ is, of course, only part of the equipment necessary for the gauging of sound values. I understand that the measuring instruments are of unusual interest, and that their design is the fruit of intermittent research extending over the last two years. In the near future it may be possible to disclose details.

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Anonymous and Dumb!

The first full-length play written specially for broadcasting under Val Gielgud's régime, is to be given from

2LO on April 17th. It will bear the title "The Dumb Wife of Cheapside," and the portentous description: "A Diverting, Moral and Most Ancient Comedie by Master Ashley Dukes."

The leading personage is an alderman haberdasher, but who will take the part the B.B.C. alone knows. The cloak of anonymity will lie on the whole cast. Presumably the dumb wife will be silent as well as anonymous. Heaven grant her support!

The British National Orchestra.

Meanwhile the British National Orchestra, shepherded by Sir Thomas Beecham, is steadily growing, and it is hoped that it will be a corporate whole in time for the autumn season. It will not assume a permanent status, however, until 1930, the concerts next autumn being in the nature of dress rehearsals.

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Conducting a Blind Band.

How is it possible to conduct a band of blind musicians? The question is immediately suggested by the news that the Silver Band of the Royal Glasgow Asylum for the Blind is to appear before the 5SC microphone on April 16th. Mr. T. Scott, the conductor, literally "pulls the strings," which radiate from his rostrum, one string being tied to the elbow or leg of each performer.

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If the Licence Figures Declined.

The bitterest critics of the B.B.C. are always faced with the inescapable fact that the number of listeners grows from month to month. The licences current at the end of February numbered 2,690,116, showing an increase of 19,205 over the figures for January, and although the corresponding period of last year showed a higher increase, viz., 32,920, it can hardly be said that we appear to be reaching the saturation point.

So long as the figures continue to ascend Savoy Hill can afford to patronise the listener with moral precepts and artistic canons of its own manufacture. But the first decline in licences may bring about an interesting reaction.

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Funeral of Marshal Foch.

The relay of Marshal Foch's funeral service from Notre Dame was extraordinarily impressive, and to one listener at least it seemed as if the "mighty rushing wind" caused by atmospheric conditions gave the funerary music an unearthly sound.

The microphones in Notre Dame might have been more suitably placed; otherwise the relay was remarkably good. Cables and land lines had been chartered, but it was found that the reception *via* wireless from Paris gave better results.

FUTURE FEATURES.

London and Daventry.

APRIL 8TH.—Roumanian National Programme.

APRIL 9TH.—British National Programme, a burlesque.

APRIL 10TH.—"The Cherry Orchard," a comedy by Anton Chekov, arranged by Dulcinea Glasby.

APRIL 13TH.—Glasgow Orpheus Society Concert.

Daventry Experimental (5CB).

APRIL 9TH.—"The Cherry Orchard."
APRIL 11TH.—Popular Orchestral Concert, from the People's Palace.

Cardiff.

APRIL 13TH.—A "Bristol" Variety Programme.

Manchester.

APRIL 11TH.—A Mock Debate.

Newcastle.

APRIL 7TH.—Service from St. Nicholas' Cathedral.

Glasgow.

APRIL 13TH.—Running Commentary on the Scotland v. Edinburgh Association Football International.

Aberdeen.

APRIL 12TH.—A "George" and "Wullie" Episode.

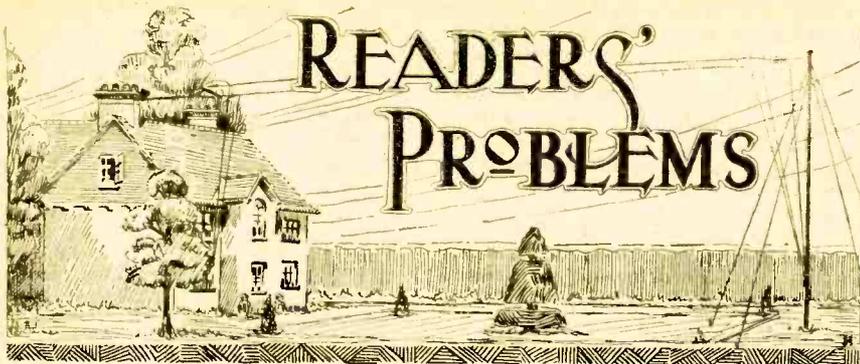
Belfast.

APRIL 13TH.—A Concert by Prizewinners in the Belfast Musical Competitions.

A Tribute to Wales.

American dictionaries are in demand by members of the Welsh National Orchestra in consequence of a high honour just paid to them in the form of an invitation to tour the United States. This orchestra is, of course, closely allied to the B.B.C., which brought about its birth in collaboration with the Cardiff City Council, the National Council of Music, and the National Museum of Wales.

Fifteen of the thirty players are truly Welsh; the others are merely non-Welsh, but one of them has been courageous enough to learn the language.



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department which are printed below; these must be strictly enforced in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Inter-stage Reaction.

I have a three-valve set, with leaky-grid detector and two L.F. stages, one of which can be cut out by means of a switch. Since connecting a moving iron milliammeter between the negative L.T. terminal and the H.T. accumulator battery, it has been quite impossible to use the three valves; when they are switched in circuit a strong whistling sound is produced in the loud speaker. The result is that I have had to abandon the use of the meter. Can you suggest why it fails to work with three valves?

A. C. P.

We deprecate the use of a meter in this manner, and doubt very much, even in cases where it does not cause instability, whether it conveys any very useful information when it is connected in the common H.T. feed lead. In your own particular case, it is certain that the comparatively high resistance of the moving-iron instrument is acting as an interstage coupling, and is responsible for the production of L.F. reaction. The meter should not be connected in a circuit common to two or more anode feeds.

Bias Battery Tricks.

(Referring to an answer to a previous query) . . . You say that the positive side of the grid-bias battery is invariably connected to L.T. negative. Without questioning the accuracy of your statement, I should like to ask if this applies to screen-grid valves; I have heard that, under certain conditions, it is better to join G.B. + to L.T. +.

L. M.

Your query was couched in general terms, and, applied to conventional circuits, our reply was correct, irrespective of the type of valve. We think you have in mind a special form of connection which enables one to obtain a small negative bias (less than the voltage of a single dry cell) for application to the grid of a screen grid-valve without the need for extra apparatus.

Reference to Fig. 1 will make this

matter clear. By using a 4½-volt bias battery connected to a 4-volt L.T. battery in the manner shown (G.B. + to L.T. +) a bias of 0.5 volt will exist between the grid of the valve and the negative side of its filament. Similarly, if a 2-volt valve is connected up in the same way with a 3-volt grid battery, a bias of 1 volt will be obtained.

With average valves in many modern circuits, the performance of the set will be improved by adopting this plan in preference to the conventional practice of using either no bias or 1½ volts negative.

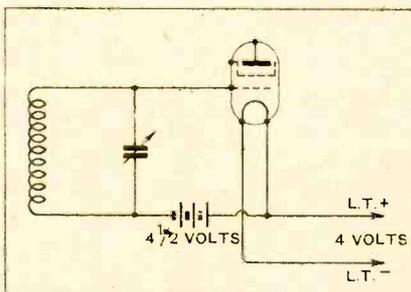


Fig. 1.—A simple way of providing a bias of 0.5 volt.

RULES.

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
- (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
- (3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
- (4.) Practical wiring plans cannot be supplied or considered.
- (5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.
- (6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufactured receivers. Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

Indirectly-heated Valves.

Provided that current consumption is of secondary importance, can indirectly-heated cathode valves be satisfactorily used on a 220-volt D.C. mains supply?

R. R. L.

Apart from the question of cost, there is no real reason why the heaters of these valves should not be supplied from D.C. mains through a suitable resistance. Of course, a series connection of the elements will be the more economical than the parallel method.

o o o o

Screen-grid H.F. Amplifiers.

I have just completed a set with a transformer-coupled screen-grid H.F. amplifier, and as this is my first attempt with the new valve, I should be glad to know if the effects I have noticed are normal. On the medium waveband amplification seems to be at a maximum towards the lower end of the tuning scale; this would suggest that the valve works best on the shorter waves, but I find that with the long-wave coils in position, amplification seems both greater and more constant over the whole tuning scale. Are these effects to be expected?

F. B.

Regarding reception on the medium waveband, it should be realised that there is a good deal of inherent reaction in a screen-grid H.F. stage, and this becomes more marked as wavelength is reduced. In fact, it is quite permissible—and, indeed, usual practice—to arrange matters so that the valve is on the verge of oscillation when the associated circuits are tuned to the minimum wavelength.

Regarding the long waves, it is a fact that H.F. amplification is much more easily obtained, and due to the comparatively large ratio of inductance to capacity in the tuned circuits, there is little apparent difference in the incidental reaction over the usual tuning scale.

o o o o

Protection for Valves.

Before making minor internal alterations and adjustments to my set, I have acquired the habit of switching off the filaments. A friend tells me that this procedure is wrong, and that the risk of burning out valves by a misplaced H.T. lead is increased by adopting this procedure. I should be glad to have your ruling on this matter.

G. C. D.

We agree with your friend; if the filaments are shunted by an L.T. battery, it is almost impossible for the voltage across them to rise to any serious extent, and, even though the H.T. voltage may be accidentally applied, no harm to the valves is likely to result. Damage to the high-tension battery itself, due to a short-circuit, is, of course, another matter, and, to be quite safe, it is wise to disconnect all battery leads before making alterations. We realise that this is a counsel of perfection that is hardly likely to be widely observed.

Systematic Testing.

After having worked well for many months, my "Everyman Four" has suddenly become dumb. I quite realise that without some definite information to work on it is unreasonable to ask you to suggest a cause for the trouble, but perhaps you will be good enough to refer me to an article describing a simple method of procedure, by means of which I may myself locate the trouble.

M. J. S.

Several articles on this subject have been published, but possibly the best from your point of view is one entitled "Testing a Standard Four," in *The Wireless World* for July 25th, 1928. The general circuit arrangement of the receiver discussed in that article is the same as that of your own set, and similar tests may be applied.

○○○○

Modified "Regional" Receiver.

In an article entitled "Interpreting Valve Data," in your issue of February 13th, mention was made of the "Regional" receiver modified for use with a pentode valve. I am interested in this conversion, and should be obliged if you would give me any suggestions for altering my own set, mentioning any details not strictly associated with the output stage which may be necessary in order to make it up to date.

H. L. M.

No very considerable alterations are necessary, but if you are going to use valves having the characteristics suggested

You will note that an H.F. choke is included in the anode circuit of the detector; provided this component is so arranged that it does not link magnetically with the H.F. transformer secondary, it will help in separating H.F. and L.F. currents, and will enable you to use a stopping resistance of lower value than formerly.

With a detector valve of comparatively low impedance, you will find it essential to increase the voltage of the grid-bias battery, and it will no longer be necessary to use a potentiometer, but this component may be retained, as it will confer a slight advantage when listening to very weak signals.

○○○○

Failure to Neutralise.

The neutralising condenser of my receiver seems to have no effect, and it is impossible to balance the set, with the result that it can only be used for local reception with the two circuits detuned. Can you tell me where I should look for the trouble? The set originally worked satisfactorily.

D. B.

It is fairly certain that the fault will be found in the neutralising condenser itself, or in the balancing winding of your H.F. transformer. In the case of the first-mentioned, it may be that the knob rotates in the usual way, but does not transmit movement to the moving vane (or vanes); trouble of this sort would not be readily apparent in the case of a completely enclosed component. With regard to the winding itself, it should be an easy matter to assure your-

Testing Condensers.

With reference to the testing unit described in the "Readers' Problems" section of your issue of January 23rd, will you tell me if it may be used for carrying out tests of condensers?

E. B. R.

Yes, the method of test in which telephones are used in series with a dry battery is quite applicable to condensers. Before beginning operations, you should assure yourself that the test leads are fitted with well-insulated contact points; these should be applied across the terminals of the component under suspicion, when a click should be heard in the headphones. On breaking the circuit, nothing should be heard; if any appreciable sound is produced, poor insulation is suggested. The click heard on "making" the circuit is due to the flow of charging current, and, if it is not produced, it can be assumed that there is an internal disconnection. The click increases in intensity with increase of capacity, and you must not expect it to be loud when testing very small condensers.

○○○○

Sundays Only.

My set (detector followed by two resistance-coupled L.F. stages) gives really satisfactory results only on Sundays. On weekdays, during both day and night, I get violent interfering noises, which I suppose come from my electric lighting system. Can you suggest a remedy?

V. W.

We think you are in error in supposing that the interference is due to your electric light circuits. If this assumption were correct, surely interference would be equally bad on each day of week? We consider it certain that the trouble is entirely due to induction from neighbouring power wires feeding machinery which is out of commission on Sundays. There is little we can do to help you, beyond recommending you to try the various palliatives for this trouble that have been suggested from time to time.

○○○○

Matching Valve Impedance.

As a temporary measure, I have been using a "high conductance" valve as an H.F. amplifier, with an "Everyman Four" type of transformer. Although the impedance of the valve is much less than specified, it seems to work quite well, but selectivity is not good. I understand that the transformer may be modified by taking off turns from the primary and neutralising windings; from which ends should these turns be removed?

M. E.

When using this type of transformer with a valve having an impedance considerably less than that specified, it is always advisable to experiment with the number of primary turns. The surplus should be removed from the high potential end, which is connected to the anode of the preceding valve. A corresponding number of neutralising turns must also be taken off from the end of the winding in connection with H.T. +.

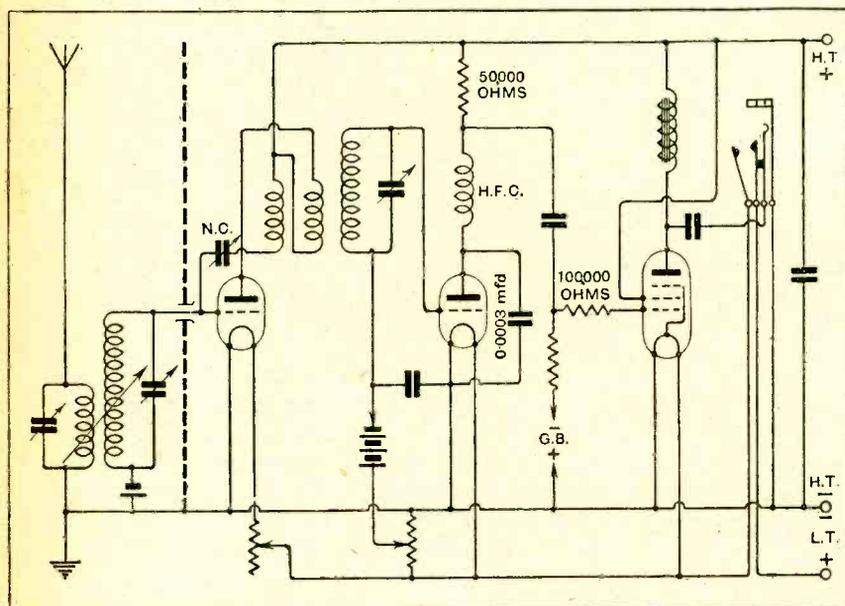


Fig. 2.—"Regional Three" receiver with pentode output valve.

in the article referred to, you will naturally reduce the value of the anode resistance. A circuit diagram of the set, with modifications, is given in Fig. 2; values may be as originally specified, except where specially marked.

self that it is in order by inspection, and by a simple continuity test. Of course, you will also pay attention to the connections from the neutralising condenser to both the grid and the balancing winding.

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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TELEVISION—THE POSTMASTER-GENERAL'S STATEMENT.

ELSEWHERE in this issue we publish the statement with regard to the Baird system of television, addressed by the Postmaster-General to the Baird Television Development Company recently. This statement has been made following the demonstration of the system given before the Postmaster-General and his technical advisors in conjunction with the British Broadcasting Corporation, when speech and image were transmitted simultaneously.

Our Forecast.

In our issue of March 13th, after it became known that following the demonstration the Postmaster-General intended to issue a statement, we commented on the matter and anticipated the nature of the statement which the Postmaster-General would issue, and it is interesting to note how very closely our anticipation of the Postmaster-General's view agrees with the official statement. In our comment we said:—

"We might go so far as to anticipate the nature of the statement which the Postmaster-General will issue, and suggest that it will be to the effect that the demonstration which he witnessed is of first-class scientific interest, and that he looks forward to greater developments in the future, but that for the present he does not feel that he would be justified in authorising the use of two stations of the B.B.C. for the regular transmission of images when, for purposes of development work, such transmissions and the use of B.B.C. high-power stations is not necessary. It may be that a compromise will be suggested by recommending B.B.C. transmissions outside ordinary broadcasting hours."

In the official statement we read:—

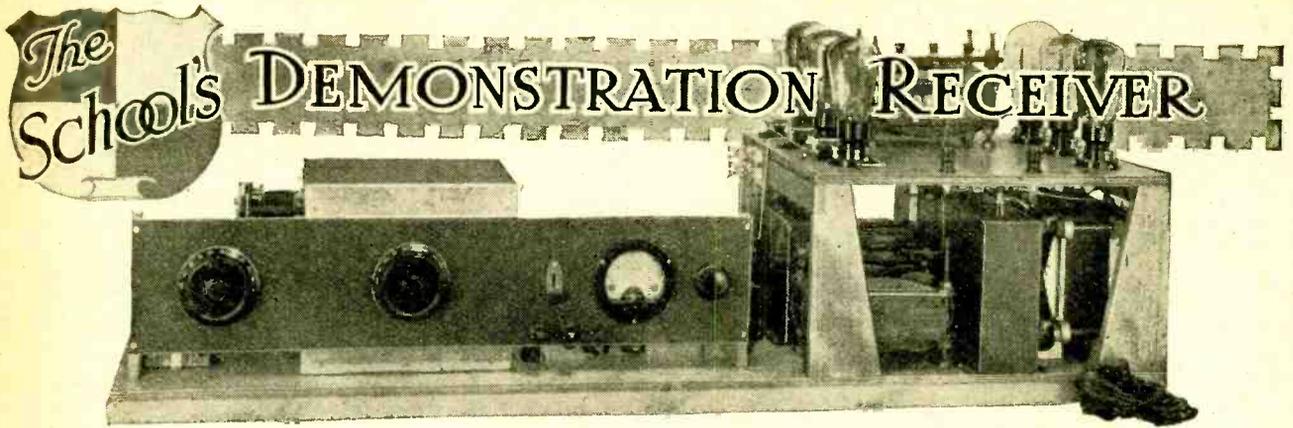
"In the Postmaster-General's opinion the system represents a noteworthy scientific achievement; but he does not consider that at the present stage of development television could be included in the broadcasting programmes within the broadcasting hours. He bases this view not so much upon the quality of the reproduction which further experiments may be expected to improve, as upon the present limited scope of the objects which can be reproduced. . . .

"He would assent to a station of the British Broadcasting Corporation being utilised for this purpose outside broadcasting hours."

We consider this to be a very fair and proper attitude for the Postmaster-General to have adopted, and it now remains to be seen what arrangements can be come to as between the Baird Company and the British Broadcasting Corporation to provide for experimental transmissions outside broadcasting hours.

A Caution.

We are glad to see that the Postmaster-General has made it quite clear in his statement that, while the Baird Company will not be precluded from selling apparatus to anyone who desires to purchase it, the purchaser must understand that he buys at his own risk at a time when television has not reached a sufficiently advanced stage to warrant its occupying a place in the broadcasting programmes, and neither the Postmaster-General nor the British Broadcasting Corporation accept any responsibility for the quality of the transmissions or the results obtained. We interpret this statement as meaning also that until such time as the system has reached a stage of development which justifies the inclusion of television in the regular broadcasting programmes of the B.B.C., that continuity of transmissions will not be guaranteed.



Including a Mains Operated Output Unit for the Moving-coil Loud Speaker.

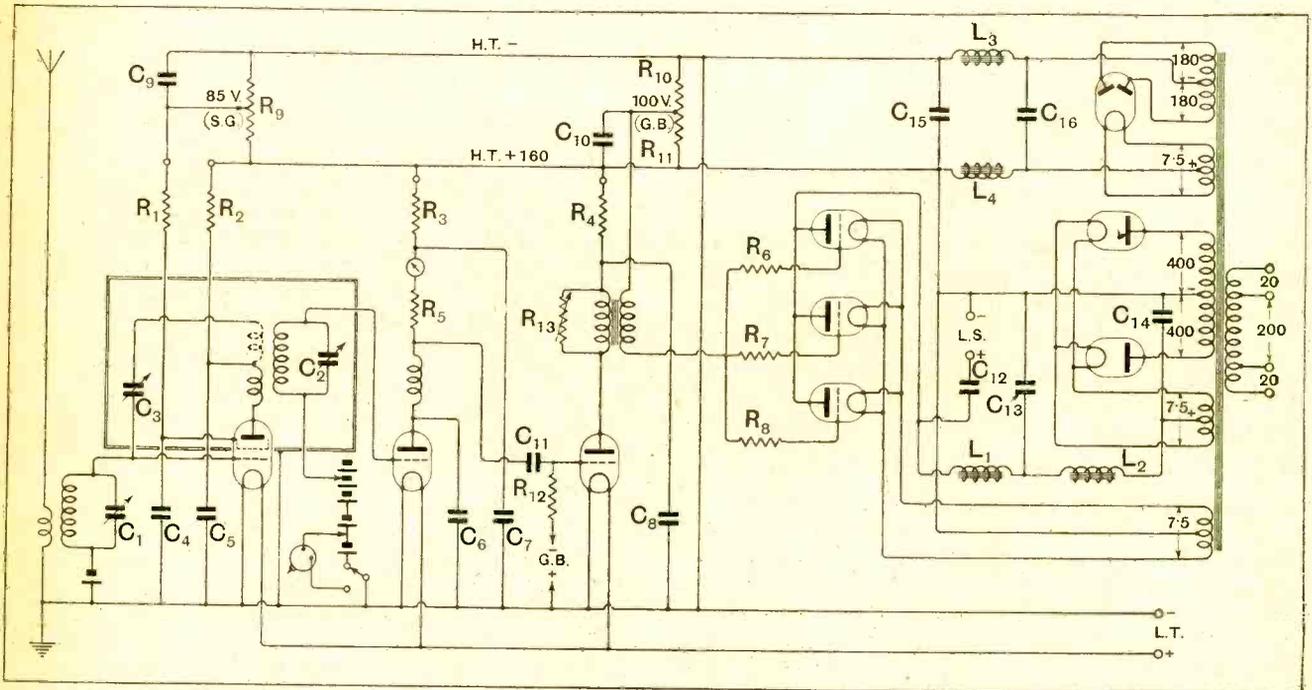
By F. H. HAYNES.

TWO years ago a demonstration receiver was described in these pages. That receiver was not built to form the subject of an article but expressly for lecture purposes, the aim being to demonstrate quality in broadcast reception. As the result of requests by readers the essential constructional data were given,¹ and it was soon revealed that this set was the very type sought after by a large body of wireless users. Chief among those interested were the radio retailers and the schools, and judging by queries it would seem

that the moving-coil loud speaker enthusiasts have adopted that design as best meeting their requirements.

By "demonstration receiver" we imply that the set is intended to give high quality reproduction to a large audience, that it shall embody all components necessary to this end without particular regard to cost, but that there should be nothing decorative or any bid for an attractive finish entailing extra cost or unnecessary labour. All components are merely screwed down to a baseboard, and as far as meeting school requirements the constructional work can be carried out without difficulty in the handicraft department.

¹ Special Demonstration Receiver, February 16th, 1927.



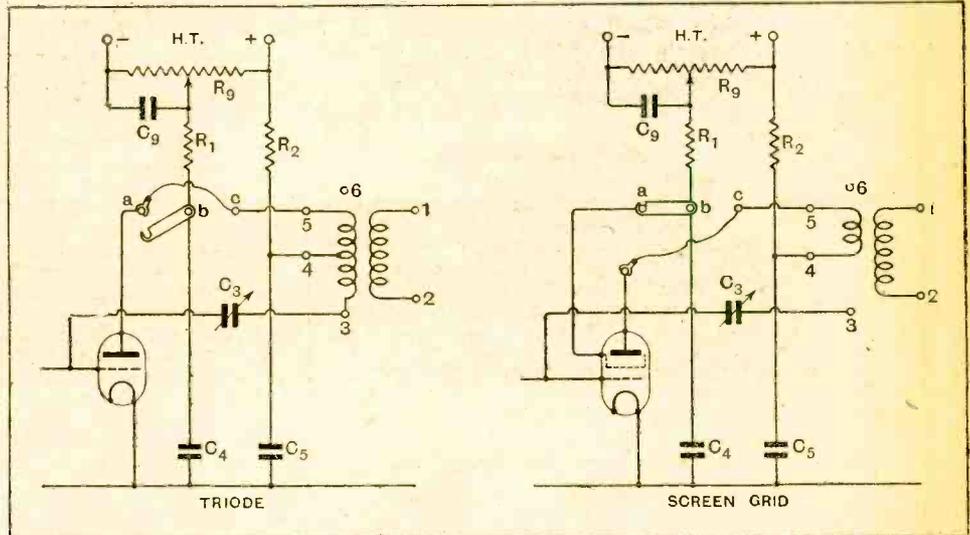
The complete circuit diagram showing the battery eliminator equipment for A.C. supply as well as the complete receiver. C₁, C₂, 0.0003 mfd.; C₃, neutralising condenser; C₄, C₅, 0.01 mfd.; C₆, 0.0002 mfd.; C₇, C₈, C₉, C₁₀, 2 mfd.; C₁₁, 0.05 mfd.; C₁₂, C₁₃, 2 mfd.; C₁₄, 4 mfd.; C₁₅, C₁₆, 2 mfd.; R₁, R₂, 600 ohms; R₃, R₄, 20,000 ohms; R₅, 50,000 ohms; R₆, R₇, R₈, 0.25 megohm; R₉, 20,000 ohms; R₁₀, 0.25 megohm; R₁₁, 0.1 megohm; R₁₂, 1 megohm; R₁₃, 50,000 ohms.

The School's Demonstration Receiver.—

An analysis of the circuit will serve as a guide in deciding to adopt a receiver of this class. First, let it be understood that it is a mains-operated set, and experience shows that unless either A.C. or D.C. mains are available, the setting up of a receiver capable of the best reproduction is almost out of the question. Although making use of a high-frequency amplifier, this receiver is intended for local station reception, for it will soon be found that when quality and volume are the aim reception must be limited to the nearest station plus the two Daventrys.

To accommodate 5XX interchangeable tuning coils are provided, but if 2LO is the local station one can dispense with the plug-in coils and omit the 1,600-metre transmission, which is, of course, always the same as that given from 2LO. Standard coils such as have long been used in *Wireless World* receivers may be fitted by constructors in the London area. These consist of Litzendraht-wound Paxolin formers with the customary aerial and anode windings. As many readers feel that a modern receiver

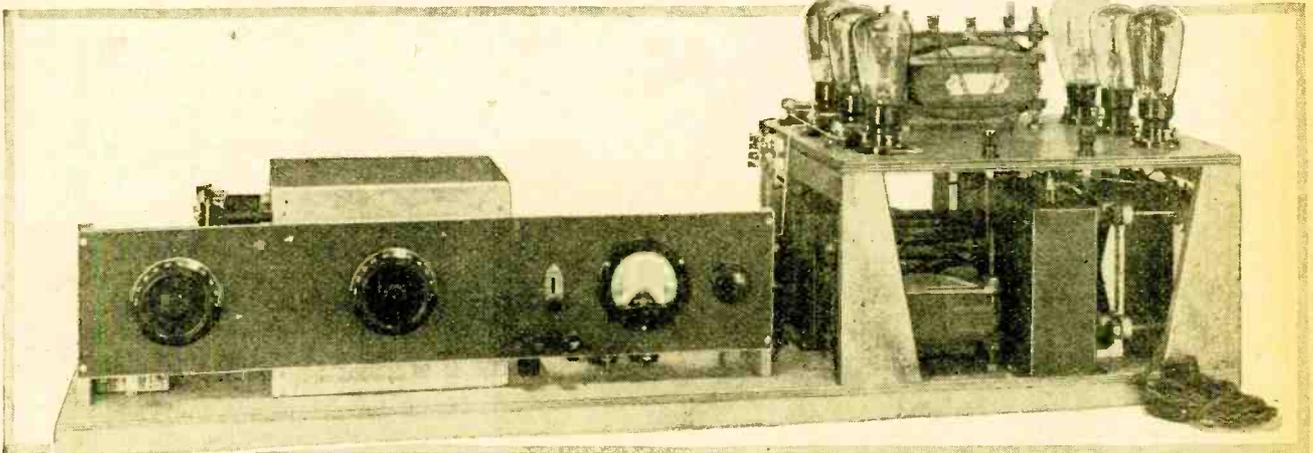
fixed wave-range coils are used a valve of moderately low impedance is recommended, such as a first-stage L.F. valve, with an A.C. resistance of some 10,000 ohms. The plug-in coils described later suit such a valve.



Simple switch-over scheme permitting the use of either triode or screen-grid valves. Shou'd the same H.F. transformer be used with the screen-grid valve as with the triode, small yet probably adequate amplification will result. If a neutralising winding connects to pin 3 with the screen-grid valve then C₃ must be set to zero.

H.F. Unit and Panel.

Complete screening of the H.F. stage is effected by the use of a metal container of liberal dimensions, so



The complete receiver with eliminator for use on A.C. supply. A separate rectifier provides the anode voltage for the first three valves and this potential serves to bias the output stage.

should embody a screen-grid stage, the circuit arrangement has been adapted to accommodate either screen-grid or triode, though this modification, which is quite worth while, should only be incorporated when following the design using the interchangeable coils. H.F. amplification is provided even in this local station receiver in order to provide an adequate input to the anode-bend detector. Oscillation or conditions bordering on self-oscillation must be avoided so that if standard

that there is plenty of room for the components, which does, of course, simplify construction. This box serves as a support for a Paxolin panel which carries the aerial and H.F. tuning condensers, gramophone pick-up terminals and switch, a low range milliammeter and volume control. Omission of the pick-up circuit will simplify both construction and wiring, and as far as schools are concerned is, perhaps, not an essential fitment. The milliammeter, too, can be regarded as optional, and if

LIST OF PARTS—DEMONSTRATION RECEIVER.

Baseboard, 12 $\frac{1}{2}$ in. \times 12 $\frac{1}{2}$ in., preferably of $\frac{3}{8}$ in. 7-ply wood.
2 Battens, 2in. \times 1in., and extending the full length of the baseboard.

Valve platform, 15in. \times 12 $\frac{1}{2}$ in., same wood as baseboard.

Wood for 4 uprights and 2 cross battens.

Panel, 24in. \times 5in. \times $\frac{1}{8}$ in. of polished Pertinax or Paxolin.

9 Valve holders (rigid type, Whiteley Boneham).

Grid leaks and holders, 1 megohm, 4 of 0.25 megohm, 0.1 megohm.

2 Variable condensers, 0.0003mfd. log. scale (G.E.C.).

Neutralising condenser (Neutrovernier, Gambrell).

2 6-pin Coil bases (Colvern).

4 Plug-in coils (new Featherweight type, Colvern).

9/40 S.W.G. Litzendraht wire and spacers.

4 Condensers, 2 mfds. (T.C.C.).

Condenser, 1 mfd. (T.C.C.).

Mica condensers, 2 of 0.01 mfd.; 0.0002 mfd.; 0.05 mfd. (T.C.C.).

H.F. choke (Lewcos).

2 Anode resistances and holders, 20,000 ohms. (R. I. Varley).

Anode resistance and holder, 50,000 ohms. (R. I. Varley).

Single pole 2-position switch (Utility W. 190/2).

L.F. transformer (Ferranti AF5).

Milliammeter, 1.5 mA. (Ferranti).

Volume control high resistance, 0—50,000 ohms. (Electrad Royalty, Rothermel).

2 Resistances, 600 ohms. (Wearite).

Potential divider, 20,000 ohms. (Climax).

6 Ebonite shrouded terminals, A, E, 2/pick-up. L.S. +, L.S. — (Belling Lee).

Screening box, 8in. \times 7in. \times 7in. (Wearite).

Mains transformer as specified (Rich & Bundy).

2 Chokes, heavy duty (Model E.166, Rich & Bundy).

2 Chokes (Model E.154, Rich & Bundy).

Condenser, 4 mfds.; 2,500 volts D.C. test (T.C.C.).

2 Condensers, 2 mfds.; 2,500 volts D.C. test (T.C.C.).

2 Condensers, 2 mfds.; 400 volts D.C. test (T.C.C.).

5 Wander plugs (Lisenin).

Grid Bias Batteries (Siemens).

Grid Bias Battery Clips (Bulgin).

Approximate cost of parts (excluding valves), £27.

In the "List of Parts" included in the description of THE WIRELESS WORLD receivers are detailed the components actually used by the designer and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed, and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

also omitted the front panel should terminate at the edge of the screening box, so that the volume control may be located near to the intervalve transformer. The dimensions of this panel then become 14 $\frac{1}{2}$ in. \times 5in.

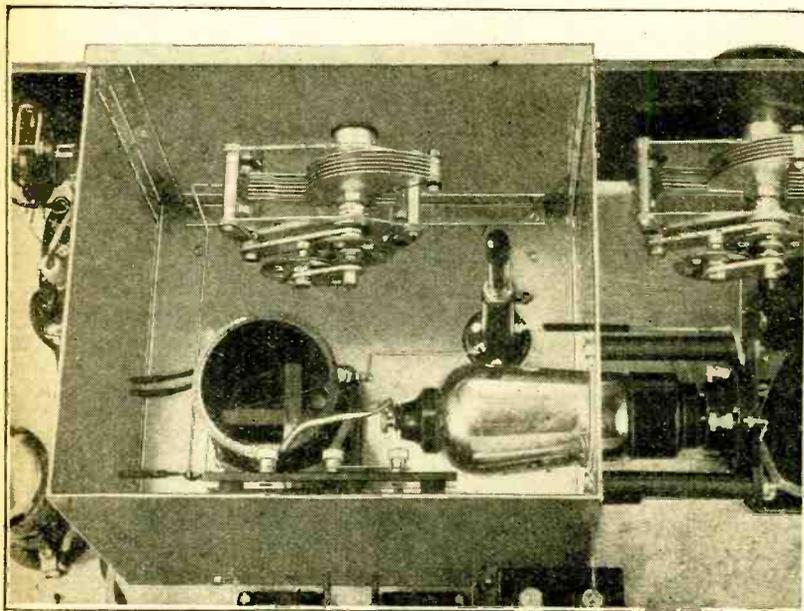
As maximum stage gain is not the aim and must, in fact, be avoided, a valve of the "RC" class is not used for detection, while the anode resistance is also of low value. The valve, a P.M.6D or H.L.610, is used with a coupling resistance of as low a value as 50,000 ohms. As H.F. oscillation passing into the stages of the L.F. amplifier is a common and definite cause of distortion, the H.F. choke combined with the anode condenser

C_6 is important. A resistance feed R_3 and condenser C_7 prevent audio-frequency potentials circulating through the common source of H.T. supply and causing distortion by reacting with the other stages. A mica dielectric condenser C_{11} of 0.05 mfd. provides a coupling to the grid of the first L.F. valve.

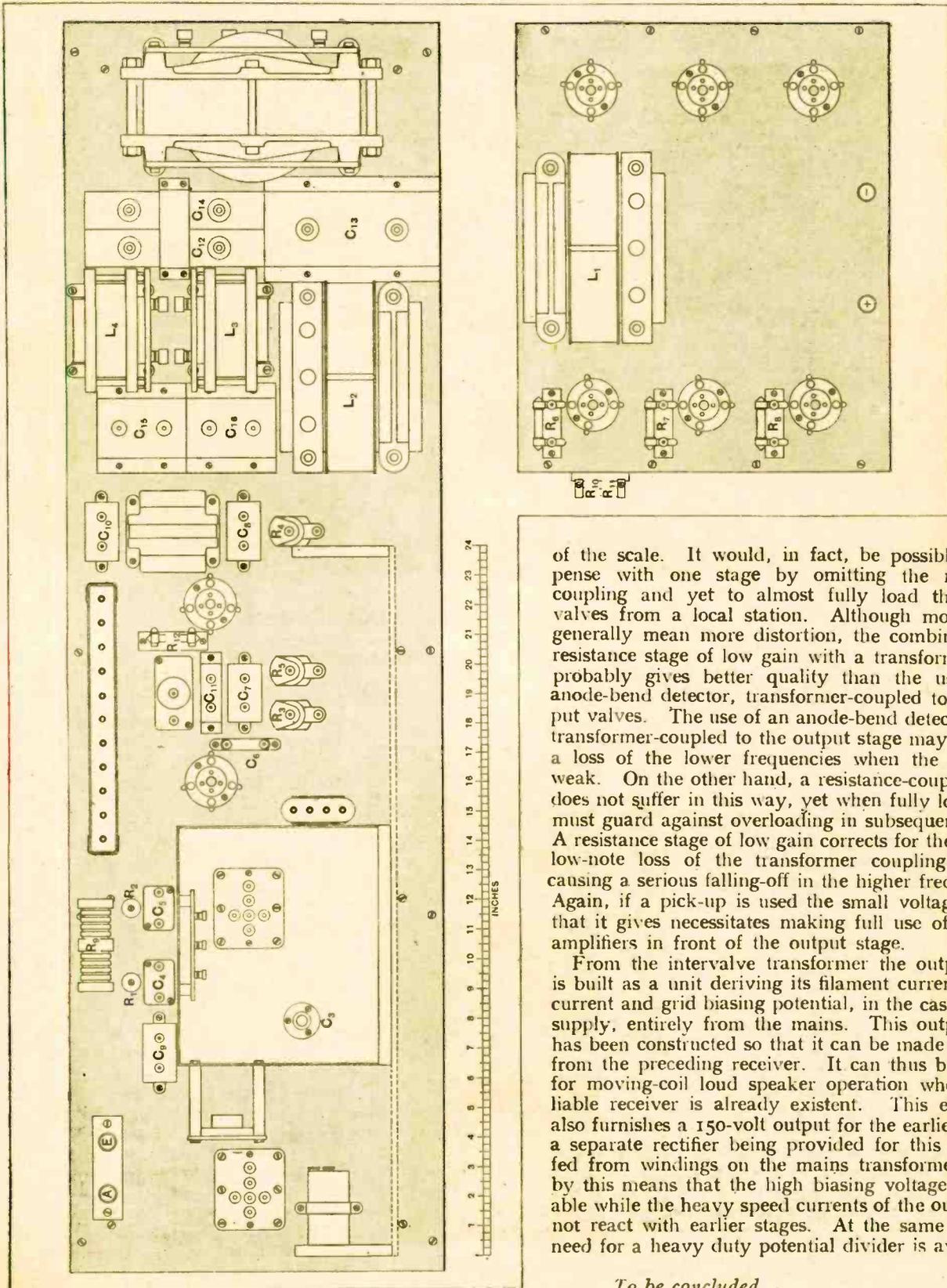
Post Detector or Volume Control.

Although it is obviously desirable to control volume as early as possible in the train of valves so as to avoid overloading, practice shows that the most convenient method is that of using a variable resistance across the primary of an intervalve transformer. Incidentally, for a given degree of modulation a maximum permissible milliammeter reading takes charge of overloading throughout the entire receiver, as well as possible underloading in the case of the anode-bend detector. As the volume control resistance R_{13} is called upon to actually by-pass part of the anode current it must be carefully selected and is limited to only a few types. R_4 and C_7 prevent inter-stage low-frequency coupling.

Each valve in the output stage is provided with a grid resistance R_6 , R_7 , R_8 . Parallel connected valves by slightly differing in their properties readily break into H.F. oscillation. These grid resistances prevent this effect, while it is easy to show that they serve as a barrier to H.F. reaching the output stage from the receiver. In spite of low-stage gain output valves of the B.12 or L.S.5A type working with their full anode voltage can be readily overloaded by notes at the lower end



Interior of screening box showing the switch-over arrangement for using either screen-grid or triode valve.



Plan view showing the location of components for assembly. By precisely following this layout the wiring up may be effected by short leads. The reference letters are those used in the circuit diagram.

of the scale. It would, in fact, be possible to dispense with one stage by omitting the resistance coupling and yet to almost fully load the output valves from a local station. Although more stages generally mean more distortion, the combining of a resistance stage of low gain with a transformer stage probably gives better quality than the use of an anode-bend detector, transformer-coupled to the output valves. The use of an anode-bend detector when transformer-coupled to the output stage may result in a loss of the lower frequencies when the signal is weak. On the other hand, a resistance-coupled stage does not suffer in this way, yet when fully loaded we must guard against overloading in subsequent stages. A resistance stage of low gain corrects for the possible low-note loss of the transformer coupling without causing a serious falling-off in the higher frequencies. Again, if a pick-up is used the small voltage output that it gives necessitates making full use of the two amplifiers in front of the output stage.

From the intervalve transformer the output stage is built as a unit deriving its filament current, anode current and grid biasing potential, in the case of A.C. supply, entirely from the mains. This output stage has been constructed so that it can be made up apart from the preceding receiver. It can thus be utilised for moving-coil loud speaker operation where a reliable receiver is already existent. This eliminator also furnishes a 150-volt output for the earlier valves, a separate rectifier being provided for this purpose, fed from windings on the mains transformer. It is by this means that the high biasing voltage is available while the heavy speed currents of the output will not react with earlier stages. At the same time the need for a heavy duty potential divider is avoided.

To be concluded



TALKING FILMS

No. 3.—The Tri-Ergon Single-unit Process.

GERMANY can claim to have played her part in the development of the speaking film; at the close of last century Messter made his first efforts

in this direction by preparing gramophone records of suitable accompanying music and trying to synchronise the playing of these records with the running of the film. Some six years ago the three inventors of the Tri-Ergon process—Vogt, Engel, and Massolle—succeeded for the first time in demonstrating a true speaking film, in which the sound was recorded, with the picture, on the film itself. Such well-known firms as the A.E.G., Siemens, and Telefunken Companies, together with Dr. Koene-mann, are working together, as the "Klangfilm Co.," on the problem of the sound film.

The old Tri-Ergon process is today being used in a considerably improved form by the German "Ton-Bild Syndikat" (abbreviated to "Tobis"), into whose hands the rights in the process and in the numerous Tri-Ergon patents have passed. The "Ton-Bild Syndikat" possesses, in addition to the Tri-Ergon process, the Danish process of Petersen and Poulsen, that of Kuechen-

meister (known as the Ultraphone) and the patents of Messter, to whom reference has already been made.

The "Tobis" group set themselves the task of combining the different processes belonging to them, and have produced a single-unit system, which is notable for the fact that the films conform to the international standards of size and perforation, so that standard film can be used in making it, with the consequence that the cinema proprietor is able to use standard projectors or to make use of speaking films of other makes. There are only a few unimportant alterations to be made to a standard projector to enable it to be used at will for silent or speaking films. The method is so devised that films of either kind can be shown by the same machine without any alteration. This implies a saving of expense for the cinema proprietor, and gives every opportunity for the extension of the use of talking films.

With regard to the technical side of the new "Tobis" process, the following points will be of interest. For recording the sounds the old Tri-Ergon method is used. By suitable methods (see Fig. 1), small narrow black lines, of about 3 mm. in width, are



Fig. 1.—Section of film. The sound-recording strip is on the left.

Talking Films.—

produced on the film; these correspond to the separate sound waves. The series of black lines, which do not vary in width, but in their density, is called the sound-strip, and the method employed, in contradistinction to the "Transverse Method," in which the lines on the film are all of the same depth but vary in width, is called the "Intensity Method." The transverse method is used by Petersen and Poulsen, as well as various other inventors.

The Position of the Sound-strip.

In the early days of their experiments the Tri-Ergon inventors printed their sound-strip on a special film, which was synchronised, during exhibition, with the ordinary picture film. Later it was decided to accommodate the sound-strip outside the perforations on one edge of the main film. Anyone who is acquainted with the construction of cinema projectors, however, knows that the outer edge of the film travels over rollers which serve to guide it, and that this part of the film is specially liable to become damaged. For this reason, and to make the film fit in with the international standard of size, "Tobis" have recently removed the sound-strip to the inside of the film, between the perforations. This was done so that the ordinary projector, with but slight alterations, could be used.

In the ordinary way this part of the film is occupied by the picture; this, however, does not normally reach right out to the perforations, but leaves a narrow margin unoccupied, and it is on this margin that "Tobis" now print their sound-strip. The pictures have to be made narrower by a minute amount, for the normal margin on a film is not quite wide enough for the sound-strip, so that a very small part of the space occupied by the

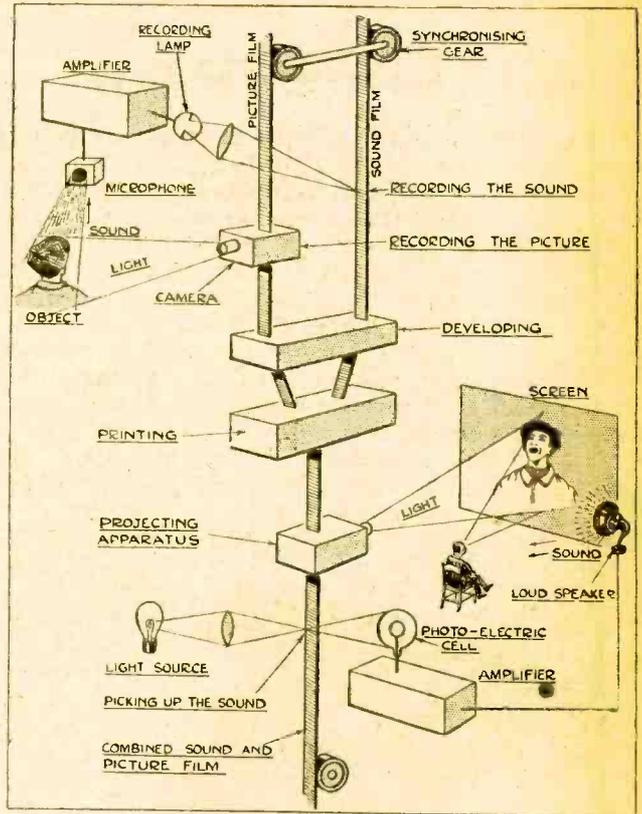


Fig. 2.—Simplified diagrammatic sketch, showing method of recording and projecting "Tobis" films.

picture has had to be taken to make up the necessary space. The narrowing of the picture is so little that it would pass unnoticed by any but an expert.

While the picture film is drawn through the projector in jerks, being moved sixteen times per second, it is necessary, for obvious reasons, to take the sound record continuously. As a consequence, it must also be drawn continuously through the sound projector during reproduction. If the sound-strip is fixed to the picture film itself, the two have to be separated for projection. This is done in practice by taking the film in a long loop through the sound projector after it has left the window of the picture projector and before it is wound up again on the lower drum.

Fig. 3 shows how this is done. The sound projector, which is also shown separately in Fig. 4, is the small

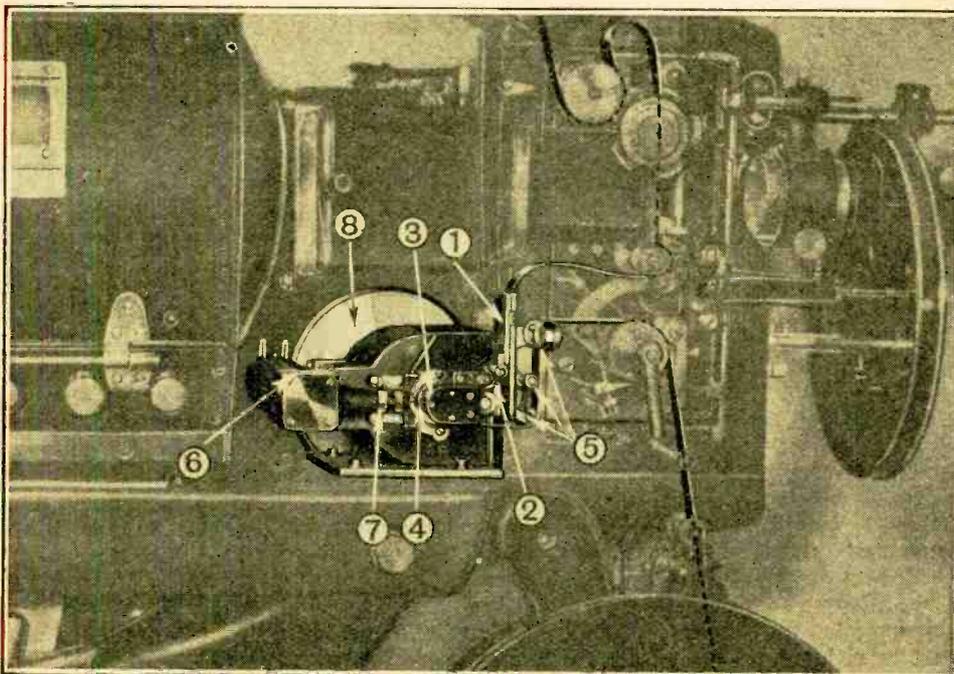


Fig. 3.—Cinema projector with sound-projecting apparatus fitted. Reference numbers are explained in the text.

Talking Films.—

machine under the condenser of the arc lamp, between the arc and the picture projector. It is clearly shown how the film is taken in a long loop after leaving the Maltese cross of the projector into a guide (1) on the sound projector. A roller (2) on this takes up the film and feeds it into the sound guide (3) in which is the sound window (4). Inside the guide (3) the film is led over a roller which has no teeth, but draws the film along by friction only. At the place where the sound-strip on the film comes the roller (2) in the sound guide (3) is interrupted. Inside this roller (2) of the guide (3), which is hollow, there is a specially constructed photo-electric cell. After the film has run through the sound guide, it is led over the rollers (5) to the spool of the picture projector, and from there to the lower fire-protecting drum. The sound-strip is illuminated by an incandescent lamp, situated in the tube (6), which carries two terminals for connecting the

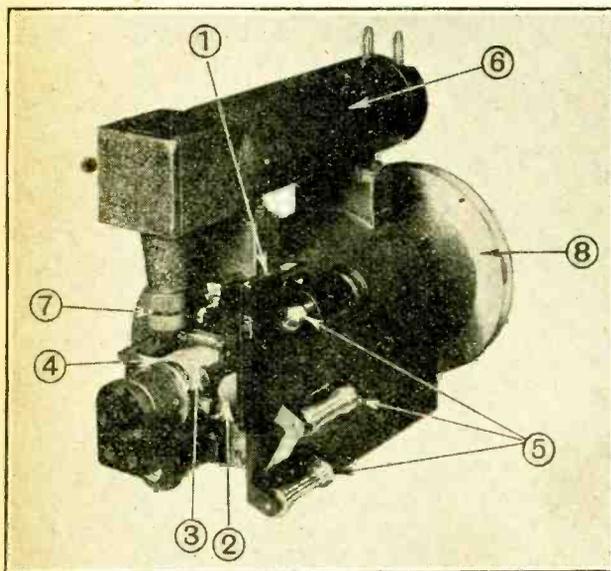


Fig. 4.—The sound projector. Reference numbers correspond with those in Fig. 3.

current for the lamp. In the front bend of the tube (6) there is a totally reflecting prism which contains a screen with a slit. At the end (7) of the tube there is a system of lenses which projects the narrow strip of light from the slit upon the sound-strip of the film. The light penetrates the lines making up the sound-strip to a greater or less extent according to their densities, and illuminates the photo-electric cell correspondingly more or less. The cell responds to the variations with corresponding electric currents which are led to a powerful two-stage, push-pull amplifier, and then to several groups of loud speakers, each of which contains a moving-coil speaker and a set of five electrostatic speakers, each tuned to a different frequency. These loud speaker groups are mounted on special stands, which latter are mounted to right and left of the screen. The instruments are concealed behind a cover of opaque material

It has already been said that the film is drawn by friction through the sound projector by means of the roller within the sound guide (3). This roller is fixed to an axle which carries a belt pulley (8) at its other end. This pulley (8) is driven by a belt from another pulley, which must be fixed to the driving axle of the picture projector. The attachment of this pulley to the axle of the projector, and the insertion of a small screen into the window to screen off the sound-strip so that it does not appear on the sheet, are the only alterations that have to be made to the projector, and these additions are easily made. The pulley (8) on the sound projector is not fixed permanently to its axle, but is connected to it by a centrifugal governor. This connects the pulley to the axle of the sound projector until the correct rate of revolution is reached. Then the pulley (8) is disconnected from the axle, and the sound projector is then operated only by the film as it passes through from the picture projector. This measure was necessary because the film stretches a little with use, and it was desired to avoid the irregularities that would arise if the two projectors were rigidly coupled during the running of the film. This stretching also supplies the reason for not using toothed wheels for moving the film through the sound projector, the rollers in which move the film by friction only.

Synchronism Ensured.

The distance between the windows on sound and picture projectors has, of course, to be taken into account in printing the sound-strip on to the film in order to ensure that speech and picture are properly synchronised during exhibition. This is done when the film is being taken, when sound and picture are separately impressed on different special films, by making special marks on both films. These marks have to be superimposed when making the positive film, and they further serve to simplify the process of threading the film through the projector. The threading of the film through a complete picture and sound projector is no more difficult than with a simple picture projector, and can easily be learnt by any operator.

The apparatus, both for reproducing and for making the film, has already been so far developed by "Tobis" that in recent demonstrations in Berlin a high degree of perfection was attained. From the commercial point of view, ease of adaptation to existing apparatus is an important feature

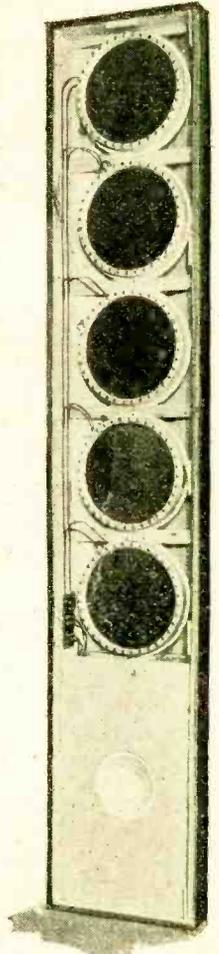
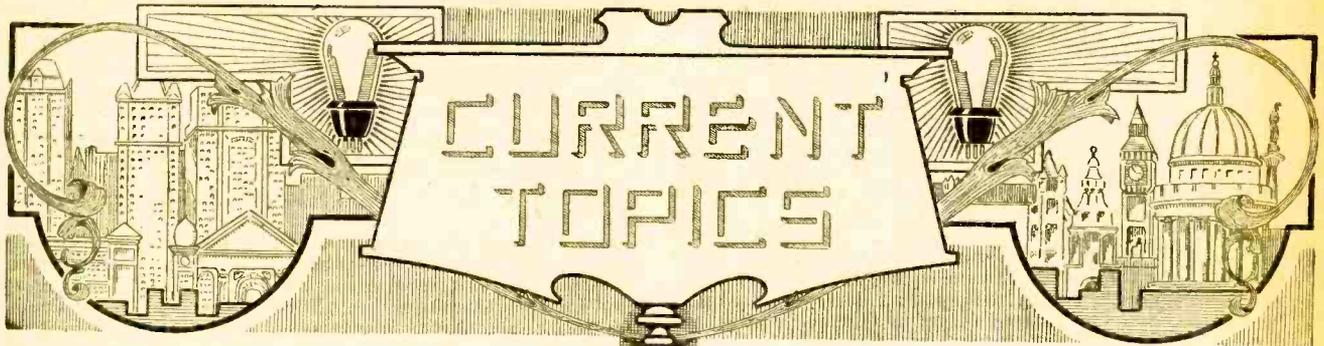


Fig. 5.—A group of loud speakers, comprising five of the "tuned" electrostatic type and a single moving-coil reproducer.



Events of the Week in Brief Review.

PICTURE TRANSMISSIONS FROM SPAIN?

Picture transmissions from Paris by means of the Fultograph system having been arranged, Captain Fulton has now arrived in Madrid to discuss the adoption of the system at Spanish broadcasting stations.

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SHORT WAVES FROM VIENNA.

The Radio Wien short-wave transmitter recently carried out satisfactory preliminary tests, and will shortly be brought into nightly operation with the relay of the ordinary Vienna broadcast programmes. Details of the official times of transmission, wavelength and power will be available within the next few days.

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EIFFEL TOWER'S WAVELENGTH.

Eiffel Tower has taken a step in the right direction by reducing its wavelength from 1,485 to 1,470 metres. Listeners to 5XX will be glad to know that a further reduction is to follow when the necessary authorisation can be obtained from the International Wireless Conference now in session at Prague.

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HOLLAND TALKS TO AUSTRALIA.

The first direct communication on short waves between Holland and Australia was achieved on March 27th, when PCLL, Kootwijk, the Dutch Government station which works the Holland-Java service, was able to connect a private telephone subscriber at Rotterdam with the Pennant Hills station, Sydney. The latter station operated on 28.5 metres. PCLL worked on its usual 18.4 metre wavelength.

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U.S. COUNTERBLAST TO WIRELESS-CABLE MERGER?

A rumour to the effect that Radio Corporation of America and the International Telephone and Telegraph Company are about to amalgamate has been denied by the companies concerned. A joint statement, however, points out that an understanding has been reached on the desirability of consolidating their interests and a tentative plan whereby such consolidation may be accomplished if the law permits.

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THE DIFFERENCE.

It has just been brought to our notice that the difference between an outside and an inside aerial is estimated to be ten shillings.—*Glasgow Weekly Herald.*

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BRITISH WIRELESS ABROAD.

British wireless apparatus is to be shown at the Zagreb Trade Fair, Yugoslavia, from April 20th-28th.

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RUSSIA'S RADIO LOTTERY.

In connection with its broadcasting system, Russia has inaugurated the first Radio Lottery, to be drawn on April



ARMoured CAR WIRELESS. A new type of car designed for patrol work on rough roads in India. The wireless transmitter and receiver can be operated on the move.

15th. The prizes consist of wireless transmitters and receivers, all kinds of components, and a number of free listening licences for one year. In all, some two million lottery tickets have been issued at 50 copecks each, and any profit accruing from the scheme is to be diverted to the extension of wireless lectures and demonstrations in schools, clubs, and other public educational institutions.

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THE BIRTH OF A BATTERY.

An interesting cinematograph film illustrating the manufacture of dry batteries has been "released" by Messrs. Siemens Brothers, Ltd., for the benefit of wireless societies. The company undertakes to provide a lecturer and all the necessary apparatus for the dis-

play, the only requirement being an electric mains supply (A.C. or D.C.) to the hall in which the film is to be shown.

The film, which is in two parts, deals with the whole process of manufacture, from the collection of raw material (manganese, electrolytes, carbons, etc.) to the completed article in its carton.

Club secretaries should make application to the company's works, Woolwich, London, S.E.18.

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INTERNATIONAL SHOW POSTPONED.

We understand that the International Wireless Exhibition arranged to take place at Bucharest from April 15th to June 1st has been postponed, the new dates being August 5th to October 1st.

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PRAGUE.

An American contingent has joined the International Wireless Conference which is now meeting at Prague. The American delegation of five is headed by Mr. William D. Terrell, chief of the Radio Division of the Department of Commerce.

The conference, which is virtually a sequel to the International Radio Convention of Washington, is considering ways and means for carrying out the provisions of the Convention in Europe. Most European Governments are represented. The agenda covers broadcast and commercial wavelengths, amateur and experimental wireless, police radio, and other important questions. The Conference concludes on Saturday next, April 13th.

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WIRELESS LINKS ON ANGLO-INDIAN AIR ROUTE.

The air mail liners on the new route from Croydon to India are in wireless communication with the ground throughout the entire journey. The usual wireless organisation is used on the London-Basle section, this comprising the stations at Croydon, Le Bourget, and the Marconi station at Basle. R.A.F. stations form links in the chain after Alexandria. From Basra to Karachi the machines can communicate with the Marconi stations at Chabar and Bunda Abbas, in Persia, while in the concluding stages they are in continuous touch with the powerful station at Karachi.

TELEVISION—THE POSTMASTER-GENERAL'S STATEMENT.

THE Postmaster-General has caused the following letter to be sent to the Secretary, Baird Television Development Company, Limited:—

Sir,—The Postmaster-General has considered the results of the recent television demonstration, in conjunction with the British Broadcasting Corporation and his technical advisers, and he has reached the following conclusions which accord generally with the opinions of those who witnessed the demonstration. The demonstration showed that the Baird system was capable on that occasion of producing with sufficient clearness to be recognised the features and movements of persons posed for the purpose at the transmitting point. It is not at present practicable to reproduce simultaneously more than perhaps two or three individuals or to exhibit any scene or performance which cannot be staged within a space of a few feet in very close proximity to the transmitting apparatus.

In the Postmaster-General's opinion the system represents a noteworthy scientific achievement, but he does not consider that at the present stage of development television could be included in the broadcasting programmes within the broadcasting hours. He bases this view not so much upon the quality of the reproduction, which further experiments may be expected to improve, as upon the present limited scope of the objects which can be reproduced.

The Postmaster-General is, however, anxious that facilities should be afforded, so far as practicable without impairing the broadcasting service, for continued and progressive experiments with the Baird apparatus, and he would assent to a station of the British Broadcasting Corporation being utilised for this purpose outside broadcasting hours. He understands that the Corporation would agree in principle to this course provided satisfactory terms were negotiated between the Corporation and the Baird Company.

It will probably be essential that any experimental demonstrations of television should be accompanied by the broadcasting of speech and, in consequence, two wavelengths and two transmitters would be required. It will not be possible to provide a second transmitter in a suitable locality which will avoid in-

terference with important wireless services in Central London until the completion of the new station of the British Broadcasting Corporation, at Brookman's Park, which is expected to be ready in July. In the meantime, it is suggested that the Company should open negotiations with the Corporation as to the financial and other arrangements which may be necessary, and it would probably be advantageous to them to enter upon discussions of the technical aspects with the Corporation's Chief Engineer.

In order to find room for a television service in broadcasting hours it will probably be necessary to utilise for the reproduction of vision wavelengths outside the bands now being used for speech broadcasting. These bands, as you are doubtless aware, are already highly congested, and it is important, therefore, that the Company should press on with experiments on a much lower band, which will be notified to you in due course.

In conclusion, it is necessary to emphasise that in granting facilities for experimental demonstrations in which the public can, if they so desire, take part, neither the Postmaster-General nor the British Broadcasting Corporation accept any responsibility for the quality of the transmission or for the results obtained. The object of the demonstrations is to afford the Baird Company a wider opportunity than they at present possess for developing the possibilities of their system of television and for extending the scope and improving the quality of the reproductions. While the Company will not be precluded from selling apparatus to anyone who desires to purchase it, the purchaser must understand that he buys at his own risk at a time when the system has not reached a sufficiently advanced stage to warrant its occupying a place in the broadcasting programmes.

I am, Sir,

Your obedient servant,

(Signed) G. E. P. MURRAY.

General Post Office, March 27th, 1929.

Editorial reference to this subject appears on page 371 of this issue.

New Amateur Call-Book.

The spring number of the Radio Amateur Call-Book has now been issued, and may be obtained from the English representative of the publishers, Mr. F. T. Carter, Flat A, Gleneagle Mansions, Streatham, for 4s. 6d. post free, or members of the R.S.G.B. can purchase their copies at a reduced price by ordering them through their secretary.

Owing to the considerable number of changes in call-signs since January 1st, to conform with the Washington Convention, the alterations and additions since the December quarterly edition was published are unusually numerous, and the list of amateur call-signs alone occupies 95 closely printed pages. The new South African call-signs ZS1A to ZU6P are given, and there is a good list of Russian stations.

In addition to the amateur stations in all parts of the world, the revised "Q" code is given, the new international prefixes at present adopted and a useful list of short-wave commercial and broadcasting stations.

We would remind readers that though the U.S.A. and a few other countries publish official lists of their amateur stations, the greater part of this useful call-book is compiled from information laboriously obtained from individual transmitters and various other sources, and, in their endeavour to make each suc-

TRANSMITTERS' NOTES.

ceeding list still more complete and reliable than its predecessor, the compilers cordially welcome authentic information regarding new call-signs allotted or identified, changes of address, or corrections to the current list. British and European wireless enthusiasts are invited to send such information either to Mr. F. T. Carter, or to the Q.R.A. section of the R.S.G.B., or the offices of *The Wireless World*. ○○○○

Nationality Prefixes.

There is still some difficulty experienced owing to the fact that amateurs in some countries have not yet adopted the new nationality prefixes, but this matter will probably soon right itself, and we anticipate being able shortly to publish a revised list of the prefixes adopted in accordance with the Washington Regulations. Meantime, EU is still being used by Russian stations in Europe and AU by those in Asia, while French Morocco and Northern Africa are distinguished from the Mother Country by the use of the letters FM.

The United States allotted the letter "K" for their colonies and dependencies,

the figure following denotes the locality, thus K1 indicates the Philippine Islands; K4, Porto Rico and Virgin Islands; K6, Hawaiian Islands, and K7, Alaska. ○○○○

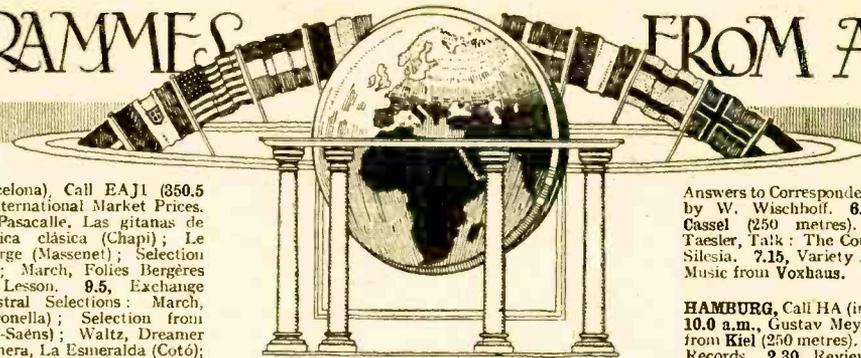
Three-Letter Call-Signs.

We understand that for certain practical reasons the G.P.O. does not wish British holders of licences for only artificial aerial to use the nationality prefix as part of their call-sign. These stations are distinguished by having three letters following the figure 2. ○○○○

New Call Signs and Stations Identified.

- G2SG** Frank A. Robinson, "Rotherwood," Jockey Rd., Sutton Coldfield.
G5CI (ex 2BOD), A. Hargreaves, 7, Ridge St., Barnoldswick, via Colne, Lancs.
G5UX G. Hume, 53, Eccles Rd., Battersea, S.W.11. (Change of address.)
G6LK E. J. Laker, 4, Alford Rd., Cranleigh.
G6XC (ex G 6VJ) A. Cross, 337, Anlaby Road, Hull (Change of call-sign.)
G6XQ J. S. Owner, 135, Springfield Rd., Moseley, Birmingham.
G6ZH W. H. Winchcombe, 160, County Rd., Swindon, Wilts.
2ABW W. S. Ellis, 694, Barking Road, Plaistow, E.13. (Change of address.)
2ACN A. H. Sartain, 40, Harrington St., Regent's Park, N.W.1.
2AFD W. J. Sharratt, 15, Woodwarde Rd., East Dulwich, London, S.E.21.
2AHV S. L. Hill, "Bartfield," Fielden Park, Manchester.
2AKG G. King, 6, Taff St., Caepartywyll, Merthyr Tydfil, S. Wales.
2ALL H. H. Oak-Rhind, The Thatched House, Reading St., Broadstairs.
2ANH J. W. Alexander, Tez Fryn, Lower Cwmwtrwch, Swansea, S. Wales.

PROGRAMMES FROM ABROAD



BARCELONA (Radio Barcelona), Call EAJ1 (350.5 metres); 1.5 kW.—8.0, International Market Prices. 6.10, Sextet Selections: Pascalle, Las gitanas de pandereta (Barta); Música clásica (Chapi); Le dernier sommeil de la Vierge (Massenet); Selection from Martierra (Guerrero); March, Folies Bergères (Lincke). 8.30, French Lesson. 9.5, Exchange Quotations. 9.10, Orchestral Selections: March, Gloria a los héroes (Gironella); Selection from Samson and Delilah (Saint-Saëns); Waltz, Dreamer of Dreams (Fiorito); Habanera, La Esmeralda (Cotó); Jota estilo rondalla (Mayral); La presó del rei de França (Sancho-Marraço). 10.0, News and Announcements. 10.5, Programme relayed from Madrid, EAJ7.

BERGEN (365.9 metres); 1.5 kW.—6.0, Programme for Girls. 7.0, Orchestral Selections. 7.20, Concertina Recital. 7.50, Topical Talk. 8.0, Talk. 8.30, Song Recital by Martin Erisch: Erikönig (Schubert); Die beiden Grenadiere (Schumann); Hildaigo (Schumann); Der Kattenfinger (Hugo Wolf); Der Sänger (Hugo Wolf) 9.0, Weather Report, News and Time Signal. 9.15, Dance Music. 11.0 (approx.), Close Down.

BERLIN (Königswusterhausen) (1,649 metres): 40 kW.—12.45, Phototelegraph Transmission. 1.20, Programme for Children. 2.0, Lesson in Elocution by Herr B. K. Graef. 2.30, Weather Report and Exchange Quotations. 2.40, Talk for Women: How to make a Workbasket out of a Cigar-Box. 3.0, Short-hand Speed Dictation. 3.30, Dr. A. Reichardt, Talk: Legal Questions connected with the Civil Service. 4.0, Programme from Hamburg. 5.0, Herr Griesser, Talk: Wrong Methods of Social Insurance. 5.50, Elegentary French Lesson. 5.55, Prof. Landsberger, Talk: Nationality in Plastic Art—the characteristics of German and English Art. 7.0, "Der Jungeselle": Farce in One Act (Rudolf Presber). 8.0, Programme from Voxhaus. 11.30 (approx.), Close Down.

BERLIN (Voxhaus) (475.4 metres); 4 kW.—9.10 a.m., Market Prices. 9.15 a.m., Time Signal, Weather Report and News. 10.0 a.m., Programme of Gramophone Records. In the Interval: Exchange Quotations. 11.55 a.m., Time Signal. 12.30, Time Signal, Weather Report and News. 1.0, Programme of Gramophone Records. 2.0, Exchange Quotations. 2.10, Agricultural Report and Time. 2.30, Talk by Dr. Paul Gerstner. 3.0, Dr. C. M. von Holten, Talk: Co-operation in Prisoners' Welfare. 3.30, Recitations from the Works of Julius Hart on the Occasion of his 70th Birthday. 4.0, Tea-Time Music relayed from the Hotel Bristol, followed by Advertising Programme. 5.10, Dr. Kurt Zielenziger, Talk: Captains of Industry in England and France. 5.35, Prof. A. Timpe, Talk: Mathematics. 6.0, Herr H. Stuckenschmidt, Talk: Our Musical Culture. 6.30, Herr Monzel, Talk: The Profession of Teacher in Secondary Schools. 7.0, Evening Variety Programme. 7.30, Humorous Recitations and Stories by Roda Roda. 8.0, Orchestral Concert: Overture to King René's Daughter; Triumph of Beauty; Meditation, Urbelo; March of the Gnomes (von Blon); Overture to Durchlaucht in Hosen (von Blon); March, Mit klingendem Spiel; Waltz-Intermezzo, Was Blumen träumen; Wedding in Lilliput; Schlummerliedchen (Translator); Waltz, Wiener Praterleben (Translator); followed by Time Signal, Weather Report, News, Sports Notes, and Dance Music. 11.30 (approx.), Close Down.

BERN (406 metres); 1.5 kW.—3.30, Programme for Children. 4.0, Orchestral Concert. 6.20,—Time Signal and Weather Report. 6.32, Herr Roth, Talk: The Cultivation of Vegetables in Spring. 7.0, Popular Programme. 9.0, News and Weather Report. 9.15, Orchestral Selections. 9.40, Dance Music. 11.0 (approx.), Close Down.

BRESLAU (321.2 metres); 4 kW.—3.15, Orchestral Concert of Favourite Marches and Waltzes: March, Alte Kameraden (Teike); Waltz, Gold and Silver (Lehár); March, Preussens Gloria (Piefke); Waltz, Donauwellen (Ivanovici); March, Hoch Heidecksburg (Herzer); Waltz, Moonlight on the Alster (Fétras); March, Unter dem Griffenbanner (Lindemann); Waltz, Die Schlittschuhläufer (Waldteufel); March, Folies-Bergère (Lincke); Waltz, Wiener Blut (Joh. Strauss); March, Abschied der Gladiatoren (Blankenburg). 4.45, The Week's Film Review. 5.20, Esperanto Lesson by Margarete Polier. 5.30, See Königswusterhausen. 6.20, Shorthand for Beginners. 6.50, Talk on World History: The Burning

SATURDAY, APRIL 13th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

of Moscow. 7.15, "Theater im Theater"—a Wireless Play (Engel and Brunar). 9.0, News. 9.30, Dance Music from Voxhaus. 11.0 (approx.), Close Down.

BRÜNN (432.3 metres); 2.5 kW.—5.0, German Transmission—News and Concert: Air from La Tosca (Puccini); Fantasy (Puccini); Air from Martha (Flotow); Solveig's Song (Grieg); Three Songs (Schmalsteil). 6.0, Programme from Prague. 6.5, Dr. John Marek, Talk: Travelling in Italy. 6.15, Programme from Prague. 7.40, "Transport No. 20"—Comedy (Vrbsky-Stepanek). 9.0, Programme from Prague. 9.20, Programme Announcements. 9.25, Dance Music.

BRUSSELS (511.9 metres); 1.5 kW.—After 7.30 p.m., Experimental Transmission on a High Power. 6.0, Concert of Chamber Music: Three Movements from the Sonata for Violin and Piano (Liska). 5.45, Elementary and Intermediate English Lessons. 6.30, Selection of Popular Gramophone Records. 7.30, "La Radio-Chronique." 8.15, Concert arranged by La Meuse, L'Antenne and Hebdio-Radio-Vision, followed by News and Announcements and Close Down.

BUDAPEST (645 metres); 20 kW.—4.40, Orchestral Concert: Potpourri, Paganini (Lehár); Potpourri, Sybill (Jacobi); Selection from The Duchess of Chicago (Kálmán). 5.40, Talk for Radio Amateurs. 6.30, Various Talks. 7.15, Concert of Choral Music. 8.15, Programme of One Act Plays and Recital of Songs. 9.30 (approx.), Time Signal, Weather Report, News and Concert from the Café Emke.

CRACOW (314.1 metres); 1.5 kW.—5.50, Miscellaneous Items. 6.10, Review of Foreign Politics of the Past Week. 6.58, Time Signal. 7.0, Fanfare from the Church of Notre Dame, followed by News. 7.30, Programme relayed from Warsaw. 9.30, Relay of a Concert from a Restaurant. 10.30 (approx.), Close Down.

DUBLIN, Call 2RN (411 metres); 1.5 kW.—1.30, Weather Report and Gramophone Records. 7.20, News. 7.30, Health Talk by Mrs. Russell, M.B. 7.45, Irish Lesson by Seamus O'Duiriinne. 8.0, Pib Uileann by Seamus MacAonghusa. 8.15, Irish and Anglo-Irish Songs by Kathleen Roddy. 8.30, Selections from the Augmented Station Orchestra. 8.50, Pianoforte Solos by Marguerite King. 9.5, Selections from the Augmented Station Orchestra. 9.30, Ballads by Mr. F. Collins. 9.45, "General John Regan"—One-Act Play by Mary Sheridan and Company. 10.15, Selection from The Girl of the Golden West (Puccini) by the Augmented Station Orchestra. 10.30, News, Weather Report and Close Down.

FRANKFURT (421.3 metres); 4 kW.—2.5, Programme for Young People. 2.55, Talk for the Housewife by Fini Pflannes. 3.35, Orchestral Concert of Operetta Music: Selection from Polenblut (Nedbal); Waltz from Der Rastalbinder (Lehár); Song; Potpourri of Der Zigeunerprimas (Kálmán); Waltz from The Countess Maritza (Kálmán); Song; Potpourri, Where the Lark Sings (Lehár); March from a Waltz Dream (Oscar Straus). 5.10, Reading by O. W. Stuhlmann from The Lives of the Caesars (Suetonius). 5.30,

Answers to Correspondents. 5.45, Lesson in Esperanto by W. Wischhoff. 6.5, Programme relayed from Cassel (250 metres). 6.25, Talk. 6.45, Clemens Taesler, Talk: The Country and the People of Upper Silesia. 7.15, Variety Programme, followed by Dance Music from Voxhaus. 11.30 (approx.), Close Down.

HAMBURG, Call HA (in Morse) (392 metres); 4 kW.—10.0 a.m., Gustav Meyer, Talk: Fairy Tales, relayed from Kiel (250 metres). 12.45, Concert of Gramophone Records. 2.30, Review of Books. 3.0, Karl Minor, Talk: German Women's Christian Names. 3.15, Heinz Liepmann, Talk: The Indiscretions of a Reporter. 3.35, Dr. Kurt Mühsam, Talk: Great Art Forgeries. 4.0, Concert of Chamber Music: Trio in E Flat Major for Violin, Horn and Pianoforte (Brahms); First Movement from the Sonata in E Minor for Cello and Pianoforte (Brahms). 5.0, Orchestral Concert of Request Items. 6.0, "An Investigation of Our Surroundings." 6.55, Weather Report. 7.0, "World Harbours," Programme of Recitations and Songs. 9.0, Talks extraneous to the Programme, News, Weather Report, Sports Notes and Snow Report. 9.30, Dance Music. 10.50, North Sea and Baltic Weather and Ice Report. 11.0, Greenly Island Day Programme in Commemoration of Hünefeldt, relayed from Bremen (273 metres): Air (Bach); Requiem (Hebbel); Talk: Günther von Hünefeldt as Man and Poet; Manuscript Poems (Hünefeldt); Gebet in der Sommernacht (Hünefeldt); Bei sinkender Nacht (Hünefeldt); Elegy on the Death of a Young Man (Schiller); Litanei, Rest in Peace (Schubert).

HILVERSUM (1,071 metres); 5 kW.—9.40 a.m., Time Signal and Daily Service. 11.40 a.m., Police Announcements. 11.55 a.m., Trio Concert. 1.40, Musical Programme, relayed from the Tuschinski Theatre, Amsterdam, under the direction of Mr. Max Tak, with Pierre Palla (Organ). 3.40, Italian Lesson, by Mr. Giovanni Rizzini. 4.40, French Lesson, by Mr. Raymond Lafont. 5.40, Concert of Trio Music. 6.25, German Lesson, by Mr. Edgar Grün. 7.25, Police Announcements. 7.45, Programme arranged by the Workers' Radio Society: Concert and Talk. 11.10 (approx.), Close Down.

HUIZEN (336.3 metres); 4 kW.—Transmits on 1,852 metres from 5.40.—11.10 a.m., Sacred Morning Recital. 11.55 a.m., Concert of Trio Music. 12.55, Gramophone Records. 2.40, Programme for Children. 4.40, Concert by Male Voice Choir and Instrumental Selections. 6.0, Talk by M. Max Gerisch. 7.0, "Fidelio," Opera (Beethoven), relayed from Aix-la-Chapelle (455.9 metres). 9.40, Light Entertainment and News.

KALUNDBORG (1,153 metres); 7 kW.—Programme also for Copenhagen (339.8 metres).—6.30 a.m., Morning Gynastics. 10.0 a.m., Weather Report. 12.15, Talk on Mozart with Musical Illustrations. 2.0, Programme for Children. 2.30, Instrumental Concert: March, The American Girls (Mahon Duganne); Waltz, Moonlight on the Alster (Fétras); Selection from Der Freischütz (Weber); Gondole d'Amour (Mercuri); Selection from The Damnation of Faust (Berlioz); Larghetto from the Second Symphony (Beethoven); Bourrée from Suite ancienne (Halvorsen); Reading; Budapest-Polka (Joh. Strauss); Serenata amorosa (Beccè); Waltz, Wine, Woman and Song (Joh. Strauss); Selection from The Pearl Fishers (Bizet); Saeterjensens Sondag (Ole Bull); Waltz from The Merry Widow (Lehár); March, El Capitan (Souza). 4.40, Exchange Quotations. 5.20, Talk, by Hardy Hansen. 5.50, Weather Report. 6.0, News. 6.15, Time Signal. 6.30, Talk, by Jorgen Banke. 7.0, Chimes from the Town Hall. 7.2, "Frentimmerliederen," Musical Play in One Act (Bouilly). 8.0, Reading, followed by News. 8.45, Concert of Light Music: Selections (Jespersen), (a) Kongemøde March, (b) Mazurka, Skaersliber, (c) Nybdor Polka; Recitations; Three Selections from Molboerne (Jespersen); Recitations; Waltz, Dinka (Jespersen); Ormonde-Cylike Galop (Jespersen). 9.45 (approx.), Close Down.

KATTOWITZ (416.1 metres); 10 kW.—4.0, Music Lesson, by Prof. F. Sachse. 4.25, Children's Letter Box. 4.55, Programme for Children. 5.50, Announcements. 6.10, Prof. K. Simm, Talk: Insects. 6.35, Recitations. 6.58, Time Signal. 7.0, Prof. Semkowicz, Talk: Upper Silesia. 7.30, Programme from Warsaw. 9.0, Weather Report and News. 9.30, Dance Music.

Programmes from Abroad.—

KAUNAS (2,000 metres); 7 kW.—5.30, Health Talk. 6.0, News. 6.30, Mr. V. Zadeika, Talk: Lithuanian Music. 7.0, Concert in Commemoration of the Ukrainian Poet, Schewzenke.

KÖNIGSBERG (280.4 metres); 4 kW.—5.35, Dr. Kaminizer, Talk: What Danzig expects from the German Government and the German People, relayed from Danzig (455.1 metres). 6.0, Programme Announcements in Esperanto. 6.5, Topical Talk. 6.30, See Königswusterhausen. 7.5, Dr. E. K. Fischer, Talk: The Modern Novel. 7.45, Variety Programme relayed from Danzig. 9.15, Weather Report, News and Sports Notes. 9.30, Dance Music relayed from Danzig. 11.0 (approx.), Close Down.

LAHTI (1,522.8 metres); 35 kW.—5.35, Orchestral Suite, No. 3 (Michele). 6.0, Talk. 6.20, Accordion Recital. 6.40, Wireless Talk, by Tatu Pekkarinen. 7.15, Orchestral Selections: Rag Doll (Brown); Selection (Doelle); Tango (Hate); Ursula (Profes). 7.45, News in Finnish and Swedish and Close Down.

LANGENBERG (462.2 metres); 20 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Cologne (263.2 metres) and Münster (267.8 metres)—12.5, Orchestral Concert: Overture to Ilka (Doppler); Waltz, Zwei Herzen und doch nur eins (Richter); Selections from Der Freischütz (Weber); Malanquea (Moszkovsky); Songs (Liszt), (a) Loreley, (b) Du bist wie eine Blume, (c) Es muss ein Wunderbares sein: Daise macabre (Saint-Saens); The Fables of La Fontaine (Mouton); Selection from Gasparone (Millöcker). 1.30, Hints for the Housewife. 2.40, Programme for Children by Els Vordenberge. 2.40, Programme for Women. 3.0, Fritz Walter, Talk: From an Unpublished Novel—Furnished Rooms. 3.30, Dr. Hanns Ulmann, Talk: French Authors. 3.55, Dr. Hahn, Talk: Industries of Central Europe. 4.15, English Lesson by Prof. Hase. 4.45, Recital of Songs by Kläre Hansen (Soprano); Der arme Peter (Schumann); Rhapsody for Pianoforte (Brahms); Brantlieder (Cornelius). 5.30, Dr. von Hansemann, Talk: The Town—its Constitution and Administration. 5.50, Morse Lesson. 6.15, Talk for Workers, by Bruno Sias. 6.40, Dr. Lips, Talk: The Development of Human Culture. 7.0, Variety Programme, followed by News, Sports Notes, Commercial Announcements, Concert and Dance Music. 12.0 Midnight (approx.), Close Down.

LEIPZIG (361.9 metres); 4 kW.—3.30, Orchestral Concert from the Works of Leon Jessel, under the direction of the Composer: Herz und Hand fügt Vaterland; Mexican Legend; Selections from The Maid of the Black Forest; Spring in Japan; Der Rose Hochzeitszug; Mondschneise; Aufmarsch der Stadtweiche; Under African Skies; Miss America; Die kleinen Rekruten; Am Colorado; Parade of the Tin Soldiers. 4.45, Wireless News and Talk. 5.20, Weather Report and Time Signal. 5.30, See Königswusterhausen. 5.55, Labour Market Report. 6.0, Dr. Wolf, Talk: Architecture of the 20th Century: the Development of Architecture in Towns. 6.30, Ernst Krohn, Talk: The German Custom-house. 7.0, Light Week-end Programme. 9.0, Time Signal, Snow and Weather Reports, News, Programme Announcements, and Sports Notes, followed by Dance Music. 11.30 (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 (426.7 metres); 3 kW.—7.0, Chimes, Exchange Quotations and Programme of Dance Music. 8.25, News and Announcements. 9.45, Weekly Agricultural Report. 10.0, Chimes, Time Signal and Musical Comedy Selection, Sybill (Jacobi); in the Interval at 12.0 Midnight (approx.), News. 12.30 a.m. (approx.) (Sunday), Close Down.

MOTALA (1,351 metres); 30 kW.—Programme also for Stockholm (438 metres), Boden (1,200 metres), Göteborg (346.8 metres), Hörby (260.9 metres), Österund (720 metres) and Sundsvall (545.5 metres)—4.0, Concert of Light Music, relayed from Göteborg: Turkish March (Beethoven); The Coming of Spring (Valdteufel); Overture to Martha (Flotow); Trümmerei (Wagner); Selection from La Bohème (Puccini); Kärleksdröm (Bloom); Hungarian Dances, Nos. 5 and 6 (Brahms). 5.0, Programme for Children. 5.30, Military Band Music, relayed from Falun (333 metres); Symphonic March (d'Örsi); Overture, Elverhöj (Kühnau); Invitation to the Dance (Weber); Selection from La Traviata (Verdi); Mora gästabad (Gudmundson-Olsson); Ave Maria (Schubert); March, Bagni di Lucca (Manente). 6.30, Talk: Professions and Professional Men. 6.45, Violin Recital, Sonata, No. 17 in A Major (Mozart). 7.10, Songs and Recital from the Thirties. 8.0, Topical Talk. 8.45, Programme of Dance Music. 11.0 (approx.), Close Down.

MUNICH (536.7 metres); 4 kW.—Programme relayed by Augsburg (566 metres), Kaiserslautern (272.7 metres), and Nuremberg (240 metres)—4.30, Paul Schweder, Talk: Motor Racing Arrangements for

Saturday, April 13th.

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the next Month. 5.0, Song Recital by Bettina Frank (Soprano), relayed from Nuremberg: Three Songs (Tcherepnie), (a) Waves and Billows, (b) Last Love, (c) The Lake in Tsarskoro Seio; Two Songs (Gretchaninoff), (a) Cradle Song, (b) Evening; Three Songs (Medtner), (a) Der Engel, (b) Das Blümelein, (c) Nur Rosen sterben wonnig. 5.35, Labour Market Report. 6.0, Answers to Correspondents. 6.30, Mandoline Recital. 7.15, Variety Programme: (a) A Short Stroll through Russia and Italy, (b) Cabaret. 9.0, Advertising Talk: The Successful Man. 9.20, News and Announcements. 9.45, Gramophone Records. 11.30 (approx.), Close Down.

NAPLES, Call INA (333 metres); 1.5 kW.—4.0, Concert: Orchestral Selections, (a) Waltz, Odette (Franceschi), (b) Serenata andalus (Ciociano); Soprano Solo, Ancora (Tosti); Orchestral Selection, Intermezzo, Scene della spiaggia (Blon); Soprano Solo, Canta il mare (De Leva); Orchestral Selection, Potpourri of Eva (Lehar); Soprano Solo, Nostalgia (Cafonazzi); Orchestral Selection, Intermezzo, Mestizia arcaica (Villanaina); Soprano Solo, La mia serenata (Staffelli); Orchestral Selections, (a) A lei che non mi sente (Bertini), (b) Intermezzo, Il pense à toi (Ancarani). 4.30, Time Signal. 4.35, Talk. 7.30, Wireless News, Time Signal, Announcements, News and Harbour Notes. 7.45, Relay of an Opera from the San Carlo Royal Theatre. 9.50, News. 9.55, Calendar and Programme Announcements. 10.0 (approx.), Close Down.

OSLO (496.7 metres); 1.5 kW.—Programme relayed by Fredrikstad (387 metres), Hamar (577 metres), Notodden (297 metres), Porsgrund (455 metres), and Rjukan (448 metres)—5.45, Programme for Children. 6.15, Weather Report and News. 6.30, Dr. Just Bing: Talk: Northern Poetry from the Time of the Reformation up to the Time of Holberg and Bellmann. 7.0, Time Signal and "Spring Revue," relayed from the Chat Noir. In the interval at 8.30 (approx.), Weather Report, News and Theatre Notes. 10.0, Dance Music. 11.0 (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT (458 metres); 0.5 kW.—5.30, "Radio Journal de France." 7.0, Talk by M. Géville. 7.15, Legal Talk. 7.30, Review of Sports. 7.45, Concert, followed by News, Weather Report and Dance Music from the Coliseum de Paris. 11.0 (approx.), Close Down.

PARIS (Eiffel Tower), Call FL (1,485 metres); 5 kW.—6.10, Weather Report. 6.20, "Le Journal Parlé"—Programme of Talks, (a) M. Marc Frayssinet: The Postilion, (b) Dr. Pierre Vachet: Health, (c) Mlle. Jacqueline Bertillon: Social Works; and Talks by other contributors.

PARIS (Petit Parisien) (336.3 metres); 0.5 kW.—7.45, Gramophone Records, Talk, News and Announcements. 8.0, Concert: Air from Véronique (Messager); Waltz from His Royal Highness (Caryll); Hindou Song (Bemberg); Overture to La Hussarde (Fourdrain); Selection from Véronique (Messager); Symphony, Harold en Italie (Berlioz); Pièce héroïque (Franck); Selection from His Royal Highness (Caryll); Les bergers d'Arcadie (Flament); Poursuites (Bousquet); Marche nuptiale d'une poupée (Lecocq). In the Intervals at 8.25 and 9.0, News.

PARIS (Radio Paris), Call CFR (1,744 metres); 15 kW.—11.30 a.m., Selection from "La Traviata"—Opera (Verdi). In the Interval at 12.0 Noon, Exchange Quotations and News. 1.0, Market Prices Report. 2.30, Exchange Quotations. 2.45, Programme for Children. 3.15, Programme of Dance Music. 3.45, Exchange Quotations and News. 5.30, New York Closing Rates. 5.35, Gramophone Concert: Ten little Miles from Town (Kahn and Schoebel); Ma poupée chérie (de Sévère); Amour discret (Resch); Air from Lakmé (Delibes); New Moon (Costa); Cordoba (Albéniz); Il faut bien que jeunesse se passe (Scottot); Accordion Solo, En cadence (Paig); Les p'tits pois (Spencer). 6.5, Agricultural Report. 6.30, Pianoforte Lesson by M. Pierre Lucas. 6.45, Metal Prices and News. 7.0, M. Chevalier, Talk: In Favour of Exportation. 7.15, Programme by Mario Cazes and his Orchestra. 8.0, Dance Music. In the Intervals—News.

PITTSBURGH, Call KDKA (63 and 27 metres); 25 kW.—11.0, Telechron Time. 11.1, Orchestral Concert

from the Fort Pitt Hotel. 11.30, The Gold Spot Pals, relayed from New York. 12.0 Midnight, Session Clock Chimes. 12.1 a.m., (Sunday), Address relayed from the Pittsburgh University. 12.15 a.m., The Home Radio Club. 12.30 a.m., Elbert R. Moses, Talk: Gems of American Literature. 12.45 to 3.1 a.m., Programme relayed from New York. 12.45 a.m., Dr. Klein, Talk: A Week of the World's Business. 1.0 a.m., The Purloin Band Programme. 1.30 a.m., Intervoven Entertainers. 2.0 a.m., Packard Programme. 2.30 a.m., Programme by the Seven-Eleven Dance Orchestra. 3.0 a.m., Longina Time. 3.1 a.m., The Pittsburgh Period. 4.0 a.m., Champion Weather Reports. 4.5 a.m., Messages to Commander Byrd. 5.0 a.m. (approx.), Close Down.

POSEN (336 metres); 1.5 kW.—5.50, Miscellaneous Items. 6.15, Violin Recital: Allegretto grazioso (Schubert); Resignation (Sinigaglia); Chanson polonaise (Wieniavsky); Romance (D'Ambrosio); Dance No. 2 (Dvorak-Kreisler); Mazurka (Mlynarsky). 6.45, Programme for Women. 7.0, "Der Orloff"; Operetta (Grauichsträden) from the Theatre at Bydgoszcz. In the Intervals: Cinema and Theatre Review and News. 10.0, Time Signal and News. 10.20, Musical Interlude. 11.0, Orchestral Concert. 1.0 a.m. (approx.) (Sunday), Close Down.

PRAGUE (343.2 metres); 5 kW.—4.50, Agricultural Report. 5.0, German Transmission: News and Dialogue. 6.0, Chimes and Wireless Notes. 6.15, Wireless Review. 7.40, Programme from Brünn. 9.0, Time Signal, News and Theatre Notes. 9.25, Programme from Brünn. 10.0, Chimes and Close Down.

ROME, Call IRO (443.8 metres); 3 kW.—7.30, Giornale parlato, followed by Review of the Press. 7.45, Military Band Concert: Marcia solenne (Palombi); Symphonic Poem, Finlandia (Sibelius); Frate Sole: I voti di Santa Chiara (Mancinelli); Ero e Leandro (Mancinelli); "La Signora non c'è"; One-Act Comedy (Manzini); Suite, La Città eterna (Mascagni); Review of Art and Literature by Lucio D'Ambra; Prelude to Suite No. 6 (Chopin); Military March, La Felicitissima (Grenet). 9.50, Giornale parlato, News and Close Down.

STUTTIGART (374.1 metres); 4 kW.—2.0, Orchestral Concert: Overture to The Bohemian Girl (Balfe); Der Frühling naht mit Brausen (Mendelssohn); Es brechen in schallender Reigen (Mendelssohn); O Jugend, wie bist du so schön (Abt); Gute Nacht, du mein herziges Kind (Abt); Lyrical Suite (Grieg); Songs, (a) Da unten im Taß (Brahms), (b) Schwesterlein (Brahms); Song without Words (Mendelssohn); Songs (Schumann), (a) Die Lotusblume, (b) An den Sonnenschein; Songs (Fielitz), (a) Die Rosen blühen, (b) Schön Gretlein; Improvisation (Schubert). 3.30, The Dansant, relayed from the Pavillon Excelsior. 5.0, Time Signal, Weather Report and Sports Notes. 5.15, Talk: The Serious and the Lighter Side of Parliament, relayed from Freiburg (577 metres). 5.45, Lesson in Book-keeping. 6.15, Curt Elvesspöck reads Sketches by Heinz Liepmann. 6.45, Time Signal and Weather Report. 7.0, "Rigoleto," Opera (Verdi), relayed from the Württ. Landestheater, Stuttgart. 9.30, News, followed by Concert: Zither Duet, Fantasia in B Flat Major (Haustein); Concerto in F Major (Pugh); Cornet à piston Solo, Fantasia in E Flat Minor (Grossmann); Guitar Solos, (a) Minuet (Ferd. Sor), (b) Andante (Haydn), (c) Etude (Albert); Sonata in F Major (Grünwald); Cornet Solo, Character Piece, Der alte Dessauer (arr. Stegmann); Concerto in E Minor (Haustein); Guitar and Zither Solo, Rhapsody on Von meinen Bergen muss ich scheiden (Haustein), followed by "Unterwelt"; Revue.

VIENNA (519.9 metres); 15 kW.—3.0, Orchestral Concert: Overture to Zampa (Hérold); Waltz, Badner Madln (Komzak); Selection from Madame Butterfly (Puccini); Waltz, Muted Strings (Uhl); Tango, Du trautes Ilsetal (Uhl); A Song from Hawaii (Boldini); Schon ist der Mai in Vorderindien, Fox-trot (Fall); Suite from Die Lotusblume (Rechtenwald); Potpourri, Hallo, Hallo! hier Wien (Morena); Song, Das Lanner-Haus (Silber); March, Enzian und Edelweiss (Silber). 4.30, Recital of Fairy Tales. 5.0, Talk: The Literature of the Renaissance. 5.30, Topical Talk. 6.0, Chamber Music: String Quartet in C Major (Raimund); Quartet in E Flat Major, Op. 47 (Schumann). 7.0, Time Signal and Weather Report. 7.5, "Chance and Co." Folk-Play in Six Fairy Scenes, followed by Phototelegraphy Transmission.

WARSAW (1385.7 metres); 10 kW.—4.55, Programme for Children. 5.50, Miscellaneous Items. 6.10, Wireless Review. 6.35, News and Time Signal. 7.0, Prof. Niewiadomsky, Talk: The History of Polish Music. 7.30, Concert; In the Interval: Theatre Notes. After the Programme, Aviation Notes, Weather Report, Police Announcements and Sports Notes. 8.30, Dance Music from the Hotel Bristol. 10.30 (approx.), Close Down.

SUNDAY, APRIL 14th.

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Programmes from Abroad.—

BARCELONA (Radio Barcelona), Call EAJI (350.5 metres); 1.5 kW.—11.0 a.m., Chimes, relayed from Barcelona Cathedral. 11.5 a.m., Weather Report and Forecast for Europe and North-East Spain and Report on Aerial Route Conditions. 1.30, Programme of Trio Selections. 2.45 to 6.0, No Transmission. 6.0, Weekly Bulletin of Grain and Cattle Market Prices. 6.10, Dance Music Selections by the Station Orchestra. 6.30, Song Recital. 7.0, Weekly Agricultural Lecture, arranged by the San Isidro Catalan Institute for Agriculture. 7.20, Selections by the Station Orchestra: Selections from I Pagliacci, Opera (Leoncavallo). 7.50, Recital of Vocal Music. 8.20, Programme by the Station Orchestra. 8.40, Sports Chronicle. 9.0 (approx.), Close Down.

BERGEN (365.9 metres); 1.5 kW.—9.30 a.m., Relay of Morning Service. 11.30 a.m., Meteorological Report and General News and Announcements. 7.0, Concert of Orchestral Music. 7.50, Talk: Topics of To-day. 8.0, Recital of Songs, by the Operatic Singer, Sigurd Hoff: Februaarmorgen ved Golfen (Alnaes). 9.0, Weather Conditions and Forecast, followed by Late News and Announcements and Time Signal. 9.15, Dance Music Programme. 11.0 (approx.), Close Down.

BERLIN (Königswusterhausen) (1,649 metres); 40 kW.—7.55 a.m., Church Chimes, relayed from the Garrison Church at Potsdam. 8.0 a.m., Morning Festival of Religious Music: Vocal and Instrumental Items and Address, from Voxhaus, followed by Relay of Chimes from Berlin Cathedral. 10.30 a.m., Musical Selections. 12.15, Talk for Chess Players by E. Nebermann. 12.45 to 1.15, Experimental Picture Transmission. 1.30 to 2.30, Three Agricultural Talks. 2.30, Reading of Fairy Tales. 3.30, Musical Selections. 7.0 (approx.), Musical or Dramatic Programme, followed by General News Bulletin and Programme of Dance Music. 11.30 (approx.), Close Down.

BERLIN (Voxhaus) (475.4 metres); 4 kW.—7.55 a.m., Chimes, relayed from the Potsdam Garrison Church. 8.0 a.m., Morning Festival of Sacred Music with Sermon and Vocal and Instrumental Numbers, followed by Chimes relayed from the Cathedral. 10.30 a.m., Musical Programme. 12.15, Talk on Chess, by E. Nebermann. 1.30, Agricultural Communications and Practical Information. 1.45, Weekly Survey of Market Prices and Weather Conditions and Forecast. 1.55, Talk on an Agricultural Topic. 2.30, Reading of Fairy Stories. 3.30, Concert of Orchestral Music. 7.0 (approx.), Concert or Play, followed by Time, Weather Report and Forecast, Late News and Announcements, Sports Chronicle and Results and Dance Music Programme. 11.30 (approx.), Close Down.

BERN (406 metres); 1.5 kW.—9.30 a.m. to 10.30 a.m., Protestant Sermon. 12.0 Noon, Time Signal and Weather Conditions and Forecast. 12.5, Concert of Popular Music. 2.0, Relay of the International Football Match, Hungary v. Switzerland, from the Wankdorf Stadium in Bern. 6.29, Time Signal and Meteorological Report. 6.30, Talk. 7.0, Concert or Play. 9.0 (approx.), General News Bulletin, Weather Conditions and Forecast and Concert by the Kursaal Orchestra. 9.40 (approx.), Close Down.

BRUSSELS (511.9 metres); 1.5 kW.—7.30 a.m., Every Hour Transmissions for Pigeon Fanciers and Information regarding Pigeon Flights at Quiévrain, Sobres sur Sambre, Moinigny, Noyon, Arras and Breteuil. 6.0, Programme for Children, arranged by the Children's Theatre, under the direction of Léon Leroy with the collaboration of the Clowns, Bonzo and Sylva. 6.30, Concert by the Station Trio. 7.30, "La Radio Chronique." 8.15, Programme by the Orchestra of the Station. 10.15, Latest Press News and Announcements. 11.0 (approx.), Close Down.

COLOGNE (263.2 metres); 4 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Langenberg (462.2 metres) and Münster (267.8 metres).—6.45 a.m., Self Defence Lesson by Doctor L. Bach. 7.5 a.m., Lesson in German Shorthand. 7.25 a.m. to 7.55 a.m., Esperanto Lesson and Review of Forthcoming Programmes in Esperanto by Alfred Dormanns. 8.5 a.m. to 9.0 a.m., Morning Festival of Soloist and Choral Music with Address. 12.0 Noon, Concert of Popular Music conducted by Eysoldt. 1.30, Literary Talk. 1.50, Talk for Chess Players. 2.15 (approx.), Talk. 2.40, Talk by Doctor Ludwig Mathar: Spring Travels through the less-known parts of Italy. 3.5 (approx.), Talk. 3.30, Concert of Popular Music. 5.0, Talk. 7.0, Musical or Dramatic Programme followed by Late News Bulletin, Sports Intelligence and Orchestral Selections and Dance Music Programme. 11.0 (approx.), Close Down.

CORK, Call 6CK (222 metres); 1.5 kW.—8.30 to 11.0, Recital of Vocal and Instrumental Music, Songs for Contralto rendered by Mabel Home. 11.0, National Anthem followed by Weather Conditions and Forecast. 11.15 (approx.), Close Down.

CRACOW (314.1 metres); 1.5 kW.—9.15 a.m. to 10.45 a.m., Divine Service relayed from a Cathedral. 10.56 a.m., Fanfare relayed from the Church of Notre Dame, followed by Time Signal. 11.5 a.m., Weather Report and Forecast. 11.10 a.m., Musical Programme. 1.0 and 1.20, Agricultural Talks. 1.40, Agricultural Bulletin by Mr. Wasniewsky. 2.0, Meteorological Report. 2.15, Concert by the Philharmonic Orchestra relayed from Warsaw. 4.30, Talk. 5.20, Popular Programme relayed from Warsaw. 6.0, Various Items. 6.56, Time Signal relayed from the Observatory. 7.0, Fanfare from the Church of Notre Dame followed by Sports Results. 7.30, Programme of Vocal and Instrumental Music from the Operatic Works of Ladislas Zelinsky: The First Act of Jeannot, Opera, rendered by Soloists and a Male Vocal Trio. Followed by News and Announcements and Light Music relayed from Warsaw.

DUBLIN, Call 2RN (411 metres); 1.5 kW.—8.30 to 11.0, Vocal and Instrumental Concert relayed from Cork. 9.25, Pianoforte Quintet in A Minor Op. 84 (Elgar), rendered by W. E. Brady's Quintet. 11.0, National Anthem and Weather Report and Forecast. 11.15 (approx.), Close Down.

GENOA, Call IGE (366.9 metres); 1.2 kW.—4.0, Relay of Concert. 7.0, Opening Signal followed by "Il Radiogiornale." 7.25, General News Bulletin from the Stefani Agency and Sports Intelligence. 7.30, Official Wireless Announcements. 7.35 (approx.), Talk by Leandro Vaccari: The Day's Events in Sport. 7.40, Programme of Vocal and Instrumental Music by the Station Orchestra conducted by Fortunato Russo: Soprano Solo, Regnava nel silenzio from Lucia di Lammermoor—Opera (Donizetti) rendered by Isa Del Gamba. 9.45 (approx.), Late News and Announcements from the "Giornale di Genova" and Close Down.

HAMBURG, Call HA (in Morse) (392 metres); 4 kW.—Programme relayed by Bremen (273 metres), Flensburg (219 metres), Hanover (566 metres) and Kiel (250 metres).—7.20 a.m., Ice Report. 7.35 a.m. (approx.), Meteorological Report. 7.40 a.m., Talk on Problems of Contemporary Economics. 8.0 a.m., Talk. 8.15 a.m., Morning Festival. 11.55 a.m., Nauen International Time Signal. 12.5 (For Hamburg, Kiel and Flensburg), Concert by the Wireless Orchestra. 12.5 (For Hanover), Selection of Gramophone Records. 12.5 (For Bremen), Morning Concert by the Station Orchestra. 1.0, Entertainment for Children by Funkeheinzmann. 3.0, Concert of Orchestral Music. 6.0, Talk. 10.50 (For Bremen, Flensburg, Hamburg and Kiel), Weather Report and Forecast for North Sea and Baltic. 11.0 (approx.), Close Down.

HILVERSUM (1,071 metres); 5 kW.—11.40 a.m., Talk: How to play Bridge. 12.10, Lunch-time Music by the Wireless Orchestra, conducted by Nico Treep. 1.40, Talk: Dramatic Criticism. 2.10, Musical Selections. 3.40, Gramophone Records. Sports Notes in the interval. 7.40, Time Signal and General News Bulletin. 7.55, Orchestral Concert. 8.55, Pianoforte Recital by Theo van der Pas. 11.10 (approx.), Close Down.

HUIZEN (336.3 metres); 4 kW.—Transmits from 5.40 to 1.52 metres.—8.5 a.m., Church Service and Sermon. 9.30 a.m., Morning Service Relay. 12.10, Concert by the Station Trio. 5.30, Church Service (on 1,852 metres), relayed from the Groote Kerk at Apeldoorn: Preacher, G. Bolikstein. Organist, Corn. Wevers. Organ and Choral Items. 7.10, Talk. 7.55 (approx.), Concert of Vocal and Instrumental Music. 9.10, General News Bulletin. 10.25, Epilogue by the Choir, conducted by Mr. Jos. Pickkers. 10.40 (approx.), Close Down.

KALUNDBORG (1,153 metres); 7 kW.—Programme also for Copenhagen (339.8 metres).—9.0 a.m., Relay of Church Service from Copenhagen. 10.30 a.m. to 10.40 a.m. (Kalundborg only), Weather Conditions and Forecast from the Meteorological Institute at Copenhagen. 11.0 a.m., Time Signal and Chimes. 11.5 a.m., General News Bulletin. 12.0 Noon, German Language Lesson. 12.30, French Language Lesson. 5.50 (Kalundborg only), Weather Report and Forecast from the Meteorological Institute at Copenhagen. 6.0, General News Bulletin. 6.15, Time Signal.

6.16, Sports Intelligence. 6.25, Talk. 6.55, Introductory Talk followed by "The Merry Widow"—Musical Comedy in Three Acts (Lehár) relayed from the Casino.

KATTOWITZ (416.1 metres); 10 kW.—9.15 a.m., Church Service Relay. 10.56 a.m., Time Signal, followed by Weather Report and Forecast. 11.10 a.m., Concert of Orchestral Music. 1.0, Talk by W. Wlosik: The Silesian Gardener. 1.20 and 1.40, Agricultural Talks. 2.0, Meteorological Report. 6.0, Miscellaneous Communications. 6.20, Half-an-Hour of Humour by Prof. St. Ligon. 6.56, Time Signal. 7.0, Biological Talk by M. Nubberg. 7.30, Popular Concert. 9.0, Meteorological Report, Press News and Announcements and Sports Intelligence. 11.0 (approx.), Close Down.

KÖNIGSBERG (230.4 metres); 4 kW.—Programme relayed by Danzig (455.1 metres). 8.0 a.m., Morning Festival of Church Music with Sermon. 9.56 a.m. (Danzig only), Weather Conditions and Forecast. 10.0 a.m. (Königsberg only), Weather Report and Forecast. 10.30 a.m., Concert of Orchestral Music. 10.55 a.m., Nauen International Time Signal. 12.0 Noon, Musical Selections. 5.35 (approx.), Talk on a Political Subject. 7.0, Relay of "The Faithful Peasant"—Opera in a Prelude and Two Acts by Victor Léon. Producer, Kurt Lesing; Conductor, Karl Hrubetz; followed by Late News and Announcements and Sports Intelligence. 9.30, Programme of Dance Music.

LAHTI (1,522.8 metres); 35 kW.—Programme also for Helsingfors (375 metres).—7.0 a.m., Relay of Morning Service in Finnish. 9.50 a.m., News and Announcements. 10.5 a.m., Musical Programme. 10.50 a.m., Weather Report and Forecast, followed by Time Signal. 11.0 a.m., Relay of Church Service in Swedish. 3.0, Programme of Popular Music by the Wireless Orchestra, conducted by Erkki Linko. 4.30, Talk. 4.57, Time Signal and Meteorological Report. 7.30, Selections by the Wireless Orchestra: Overture to Semiramis—Opera (Rossini). 7.45, Late News and Announcements in the Finnish and Swedish Languages. 8.15 (approx.), Close Down.

LANGENBERG (462.2 metres); 20 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Cologne (267.2 metres) and Münster (267.8 metres).—6.45 a.m., Lesson in Self-Defence. 7.5 a.m., German Shorthand Lesson by Hans Molitor. 7.25 a.m., Lesson in Esperanto. 7.45 a.m., Survey in Esperanto of Programmes of the Week. 8.5 a.m. to 9.0 a.m., Religious Morning Festival with Sermon and Soloist and Choral Items. 12.0 Noon, Concert of Light Music conducted by Eysoldt. 1.30, Talk on Literature by Arnold Stecher. 1.50, Talk on Chess by Doctor A. van Niss. 2.15 (approx.), Talk. 3.5 (approx.), Talk. 3.30, Musical Selections. 5.0, Talk. 7.0, Relay of "Czar and Carpenter": Opéra-comique in Three Acts (G. A. Lortzing), produced by Anheisser. Followed by Late News and Announcements, Sports Notes and Programme of Light and Dance Music. 11.0 (approx.), Close Down.

LEIPZIG (361.9 metres); 4 kW.—Programme relayed by Dresden (317.1 metres).—7.30 a.m., Recital of Organ Music from a Church in Leipzig. 8.0 a.m., Morning Festival of Vocal and Instrumental Music. 10.0 a.m., Talk. 10.30 a.m., Talk. 11.0 a.m., Concert. 12.0 Noon and 12.30, Agricultural Talks. 1.0, Review of the Foreign Press. 2.0, Musical Selections. 4.30, Relay from the Dresden State Opera House of "The Mastersingers of Nuremberg": Opera in Three Acts (Wagner). Followed by Time Signal, General News Bulletin, Sports Intelligence and Dance Music Programme. 11.30 (approx.), Close Down.

LYONS (Radio Lyon) (291 metres); 1.5 kW.—11.0 a.m., Concert of Orchestral Music: Selections from Die Fledermaus: Opera (Strauss). 6.30, "Le Journal parlé" including News and Announcements from the Press, Review of Entertainments and Agricultural Chronicle. 7.0, Concert of Vocal and Instrumental Music.

MADRID (Union Radio), Call EAJ7 (426.7 metres); 3 kW.—2.0, Chimes Relay followed by Time Signal. 2.5, Programme by the Station Orchestra. 3.30 to 7.0, No Transmission. 7.0, Chimes Relay followed by Programme of Dance Music. 8.30 to 10.0, No Transmission. 10.0, Chimes relayed from the Gobernación and Time Signal. 10.5, Concert of Popular Music by the Orchestra of the Station, Prelude: La fille aux cheveux de lin (Debussy). 10.30, Selections of Band Music relayed from the Hotel Nacional. 12.0 Midnight, Relay of Chimes. 12.5 a.m. (Monday), Continuation of the Concert. 12.30 a.m. (approx.), Close Down.

MILAN, 1MI (504.2 metres); 7 kW.—9.0 a.m., Opening Signal followed by Lesson in English. 9.30 a.m., Interpretation of the Gospel. 9.40 a.m., Concert of Vocal and Instrumental Religious Music. 11.30

Programmes from Abroad.—

Sunday, April 14th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

a.m., Time Signal. 11.32 a.m., Musical Programme by the Station Quartet. 12.30 to 3.0. No Transmission. 3.0, Opening Signal. 3.2, Comedy relayed from the Arcimboldi Theatre. 3.45, Concert of Popular Music by the Station Quintet and Soloists: Quintet Selection, Peer Gynt Suite, No. 1 (Grieg). 7.30, Opening Signal. 7.31, Official Wireless Announcements. 7.40, Lecture by C. A. Blanche on a Historical Theme. 8.0, Relay of an Opera from the Scala Theatre. In the intervals: Town and Country. Talk by Ulderico Tegani. Sports Intelligence and Late News Bulletin from the Stefani Agency. 10.30 (approx.), Close Down.

MOTALA (1,351 metres) : 30 kW.—Programme also for Stockholm (438 metres), Boden (1,200 metres), Göteborg (346.8 metres), Hörby (266.9 metres), Österlund (770 metres) and Sundsvall (515.5 metres).—10.0 a.m., Divine Service relayed from a Church in Stockholm. 3.30, Reading. 4.0, Programme for Children. 4.55, Chimes relayed from the Town Hall at Stockholm. 5.0, Relay of Evening Service. 6.45, Introductory Talk and Relay of "The Barber of Seville" (Opera (Rossini) from the Royal Opera House. 8.15, Late News and Announcements and Meteorological Report. 8.45, Musical Programme. 9.45 (approx.), Close Down.

MUNICH (536.7 metres) : 4 kW.—Programme relayed by Augsburg (566 metres), Kaiserstern (272.7 metres) and Nürnberg (240 metres).—10.0 a.m., Relay of Chimes from Munich Town Hall. 10.10 a.m., Transmission of Weather Chart for Bavaria. 12.5, Time, Weather Report and Forecast and Survey of Programmes of the Week. 3.0 (approx.), Musical Programme. 7.0, Das "Dorf ohne Glocke". Operetta in Three Acts (Eduard Künnecke); followed by Late News and Announcements.

NAPLES, Call INA (333 metres) : 1.5 kW.—8.30 a.m., French Language Lesson by Professor Etienne Verdier. 9.0 a.m., Programme of Religious Music. 3.45, Entertainment for Children. 4.0, Concert of Vocal and Instrumental Music. 4.30, Time Signal. 7.30, Official Wireless Announcements. 7.32, Il Radiogiornale. 7.50, Report of the Naples Harbour Authorities. 8.0, Time Signal. 8.2, Concert of Vocal and Orchestral Operatic Music and Recitations. Ecco ridento in cido from The Barber of Seville—Opera (Rossini) rendered by R. Rotondo (Tenor) with Orchestral accompaniment. In the interval, Prose and Verse Recitations from his repertoire by E. Murolo. 9.0, Sports Results. 9.55, Calendar and Review of Forthcoming Programmes. 10.0 (approx.), Close Down.

OSLO (496.7 metres) : 1.5 kW.—Programme relayed by Fredrikstad (397 metres), Hamar (577 metres), Notodden (297 metres), Porsgrund (455 metres) and Bjnkan (448 metres).—8.15, Weather Report and Forecast, followed by General News Bulletin. 6.30, Talk. 7.0, Time Signal. 7.2, Programme by the Orchestra of the Station, conducted by M. Hugo Kram. 8.30, Weather Report and Forecast and Press News and Announcements. 8.50 (approx.), Topical Talk by a Journalist.

PARIS (Ecole Supérieure), Call FPTT (458 metres) : 0.5 kW.—Programme relayed at intervals by the following stations: Bordeaux, PTT (275 metres), Eiffel Tower (1,485 metres), Grenoble (416 metres), Lille (267 metres), Limoges (296 metres), Lyons, PTT (473.2 metres), Marseilles (303 metres), Rennes (230 metres), Toulouse, PTT (269 metres).—7.0 a.m., Press News and Announcements and Time Signal. 8.25 a.m., International Time Signals and Meteorological Report. 12.30, Concert of Orchestral Music arranged by the General Association of French Wireless Amateurs. Selections from The Valkyrie—Opera (Wagner). 5.30, Wireless Economic Intelligence. 7.15, Talk. 7.30, Musical Programme by the General Association of Wireless Listeners, followed by Late News and Announcements, Time, Meteorological Report and Dance Music from the Coliseum de Paris. 12.0 Midnight, Close Down.

PARIS (Eiffel Tower), Call PL (1,485 metres) : 5 kW.—7.56 a.m., Time Signal on 32.5 metres. 9.28 a.m., Time Signal on 2,650 metres. 4.45, "Le Journal parlé," including Police Memoirs, Sports Intelligence and Results. 6.10, Weather Conditions and Forecast. 6.20, Dramatic Performance. 7.50, Time Signal on 32.5 metres. 10.28, Time Signal on 2,650 metres.

PARIS (Petit Parisien) (336.3 metres) : 0.5 kW.—7.45, Programme of Gramophone Records. 7.50, Talk. 7.55, Press News and Announcements. 8.0, Orchestral Concert with the collaboration of artists of the Opéra and the Opéra-comique. 8.25, General News Bulletin. 8.30, Programme of Symphony Music, conducted by M. Estlye, Professor at the Paris Conservatoire. 9.0, Late News and Announcements. 9.10, Programme of Symphony Music continued. Orient et Occident—March (Saint-Saëns). 10.0 (approx.), Close Down.

PARIS (Radio I.L.) (370 metres) : 1 kW.—11.30 a.m., Programme arranged by Radio Liberté, including General News and Announcements and Concert of Popular Music by the Charles Serignes Trio. 12.0 Noon, Carillon de Fontenay. 1.30, Communications and Announcements from "La Radio Agricole Française." 2.0, Programme of Dance Music offered by "Les Etablissements Radio LL." 8.0 (approx.), Concert. 9.0, Carillon de Fontenay. 9.15 (approx.), Close Down.

PARIS (Radio Paris), Call CFR (1,744 metres) : 15 kW.—7.0 a.m., General News and Announcements and Review of the Press. 7.30 a.m., Daily Physical Culture Lesson by Doctor Duffre. 11.0 a.m., Sermon by the Reverend Father Lhaude, followed by Recital of Sacred Music, with the collaboration of a Choir. 11.30 a.m., News and Announcements. 11.45 a.m., Programme of Dance Music by the Jazz du Grand Vatel Orchestra. In the interval, Humorous Interlude by Bilboquet. 3.30, Odéon, Selection of Gramophone Records, organised by "L'Industrie Musical." In the intervals, Press News and Announcements. 5.30, Pathe Half-Hour of Gramophone Music. 6.0, Agricultural Bulletin. 6.30, Press News and Announcements. 6.45, Radio-Paris Guignol. 7.30, Radio-Paris Café Concert. In the intervals, Press Review and Communications. 9.30 (approx.), Close Down.

PITTSBURGH, Call KDKA (63 and 27 metres) : 25 kW.—4.0, Sessions Clock Chimes. 4.1, Relay of Divine Service. 6.29, Telechron Time. 6.30, Allegheny County Memorial Park Programme. 7.0, Programme by the Roxy Symphony Concert, relayed from New York. 9.0, Recital of Organ Music by Dr. Charles Heinrich of the Carnegie Institute. 9.30, Programme by the McKinney Musicians, relayed from New York. 10.0, Relay of Evening Service from the Shadyside Presbyterian Church. 11.0, Telechron Time. 11.1, Orchestral Selections relayed from the William Penn Hotel. 11.30, Relay of Whittall Anglo-Persians Programme from New York. 12.0 Midnight, Sessions Clock Chimes. 12.1 a.m. (Monday), Divine Service relayed from the Calvary Protestant Episcopal Church. Pastor: E. J. Van Etten. 1.0 a.m., Enna Jettick Melodies relayed from New York. 1.15 a.m., Collier's Radio Hour relayed from New York. 2.15 a.m., Programme of the Utica Jubilee Singers relayed from New York. 2.45 a.m., El Tango Romantico relayed from New York. 3.15 a.m., Longines Time relayed from New York. 3.16 a.m., Champion Weather Reports. 3.20 (approx.), Close Down.

POSEN (336 metres) : 1.5 kW.—9.15 a.m. to 10.45 a.m., Relay of Morning Service. 11.10 a.m., Time Signal. 11.15 a.m. to 11.35 a.m., Two Agricultural Talks. 11.55 a.m., Lecture for Housewives. 4.30, Talk on Miscellaneous Subjects by Mr. Winiewicz. 4.50, Programme for Children. 5.20, Recital of Vocal Music. 6.0, Bulletin of the Catholic Association of Polish Youth. 6.45, Talk by Mr. B. Busiakiewicz: Silva rerum. 7.0, Jubilee Concert by Alexander Michalowski (Pianist) relayed from Posen University Hall: Programme from the Works of Chopin: Ballad in G Minor; Theatre and Cinesoa Programmes and News in the intervals. 9.0, Time Signal followed by Sports Intelligence. 9.20, Dance Music Selections relayed from the Café Wielkopolska. 11.0 (approx.), Close Down.

PRAGUE (343.2 metres) : 5 kW.—8.0 a.m., Morning Festival of Religious Music. 3.30, Concert of Light Music. 4.30, Programme for Workers: Talk. 5.0, News and Musical Programme for German Listeners. 6.0, Sports Intelligence. 7.0, Light Variety Programme. 9.0, Time Signal, and Late News and Announcements. 9.15, Notes on Forthcoming Theatre Programmes. 9.20, Concert of Popular Music. 10.0 (approx.), Chimes and Close Down.

RABAT, Call PTT (414 metres) : 2 kW.—12.30 to 2.0, Concert by the Station Orchestra. 4.0 to 5.0, Musical Programme. 8.0, Transmission of "Le Journal Parlé" containing General News and Announcements. 8.15, Retransmission of European Broadcasting Stations. 8.30, Concert of Vocal and Instrumental Music by the Station Orchestra: Two Dances, (a) Persian, (b) Egyptian (Ganne). In the interval at 9.30 (approx.), Sports Talk and Results. 10.30 (approx.), Retransmission of European Broadcasting Stations. 11.0 (approx.), Close Down.

ROME, Call IRO (443.3 metres) : 3 kW.—8.30 a.m., Opening Signal. 9.0 a.m. to 9.45 a.m., Recital of Religious Music with Vocal and Instrumental Items. 10.0 a.m., Transmission from the "Casa di Dante." Lecture on Il Purgatorio. 12.0 Noon, Opening Signal. 12.5 to 1.0, Programme by the Station Trio. 1.0 to 4.0, No Transmission. 4.0, Opening Signal. 4.5 to 5.30, Concert of Variety Music. 6.50, General News Bulletin and Agricultural Lecture. 7.15, Sports Chronicle and Various Communications. 7.29, Time Signal followed by Official Wireless Announcements. 7.45, Programme of Italian Opera: Relay of "Falstaff" (Opera (Verdi)). During the interval, Reading of a Short Story. 9.50, Late News and Announcements. 10.0 (approx.), Close Down.

SEVILLE (Union Radio), Call EAI5 (369.0 metres) : 2 kW.—2.0, Concert by the Wireless Orchestra followed by Gramophone Selections and Programme of Spanish Music. 3.0 to 9.30, No Transmission. 9.30, Concert of Popular Music by the Station Orchestra followed by Programme of Flamenco Songs and Dance Music. 11.30 (approx.), Close Down.

STAMBOUL (1,200 metres) : 5 kW.—5.0, Concert of Turkish Music. 6.45, Weather Conditions and Forecast followed by Time Signal. 7.0, Programme of Popular Music by the Wireless Orchestra. 8.30, Late News Bulletin. 9.45 (approx.), Close Down.

TOULOUSE (Radiophonie du Midi) (389.6 metres) : 8 kW.—11.45 a.m., Orchestral Concert. 12.0 Noon, Time Signal. 12.5, Concert (continued). 12.45, General News Bulletin from "Le Télégramme." "L'Express," and "Le Midi Socialiste." 1.0, Sermon. 7.0, Parisian Stock Exchange Quotations and Grain Market Prices and General News Bulletin from the Parisian Press. 7.30, Concert of Popular Music. 8.0, Time Signal. 8.1, Programme arranged by "L'Association des Commerçants Radio-électriciens du Midi." 9.15, News and Announcements from North Africa, followed by Late News Bulletin. 9.30 (approx.), Close Down.

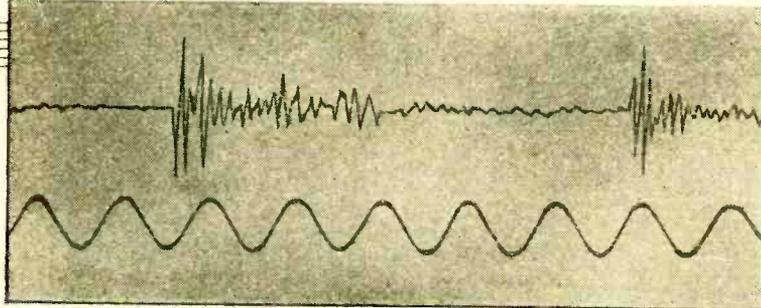
VIENNA (519.9 metres) : 15 kW.—Programme relayed by Graz (354.2 metres), Innsbruck (455.9 metres), Klagenfurt (455.9 metres) and Linz (250 metres).—9.20 a.m., Selections by the Viennese Boys' Choir, under the direction of Prof. H. Müller. 10.0 a.m., Programme of Light Music by the Viennese Symphony Orchestra. 3.0, Popular Concert. 7.0, Jubilee Concert of the First Viennese Mandolin Orchestral Society, conducted by Rudolf Schmidhuber, with the collaboration of Soloists and a Band of Wind Instruments: Toreador and Andalousian Dance from the Suite—Fancy Dress Ball (Rubinstein). 10.30 (approx.), Close Down.

VILNA (456 metres) : 1.5 kW.—9.15 a.m. to 10.50 a.m., Morning Service relayed from a Cathedral. 10.56 a.m., Time Signal, followed by Press News and Announcements relayed from Warsaw. 1.0 to 2.0, Three Agricultural Talks relayed from Warsaw. 2.0, Time Signal. 2.15, Programme by the Warsaw Philharmonic Orchestra. 4.30, Talk from Warsaw. 7.30, Relay of Concert from Warsaw. 9.0, Aerial Route Notes for Aviators and Weather Report and Forecast. 9.20, Police Announcements and Sports Intelligence. 11.0 (approx.), Close Down.

WARSAW (1,385.7 metres) : 10 kW.—9.15 a.m., Morning Service relayed from a Cathedral. 10.56 a.m., Time Signal and Fanfare relayed from the Church of Notre Dame at Cracow, followed by Aerial Route Notes for Aviators and Weather Conditions and Forecast. 11.10 a.m., Relay from the City Council Chamber of a Programme in Honour of the Tenth Anniversary of the Foundation of the Post Office Savings Bank. 1.0, 1.20 and 1.40, Talks for Agriculturists. 2.0, Weather Report and Forecast. 2.15, Orchestral Concert. 4.30, Talk on Polish Literature for Graduates. 5.20, Popular Programme of Music and Literature. 6.20, Talk. 6.45, General News Bulletin. 5.56, Time Signal. 7.0, Intellectual Amusements by C. Jablonovskv. 7.30, Concert of Popular Music, Theatre Notes in the intervals. In the interval at 8.0, Literary Programme. 9.0, Time Signal. 9.5, General News Bulletin, Notes for Aviators, Weather, Police Announcements and Sports Intelligence. 9.20, Concert of Light Music from a Restaurant. 10.30 (approx.), Close Down.

ZÜRICH (489.4 metres) : 1 kW.—10.0 a.m., Concert by the Station Orchestra. 11.28 a.m., Weather Conditions and Forecast. 11.30 a.m., Concert of Gramophone Records. 3.0, Concert by the Carletti Orchestra relayed from the Carlton-Elite Hotel. 6.30, Time Signal. 6.33, Sermon. 7.0, Edmund Eysler Programme. From "Bruder Straubinger" to "Die goldne Meisterin," by Soloists and the Station Orchestra, under the direction of the Composer. 9.0, Late News and Announcements supplied by the "Neue Züricher Zeitung."

TRANSIENTS alias "ATTACK"



Records of Output from Loud Speakers when Impulsed.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

(Concluded from page 348 of last week's issue.)

THE results of some of the tests, portrayed in all their gross grandeur in Figs. 7, 11, 13, 15, 16, 17, 18, 19, should prove of considerable interest, because they apply to every reader who uses a loud speaker for broadcast or other reproduction.

In Fig. 7 we have the transient waveform as registered for the well-known "Kone" type of loud speaker. Section (1) of the record occurred when the current through the loud speaker was *broken*, whereas section (2) was obtained when the current was *made*. Although the actual shapes are different in detail, the main, or overall, effect is substantially similar. The sine wave current shown on the record was for the purpose of obtaining a time base. Its frequency is 160 cycles per second, and from this it is possible to compute the main frequencies involved in the transient.

The transient at, say, "make" (Fig. 7 or 11) consists of two *salient* oscillations, (a) an oscillation of fairly high frequency superposed on (b) an oscillation of low frequency. This will be more readily understood when the action of the impulse is analysed. In Fig. 8 is sketched a damped sine wave of low frequency. When the current suddenly rises it drives the *reed* and the

diaphragm outwards. Then the current remains steady, but the diaphragm having overshot the mark, so to speak, comes back and starts oscillating to and fro

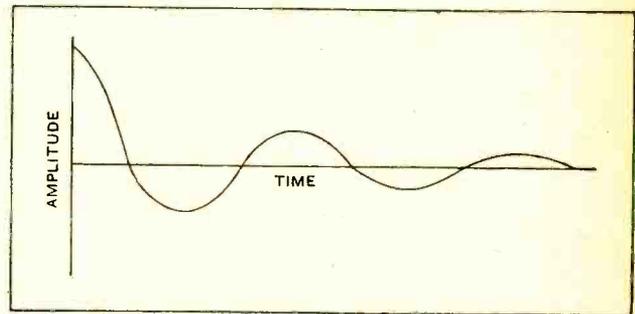


Fig. 8.—Diagram showing a damped sine wave. This corresponds roughly to the main lower frequency oscillation of the loud speaker.

until finally the oscillation is damped out due to the frictional and other losses in the system. Since the reed—in this case the driving agent—was severely jostled out of position on the initiation of the current, it oscillates at a frequency determined by its mechanical properties and size, together with a certain mass of diaphragm (not the whole of the diaphragm) which it drags about. This oscillation is indicated in Fig. 9. When the oscillations of Figs. 8 and 9 are combined the result is that shown in Fig. 10. By comparison with Fig. 10, the curve of Fig. 7 is irregular. This must be expected, since there are more than two frequencies, and the conditions of oscillation are extremely complicated.

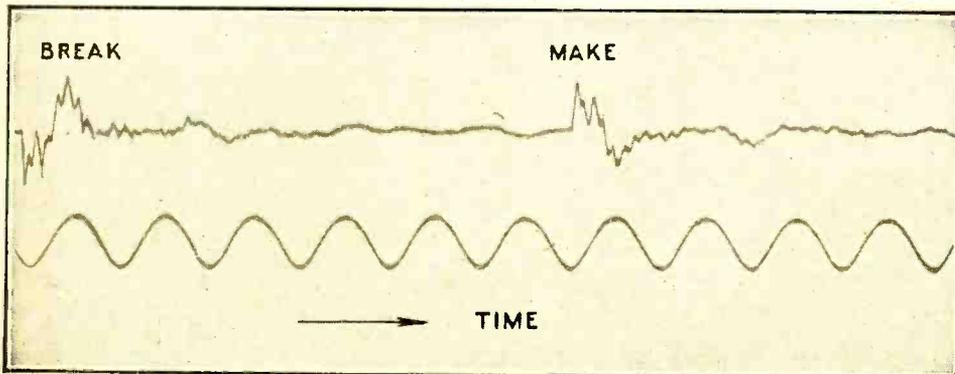


Fig. 7.—Acoustic output from "Kone" loud speaker when supplied with square-top input. Marking wave $f = 160$ cycles per second. Frequency of main diaphragm oscillation ≈ 180 cycles, and of main reed oscillation (plus part of diaphragm) $\approx 1,000$ cycles.

Transients alias "Attack."—

In Fig. 7 the frequency of the diaphragm oscillation is in the neighbourhood of 170 to 200 cycles, and that of

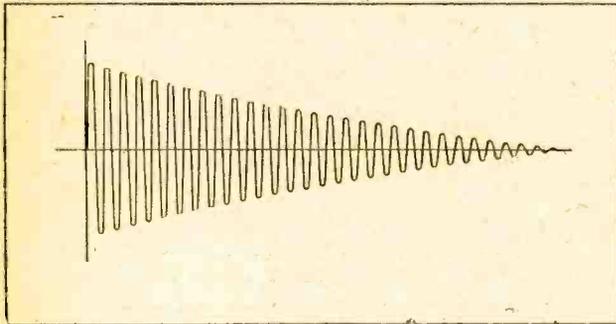


Fig. 9.—Showing higher frequency (damped) oscillation due to the reed plus part of the diaphragm.

the reed oscillation 800 to 1,000 cycles per second. The interval between make and break is 0.03 second, from which it is clear that the diaphragm oscillation is moderately damped.

By putting a suitable wooden enclosure behind the "Kone" loud speaker, the natural oscillations of the diaphragm were accentuated and prolonged as shown in Fig. 11.¹ The point of break was marred by chattering at the contact for about 1-15th the time interval between make and break, *i.e.*, 0.002 sec. Here the input from the microphone was taken to a step-up transformer before being applied to the input

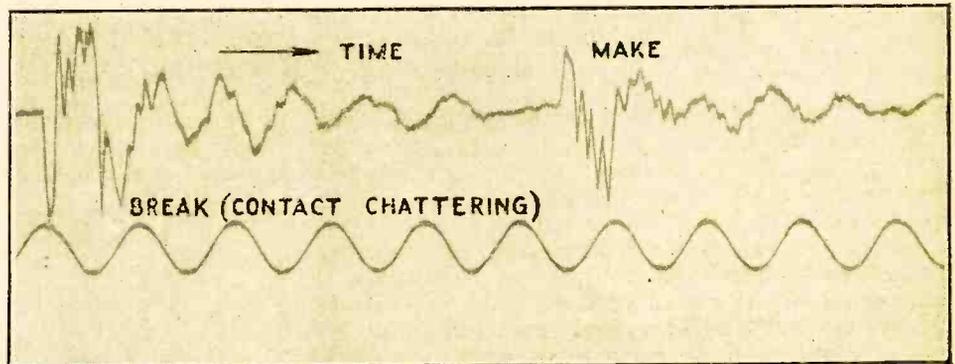


Fig. 11.—Showing effect of reinforcing lower diaphragm resonance of "Kone." The oscillation is much less damped than in Fig. 7. In this case the microphone input was a step-up transformer, and the output a choke-condenser combination to recorder as shown in Fig. 12.

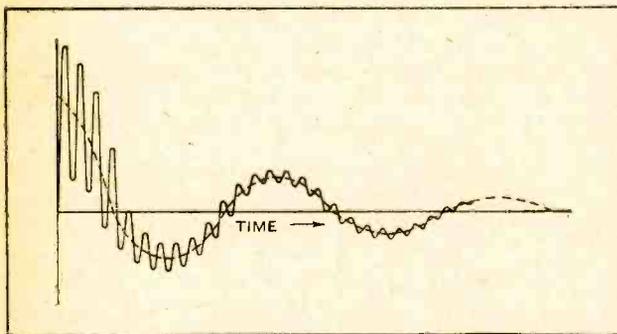


Fig. 10.—Diagram illustrating combination or superposition of the main diaphragm and reed oscillations of Figs. 8 and 9.

of the amplifier. The first valve of the latter was eliminated and only three stages used, since this gave adequate magnification.

Fig. 13 shows the effect of the square-topped transient upon a low resistance coil of 55 turns fixed to a conical diaphragm 9½ inches diameter. The coil was fed from

the impulsing valve by a transformer as shown in Fig. 14. The electromagnetic damping of the system is adequate to render the diaphragm when moving as a whole on its surround absolutely aperiodic.² The main low frequency diaphragm oscillation of 120 cycles (not the oscillation of the diaphragm on its surround, since this is about 10 per sec.) is heavily damped. The characteristics of the oscillation are similar to those depicted in Fig. 7. It is surprising to find a high frequency oscillation in the neighbourhood of 2,000 cycles per second, since there is no need to generate it. This oscillation is doubtless due to the effect of the neck of the coil acting as a spring or to some pronounced high "mode" of oscillation of the diaphragm.

As a contrast with this particular diaphragm we have in Fig. 15 the case of the Rice-Kellogg. Although the general shape of the transient is similar to those already

cited, the explanation of the effect is somewhat different. In this case we have a low frequency oscillation in the neighbourhood of 80 cycles—strictly speaking it is only possible to get an approximate idea of the frequency on any of the records, due to the irregularity of the curves. Upon this low frequency oscillation is superposed a higher frequency of about 700 cycles. The 80-cycle oscillation is the natural frequency of the diaphragm (moving as a whole) on its leather surround,³ whilst the

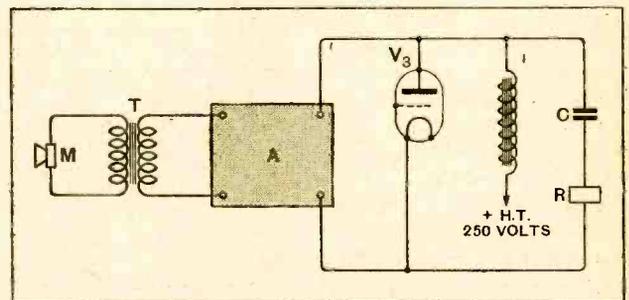


Fig. 12.—Diagram showing circuit arrangement of amplifier for Fig. 11.

² Transformer-coupled coils are aperiodic if the surround is not tight.

³ Although transformer coupling is used, the motion is not aperiodic owing to the stiffness of the surround.

¹ The actual frequency of the enclosure was not measured.

Transients alias "Attack."—

higher frequency probably corresponds to the first natural "mode" of oscillation of the diaphragm (which is only 6 inches diameter). There may be an oscillation at 5,000 cycles or thereabouts due to the coil neck, but it is invisible on the record. The distinction between the Rice-Kellogg and the coil drive of Fig. 13 is as follows:—

(1) The low-frequency oscillation of the Rice-Kellogg is due to the diaphragm moving as a whole on its surround, whereas in Fig. 13 the corresponding oscillation occurs where the diaphragm "breaks up" and vibrates segmentally like a bell.

(2) The higher Rice-Kellogg oscillation is probably the first "mode" of its diaphragm where it vibrates segmentally, whereas in Fig. 13 the corresponding oscillation is either due to the neck of the coil or to some higher diaphragm mode. Moreover, the high oscillation of the Rice-Kellogg is equivalent to the low oscillation of Fig. 13.

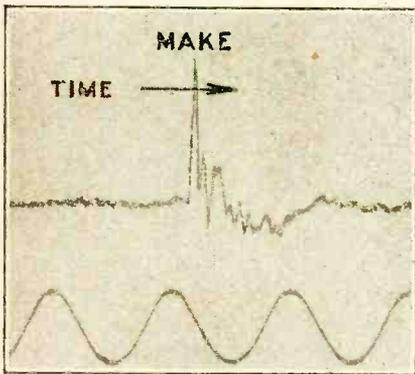


Fig. 13.—Acoustic output from transformer-coupled moving coil loud speaker with 55 turns 2 inches diameter. Diameter of cone 9/16 inches. There is a low-frequency oscillation of 120 cycles due to the first "mode" of the diaphragm, and a high-frequency oscillation of 2,000 cycles. There is no oscillation of the diaphragm as a whole on its support.

the result obtained with an ordinary desk type telephone earpiece with the usual flat stalloy diaphragm 2 inches in diameter. The damping is not really serious, and the natural oscillation of the diaphragm, whose frequency is 1,000 cycles per second, persists for quite a long time. When one's ear is pressed against the ebonite cap the damping is much greater, and the duration of the transient is correspondingly curtailed.

Results obtained from an experimental reed-type of speaker with large and very

⁴There is also the possibility of the centering device introducing a natural oscillation.

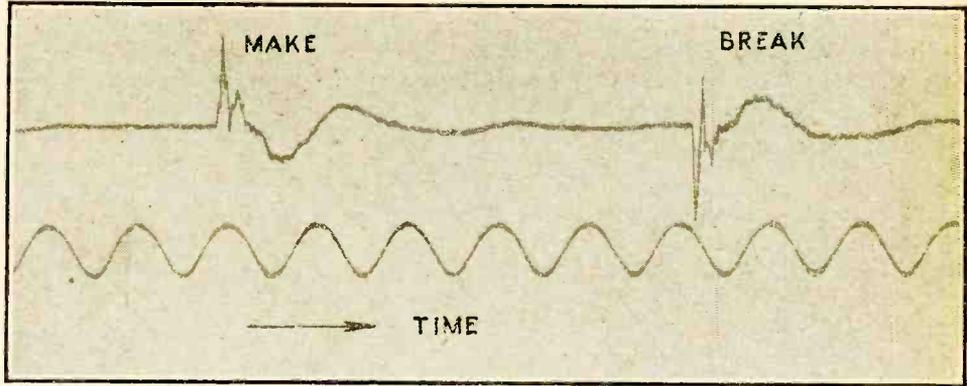


Fig. 15.—Acoustic output from Rice-Kellogg loud speaker with permanent magnet and 10 to 1 transformer due to square-topped waveform. The low-frequency oscillation of the diaphragm on its leather surround is about 80 cycles, and the high-frequency oscillation is just about 700 cycles. Although transformer coupling is used the motion of the coil is not aperiodic.

small diaphragms are shown in Figs. 17 and 18. The large diaphragm is heavily damped whilst the oscillation persists with the small one as would be expected by virtue of reduced losses.

In conclusion there are several points upon which we can comment in order to avoid misunderstanding.

the first "mode" of its diaphragm where it vibrates segmentally, whereas in Fig. 13 the corresponding oscillation is either due to the neck of the coil or to some higher diaphragm mode. Moreover, the high oscillation of the Rice-Kellogg is equivalent to the low oscillation of Fig. 13.

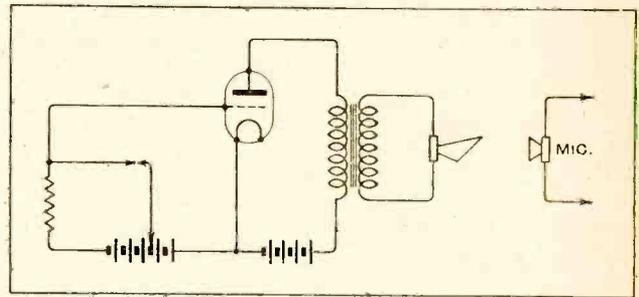


Fig. 14.—Arrangement of valve (L.S.5A.) and loud speaker for obtaining the record of Fig. 13.

In some of the records there is a persistent oscillation of higher frequency due to a slight interference. The records were taken with the microphone on the axis of the loud speaker fairly near to it. This would introduce errors due to alteration in the acoustic pressure distribution more particularly at the higher frequencies.

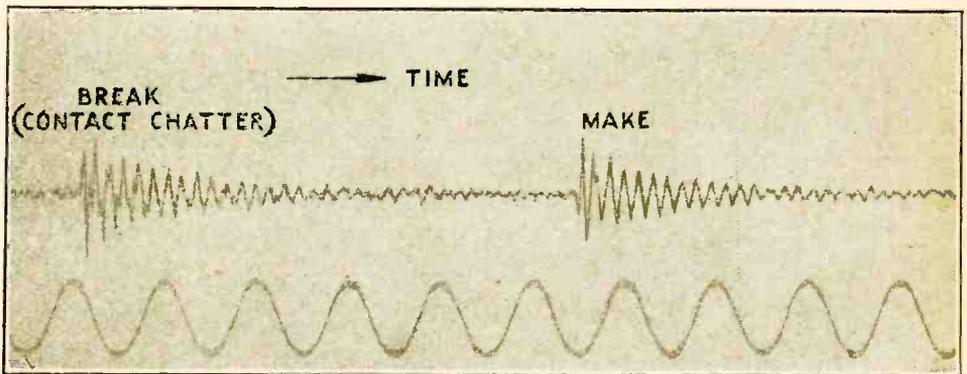


Fig. 16.—Acoustic output from desk type telephone with 2 inch stalloy diaphragm due to square-topped waveform. Break is marred for about three complete oscillations due to the relay contact chattering. Note that the oscillation persists practically the whole interval between make and break, i.e. 0.03 second. The frequency is about 1,000 cycles.

Transients alias "Attack."—

The apparatus was arranged in a draped enclosure so that the direct output from the speakers was secured as far as possible. In an ordinary room the transient waveform depends upon sound reflections from the walls, and this was avoided to show the output "straight from the horse's mouth." However, to illustrate room effect Fig. 19 has been added. It should be compared with the corresponding draped case shown in Fig. 15. The general shape

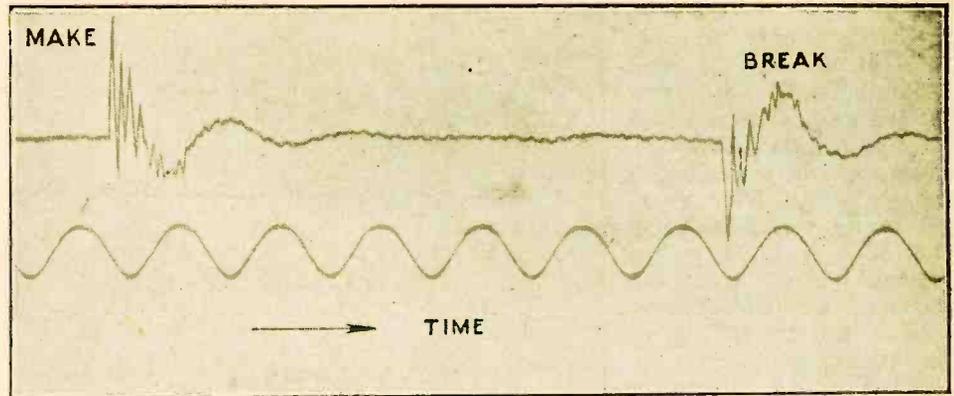


Fig. 17.—Acoustic output from experimental reed-driven loud speaker with large conical diaphragm. The main diaphragm oscillation persists for about two oscillations. Its frequency is about 100 cycles. The higher frequency is about 2,000 cyc.es.

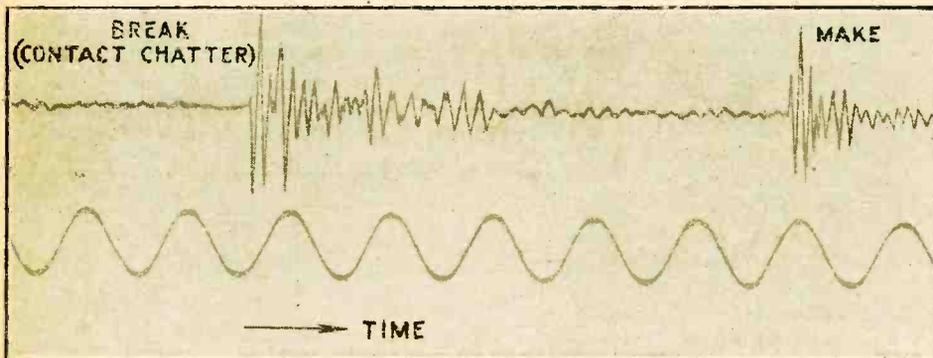


Fig. 18.—Acoustic output from experimental reed-drive with conical diaphragm 2 inches in diameter with nat circular paper surround 1 1/2 inches wide. There appear to be two oscillations superposed having frequencies of 1,000 and 500 cycles respectively. The damping is relatively small. The first three oscillations at break are marred by a chattering relay contact.

of the transients of Figs. 15 and 19 is similar. But in Fig. 19, where the speaker used with a baffle was open to the air, there is evidence that the oscillations of higher frequency are of greater amplitude. The shape of the transient will, of course, vary according to the position of the microphone in the room (relative to the loud speaker) and with the degree of room damping.

When a frequency in the neighbourhood of one of the natural oscillations of a system is suddenly applied to said system, the response is usually vigorous. For example, let the natural frequency of a loud speaker diaphragm be 200 cycles, and suppose we apply for a fraction of a second a current whose frequency is 200 cycles, the response would be relatively much greater than that to an equal current whose frequency was 1,000 cycles. Cases of this nature occur when loud speakers are used for broadcast or other reproduction, but they have been omitted from

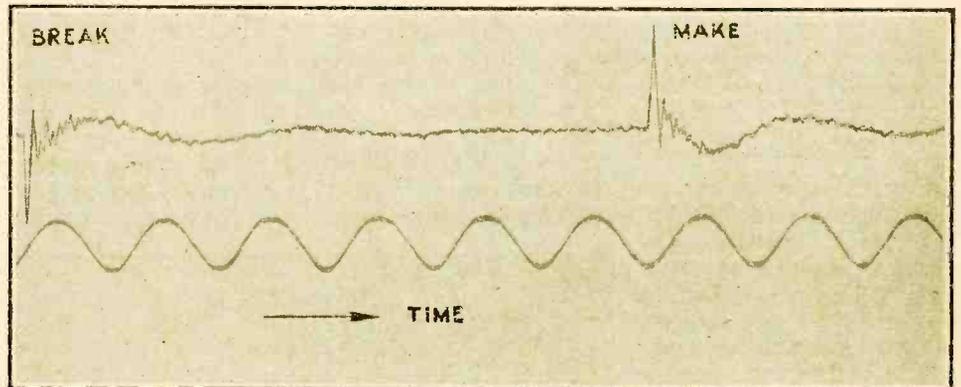


Fig. 19.—As in Fig. 15, but loud speaker in room without draping. The higher frequency components are now more prominent.

magnitudes, nor with the number of natural oscillations of a diaphragm, since our purpose was a general one, devoid of the minutiae which must enter when the problem is viewed with the precision requisite for quantitative analysis.

My object will have been achieved if the reader now realises the inherent defects of loud speaker diaphragms and the difficulties with which the designer has to contend.

the present contribution, so that the reader can see exactly what happens under certain severe conditions where the frequency of the applied impulse has no value in particular.

Moreover, although we may not appear to have attained a high degree of academic perfection, the records are adequate testimony to the results to be expected when sudden sounds are reproduced by loud speaker diaphragms.

We are not at the moment concerned with the relative

WIRELESS AND THE WEATHER.

The G. J. Symons Memorial Lecture of the Royal Meteorological Society on March 20th was delivered on the above subject by Mr. R. A. Watson Watt, Superintendent of the Radio Research Station, Slough.

WIRELESS AND WEATHER WARNINGS.—I.

IN the first section on wireless and weather warnings the lecturer reviewed the services rendered by radio communication to practical meteorology. Synoptic data for a whole hemisphere could be available within four or five hours of observation; data from ships in the Atlantic could be received in time; the broadcast nature of wireless was ideally suited for rapid and economical interchange of data over wide areas; aircraft generally, and long-range aircraft in particular, were dependent on a wireless organisation for effective action and safety.

The first two points were well exemplified by the Northern Hemisphere chart, issued from the Meteorological Office at 11 a.m. that day, containing 7 a.m. data from America and from the line of the Trans-Siberian Railway, as well as European and Atlantic observations. The annually increasing bulk of the Meteorological Office volume, "Weather Reports by Wireless Telegraphy," was an illustration of the third service referred to above.

In connection with the supply of meteorological information to aircraft (and others), a demonstration was given (in conjunction with British Wireless Pictures, Ltd.) of the transmission of a weather synoptic chart and of the printed "General Inference and Forecast" based on it. From a local transmitter in the lecture room a weather map for 1 p.m. that day was transmitted and reproduced on a Fultograph receiver which

was projected in operation by means of an epidiascope, so as to be visible on the screen. The audience was thus able to follow the development of the picture as it was received. During the course of the lecture a weather map and printed forecast were also received by wireless from the transmitter at the Royal Airship Works, Cardington. These were based on observations made at 6 p.m., and were displayed in the lecture room within little more than two hours of the time of the observations at the various meteorological stations.

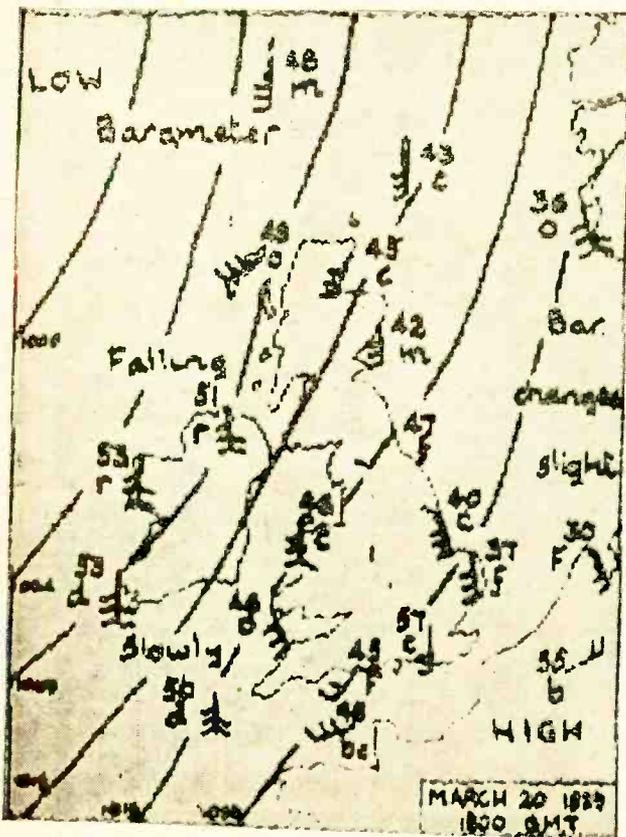
It was suggested by the lecturer that the air navigator could receive data and forecast matter in this manner, with the advantage of ready-drawn synoptic charts prepared with all the facilities of a ground station and with the accuracy and skill of a specialist in synoptic meteorology.

In connection with the demonstration, it was stated that actual broadcast transmissions of synoptic charts was likely shortly to be inaugurated.

Echoes and Reflections of Wireless Waves.

The lecturer then came to review the general relations of wireless signals to cosmic phenomena, both as regards propagation and atmospherics.

The effect of the upper layer in propagation was discussed. Long waves are returned from heights of about 75 km. by a process more resembling reflection from a poor mirror than refraction. Broadcast waves are returned by a process of more



GENERAL INFERENCE FROM OBSERVATIONS AT 1:00 GMT., MARCH 20 1929.

THE CONTINENTAL ANTICYCLONE IS PASSING AWAY SOUTHEASTWARD AND A LARGE DEPRESSION IS SPREADING IN FROM THE ATLANTIC. SOME RAIN OR DRIZZLE WILL OCCUR IN WESTERN AND NORTHERN DISTRICTS BUT IN THE SOUTHEAST THERE WILL BE LITTLE OR NONE FOR ANOTHER 24 HOURS.

FORECAST FOR SE ENGLAND TOMORROW

WIND SOUTH TO SOUTHWEST, LIGHT OR MODERATE. CLOUDY, LOCAL COASTAL FOG AND DRIZZLE. VERY MILD.

Weather synoptic chart and "general inference and forecast" received during the lecture by means of Fultograph picture-receiving apparatus.

Wireless and the Weather.—

gradual refraction from a height of about 100 km., by a layer of ionic density of about 10^5 electrons per cubic centimetre. Towards the end of the dark period they may proceed to a height of 220 km. before they find sufficient electrons to turn them back earthward.

The lecturer suggested that it was fair to assume that with a wide enough range of wavelengths it would be possible to measure the height at which selected ionic densities occur, and obtain data as to the gradient of ionisation up to hundreds of kilometres. It was probable that such soundings would give more detailed information as to the constitution of the atmosphere at great heights than would any other method.

A diagram correlating temperature, pressure, height, etc., with probable ionic densities was displayed during the address.

Echoes of short-wave signals were then dealt with. These are due to signals reaching the receiver by different paths round the earth, and also to signals which may have traversed the earth's circumference two or three times. Additional to these, however, there is the matter of long-period echoes reported last May by Störmer. These have been observed at periods of from 1 to 15 seconds after the initial signal. In explanation Störmer postulates a girdle of ions about the earth, in the form of a torus, generated by the revolution about the earth's magnetic axis of an oval tangential to that axis at the centre of the earth. He showed that electrons discharged from the sun would form such a torus under the action of the earth's magnetic field, and suggests that the long-delayed echoes are due to deflection from the earthward surface of this girdle. The most favourable configuration for reflection occurs with the sun on the plane of the earth's magnetic equator. Such echoes were first measured in October last year, when this configuration occurred. They were then lost, but Prof. E. V. Appleton has recently observed them again at the time when Störmer predicted their reappearance.

Turning to the matter of atmospherics, the lecturer reviewed the present position of knowledge as revealed by observations of atmospheric wave structure, directional recorder results, and observations on individual atmospherics, using the cathode-ray direction-finder system.¹

The Effect of Weather on Wireless.

The lecturer here reviewed the effects of weather phenomena on wireless. The first effect noted was that of atmospherics, and details were given of the correlation of experimental results with reported meteorological conditions.

Reviewing the information, the speaker was led to the following beliefs—that the great sources of the world's supply of atmospherics lie in the great thunderstorm areas, that the great majority of atmospherics in temperate latitudes come from considerable distances, and that he believed all atmospherics to originate in discharges of the same nature as lightning, although possibly no very large percentage may reach or be visible from the ground.

In connection with the effects of other weather phenomena on wireless, the lecturer quoted an early paper by Admiral of the Fleet Sir Henry Jackson. This was based on observations made chiefly in the Mediterranean, and it was concluded that when the south-westerly sirocco wind—laden with damp, and often charged with salt from spray, and with dust particles from the African coast—was prevalent, the maximum signal distance was generally less than in winds (wet or dry) from any other quarter. The proportional distance was about 60 to 80 per cent.

Austin had shown that long-wave signals over distances of about only 300 km. were weak when the air temperature along their path was high.

Observations at Lindenberg (Germany) had shown that surfaces of air discontinuity between sender and receiver diminished the received energy, while surfaces of discontinuity over the sender increased the received energy. In directional observations made by the German workers, systematic errors up to 10 degrees were observed and ascribed solely to the air conditions in each case, i.e., a discontinuity between the stations. The lecturer suggested, however, that the ordinary coil direction finder was not free from error due to downcoming waves, and

that the Adcock type of directional antenna² would be preferable, especially in conjunction with a cathode-ray indicator system.

The effects considered, however, offered prospects first of a rich field of investigation in geophysical relationships, and secondly of a possible useful addition to the equipment of practical meteorology.

Does Wireless Affect the Weather?

On the effect of wireless on weather, the lecturer was first inclined to the view similar to that of a passage immortalised by Dr. Johnson. This was to be found in a book (dated 1752) on the natural history of Iceland, where a chapter consisted of the statement, "Concerning snakes—there are no snakes to be met with throughout the whole island."

On second thoughts, however, he examined the vexed question that broadcasting had increased rainfall, and showed—by considerations of the thermal energy represented by one inch of rain—that the annual rainfall of the English countryside represented a third of a million horse-power per square mile, night and day throughout the year. The energy due to broadcasting was, during working hours, about $\frac{2}{3}$ horse-power for Great Britain, and $\frac{1}{10}$ horse-power per square mile for Europe. Artificial rain for a tennis court would, at a favourable electrical rate, cost £800 a year, while the B.B.C. spent only 3d. per year on transmitter power from London for each London licence holder, while the corresponding figure for all the B.B.C. stations was only 3d.

WIRELESS AND WEATHER WARNINGS.—II.

In this final section the lecturer dealt with the possibilities of utilising wireless phenomena in the service of meteorological forecasting.

The first application to present itself was thunderstorm detection and location. Close collaboration was necessary in determining the extent to which radiophysicists and meteorologists could interpret results of directional observations on this subject. How far could this great sounding range be used in the network of stations needed to give meteorological data for long air routes?

The Lindenberg work referred to might help in the location of surfaces of air discontinuity, and lead to inference of the nature of the intervening meteorological "fronts."

Lastly, samples of ionisation densities brought down by the electromagnetic "wave-gun" might be used to determine how meteorological phenomena are related to the electrical state of the upper layer.

After the lecture there was demonstrated a new form of cathode-ray direction finder, such as has been used for the directional work on individual atmospherics.

Whereas the first form of this system described by Messrs. Watson Watt and J. F. Herd³ utilised very large outdoor loops, the apparatus, now demonstrated in operation on signals and atmospherics, used frames of about 3ft. square, housed with all its amplifying gear in a room and entirely self-contained.

AERIAL CHAOS IN PARIS.

THE haphazard methods associated with broadcasting in France are not, apparently, confined to the transmitting side. The Paris municipal authorities are considering what action shall be taken in regard to listeners' aerials. According to our Paris contemporary *Radio Magazine*, the roofs of the city are disfigured in a lamentable fashion by all kinds of masts and wires, many of which are not even properly fixed, but sway about in an alarming manner with every gust of wind.

Owing to official laxity, listeners are becoming increasingly daring, and few hesitate to fling their aerials across the streets in pursuit of the elusive millivolt.

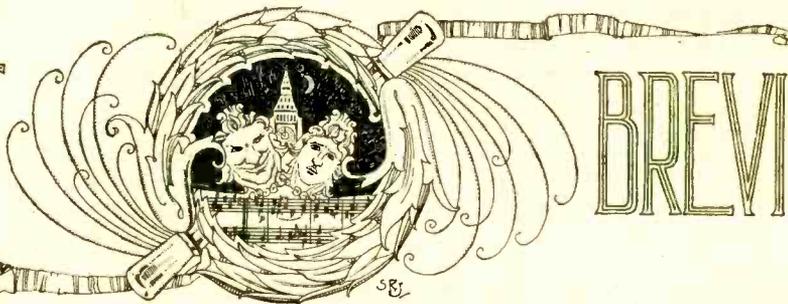
French listeners will have only themselves to thank if the heel of authority suddenly descends and provides them with a radio D.O.R.A.

² Cf. *Experimental Wireless*, February, 1928.

³ *The Wireless World*, March 10th, 1926, and *Experimental Wireless*, April, 1926.

¹ Cf. *Experimental Wireless*, November, 1928.

BROADCAST



BREVITIES

By Our Special Correspondent.

Television and the Regional Scheme.—A Reason for Anonymity?—Political Broadcasts.—Grand Opera Season.

Television from B.B.C. Stations.

Now that the Postmaster-General has decided to countenance the use of B.B.C. stations for television tests, the Baird company is confident that experiments can be started long before the opening of the Brookman's Park station in July.

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A Modified Regional Scheme.

By the way, if the twin wave regional type of station is found to be ideally suited to television broadcasts, will the original regional scheme be modified? And if so, what will Captain Eckersley have to say about it? The scheme which "P. P." has cherished for the last three years has the sole object of supplying alternative programmes. Will television queer the pitch? These are pertinent questions, the answers to which will be worth watching for in the next few months.

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Anonymous Actors.

If the B.B.C. were contemplating the establishment of a repertory company of broadcast actors an explanation would be afforded for the decision to conceal their names. The B.B.C. would, of course, realise that the regular appearance, night after night, of the same names on the programme sheet might provoke sordid insinuations from the multitude, who might go so far as to suggest that unwarrantable economies were being practised. Anonymity would therefore be the best policy.

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Variety of Talent Needed.

The main objection to a broadcast repertory company, if such were formed, is that the voice cannot be effectively disguised over the microphone; hence the B.B.C.'s dramatic work would fall into the same monotonous mould which has taken the soul out of many other programme features. The old familiar voices would be heard in "Hamlet" one week, and "Cinderella" the next. No doubt a repertory company would make the B.B.C. independent of the theatrical profession, at a cost comfortable to the B.B.C., but less comfortable to the listener. The B.B.C. should be able to afford variety of talent as well as of material.

Acquiescent Actors.

Actors are astonishingly silent in regard to the new *régime* of anonymity. A B.B.C. official assures me that not a single contract has been declined since the fiat went forth, which suggests that the traditional "hard-uppishness" of the profession has not diminished.

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Burnt Out.

A rumour that the Bradford relay station had been completely destroyed by fire caused some excitement at Savoy Hill a few days ago. Actually the damage amounted to a burnt-out coil.

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5-metre Artists.

According to the B.B.C., the first artists to broadcast across the Atlantic on the ultra-short wavelength of 5 metres are E. V. Ridgway and his partner, Frances Gayton, whose voices, it seems, went out recently from the amateur station, 5KI, owned by Mr. Charles Kidd, of Bristol, and were heard in America. They will repeat their "turn,"

a duologue, from Cardiff on Saturday next, April 13th.

Glasgow in London.

The effect of a 400-mile land line on a musical transmission will be nicely gauged by Glasgow listeners on Saturday next, April 13th, when they will hear their local lights, the famous "Glasgow Orpheus Choir," broadcasting from the Queen's Hall, London. This will be the choir's annual London concert, and it will be transmitted from all stations except 5GB.

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Broadcasting Grand Opera.

2LO and 5XX listeners will be able to "attend" the opening performance of the Grand Opera season at Covent Garden on April 22nd. They will hear Act I of Strauss's "Der Rosenkavalier." Several other excerpts will be broadcast during the season, some of them through 5GB.

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"Square Pegs."

Daventry 5GB is the station for "first nights" in radio drama.

"Square Pegs," a "polite satire" by Clifford Bax, which contrasts the love-making of the sixteenth century with that of to-day, will be heard by 5GB listeners on April 20th.

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Politics at the Microphone.

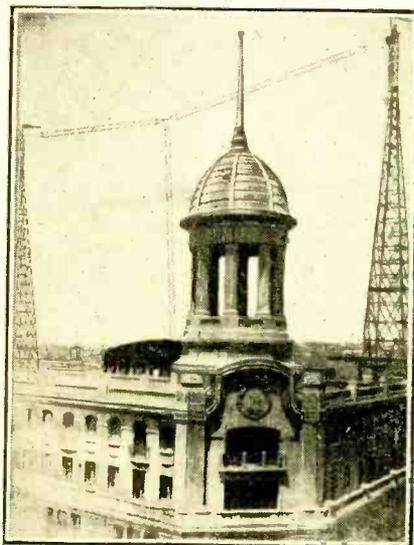
Whether we like it or not, arrangements have been concluded for a series of political broadcasts before the Dissolution of Parliament. The first political address in the broadcasting campaign was given on Monday last, when the Government standpoint was championed.

Further political broadcasts have been arranged, as follows:—

- April 11th.—Opposition (Labour).
- April 16th.—Government.
- April 19th.—Opposition (Liberal).
- April 22nd.—Government.
- April 25th.—Opposition (Labour).
- April 30th.—Government.
- May 3rd.—Opposition (Liberal).

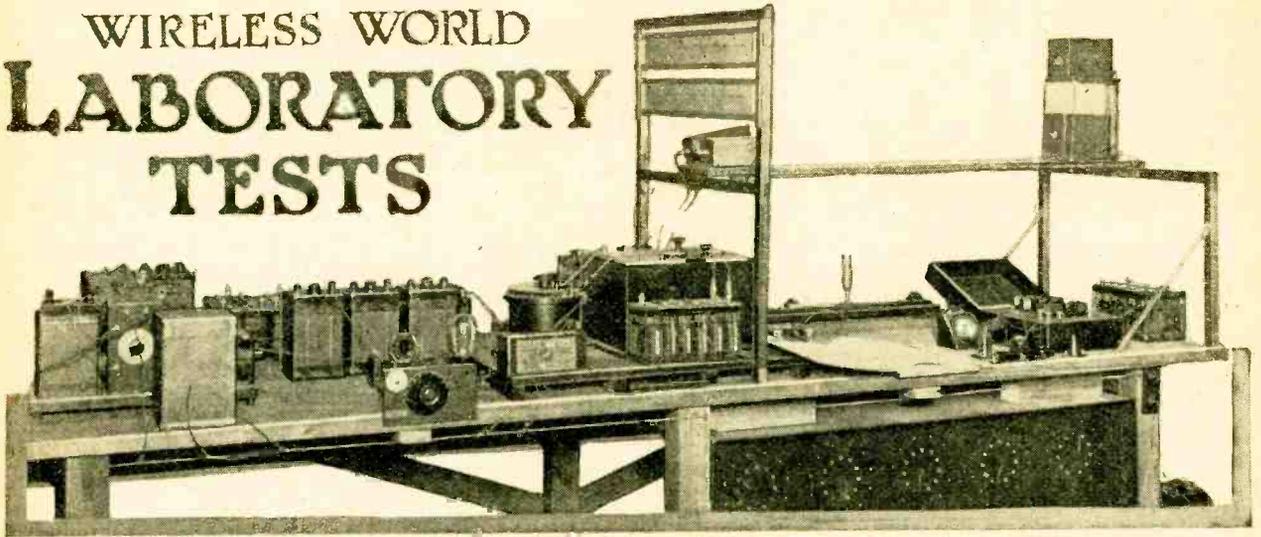
These addresses will be given at 9.15 p.m., half an hour being reserved on each occasion.

During the General Election period, following the precedent of 1924, one opportunity for a broadcast speech will be offered to each party.



"BROADCASTING HOUSE" OF SPAIN. Union Radio, Madrid (EAJ7), which can be heard nightly on about 425 metres.

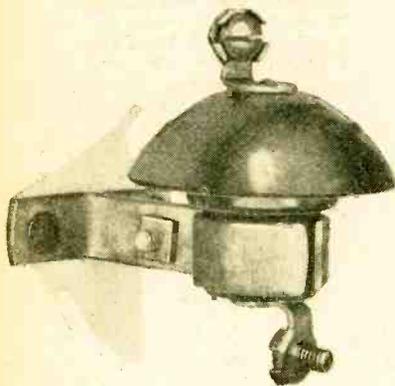
WIRELESS WORLD LABORATORY TESTS



A Review of Manufacturers' Recent Products.

WIRT LIGHTNING ARRESTER.

This accessory, which should be fitted by the bracket supplied on the wall outside the house, has been designed to give protection to the receiver in case of lightning. The aerial down-lead and lead to the set are connected to the terminal on top of the cowl, while the lower terminal



Wirt lightning arrester.

is joined to earth and to the earth terminal on the set.

The device consists of a bakelite moulded tube screwed into the under side of the cowl, which is a bakelite moulding also. Inside the tube is a safety gap consisting of a brass rod kept by spring tension firmly in contact with a small stud set in the centre of a brass cup containing a hard substance assumed to be heat-resisting material.

Should the aerial accumulate a charge due to the proximity of an electrical storm, it will jump the gap and find a direct path to earth. The price of this useful accessory is 7s. 6d., including wall bracket, and is obtainable from Messrs. E. R. Morton, Ltd., 117, Charlotte Street, London, W.1.

"QUINT" BIFLEX EARTH TUBE.

This earthing device is made from high-conductivity copper tube, 24in. long and 1in. in diameter. To impart extra rigidity, longitudinal flutes have been stamped in the sides of the tube for a short distance at each end, and this should help to counteract any tendency to buckle when being driven into hard soil.

Although the top of the tube is further reinforced by a stout metal ring, it would be advisable, when driving the tube into very hard ground, to employ a wooden mallet rather than a metal hammer, as this will lessen the shock and prevent serious distortion to the top.

Holes have been drilled at intervals along the tube, the object of which is apparently to enable any water poured into the tube to percolate into the soil surrounding it. This may be necessary to ensure a good electrical contact with the earth in very dry weather.

It is a wise policy to bury the earth tube in a shady corner, as the ground will retain its moisture longer than if exposed to the sun's rays, and a better "earth" will ensue.

This device is a product of The "Quint" Tubes, Ltd., 92, Cannon Street, London, E.C.4, and the price is 2s. 6d.

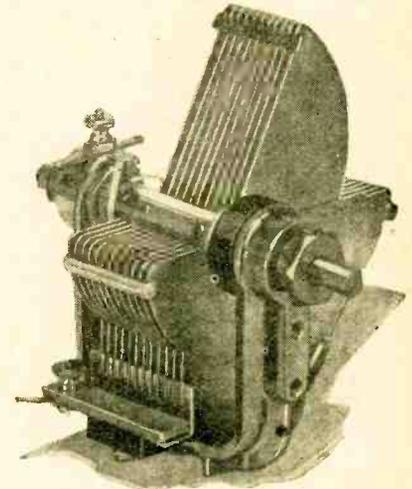
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ART ET TECHNIQUE VARIABLE CONDENSER.

Of late variable condensers have received so much attention from designers and manufacturers in this country that the activities of manufacturers elsewhere have not been receiving the attention hitherto accorded them. That some are well to the fore is evidenced by the many good points in the design of the Art et Technique variable condenser, a French product of the "log-line" type. The principal point of interest is the method of supporting the moving vanes. These are soldered into slots cut in a hollow

shaft carried in one ball bearing and one conical bearing. They are supported by a "U"-shaped cast aluminium frame. A 1/2 in. brass spindle runs through the centre of the hollow shaft and protrudes beyond both bearings, thus facilitating "ganging," should this be desired. Special connecting sleeves are available.

The fixed set of vanes is mounted on



Art et Technique variable condenser.

an ebonite block, and these have been shaped to ensure a small minimum capacity at the zero setting. In the sample tested the minimum was found to be 15 micro-mfd. and the maximum 0.000508 mfd. This is one of the standard models having a stated capacity of 0.0005 mfd. maximum.

Contact with the moving vanes is made through a spring pigtail which terminates at a small terminal on the frame. Two small terminals provide alternative contact points with the fixed plates. These are small and not very accessible, and

could be placed with advantage at the back of the condenser, where more space is available to accommodate larger terminals.

Both banks of vanes are silver plated to ensure a low high-frequency resistance; while the frame is heavily nickelled. A single-hole fixing bush is fitted, but provision is made for alternative methods of mounting. A drilling template is supplied to facilitate positioning the holes required for fixing the condenser in a more rigid manner. Each carton contains a small spanner and key for adjusting the bearings, should this be found necessary.

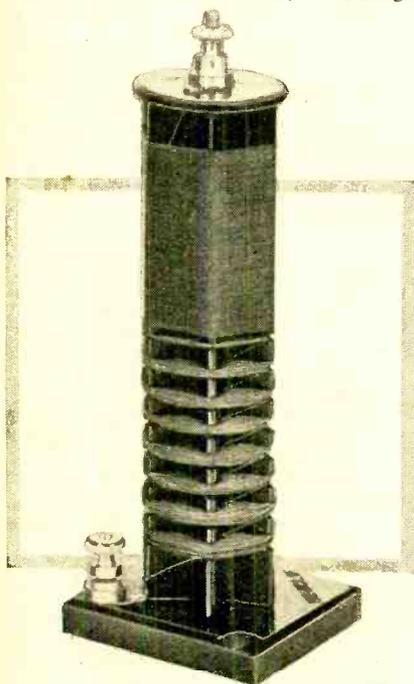
The standard 0.0005 mfd. type is offered at 15s., but cheaper models will be available shortly.

The sole concessionaire in this country is M. Benoit, 4, Manor Gardens, Gunnersbury Lane, London, W.3.

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BERCLIF H.F. CHOKE.

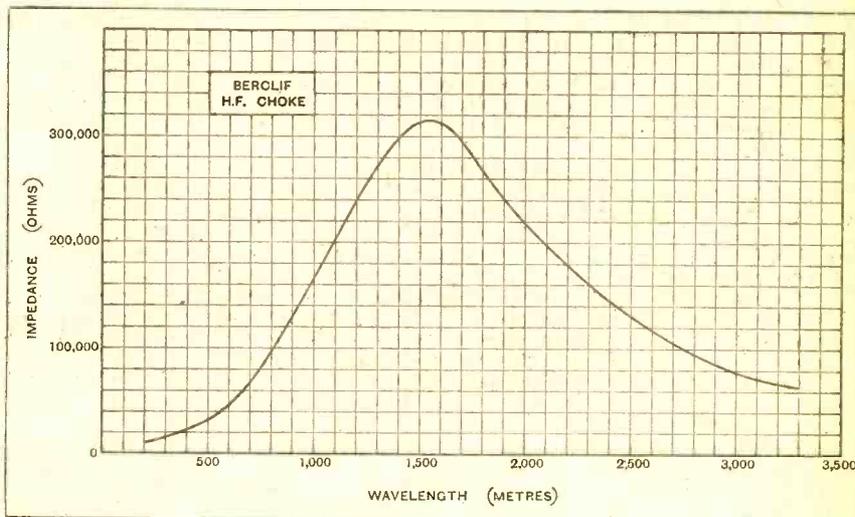
In designing this H.F. choke the makers have kept in mind the audio-frequency aspect as well as radio-frequency function of the choke. They have sought



Berclif H.F. choke; D.C. resistance, 330 ohms.

to increase the radio-frequency choking effect by reducing self-capacity rather than by increasing inductance, as a highly inductive choke is likely to disturb the audio-frequency characteristic of the receiver. To this end the choke is wound in graduated sections, the final section consisting of a single-layer winding 1 1/4 in. long.

The characteristic curve of the choke shows that the performance is quite up to standard, yet the inductance is of the order of only 100 mH. At 200 metres the impedance is 9,900 ohms, at 500 metres 30,500 ohms and at 1,600 metres 309,000



Impedance curve of Berclif H.F. choke; external capacity 8 micro-mfd.

ohms. Resonance occurred between 1,500 and 1,600 metres under the conditions of the test in which the external capacity was 8 micro-mfd.; but under receiving conditions the effective capacity in shunt would be considerably higher, and the choke can be used with confidence on all wavelengths up to 1,600 metres without fear of self-oscillation.

The makers are Messrs. Simmonds Bros., Shireland Road, Smethwick, Staffs, and the price is 8s. 6d.

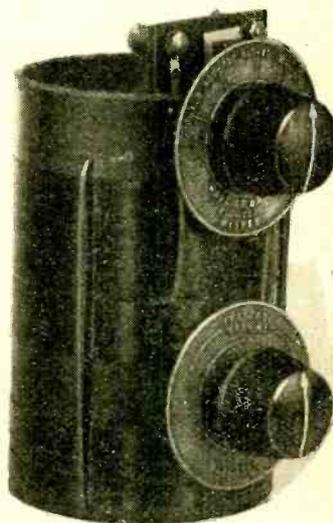
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CHAKOPHONE DE LUXE AERIAL TUNER.

The latest Chakophone aerial tuner follows the same general lines as the earlier models, but has incorporated a five-point switch for selecting the various wavebands. When tuned by a 0.0005 mfd. variable condenser, continuous tuning from 300 to 2,000 metres is possible. This device is particularly suitable for regenerative circuits where simplicity of operation is the first consideration. In view of the fact that the aerial is connected to the grid end of the inductance, selectivity, in the proximity of a broadcast station, will not be of a high order, but under less exacting conditions reasonable selectivity may be expected.

A reaction coil is fitted, this taking the form of a small cylindrical coil rotating inside one end of the main former. An impregnated cardboard tube 3 in. in diameter and 5 in. long supports the aerial inductance; the reaction coil being carried on a paxolin tube 2 1/4 in. in diameter and 1 1/4 in. long. Two terminals are provided for aerial and earth; the connections to the reaction coil being made by two "flex" leads.

Two holes only are required for fixing purposes, and the device can be mounted horizontally or vertically as required. A wiring diagram is given on the carton showing the connections to the various windings, and a table indicates the wavelengths covered by each section of the coil when connected to a standard size receiving aerial.



New Chakophone aerial tuner with reaction and waveband switch.

The makers are The Eagle Engineering Co., Ltd., Eagle Works, Warwick, and the price is 10s. 6d.

o o o o

CATALOGUES RECEIVED.

Messrs. Sydney S. Bird and Sons, Ltd., Cyldon Works, Sarnesfield Road, Enfield Town, Middlesex.—Illustrated leaflets of Cyldon variable condensers, with special reference to drum controls.

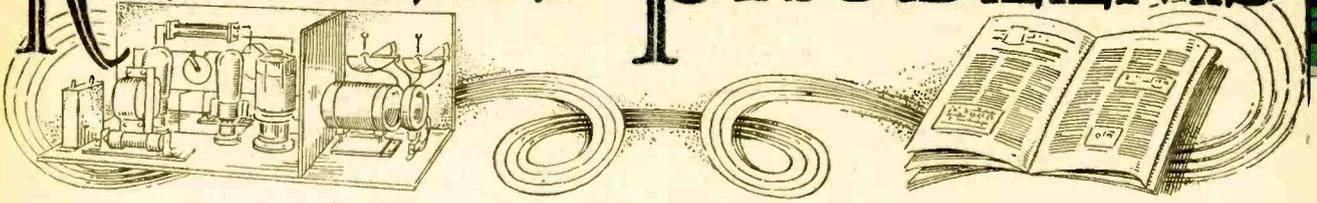
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Messrs. Henry Joseph, 11, Red Lion Square, High Holborn, London, W.C.1.—Illustrated catalogues of cone loud speakers, reed and balanced armature units and gramophone pick-up.

o o o o

Messrs. F. Squire, 24, Leswin Road, Stoke Newington, London, N.16.—Illustrated folder of aluminium frames and cone units for reed and balanced armature loud speaker movements.

READERS' PROBLEMS



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Transmitting Licences.

I should like to obtain a transmitting licence; will you give me a hint as to the method of procedure?

A. T. M.

Applications for these licences must be addressed to the Secretary, G.P.O., London. It is necessary for the applicant to satisfy the authorities as to his ability to send and receive messages in the Morse code, and also of his intention to undertake some definite line of research.

Megavox Reaction Control.

When first constructed, my "Megavox" receiver worked well, and reaction control was as good as could be desired. Lately, however, the reaction condenser seems to have no effect, although the set otherwise is behaving normally. Can you suggest a likely cause of this trouble?

A. T. L.

We do not think that this fault should be had to trace; you have probably already examined the obvious connections on the reaction condenser, etc., and we think that the fault will be found to exist in the base of the anode-coil holder. Most probably you will find that the pin to which the reaction winding is connected is not making contact with its clip.

A Fictitious Fault.

In an attempt to improve the stability of my "two H.F." set, I have recently rewired it, and added the various decoupling schemes recently discussed in your journal. My efforts have been successful, as the set works infinitely better than before; but I am worried by the behaviour of the anode bend detector; its grid circuit has been decoupled, as bias is obtained from a battery common to other valves. My trouble is this: removal of the plug from the bias battery makes no difference whatsoever to the strength of signals, although their intensity is reduced when the plug is reinserted into a lower voltage tapping socket. I cannot see how the valve can work without proper bias; what do you think is wrong?

W. M. L.

We are inclined to the opinion that the symptoms you describe are by no

means indicative of a fault, but suggest that the insulation of your detector grid circuit is of a high order.

We expect that your circuit is arranged as in Fig. 1, with a large by-pass condenser and a decoupling resistance; if this assumption is correct, the condenser

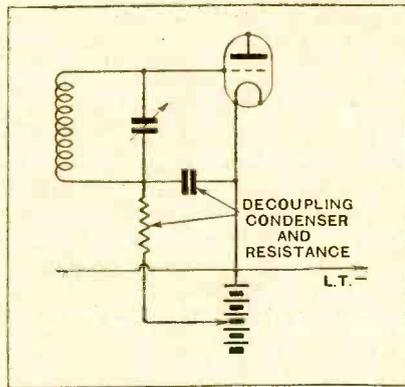


Fig. 1.—Grid bias from the electrostatic charge stored in a by-pass condenser.

will be charged to the potential of the bias battery, and will retain this charge for some time after the plug is removed, as there is no discharge path.

Of course, when you make contact between the bias plug and a lower volt-

age socket, the voltage on the condenser will be reduced to something less negative than that required for best detection, and signals will be noticeably weaker.

o o o o

Anode Current Variations.

Is it normal that the total anode current consumed by a receiver should remain constant whether or no any signals are actually being received? I have observed this effect in my own set, but have always understood that a valve operates by virtue of changes in anode current, and cannot see how signals should be audible without such variations being apparent.

E. R.

The mean current (as indicated by a milliammeter) consumed in the anode circuit of an amplifying valve should, if it is properly operated, be unaffected by the application of signal voltages to the input end of the receiver, of which it forms a part, although in practice these ideal conditions are seldom attainable, and some slight fluctuation is often produced.

With regard to the detector, whether it operates on the anode or grid principle, it is a fact that the application of a signal voltage to its grid will introduce a change in anode current; otherwise there cannot be rectification. We think in your particular case that the current taken by the amplifying valves is very large in comparison with that consumed by the detector, and consequently the variation that takes place when the signal is tuned in will pass unnoticed, as it may amount only to a small fraction of a milliamper.

o o o o

Modified H.F. Stage.

Do you recommend me to fit a screen-grid H.F. valve to my "Everyman Four" receiver? I do not wish to add any screening over and above that already included in the set.

T. B. S.

It is almost impossible to obtain a very high degree of magnification from a screen grid valve unless screening is more complete than that customarily included when a neutralised triode is used. Unless you are willing to modify your present set in this way, we think you would be disappointed with the results obtained with your proposed alteration, and consequently do not recommend it.

RULES.

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
- (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
- (3.) Designs or circuit diagrams for complete receivers cannot be given: under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
- (4.) Practical wiring plans cannot be supplied or considered.
- (5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.
- (6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufactured receivers. Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

The Wireless World

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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NEW BROADCAST LICENCE CONDITIONS.

THE weak point in wireless as a means of point-to-point communication has always been that it is subject to eavesdropping on the part of anyone who cares to listen in on the particular wavelength on which the transmissions are taking place. In pre-broadcasting days, when the Post Office issued experimental licences to amateurs, the stipulation was always made that anything which might be overheard by the station, such as intercommunication between ships and the shore, was to be treated confidentially and not disclosed to other persons. That was a very reasonable stipulation to make, and was necessary in the interests of insuring a reasonable degree of secrecy of communication, and, to the best of our knowledge, there have been no instances of any serious neglect to observe this regulation on the part of those to whom such licences were granted.

When broadcasting started and a special broadcast receiving licence was issued through the Post Office, the same stipulation appeared on the back of the licence

form, to the effect that the licensee would not divulge or make any use of any message received other than time signals, musical performances, and messages sent for general reception.

The Licence Changes.

Within the last few weeks the conditions printed on the back of the broadcast licence forms have been modified so as to attempt to restrict the use of a wireless receiver, for the licensee is told that his receiver is only to be used for the reception of

"broadcast programmes and messages sent for general reception and messages sent from an experimental station in connection with experiments carried out by the licensee," and further that

"The licensee shall not use or allow the station to be used for the receipt of messages other than messages intended for receipt thereby or sent for general reception. If any other message is unintentionally received by means of the station the licensee shall not make known or allow to be made known its contents, its origin or destination, its existence or the fact of its receipt to any person (other than a duly authorised officer of His Majesty's Government or a competent legal tribunal), and shall not reproduce in writing, copy, or make any use of such message or allow the same to be reproduced in writing, copied, or made use of."

A great deal of enjoyment, interest and instruction has been derived in the past from listening to morse transmissions and to such other communications as, for instance, the conversations between cross-Channel planes in flight. To be told, in regulations which are not enforceable, that one must no longer listen to these and that, in fact, the existence of such messages must not be known, seems to us to be more likely to stimulate an interest in eavesdropping than to act as a deterrent.

The Postmaster-General is responsible for controlling the wireless transmitters of this country, yet in the Correspondence columns of this issue we publish a letter from a listener who complains bitterly that a Post Office experimental station persistently breaks in on his reception of the broadcast programmes. According to the Post Office it is illegal to listen to such a transmission. Are we then to suppose that our correspondent is transgressing the conditions of his broadcast permit when he writes to complain to us of the interference of these experimental transmissions? Is he to close down his set for fear that he might overhear this Post Office experimental transmitter, and thereby learn of its existence? If he reads morse or the station transmits telephony, what is the penalty if he learns the nature of the communications? These are questions which we think the Post Office should answer before such conditions are imposed upon the listener.

Wireless
World
S-G Multiple Valve PORTABLE

A Self-contained Set with High-amplification H.F. Stage.

By H. F. SMITH.



PRESENT-DAY practice in the matter of portable receiver design favours the use of two H.F. valves, generally with aperiodic couplings, and almost invariably with a low amplification per stage. There is a good deal to be said in favour of such an arrangement: two stages of this sort should give more overall amplification than a single one of high efficiency, and, provided we keep on the right side of the border line between some amplification and none at all, everything is well. As long as the set does not depend entirely on reaction for its sensitivity, it will certainly have advantages in the way of easy operation, but, in spite of this prevailing vogue, it is considered that many readers will be interested in the opposite type of H.F. amplifier, in which an attempt is made to attain the highest possible stage gain. Thanks to thorough screening and the application of suitable decoupling methods, it is now possible to devise such an amplifier, even though it has to work in the very difficult conditions that perforce exist in a portable receiver.

Although a Loewe multiple valve is used in the present set, it is hardly to be considered as essential to the basic

design, but, to replace it by the equivalent three ordinary valves and their associated couplings would be a difficult task unless the dimensions of the containing cabinet were slightly increased. As most readers will know, the "three in one" valve, which has attained wide popularity in Germany, and is now manufactured in this country, contains a detector and two resistance-coupled L.F. amplifiers in a single glass bulb. Its series-parallel connected filaments consume 0.34 amp. at 4 volts, and its modest requirements in the matter of anode current make it particularly suitable for a

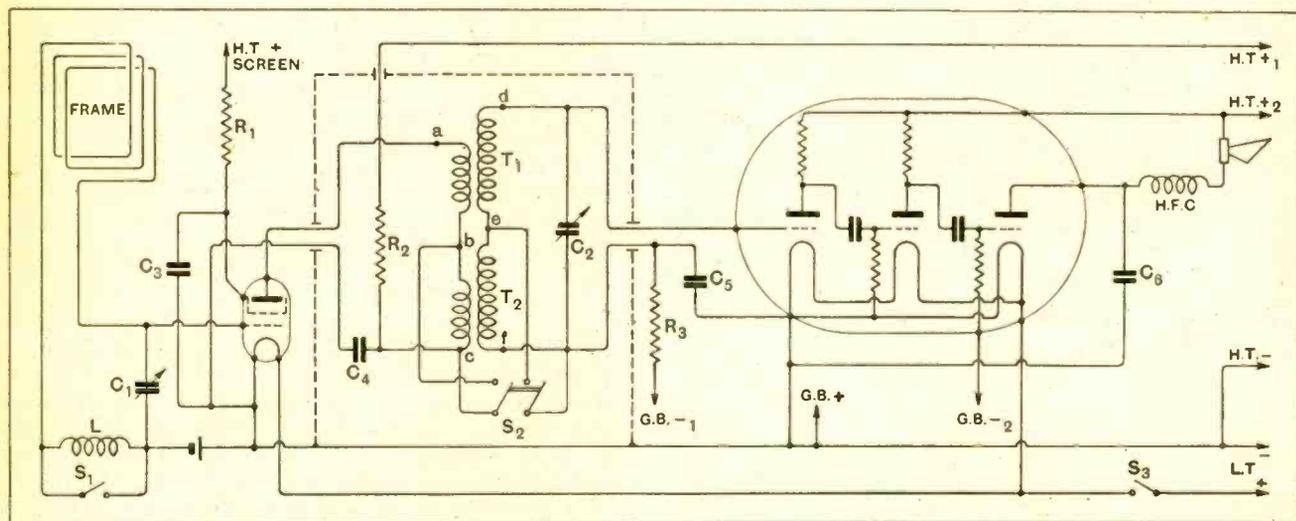


Fig. 1.—Circuit diagram. R_1, R_2, R_3 , decoupling resistances, 600 ohms.; C_1, C_2 , tuning condensers, 0.0003 mfd.; C_3, C_4, C_5 , by-pass condensers, 0.1 mfd.; C_6 , 0.002 mfd.; T_1 , short-wave H.F. transformer; T_2 , long-wave H.F. transformer; S_1, S_2 , wave-changing switches; S_3 , on-off switch; L , long-wave loading coil.

S.G. Multiple Valve Portable.—self-contained set. Furthermore, its inclusion tends to simplify very considerably the wiring of the receiver.

The complete circuit diagram is given in Fig. 1. As the H.F. amplifier is particularly effective on the long waves, it was considered unnecessary to complicate construction by providing a two- or three-section frame aerial; instead, a simple winding, "loaded" for long-wave reception by a coil L, is used.

H.F. amplification is by a screen-grid valve with transformer coupling, waveband switching being effected by the simple expedient of connecting both long- and short-wave primaries in series and connecting a double-pole switch so as to short-circuit the former set of windings—an arrangement that is perfectly adequate in this case. The screening grid and anode circuits are both decoupled in the conventional manner, H.F. currents being deflected back to negative filament by the resistances R_1 and R_2 through the by-pass condensers C_3 , C_4 (which, incidentally, should be chosen for low H.F. resistance).

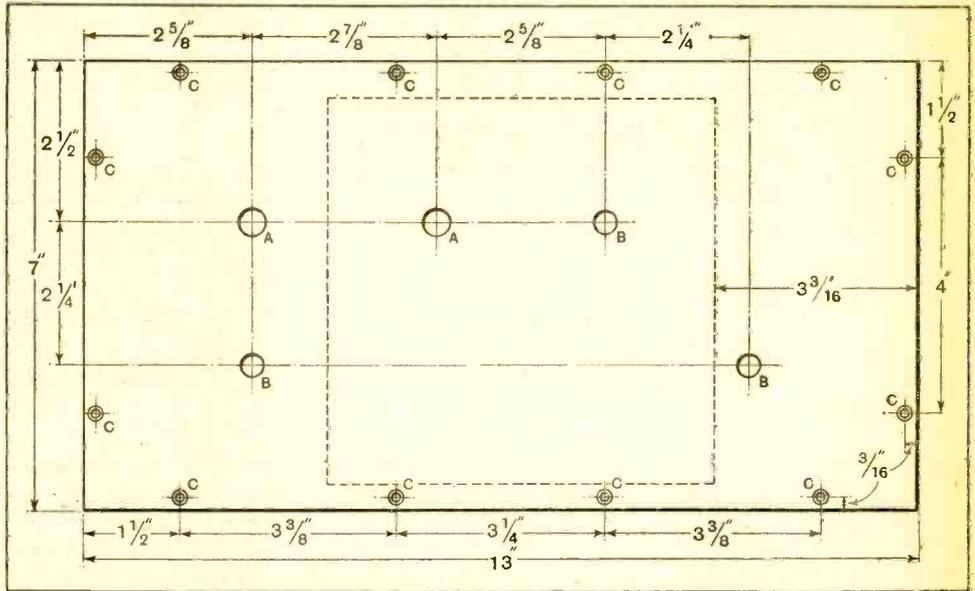


Fig. 2.—Drilling details of the front panel. Position of screening box, mounted behind it, is shown in dotted lines. A, $\frac{1}{8}$ in. dia.; B, $\frac{1}{4}$ in. dia.; C, $\frac{1}{2}$ in. dia., countersunk for No. 4 woodscrews.

wound in such a way that its magnetic field is restricted, while the condenser should have the largest capacity that can be used without impairing quality of reproduction; a value of 0.002 mfd. was actually used.

Simplifying the Constructor's Task.

The apparatus is mounted in an upright cabinet obtained ready-made and complete with internal

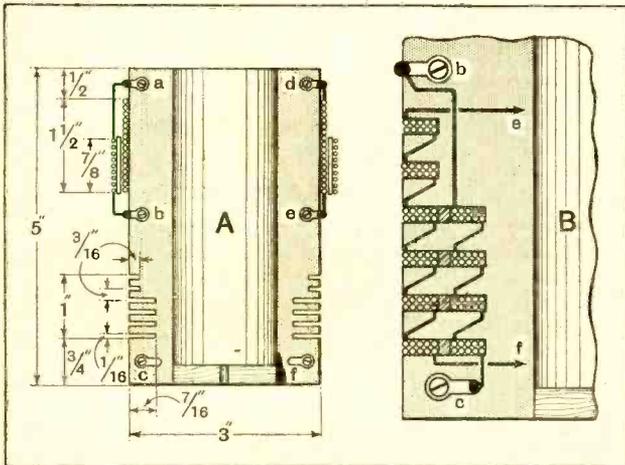
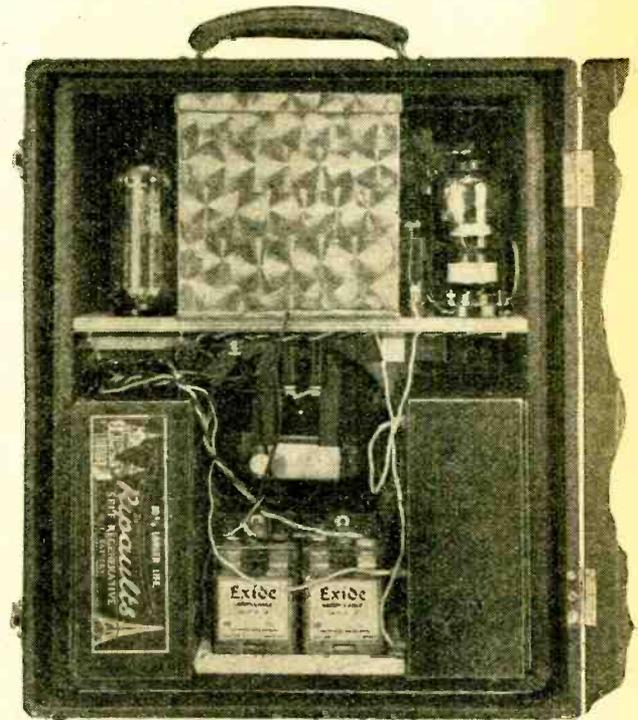


Fig. 3.—(A) H.F. transformer former and details of short-wave windings. (B) Enlarged section showing winding of long-wave transformer. Lettering of terminal points corresponds with that in other diagrams.

The H.F. transformer secondary is joined across input grid and filament of the multiple valve through another by-pass condenser C_5 , grid bias (for anode bend detection) being applied through a third decoupling resistance R_3 . In order to dispose of H.F. currents that get through the valve, an H.F. choke and by-pass condenser (C_6) are connected, respectively, in series with the anode lead and between anode and filament. The choke must be



Rear view of receiver. The loud speaker is mounted above the L.T. battery.

S.G. Multiple Valve Portable.—framework from Will Day, Ltd. Due largely to economy in space effected by the use of the multiple valve, there is sufficient room for two 60-volt H.T. batteries of double capacity; the current consumed by the valves is well within their capabilities, and consequently upkeep cost in this respect is by no means excessive.

Constructional details of the set proper follow fairly conventional lines, and work is started by preparing a panel and baseboard of a suitable width to fit across the upper part of the framework. Although the multiple valve does not appear to be unduly liable to damage from shocks, it is obviously necessary to provide some form of mechanical insulation, if only to prevent the development of microphonic noises; the method of suspension adopted, though perhaps rather crude, has proved completely effective. As will be seen from Fig. 5, a hole of sufficient diameter to provide a clearance for the body of the valve holder is cut through the base-

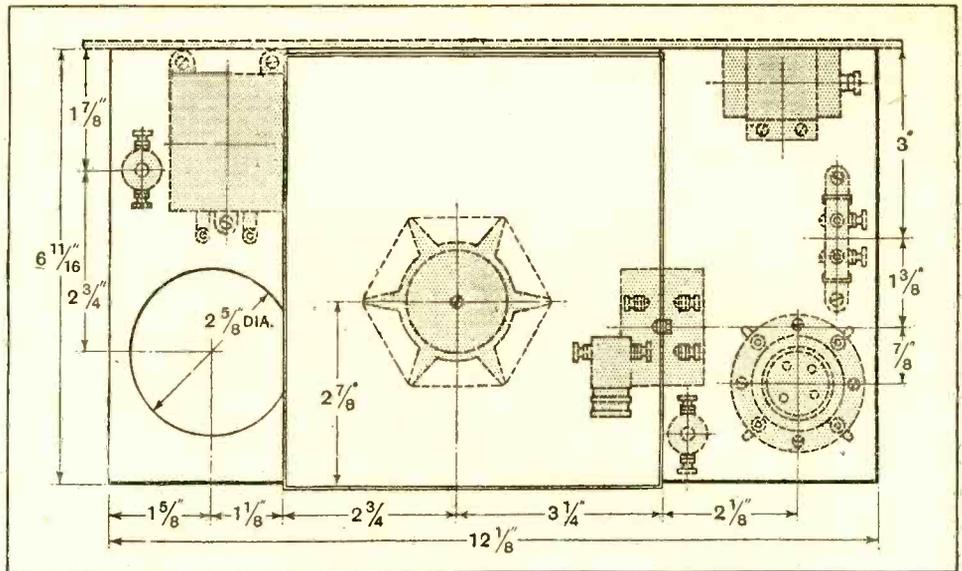
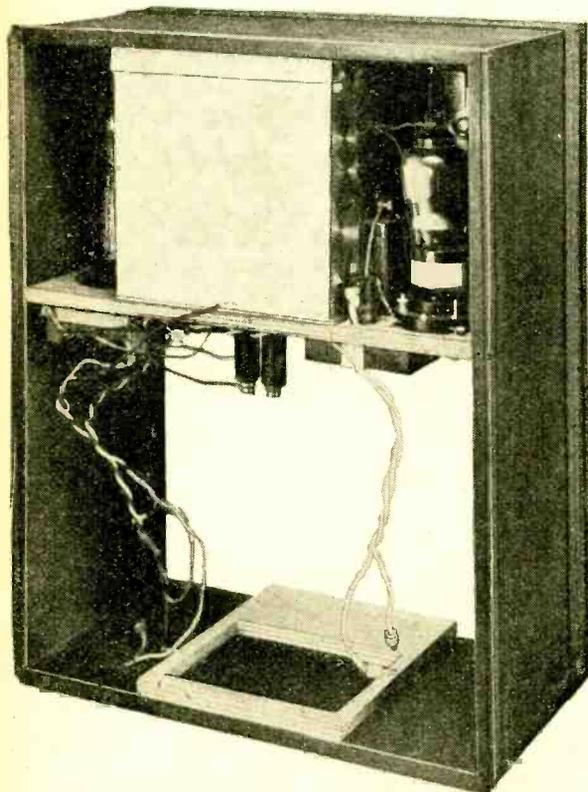


Fig. 4.—Layout of components on the baseboard, which is of plywood, 1/2 in. thick.

board, to the under side of which is cemented a sponge rubber pad with a concentric hole which just fits the flange. The holder is now passed through from below, and is secured in position by rubber bands slipped over the corners of its rectangular base and anchored to brass hooks screwed into the wood.

The H.F. Transformer and its Screen.

Before proceeding further, it is necessary to prepare the screening case and H.F. transformer. The first mentioned is a simple rectangular copper box of No. 28 or 30 gauge metal with soldered joints and a lid overlapping by 1/2 in.; it was made to the writer's specifica-



Another view showing framework removed from case. Note frame aerial winding and wooden block for retaining batteries in position.

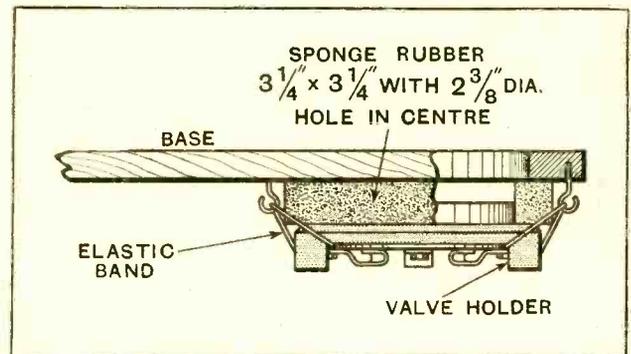


Fig. 5.—Sectional sketch showing shock-absorbing mounting for multiple valve holder.

tion by Lock-Atkinson Wireless. Measurements are 6 in. wide, 6 1/2 in. deep, and 6 in. high. As it is a difficult matter to ensure that the lid will make a good electrical seal, it is recommended that a sheet of copper gauze, slightly larger than the top of the box, and with its edges turned down, should be interposed between case and lid; screening will be improved by the natural springiness of this material, which will ensure that electrical contact is made at a number of points. Positions

S.G. Multiple Valve Portable.—

for holes in the front can be taken from Fig. 2; they naturally coincide with the fixing holes for the components mounted on the panel.

The long- and short-wave H.F. transformers are similar to those described by the writer for the S.G.

be experienced in wiring it. It is necessary that the condenser C_2 should be completely insulated from the screening box, and this end is attained by drilling a large clearance hole through it and interposing a sheet of insulating material between frame and metal. At the same time, care must be taken to see that the box stands back at least $\frac{1}{16}$ in. from the surface of the panel, in order that the lid may be fitted; accordingly, a sheet of cardboard or something similar should be placed in position before the condenser and wave-change switch S_2 are finally mounted.

Mention should be made of the method of mounting the by-pass condensers C_3 and C_4 . These are secured to opposite faces of the side of the screening box by a single screw and nut, the metal being previously scraped clean so that an electrical contact is made with their containers. The decoupling resistance R_2 is mounted directly on one of the

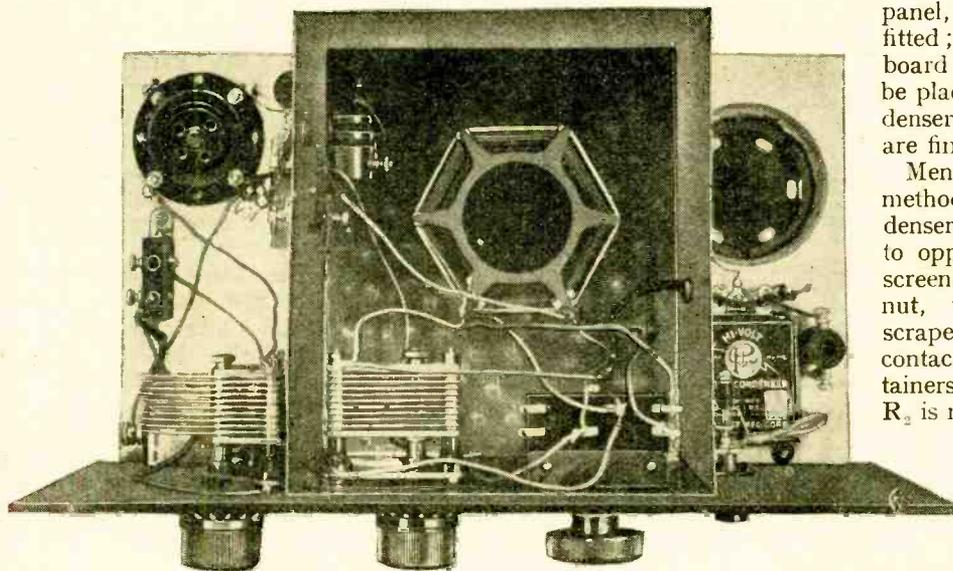
lugs of C_4 .

The "Gripso" switches used for S_1 and S_3 are fitted with indicating discs which should be set so that the words "long" and "short" are shown through the

dial aperture of the first mentioned, while the second must be set to read "on" and "off" in the appropriate positions.

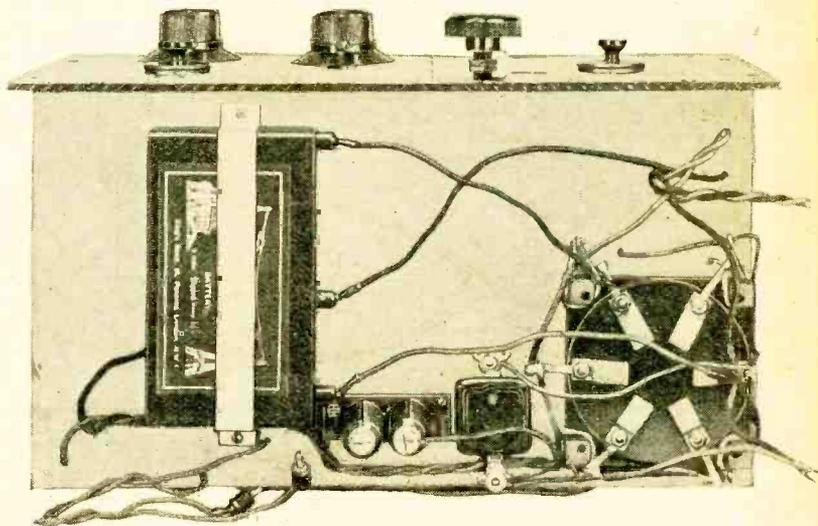
Looking after Grid and Plate Leads.

Wiring is effected throughout with flexible rubber-covered leads; rigid bare wire conductors seem to be out of place in a portable set, as they are likely to be displaced by vibration. Special care should be taken with the wiring of the H.F. anode and detector grid



Plan view of receiver, with lid of screening box removed.

Regional Receiver,¹ and are wound as a unit on a 5 in. length of Redfern deep-rib ebonite former as shown in Fig. 3. On account of unavoidable interaction effects between the plate circuit and the frame aerial, the maximum permissible coupling on the short waves is slightly less than in the original receiver: the primary has 35 turns of No. 40 D.S.C., wound over a secondary of 65 turns of No. 9/40 Litz. As selectivity gives no trouble in a frame aerial set, it is possible, on the long-wave side, to take advantage of the reduced feed-back through the residual capacity of the valve, and to use a primary of four sections, each having 35 turns of No. 40 D.C.C. wire. These sections are wound in the deep slots cut in the ribbed former, and over them, separated by small blocks of insulating material $\frac{1}{16}$ in. thick placed in each slot, are the six secondary sections, each with 35 turns of No. 32 D.S.C. wire. All four windings must be in the same direction, and their ends are anchored to soldering tags screwed to adjacent ribs—primaries on one rib and secondaries on the other. Particular care has been taken to avoid the necessity for making connections in inaccessible positions, and if, before mounting the transformer in its screening box, lengths of flexible wire are soldered to each tag, no difficulty will



Components mounted on under-side of baseboard.

¹ *The Wireless World*, March 27th and April 3rd, 1929.

S.G. Multiple Valve Portable.—

circuits, of which the "go" and "return" leads are run parallel and close together in pairs, so as to prevent the formation of inductive loops. These points are

made clear both in the theoretical and practical diagrams. Short lengths of "Harbros" twin wire, consisting of a pair of conductors spaced about $\frac{3}{32}$ in. by a woven web, were used for these connections; as the dielectric

between the wires is largely composed of air, no serious losses are introduced.

Before wiring the Loewe valve holder, it is as well to mark the various terminal tags, determining their positions with respect to the slots of the bayonet catch fitting; these positions can be ascertained with the help of Fig. 6, or the diagram printed on the valve box.

The loop aerial, with 16 closely wound turns of insulated wire, is supported by the framework in the position shown in an accompanying photograph. Ends of the winding are passed through the woodwork adjacent to their junction points (H.F. valve grid and one of the loading coil holder terminals). Sufficient length should be left to allow of connection when the set proper is partially inserted in the framework.

A wooden block is fitted to the "Zampa" cone chassis, and the "Blue Spot" loud speaker unit may be screwed direct to this, the metal distance pieces being used to give the necessary spacing; or, as in the case of the receiver illustrated, the wood may be removed and the unit secured directly to the radial supporting arms. The complete loud speaker is screwed to the back of the fretted aperture cut in the front of the cabinet.

Wooden Battery Chock.

In order to provide supports for the batteries, a piece of wood, shaped as shown in the photograph on page 398, is screwed to the lower member of the framework; a rectangular aperture is cut to take the accumulator, and the wood is of such a width that the H.T. batteries slide into the space between its edges and the sides of the framework. They are further supported by the radial

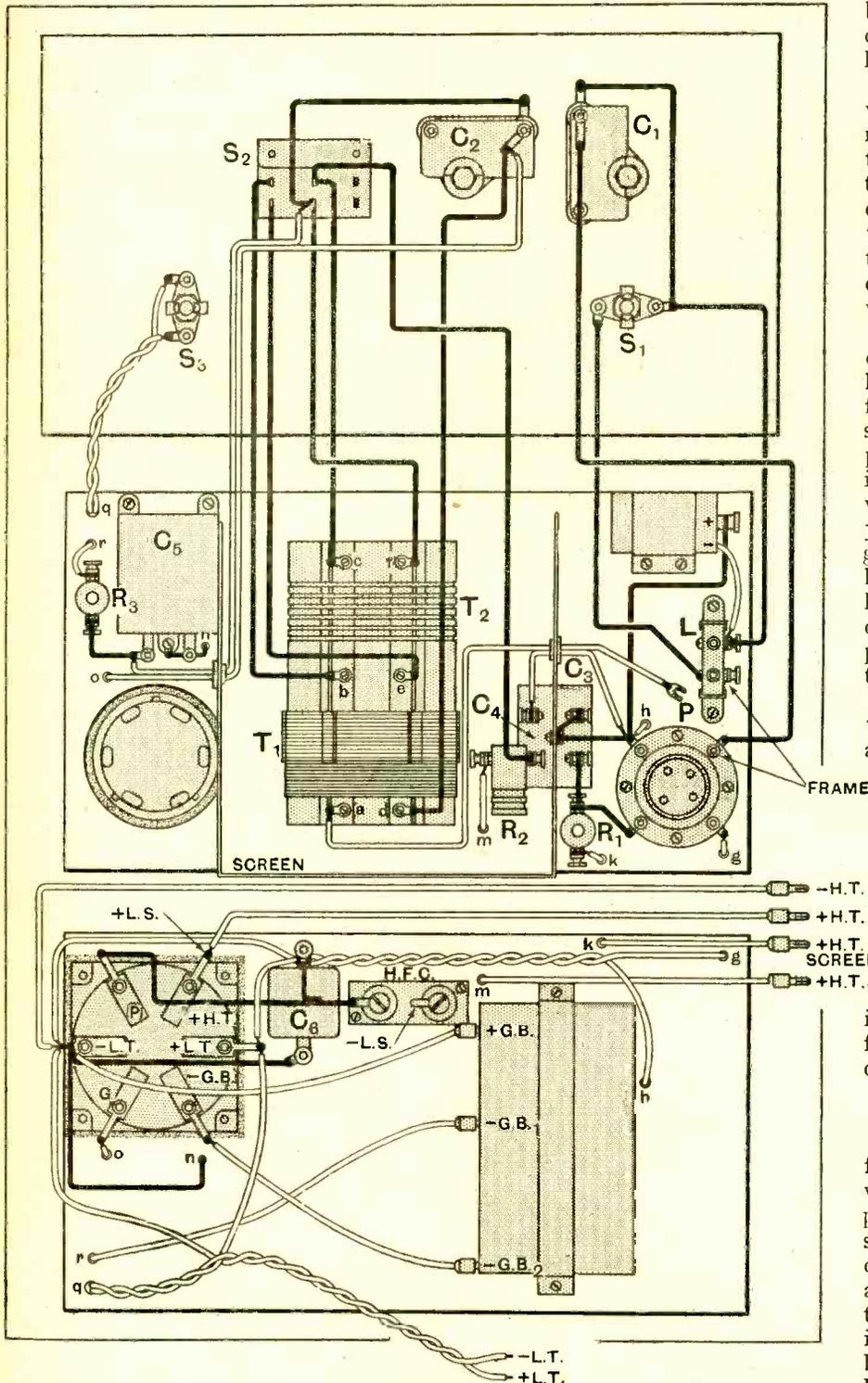


Fig. 6.—Practical wiring plan. Leads passing through baseboard may be traced by observing the corresponding lettering. Points of attachment for loud speaker and frame aerial are shown. Extra earthing leads are taken from rear lower edge of screening box and from metal loud speaker frame to L.T.—terminal.

LIST OF PARTS.

- 1 Portable set cabinet (Will Day, Ltd.).
- 1 Panel, 13in. by 7in. by 3/4in. (Pertinax).
- 2 Variable condensers, 0.0003 mfd. (Utility "Mile").
- 2 Dials for do., 2in. dia. (Igranite).
- 3 Fixed condensers, 0.1 mfd., paper dielectric (Polymet).
- 1 Fixed condenser, 0.002 mfd., mica (Polymet).
- 1 Coil, plug-in type, No. 250 (Igranite).
- 1 Holder for do. (Lotus).
- 1 Valve holder (Lotus).
- 1 Ribbed ebonite former, 3in. dia., 5in. long, deep rib type (Redfern).
- 3 Decoupling resistances, 600 ohms (Wearite).
- 1 Switch D.P.D.T. knob pattern (Utility).
- 2 Switches, single pole, on-off (Gripso).
- 1 H.F. choke, binocular type (McMichael).

- 1 Dry cell (Ever-ready, "O" size).
- 50ft. Litz wire, 9/40, S.S.C. and D.S.C. overall (Lewcos).
- 1 Cone loud-speaker chassis (Zampa).
- 1 Loud-speaker unit (Blue Spot).
- 2 60-volt H.T. batteries, double capacity (Ripaults).
- 1 9-volt grid bias battery (Ripaults).
- 1 4-volt unspillable accumulator, 10 A.H. (Exide, Type 2-1VPY4).
- 9 Wander plugs, miniature type (Elex).
- 100ft. Frame aerial wire (Ripaults, Type 10/40).
- 1 Loose Multiple Valve, Type 3 N.F., with holder.
- 1 4-volt Screen-grid valve.
- Copper for screening box, wire, wood, screws, etc.
- Approximate total-cost, including valves, batteries, and Loewe valve royalty, £12 15s.

In the "List of Parts" included in the descriptions of THE WIRELESS WORLD receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instruments. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

arms of the loud speaker. Preliminary tests should be made with anode and grid voltages as specified by the makers for the valves (a Mullard P.M.14 was used as an H.F. amplifier). A good average value of H.T. pressure for the multiple valve is 100 volts. If instability is evident, the first step should be a reversal of the frame aerial, followed by a similar reversal of H.F. choke connections. These recommendations may seem to be very unscientific, but it is almost impossible accurately to foresee the various stray couplings that are bound to be taking place—in spite of elaborate precautions. These couplings may be pro- or anti-reaction,

depending on the run of the wiring, etc., and on the "sense" of the frame aerial connections.

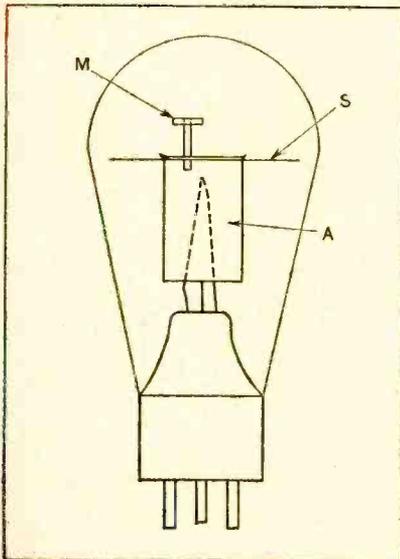
A certain amount of incidental reaction is inherent, and, indeed, is of some advantage in a screen-grid H.F. amplifier, particularly when a frame aerial is used. The sensitivity of the present set may be controlled within narrow limits by adjustment of screen-grid voltage.

Range may be conservatively estimated at fifty miles in daylight under any reasonable conditions; this figure is exceeded in the case of powerful transmitters such as 5GB. After dark a number of Continental stations can be received.

This receiver is available for inspection at the Editorial Offices, 116/117, Fleet Street, E.C.4

Clear-glass Valves.

In certain cases, for instance, rectifying valves with high-emission filaments, the presence of the magnesium film left on the inside surface of the bulb in the "gettering" process is a disadvantage, because it prevents free heat-radiation. Internal heat is reflected back until the anode gets red-hot, and sometimes even the glass base begins to soften.



To facilitate free heat-radiation in a rectifying valve a mica screen S is inserted.

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Patent Novelties.

As a remedy, the parts of the bulb immediately surrounding the cylindrical anode can be kept free from deposit in the following way. During assembly, a mica or glass screen S is mounted on the top of the cylindrical anode A so as to divide the glass bulb into two compartments. A small metal tongue carrying a piece of magnesium M is welded to the anode and passes through the screen S as shown. In the "gettering" process the magnesium M is vaporised by H.F. eddy currents as usual to eliminate any residual gas, but is deposited only upon the upper surface of the bulb, leaving the lower parts "clear" to facilitate cooling by heat-radiation. (Patent No. 274,507.)

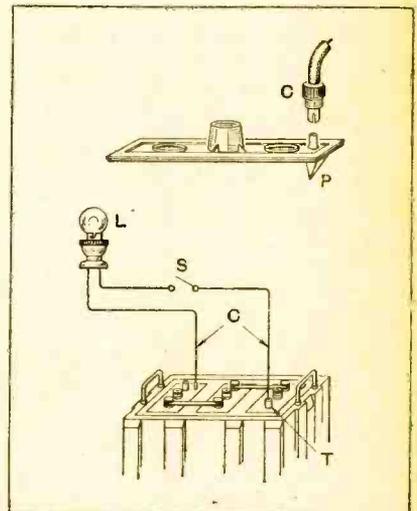
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"Topping" Accumulators.

When the walls of the cell are made of opaque material it is impossible to verify the level of the electrolyte by external inspection. There are several ways in which this difficulty can be overcome. For instance, the filling-spout can be fitted with a contact, which automatically closes a circuit to flash a lamp or ring a bell when the proper level is attained; or a similar contact can be fitted on the walls or cover of the cell.

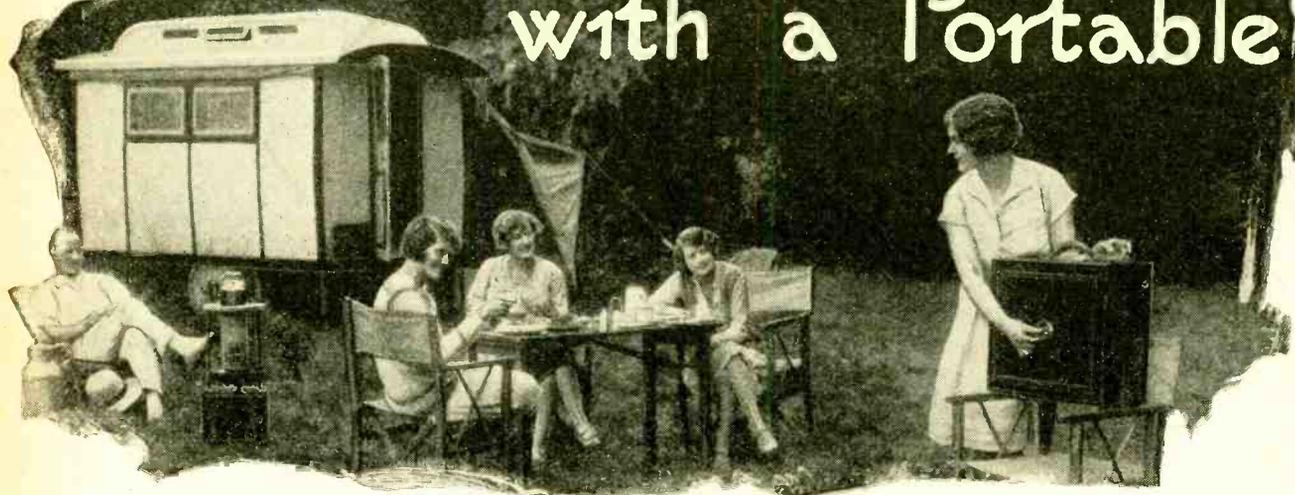
The figure illustrates an alternative method for use with an accumulator fitted with a cover of antimony-lead alloy, which is a conductor though resisting the action of the electrolyte. A projection P is cast on the inner surface of the cover of sufficient size just to make contact when the electrolyte is at the correct level. A second small projection T is cast on the upper surface to engage with a testing circuit C containing a flash-lamp L and switch S.

(Patent No. 293825.)



An acid-level indicator for accumulators with opaque containers.

Out and About with a Portable



A Fantasy of Fiction and Fact.

ALTHOUGH the portable receiver was not unknown in pre-broadcasting days it was used for sterner purposes than for its present one of reproducing the petulant cry of the nightingale while ensconced in a comfortable armchair (the listener and not the nightingale, which is probably in the studio complete with scratch filter); this fact can be verified by all regular readers who care to refer back to page 167 of their issue of this journal dated November 4th, 1922.

It was not until the summer (*sic*) of 1923, however, that there came the dawn of the palæo-suitcase era, and portable receivers appeared at tennis parties, at "goff" clubhouses, on the river, and at places where men go annually in the summer to perform mysterious rites with spirit stoves and other paraphernalia, thereby inflicting upon themselves the stern discomforts originated by their forefathers. Fortunately, however, many were built, but few worked.

"This Progress."

During the following year, reinforced by improved valves and other modifications, their raucous roaring put into the shade the puny tintinnabulations of the riverside gramophone, and by 1926 valve efficiency was so far improved that the sport-loving North-countryman found that he was enabled to enjoy all the pleasures of motor boating from Wigan pier.

Now at last the long-range portable is with us permanently for good or ill; indeed, it is making a bold bid to oust the ordinary type of set, and must eventually do so. The writer long since constructed an excellent portable receiver for home use only, and has for some time past employed it for his domestic needs, i.e., good loud speaker reception of London and the two

Daventrys. It is, of course, complete with built-in frame aerial and cone loud speaker, but no power is taken from batteries, this being derived from A.C. mains. The instrument is merely fitted with a length of "flex," and can thus be carried from room to room, power being obtained from the nearest light socket.

It has two valves, and is, in fact, the "A.C.2" receiver, described in *Wireless World* some few months back, converted to portable form, and there would seem to be no valid reason why a more ambitious instrument should not be built now that A.C. mains valves of the screen-grid type are available. It should be pointed out, however, that there is a great gulf fixed between the two types of set. The one mentioned as being now in use makes use of a simple regenerative arrangement, and, therefore, no elaborate screening is necessary. In the second case, however, matters will be quite different. Extensive screening will be imperative.

How to Avoid the B.B.C. Programmes.

But come, this is not the type of portable with which we can get out and about as indicated by the title of this article. We must, if we desire loud speaker reception, of anything, give up all thoughts of portables that can be carried whether "by a child" or otherwise, and must dismiss from our mind any foolish ideas of dispensing with the services of some method of conveyance. If we are going to have a picnic, therefore, whether by land, by water, or by air, it is necessary to proceed to the scene of action, or the aerodrome, by some form of velocipede.

What type of portable do we need? If we are within twenty miles or so of a main broadcasting station, three

Out and About with a Portable—

valves will be ample, but if we intend to go farther afield, or live at some distance from a broadcasting station, we had better have two good H.F. stages (screen-grid, of course), in addition to detector and L.F.

Now the summer programmes provided by the B.B.C. do not always fit in with the picnicker's desires, and someone might suggest that it wouldn't be a bad idea if a portable gramophone were taken along as well. Perish the thought of such additional impedimenta when we can obtain a portable receiver complete with collapsible tone arm, built-in motor, and gramophone pick-up, which will give us more volume and better quality; and if our portable is to be home-constructed, we can easily arrange for this little refinement ourselves, without seriously increasing either the weight or bulk of the instrument, for it must be remembered that it will be fairly heavy already, as we are using five valves.

The Origin of Restaurant Orchestras.

Now, where shall we go? What about the river? By all means, and so we hire a punt, unloose it, and slip softly down stream. We switch on, and at once bedlam is let loose, and above the dreadful cacophony of squeals and roars we hear part of the lunch-time music from some Restaurant des Gourmands, where it has become fashionable of late years to employ an orchestra to fulfil a somewhat similar "drowning" function to that performed by the military band on the field of battle a century ago.

At once we spring to the little black knob labelled "reverse reaction control," and, giving it a slight touch, all is silent, and after frantically experimenting with the positions of our wander plugs for half an hour (too late we realise our foolishness in not paying more attention to "Permutations and Combinations" in our algebraic studies at school), the set starts up again with magnificent quality, just enabling us to catch the announcer's voice telling the world that all stations are closing down till 3.30, when a talk will be given on the habits of mosquitoes. In disgust we unfold our collapsible tone arm and start up the motor, only to find that we have forgotten the records.

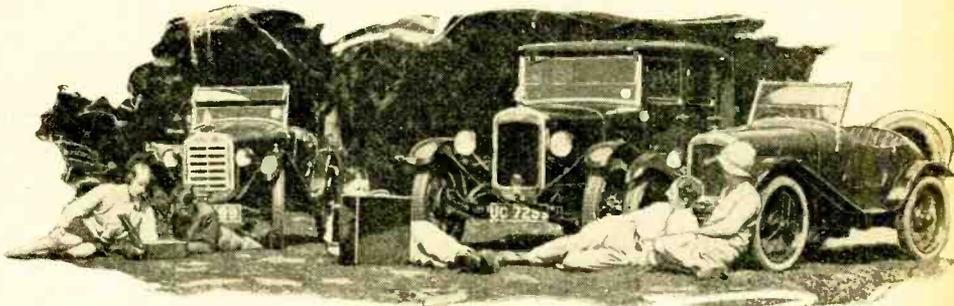
Mournfully we drift down stream, and presently we hear the rapid chugging of a motor boat coming towards us. Instinctively we draw in to the side, for we have heard what river hogs these evil-smelling contraptions are. Presently we see the boat approaching us, and are surprised that the engine has apparently to be assisted by a pair of oars, but as she draws near the mystery is explained. The only motor boating that is being done is by a gargantuan portable receiver, and as we draw closer still and watch the angry owner breathing soft words into his beard, we recognise the

set as the "Frankenstein Five," designed by Cyrus Q. Tonks, of the "Ironmonger's Companion." We shout across a few hasty references to back numbers of our favourite wireless journal, and are thankful that we resisted our first impulse and did not build that particular set after all.

"Featuring Thomas Gray."

Tiring of the river, we presently return, and as dusk falls betake ourselves to the car accompanied by the sound of the first news bulletin. Moving rapidly along we pass encampments here and there, boy scouts in some cases sitting round the camp fire with portable receivers largely in evidence. We are just in time to save one instrument from being hurled into the flames by its indignant owner, as we are able to lend him a spare valve which a thoughtless camping party had not remembered to bring. Musing awhile, we make a mental note that the subject matter of our next "Letter to the Editor" shall be a peremptory demand that all portables be fitted with a pocket for a spare valve, and "Why on earth have you not thought of it before?"

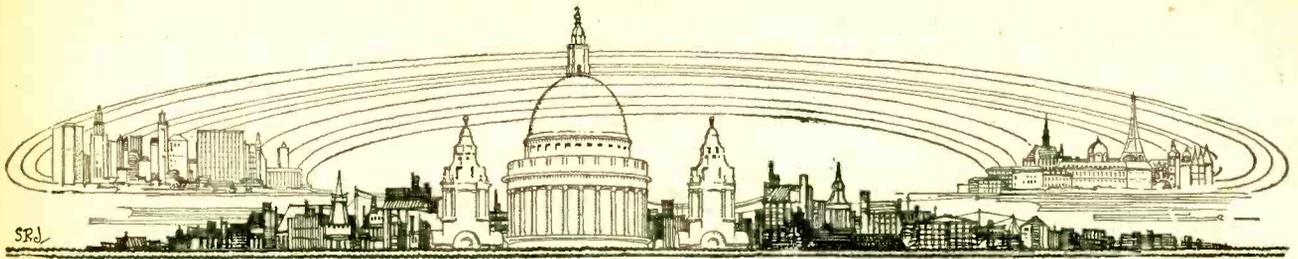
Proceeding peacefully through the countryside listening to the main portion of the evening wireless programme, we pass slowly through a village, and our attention is attracted by strange ghostly noises from the old churchyard, a weird commingling of hooting, plodding and rustling, all bound up by strange champing noises as of many cows. At last we see the big red motor coaches which tell their own tale; only a party of Americans "doing" Stoke Poges (effects and "noises



"It is necessary to proceed to the scene of action . . . by some form of velocipede."

off" by Electrical Reproductions (1929), Ltd.; gum chewing by kind permission of the vicar).

Rounding a corner we came upon a perplexed village constable standing in front of a small boy holding a crystal, and wondering whether to charge him under the Wireless Telegraphy or Fortune-telling Acts. Three minutes later the spectacle of a grim-visaged high official of the post office standing with arms akimbo before her general stores-cum-post office brought to memory the new regulations: none of us had remembered to warn poor little Willie at home *not* to switch on during the Children's Hour, and with one accord the whole horrible possibilities of two stations and only one licence came to our minds, as we recalled in imagination the details of the famous picture with its poignant title "When did you last see your father?" We bowed our heads to the inevitable. And so to the recharging station.



S.R.L.

CURRENT TOPICS

Events of the Week in Brief Review.

SUNSPOTS ON THE WAY.

Professor Stetson, of the astronomical laboratory at Harvard University, predicts a bad patch for wireless reception at the end of the present year owing to sunspots.

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THE REPORTABLE SET.

According to *The World's Press News*, Mr. Charles Musser, a Washington newspaper man, has built a portable radio transmitter for "covering" news stories which call for quick and full reports to his office. The instrument is carried in a suit case and is said to have a range of 150 miles.

It is not stated whether Mr. Musser employs the beam system to render his reports exclusive

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COSTLY SET FOR CHILDREN'S HOSPITAL.

The Metropolitan Asylums Board proposes to provide a wireless receiving installation at Princess Mary's Hospital for Children at an estimated cost of £360.

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EDUCATIONAL BROADCASTING.

Mr. Lynton Fletcher, B.A., of the B.B.C., will lecture on "Recent Developments in Educational Broadcasting" before the Royal Society of Arts, John Street, Adelphi, London, W.C.2, at 8 p.m. on Wednesday, April 24th. The lecture will be illustrated by lantern slides.

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A WIRELESS PORTRAIT.

The broadcast portrait of Sir Henry Wood was reproduced in our issue of March 27th by the courtesy of Wireless Pictures (1928), Ltd.

NO TIME FOR STUTTERING.

We learn that Scotsmen who stutter are speedily cured by a course of transatlantic telephony at £3 per minute.

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ANTARCTIC WONDERS.

"The applause (from New York) was instantly carried back to Commander Byrd, sitting with the microphones over his ears."—Daily paper.

We now understand why the great explorer was unable to reply by telephony.

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WANTED: CHEAPER WIRELESS TELEPHONY.

High costs of working are now regarded as the only obstacle to the installation of wireless telephones on board ship for the use of passengers. At a meeting of Hamburg shipowners last week it was stated that the estimated cost of £5 for three minutes' conversation was prohibitive.

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WIRELESS LUXURY IN U.S.

The latest vogue in American radio cabinets, says "Radio" of San Francisco, calls for the addition of a revolving colour cylinder, whereby soft lights of various colours are thrown on a pleated white silk grill cloth in the loud speaker compartment while the music is being received.

What price television now?

WITHOUT COMMENT.

From the correspondence column, daily paper:—

"S.R., Permit me to remark upon the differences in output of a vegetable garden traversed by an aerial. It appears to have the same intensive effect as that of an artificial manure such as superphosphate.

"Would it not be well if scientists turned their attention to the subject?"

"Cookham, Berks. C—C—."

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WIRELESS WITH THE BYRD EXPEDITION.

Not the least impressive feature of the recent wireless conversations with the Byrd Antarctic Expedition has been the use of wireless to expedite the divorce proceedings which are being taken by Mr. G. Brown, commander of the expedition supply ship, against his wife in Philadelphia. By permission of the Court, Mr. Brown's counsel was able to take his evidence by wireless from New Zealand.

The expedition has successfully received broadcast programmes from New York, 12,000 miles away.

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U.S. RADIO-CABLE MERGER PROHIBITED.

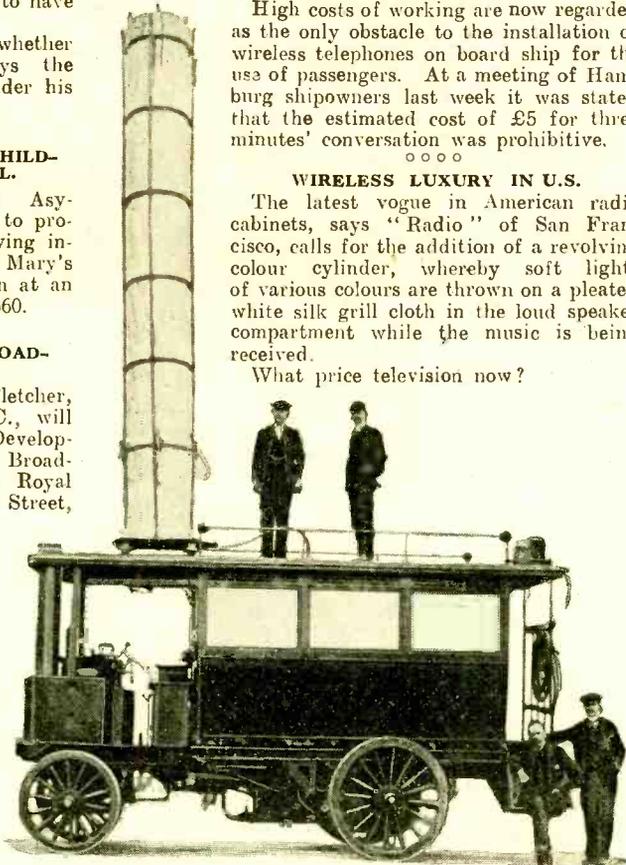
The latest radio laws of the United States forbid the suggested alliance between the Radio Corporation of America and the International Telephone and Telegraph Company, says a Washington message.

When the merger proposal first came to light, it was immediately regarded as the American reply to the wireless-cable merger in Britain. Had the scheme materialised, the new organisation would have been the largest of its kind in the world.

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I.E.E. SUMMER MEETING.

The 1929 Summer Meeting of the Institution of Electrical Engineers will take the form of a twelve days' tour in France at the invitation of the Société Française des Electriciens. Visits will be paid to the Sainte Assise wireless station, various generating stations, including the hydro-electric plant of the Paris-Orleans Railway, and other places of interest. The meeting extends from June 11th to 22nd.



AN EARLY "TRANSPORTABLE SET" photographed 25 years ago. On the extreme right is Senator Marconi, accompanied by Sir (then Dr.) Ambrose Fleming.

B.B.C. TRANSATLANTIC TESTS.

We understand that tests are now being conducted from 10 to 10.30 p.m. G.M.T. on Thursdays between 5SW, Chelmsford, and WNXX, Pittsburgh, the former working on its normal wavelength of 25.5 metres and the latter on about 25 metres.

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P.M.G. AND PORTABLES.

Much vexation of spirit among conscientious owners of portable sets was dispelled last week by the following announcement of the Postmaster-General:—

In view of the increasing popularity of portable wireless sets, the Postmaster-General has decided that in future a wireless licence should cover not only the use of wireless sets at the address shown on the licence but also the use of one portable set at any place in Great Britain or Northern Ireland by the licensee or any mem-

building, such as a lodge or for a portion of the same address under a separate tenancy.

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PORTABLE SETS ON SHOW.

An exhibition of modern portable sets and other productions of some of the leading wireless manufacturers is now being held at York House, Southampton Row, London, W.C.1, by the Ridged Cone Co., Ltd. An additional attraction is afforded by demonstrations of picture reception on a "Fultograph" instrument. Admission to the exhibition is free.

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SINGLE WAVELENGTH WORKING: NEW STYLE.

A peculiar form of single wavelength working, with synchronised programmes, is to be tried out in Virginia, according to a Washington message. Permission to construct four experimental transmitters has been granted to the

SHORT WAVES TO THE ARGENTINE.

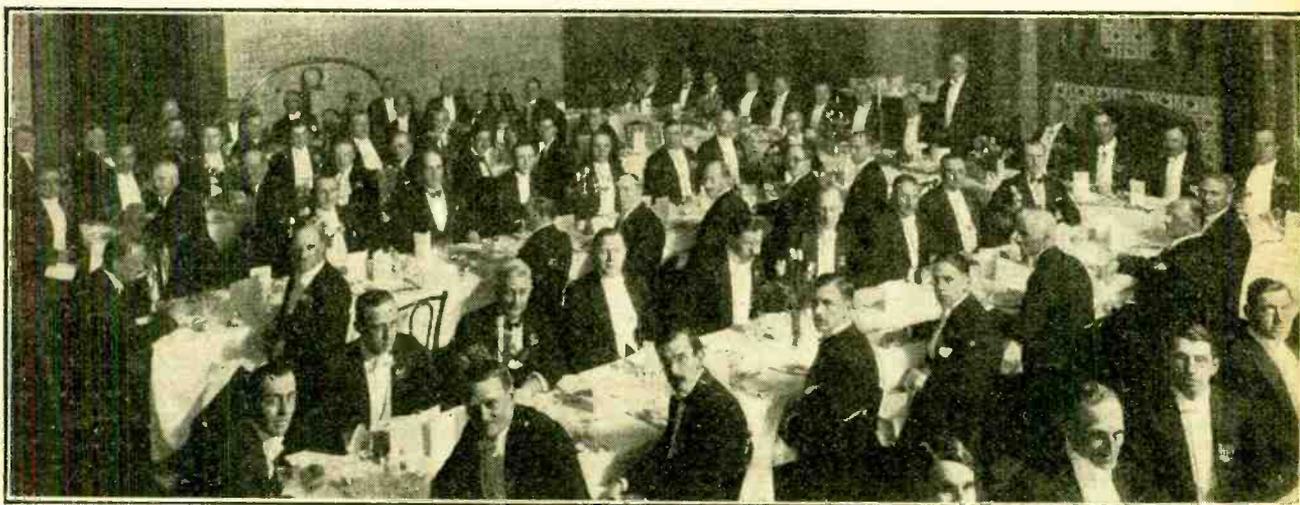
Under the title, "The Popular Argentine," a note in our issue of February 27th may have given the impression that all short-wave telephony between Europe and Buenos Aires is conducted via the German station at Nauen. This is not the case. A regular service to Buenos Aires is maintained by the French station at Sainte Assise.

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AIRCRAFT WIRELESS PROBLEM.

The alleged absurdity of depending upon an airplane's engine for power to operate the wireless transmitter is causing concern in Washington where, as the result of bitter experience, airmen are complaining that most aerial emergencies are brought about by engine failure.

In trans-water flights, with which the discussion is mainly concerned, the wind-driven generator is useless in the case of



The annual dinner of the British Wireless Dinner Club held recently at the Hotel Cecil. Those having the necessary qualification are invited to make application for membership of the Club is open to those who served as commissioned officers in some branch of wireless in one of the services during the war or who are at present so serving. Particulars of membership.

ber of his household. When a portable set is used away from the home address, the person using it must carry the licence with him and produce it if asked to do so by an authorised officer of the Post Office.

This new facility will take effect immediately; but no rebate will be allowed in respect of a separate licence already taken out for a portable set. The conditions printed on the licence forms will be amended in due course.

General Post Office.

9th April, 1929.

In issuing this statement the Postmaster-General also referred to the general conditions affecting receiving licences. It was pointed out that a licence covers any number of sets used by a householder, his family and his domestic staff; that a licence covers the temporary use of receiving apparatus at another residence provided that no receiving apparatus is being worked at the home address; and that a separate licence is necessary for a separate

Continental Broadcasting Corporation of New York by the Federal Radio Commission.

The system under test employs two key stations, each transmitting a high-frequency carrier wave. These are modulated by the local stations, each of which transmits the same "bottled programme" in the form of a gramophone record synchronised with its neighbours. The company plans to build a chain of 100 stations, but it remains to be seen whether the Federal Radio Commission approves of the experiments.

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THE ELEMENTS UNDER HIGH PRESSURES.

The Physical Society announces that the Fourteenth Guthrie Lecture will be given by Professor P. W. Bridgman, of Harvard University, on "The Properties of the Elements under High Pressures." The lecture will be delivered at 5 p.m. on Friday next, April 19th, in the Imperial College of Science, South Kensington. Admission is free.

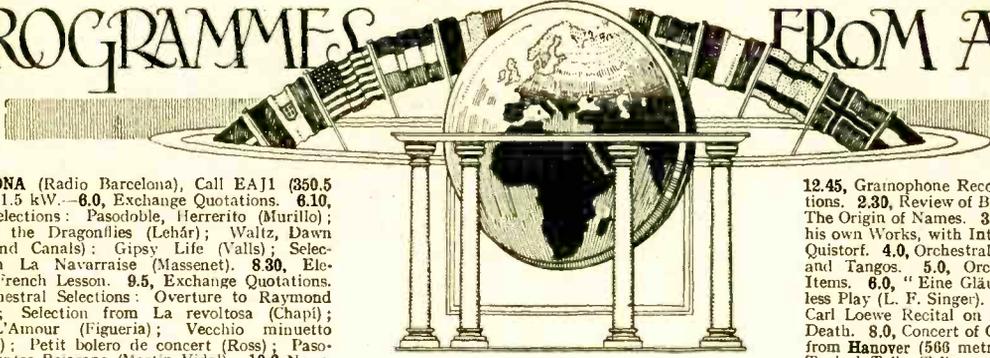
a forced descent, and attention is therefore being turned to auxiliary petrol engines. That hand-driven generators are unreliable was proved on Commander Bartlett's Transpacific flight to Colon. Two planes were used, each fitted with emergency hand-driven gear, but neither was able to establish communication with other stations when on the water, although both crews exhausted themselves in trying to generate sufficient current.

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SOLAR ECLIPSE TESTS.

The total eclipse of the sun on May 9th, which will be visible in parts of South Africa, the Malay States and Australia, is to be the occasion of special wireless tests under the direction of General Ferrié, President of the Comité Français de Radiotélégraphie Scientifique. A research party has left France for the volcanic island of Bai-Kam, in the Mekong delta, Cochin China, taking with them an aeroplane equipped with a 500-watt c.w. transmitter.

PROGRAMMES FROM ABROAD



SRJ

BARCELONA (Radio Barcelona), Call EAJ1 (350.5 metres); 1.5 kW.—8.0, Exchange Quotations. 6.10, Sextet Selections: Pasodoble, Herrerito (Murillo); Dance of the Dragonflies (Lehár); Waltz, Dawn (Valley and Canals); Gipsy Life (Valls); Selection from La Navarraise (Massenet). 8.30, Elementary French Lesson. 9.5, Exchange Quotations. 9.10, Orchestral Selections: Overture to Raymond (Thomas); Selection from La revoltosa (Chapi); Waltz, L'Amour (Figueria); Vecchio minuetto (Sgambati); Petit bolero de concert (Ross); Pasodoble, Fuentes Bejarano (Martín Vidal). 10.0 News. 10.5, Programme relayed from Madrid, EAJ7.

BERGEN (365.9 metres); 1.5 kW.—8.0, Programme for Girls. 7.0, Orchestral Concert. 7.30, Saxophone Recital. 7.50, Topical Talk. 8.0, Talk: Volcanic Action. 8.30, Recitations. 9.0, Weather Report, News and Time Signal. 9.15, Programme of Dance Music. 11.0 (approx.), Close Down.

BERLIN (Königswusterhausen) (1,649 metres); 40 kW.—1.20, Programme for Children by Ursula Scherz. 2.0, Lesson in Elocution by B. K. Graef. 2.30, Weather Report and Exchange Quotations. 2.40, Programme for Women. 3.0, Educational Talk. 3.30, Talk by Otto Mosbach. 4.0, Programme relayed from Hamburg. 5.0, Bernhard Otte, Talk: Is Welfare Work becoming a Nuisance? 5.30, Elementary French Lesson. 5.55, Dr. Amman, Talk: Switzerland and the Swiss. 7.0, "Rural" Programme: Easter Hymn, Song of the 19th Century (Palestrina, arr. Böhm); Selections, Hackenberger, (a) Marsch der Querfeier, of the 10th Century, (b) Gausen Lied, Marching Song of 1582, (c) Fanfare der Pappenheimer Reiter und Pappenheimer Marsch from the Thirty Years War, Talk: What a Village Boy experienced in the Thirty Years' War; Stralsunder Fanfare, Music from Wallenstein's Retreat August 1028; March of the Finnish Cavalry of the Thirty Years' War; Björneborgarnes—Swedish Cavalry March of the Thirty Years' War; followed by Programme from Voxhaus.

BERLIN (Voxhaus) (475.4 metres); 4 kW.—9.10 a.m., Market Prices. 9.15 a.m., Time Signal, Weather Report and News. 10.0 a.m., Programme of Gramophone Records. In the Interval—Exchange Quotations and Weather Report. 11.55 a.m., Time Signal. 12.30, Time Signal, Weather Report and News. 1.0, Programme of Gramophone Records. 2.0, Exchange Quotations. 2.10, Agricultural Market Prices and Time. 2.30, Virginia Neuhaus-Raspe, Talk: Journeys in Tripoli. 3.0, Heinz Ludwig, Talk: From Comedian to Actor. 3.30, The Microphone in the Tree-tops, relayed from Werder, followed by Advertising Talk. 5.10, Dr. Paul Frank, Talk: Medical Hygiene. 5.35, Dr. Siegfried Mauermann, Talk: Western Europe and the German Spirit. 6.0, Otto Debal, Talk: The Present Position in Trade-Unions. 6.30, Herr von Lucanus, Talk: From the Book of Nature—Animals of Former Times. 7.0, Concert of Popular Songs and Operetta Music: Overture to Venus auf Erden (Lincke); Soprano Solo, Unterm Machandelbaum (Holländer); Tenor Solo from Der Juxbaron (Kollo); Waltz from Polish Industry (Gilbert); Selection from Film Magic (Kollo); Soprano and Tenor Duets (Gilbert), (a) Duet from The Cinema Queen, (b) Waltz from The Woman in Purple; Heimlich, still und leise (Lincke); Duets for Soprano and Tenor from Die geschiedene Frau (Fall); Selection from Die Scheidungsreise (Hirsch); Overture to Auf ins Metropol (Holländer); How does a Popular Song originate?—Conversation with Vocal Illustrations; Overture to The Betrothal by Lantierlight (Offenbach); Czardas from Die Fledermaus (Joh. Strauss); The Kiss Waltz (Joh. Strauss); Tenor Solo from Herbstmäner (Kálmán); Duet from The Dollar Princess (Fall); Waltz from Eva (Lehár); Hungarian March from Gipsy Love (Lehár); followed by Time Signal, Weather, News, Sports Notes and Dance Music. 11.30 (approx.), Close Down.

BERN (406 metres); 1.5 kW.—4.0, Orchestral Concert. 6.29, Time Signal and Weather Report. 6.30, Herr Schweizer, Talk: The Police System in Berlin. 7.0, Recital of Modern Pianoforte Compositions. 7.15, Programme from Zürich. 7.45, Popular Programme. 9.0, News and Weather Report. 9.15, Orchestral Selections. 9.40, Dance Music. 11.0 (approx.), Close Down.

BRESLAU (321.2 metres); 4 kW.—5.20, Margarete Polier, Talk in Esperanto: Lessing and Breslau.

SATURDAY, APRIL 20th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

5.30, Programme from Königswusterhausen. 6.20, Elementary Shorthand Lesson. 6.50, Georg Lichey, Talk: At the Turning Points of World History—Bismarck. 7.15, Concert of Light Music: Orchestral Selection, Overture to Pique Dame (Suppé); Walzer beim Wein (A. Strasser); Loblied der Berliner (P. Strasser); Loblied der Berliner Jungens (Krome); Wann der Mond am Himmel steht (Stransky); Orchestral Selection, Waltz from the Little Dutch Girl (Kálmán); Humorous Songs, Orchestral Selection, Fox-Trot Meine drei Kusinen: (Marbot); Willjald (Wilczynsky); A Curious Adventure (Wilczynsky); Orchestral Selection, Slow Fox-Trot, Glaub mir, ich bin dir gut (Egen); Humorous Songs; Orchestral Selection, Waltz Boston, Dunkelrote Rosen (Plessow); Verse Selections (Wilczynsky); Orchestral Selection, Fox-Trot (Nelson). 9.0, News. 9.30, Dance Music relayed from Voxhaus. 11.0 (approx.), Close Down.

BRUNN (432.3 metres); 2.5 kW.—5.0, German Transmission: News and Concert. 6.0, Programme from Prague. 6.5, "Don Juan"; Opera (Mozart) relayed from the National Theatre. 9.0, Programme from Prague. 9.25, Programme from Prague.

BRUSSELS (511.9 metres); 1.5 kW.—5.0, Dance Music from the St. Sauveur Palais de Danse. 5.45, Elementary and Intermediate English Lessons. 6.30, Popular Gramophone Records. 7.30, La Radio-Chronique. 8.0, Concert by the Royal Conservatoire at Liège, under the direction of M. François Rasse. Acts 1 and 3 from "Siegfried"; Opera (Wagner), followed by News and Esperanto Announcements.

BUDAPEST (545 metres); 20 kW.—5.0, Orchestral Concert of Ballet Music. 6.15, Talk. 7.0, Programme of One-Act Plays, Songs and Gramophone Records. 8.45, Time Signal, News, and Concert of Zigane Music. In the Interval, Weather Report.

DUBLIN, Call 2RN (411 metres); 1.5 kW.—1.30, Weather Report and Gramophone Concert. 7.20, News. 7.30, Miss E. C. FitzHenry, Talk: Sir John Gilbert. 7.45, Irish Lesson by Seamus O'Duinnane. 8.0, Selections by the Augmented Station Orchestra. 8.30, Vocal Variety by Fay Sargent and Joan Burke. 9.0, "The Blue Corpse"; A Burlesque Thriller (Bryan). 9.30, Baritone Solos by P. J. Duffy. 9.45, Cello and Vocal Recital by J. Schofield and Mary Maguire. 10.15, Selections by the Augmented Station Orchestra. 10.30, News, Weather Report and Close Down.

FRANKFURT (421.3 metres); 4 kW.—2.5, Programme for Children. 2.55, Talk for the Housewife by Fini Pfannes. 3.35, Orchestral Concert of the latest Dance Music. In the Interval: News and Announcements. 5.10, Reading by O. W. Studdmann, from The Lives of the Caesars (Suetonius). 5.30, Answers to Correspondents. 5.45, Lesson in Esperanto by W. Wischoff. 6.5, Dr. Wilhelm Heinitz, Talk: Music of the Arabs, with Gramophone Illustrations. 6.45, Educational Talk. 7.15, A Farce by Toni Impekonen, followed by Saxophone Music, and Dance Music from Voxhaus. 11.30 (approx.), Close Down.

HAMBURG, Call HA (in Morse) (392 metres); 4 kW.—10.0 a.m., Educational Talk. 12.5, Exchange Quotations, News, Weather Report, Tide and Ice Reports.

12.45, Gramophone Records. 1.40, Exchange Quotations. 2.30, Review of Books. 3.0, Karl Minor, Talk: The Origin of Names. 3.25, Wilhelm Plog reads from his own Works, with Introductory Talk by Hermann Quistorf. 4.0, Orchestral Concert of Minuets, Gavottes and Tangos. 5.0, Orchestral Concert of Request Items. 6.0, "Eine Gläubigerversammlung"; Wireless Play (L. F. Singer). 6.55, Weather Report. 7.0, Carl Loewe Recital on the 60th Anniversary of his Death. 8.0, Concert of German March Music, relayed from Hanover (566 metres). In the Interval at 9.0, Topical Talk, Talks extraneous to the Programme, News, Weather Report, Sports Notes, Snow Report and Police Announcements. 10.30, Dance Music. 10.50 (in an Interval) North Sea and Baltic Weather and Ice Report. 12.0 Midnight (approx.), Close Down.

HILVERSUM (1,071 metres); 5 kW.—9.40 a.m., Time and Daily Service. 11.40 a.m., Police Announcements. 11.55 a.m., Concert of Trio Music. 1.40, Musical Programme relayed from the Tuschinski Theatre, Amsterdam, under the direction of Mr. Max Tak, with Pierre Palla (Organ). 3.40, Italian Lesson by Mr. Giovanni Rizzini. 4.40, French Lesson by Mr. Raymond Lafont. 5.40, Time Signal. 5.42, Trio Concert. 6.25, German Lesson by Mr. Edgar Grün. 7.25, Police Announcements. 7.40, Time Signal. 7.45, Programme arranged by the Workers' Radio Association: Concert and Talk. 11.10 (approx.), Close Down.

HUIZEN (339.8 metres); 4 kW.—Transmits on 1,852 metres from 5.40 p.m. 11.10 a.m., Sacred Recital. 11.55 a.m., Concert of Trio Music. 12.55, Gramophone Records. 2.40, Programme for Children. 5.10, Gramophone Records. 6.20, Talk by M. Perk. 6.30, Gramophone Records. 7.10, Talk by the Rev. A. Suys. 7.40, The Great Show-places of the World (Caldéron de la Barca), Music by Haak. 10.40, Gramophone Records. 11.10 (approx.), Close Down.

KALUNDBORG (1,153 metres); 7 kW.—Programme also for Copenhagen (339.8 metres).—6.30 a.m., Morning Gymnastics. 10.0 a.m., Weather Report. 12.15, Educational Talk in German—Thomas Mann. 2.0, Programme for Children. 2.30, Concert: March, Frisch voran (Blankenburg); Waltz, Les Adieux (Fétras); Berlin wie es weint und lacht (Conradi); Selection from Mignon (Thomas); Pólsk; Fædrelandssang (Gade); March, Wien bleib Wien (Schrammel); Violin Solos, (a) Russisk Vuggesang (Grandet-Brown); (b) Slavonic Dance in G Minor (Dvorak-Kreisler); (c) Capriccio all' antica (Sinigaglia), (d) Serenade from Les Millions d'Arlecins (Drigo), (e) 18 spindlestuen (von Hubay); The Liberty Bell March (Sousa); Waltz from The Count of Luxembourg (Lehár); Selection from Gamle Minder (Möller); Selection from Martha (Flotow); Largo (Händel); Gallop; En Carrière (Hass). 4.40, Exchange Quotations. 5.20, E. Erstad Jürgensen, Talk: The Laying Out of Gardens. 5.50, Weather Report. 6.0, News. 6.15, Time Signal. 6.30, Carl Gad, Talk: Modern Foreign Authors—W. C. Yeats. 7.0, Chimes from the Town Hall. 7.2, Concert of French Rocooco Music: Selections (Lully), (a) Introduction, (b) Nocturne, (c) Minuet, (d) Prelude-March; Selections from Castor and Pollux (Rameau), (a) Gavotte, (b) Minuet, (c) Passepied. 7.30, "Le Misanthrope"—Comedy (Molière); followed by News. 9.15, Concert of Light Music: Overture to Le Postillon de Longjumeau (Adam); Mauresque (Granados); Dance of the Marionettes (Gillet); Selection from The Drum Major's Daughter (Offenbach); Chant du soir (Elgar); Waltz and Czardas from Coppélia (Delibes); March, El Capitán (Sousa). 10.0, Dance Music from the Industri Restaurant. 11.0, Chimes from the Town Hall. 11.15 (approx.), Close Down.

LAHTI (1,500 metres); 35 kW.—5.35, Trumpet Selections. 6.0, Violin Recital. 6.20, Duets. 6.40, Orchestral Selections: Romance (Svendson); Norwegian Rhapsody (Svendson). 7.0, Recitation. 7.20, Orchestral Selections from the Works of Grieg. 7.45, News in Finnish and Swedish and Close Down.

LANGENBERG (462.2 metres); 20 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Cologne (263.2 metres), and Münster (267.8 metres).—12.5, Orchestral Concert: Overture to The Water Carrier (Cherubini); Waltz, Thousand and One Nights (Strauss); Selections from Werther (Massenet); Rumanian Folk Dances (Bartók); Italian Barcarolle (Czibulka); Waldesflüster (Czibulka); Suite, Old China (Niemann); Malled (Micheli); Potpourri, Wir flüsteru

Programmes from Abroad.—

Saturday, April 20th.

All Times are reduced to Greenwich
Mean Time and are p.m. except
where otherwise stated.

(Dostal). 1.30, Hints for the Housewife. 1.40, Prof. Bruck, Talk: Tax-collectors. 2.30, Economic Report, Weather and Sports Notes. 2.40, Programme for Children. 3.5, Literary Programme. 3.30, Dr. Emmy Wingerath, Talk: The Social Position of Professional Women. 4.0, Dr. Schlunz, Talk: The Industrial Position in Westphalia and the Rhineland in the First Quarter of 1929. 4.25, English Lesson by Prof. Hase. 4.45, Orchestral Concert: Overture to Euryanthe (Weber); Air from Aida (Verdi); Suite, Aus aller Herren Länder (Moszkovsky); Air from Turandot (Puccini); Coronation March from King Tula (Volbach). 5.30, Dr. van Hansemann, Talk: The Town—its Constitution and Administration. 5.50, Morse Lesson. 6.15, Talk for Workers. 6.40, Dr. Lips, Talk: The Development of Culture. 7.0, Variety Programme, followed by News, Sports Notes, Commercial Announcements, Musical Selections and Dance Music. 12.0 Midnight (approx.), Close Down.

LEIPZIG (361.9 metres); 4 kW.—3.30, Orchestral Concert: Overture to Die beiden Husaren (Doppler); Suite, Jeux d'enfants (Bizet); Selections from L'Amico Fritz (Mascagni); Norwegian Dance (Grieg); Waltz, Frühlingskinder (Waldteufel); Wiener Spaziergänge (Komzak). 4.45, Wireless News and Talk. 5.25, Weather Report and Time Signal. 5.30, See Königs-wusterhausen. 5.55, Labour Market Report. 6.0, Prof. Schirrmann, Talk: Hostels for Young People. 6.30, Talk by Erna Scholze. 7.0, Eduard Mörike Memorial Concert, relayed from Chemnitz. 9.0, Time Signal, Weather Report, News, Programme Announcements and Sports Notes; followed by Dance Music relayed from Voxhaus. 11.30, (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 (428.7 metres); 3 kW.—7.0, Chimes, Exchange Quotations and Programme of Dance Music. 8.25, News. 9.45, Weekly Agricultural Review. 10.0, Chimes and "Don Quintín el amargao"—Farce in Two Acts (Arniches), Music by Guerrero. 12.0 Midnight (in the Interval), Chimes and News. 12.30 a.m. (approx.), (Sunday), Close Down.

MOTALA (1,351 metres); 33 kW.—Programme also for Stockholm (438 metres), Böden (1,200 metres), Göteborg (340.8 metres), Hörby (200.9 metres), Österund (770 metres) and Sundsvall (545.5 metres).—4.0, Concert of Light Music: Rakoczy Overture (Keler-Béla); Oriental Suite (Poppy); Selection from La belle Hélène (Offenbach); Waltz, Tesoro mio (Becucci); Slovakian Dances (Felber-Artok); Bellmannsmelodier. 5.0, Programme for Children. 5.30, "It pays to advertise": Comedy. 6.45, Sonata for Violin and Piano forte in B Flat Major No. 15 (Mozart). 7.15, Military Band Concert relayed from Östersund: March, The Washington Grays (Grafulla); Overture to Madelon (Bazin); Waltz, A Day in Seville (Waldteufel); Bayadère Dance (Rubinstein); Minne från Jämtland (Wohlfahrt); Two Scandinavian Dances (Grieg); Selection from The Duchess of Chicago (Kálmán); Alianza (Beretta). 8.15, News and Weather Report. 8.45, Topical Talk. 9.0, Dance Music. 11.30 (approx.), Close Down.

MUNICH (538.7 metres); 4 kW.—Programme relayed by Augsburg (506 metres), Kaiserslautern (272.7 metres) and Nürnberg (240 metres).—5.35, Labour Market Report. 6.0, Answers to Queries. 6.30, Choral Concert: Abschied (Kirchl); Braun Maidelein (Kirchl); Treue Liebe (Heim); Altes deutsches Minnelied (Otto); Ach Elsiein (Kunz); Folk Song, Verlorenes Lieb; Ich bin so frei (Meyer); Liebeshindernis Vernay; Reizend (Wagner); Der schlamperte Mesner. 7.5, Dialect Programme. 7.20, Orchestral Concert: Barcarolle from The Tales of Hoffmann (Offenbach); Overture to Poet and Peasant (Suppé); Variations on Komm ein Vogel geflogen (Ochs); La Mattinata (Leoncavallo); Two Xylophone Solos, (a) Bertha Anderstein (Eberlein), (b) Kunstreiter-Galopp (Oertel); Rhapsody on Bavarian Folk Melodies (Pützing); Potpourri, Aus deutschen Gauen (Christern). 8.35, "A Day in the Pusztá": Musical Sketch (Welchand) Music by F. Jäger. 9.20, News. 9.45, Orchestral Concert from the Oleano Casino. 11.0 to 11.45, No Transmission. 11.45, Programme of European Folk Music: Russia-Russian Gipsy Melodies and Folk Songs, Eisblumen (Leuschner); Hungary-Hungaria (Leopold); Austria-Potpourri, Ein Abend in Grinzing beim heurigen Wein (Dauber); Germany-Potpourri of Folk Songs and Marches, Jung Deutschland (Weninger). 12.45 a.m. (approx.) (Sunday), Close Down.

NAPLES, Call INA (333 metres); 1.5 kW.—4.0, Concert: Orchestral Selections (Longo), (a) Berceuse, (b) Intermezzo, Le campane di S. Petronio; Soprano Solo, Se tu canti (Tosti); Orchestral Selection, Intermezzo, Angelus (De Micheli); Soprano Solo, Il marinaio canta (De Lucia); Orchestral Selection, Potpourri, The Merry Widow (Lohár); Soprano Solo

from Rigoletto (Verdi); Orchestral Selection, Intermezzo, Leggenda (Mascheroni); Soprano Solo, from La sonnambula (Bellini); Orchestral Selections, (a) Intermezzo, Luna e laguna (Sagaria), (b) Intermezzo, Cavallini a donolo (Piovano). 4.30, Time Signal. 4.35, Talk. 7.30, Time Signal, Wireless Talk, Announcements, News and Harbour Notes. 7.45, Relay of an Opera from the San Carlo Royal Theatre. 9.50, News. 9.55, Calendar and Programme Announcements. 10.0 (approx.), Close Down.

OSLO (493.7 metres); 1.5 kW.—Programme relayed by Freløystad (387 metres), Hamar (577 metres), Notodden (297 metres), Porsgrunn (455 metres) and Rjukan (448 metres).—5.45, Programme for Children. 6.15, Weather Report and News. 6.30, Recitation of Legends. 7.0, Time Signal, followed by Orchestral Concert: Chant d'amour (Massenet); French Serenade (Grieg); Maria Magdala (Pedrolle); Le Baier (Micheli); Romance (Rubinstein); Russian Dance (Moussorgsky); Idyll (Hurum); Tzigane Romance (Meisel); Ave Maria (Schubert); Intermezzo roccoco (Aletter); Siamesische Wachtparade (Lincke). 8.30, Weather Report and News. 8.50, Topical Talk. 9.5, "Madam, I love you": Comedy in One Act (Weber). 9.45, Gramophone: Records of Dance Music. 11.0 (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT (458 metres); 0.5 kW.—6.30, "Radio Journal de France." 8.0, Talk by M. Lassalle. 8.15, Science Talk by M. Cépède. 8.30, Review of Sports. 9.0, Programme from the Amphitheatre of the Sorbonne, followed by Time Signal, News, and Weather Report.

PARIS (Eiffel Tower), Call FL (1,495 metres); 5 kW.—5.0, Padeloup Concert. 7.10, Weather Report. 7.20, "Le Journal parlé"—Programme of Talks (a) M. Marc Frayssinet—The Postilion, (b) Dr. Pierre Vachet—Health, (c) Mlle. Jacqueline Bertillon—Social Works and Talks by other contributors.

PARIS (Petit Parisien) (338.3 metres); 0.5 kW.—8.45, Gramophone Records, Talk and News. 9.0, Concert: Overture to La fille de Madame Angot (Lecocq); Selection from Maia (Leoncavallo); Invitation to the Waltz (Weber); Spanish Caprice (Rimsky-Korsakoff); Rapsodie sur des airs du pays d'Océ (Lacombe); Pirotot ioyeux (Lavadé); La fête au village lorrain from the Suite lorraine (De Boisdeffre). In the intervals at 9.25 and 10.0, News.

PARIS (Radio Paris), Call CFR (1,744 metres); 1.5 kW.—12.30, Selections from the Voyage en Chine (Bazin). In the interval at 1.0, Market Prices and News. 2.0, Market Quotations. 3.30, International Market Prices. 3.45, Programme for Children. 4.15, Dance Music. 4.45, Market Prices and News. 6.30, New York Exchange Rates. 6.35, Gramophone Concert: Orchestral Selections from Les Cloches de Corneville (Piaquette); Song, Je garde en moi ton baiser (Beguin), by Vorelli; Violin Solo, Berceuse (Fauré) by Mlle. Yvonne Curti; Vocal Selection from The Barber of Seville (Rossini) by M. André Baugé; Enchantment (Massenet) by Mme. Ninon Vallin; Nocturne from the Second Quartet (Horodine); Selection from The Damnation of Faust (Berlioz) by Ruhlman's Symphony Orchestra; Old Black Joe (Stephen); Fox-Trot, La Doodie La Da Da (Robinson) by Willard Robison and his Orchestra. 7.5, Agricultural Report. 7.30, Lesson in the Interpretation of Modern French Music. 7.45, Metal Prices and News. 8.0, Talk. 8.15, Concert: Pregneria (Stradella); Erläute (Pasquini); Pastoral (Haydn). 9.0, Dance Music. In the intervals—News.

PITTSBURGH, Call KDKA (63 and 27 metres); 2.5 kW.—11.0, Telechron Time. 11.1, Studio Programme. 11.30, The Gold Spot Pals, relayed from New York. 12.0 Midnight, Sessions Clock Chimes. 12.1 a.m. (Sunday), Address arranged by the University of Pittsburgh. 12.15 a.m., The Home Radio Club. 12.30 a.m., Talk on Literature. 12.45 a.m. (G.M.T.), to 4.1 a.m. (B.S.T.), Programme relayed from New York. 12.45 a.m., Commercial Talk. 1.0 a.m., Puro Band Programme. 1.30 a.m., Interview Entertainers. 2.0 a.m. (G.M.T.), 3.0 a.m. (B.S.T.), Packard Programme. 3.30 a.m. (B.S.T.), Programme by the Seven-Eleven Dance Orchestra. 4.0 a.m. (B.S.T.), Longines Time. 4.1 a.m. (B.S.T.), The Pittsburgh Period. 5.0 a.m. (B.S.T.), Champion Weather Reports. 5.5 a.m. (B.S.T.), Emergency Messages to the

Far North, followed by Dance Music from the William Penn Hotel.

PRAGUE (343.2 metres); 5 kW.—4.50, Agricultural Report, followed by German Transmission—News and Song Recital. 6.0, Chimes and News. 6.5, Radiofeuilleton. 6.15, Concert of Light Music. 7.30, A Comedy. 8.0, Concert of Russian Music. 9.0, Time Signal, News and Theatre Notes. 9.25, Concert of Popular Music. 10.0, Time Signal and Close Down.

ROME, Call IRO (443.8 metres); 3 kW.—7.29, Time Signal. 7.30, Report of the International Labour Office at Geneva. 7.45, Military Band Concert: March, Impressioni americane (Manente); Selection from Aida (Verdi); Norwegian Dance (Grieg); "Lettera smarrita"—Comedy in One Act (Niccodemi); Intermezzo from Daphne (Mülé); Selection from Loreley (Catalani); Coronation March from The Prophet (Meyerbeer); Review of Art and Literature; Histoire d'un Pierrot (Costa); Danza originale (Manente). Passa la Serenata (Cortopassi). 9.50, Giornale parlato and News. 10.0 (approx.), Close Down.

SCHENECTADY, Call 2XAF (31.43 metres); 30 kW.—11.29, Time Signal and White House Coffee Programme relayed from New York. 12.0 Midnight, Ed Trautman and his Blue Ribbon Entertainers. 12.30 a.m. (Sunday), Musical Programme relayed from Rochester. 1.0 a.m., Talk by Sidney W. Ashe. 1.15 a.m., Selections by the Hotel van Curler Orchestra. 1.30, Mildred Hunt and the Marimba Orchestra relayed from New York. 2.0 a.m. (G.M.T.), 3.0 a.m. (B.S.T.), General Electric Hour with Walter Damosch conducting, relayed from New York. 4.0 a.m. (B.S.T.), Lucky Strike Programme relayed from New York. 5.0 a.m. (B.S.T.), Special Broadcast to Commander Byrd at Little America. 6.0 a.m. (B.S.T.) (approx.), Close Down.

STUTTGART (374.1 metres); 4 kW.—2.0, Orchestral Concert from Italian Opera: Overture to The Force of Destiny (Verdi); Prologue and Selection from I Pagliacci (Leoncavallo); Air from Iris (Mascagni); Selections from Cavalleria Rusticana (Mascagni), (a) Intermezzo, (b) Serenade, (c) Duet; Overture to Sicilian Vespers (Verdi); Duet from Aida (Verdi); Selections from Il Trovatore (Verdi) Trio from A Masked Ball (Verdi); Lazaret Scene (Ponchielli). 3.30, Thé-Dansant relayed from the Pavillon Excelsior. 5.0, Time Signal and Weather Report. 5.15, Talk: Modern Religious Art, relayed from Freiburg (577 metres). 5.45, Dr. P. Schickler, Talk: Leonardo da Vinci as Technologist and Naturalist. 6.15, Book-keeping Lesson by Dr. Wolff. 6.45, Time Signal, Weather Report and Sports Notes. 7.15, Programme from Frankfurt, followed by News (Stuttgart), and Dance Music from Voxhaus. 11.30 (approx.), Close Down.

TOULOUSE (Radiophonie du Midi) (389.6 metres); 8 kW.—12.45, Concert. 8.0, Exchange Quotations and News. 8.30, Mandoline Recital: Liebesstädchen (Lincke); Selection (Eilendberg); Dream of Love after the Ball (Czibulka); Liebeslied (Lincke). 8.45, Selections from "Faust" (Gounod). 10.15, North African News. 10.30 (approx.), Close Down.

VIENNA (519.9 metres); 1.5 kW.—4.35, Concert: Songs, (a) Air from The Bartered Bride (Smetana), (b) Air from La Gioconda (Ponchielli), (c) Song from Roussalka (Dvorák); String Quartet in D Minor (Stöhr). 5.15, Reading of Fairy Tales. 6.0, S. Loewy, Talk: Famous Charlatans and Adventurers. 6.30, Topical Talk. 7.0, Time Signal and Weather Report. 7.5, "Absalom's Hair"—Drama in Three Acts (Calderon de la Barca), Paraphrase by Otto Zoff, followed by Concert of Russian and Polish Music: Prelude (Rachmaninoff); Selections from Boris Golounoff (Moussorgsky); Serenata for Violin (Moszkovsky); Selection from Pique Dame (Tchaikovsky); Menuet célèbre (Palerewsky); Polonaise in A Major for Violin (Wieniawsky); Fantasia on the Works of Chopin, Chopiniana (Schmidt); Scenes from Halka (Moniuszko); Wedding March from Feramors (Rubinstein), followed by Phototelegraphy Transmission.

WARSAW (1,385.7 metres); 10 kW.—5.50, Miscellaneous Items. 6.10, Wireless Review by Dr. M. Stepovsky. 6.35, News. 6.56, Time Signal. 7.0, Prof. Niewiadomsky, Talk: The History of Polish Music. 7.30, "Flora Bella"—Opera in Three Acts (Cuvillier). In the interval—Theatre Review. After the Programme—News, Weather Report, Police Announcements and Sports Notes. 9.30, Dances Music from the Hotel Bristol. 10.30 (approx.), Close Down.

ZÜRICH (499.4 metres); 1 kW.—3.15, Time Signal and Weather Report. 6.17, Concert of Quintet Selections. 7.15, Minna Magdalena—Grotesque (Kurt Gätz). 7.45 (approx.), Popular Concert. 9.0, Weather Report and News. 9.10, Gramophone Dance Music.

Programmes from Abroad.—

SUNDAY, APRIL 21st.

All Times are reduced to British
Summer Time and are p.m. except
where otherwise stated.

BARCELONA (Radio Barcelona), Call EAJ1 (350.5 metres); 1.5 kW.—11.0 a.m., Relay of Chimes from the Cathedral at Barcelona. 11.5 a.m., Announcement of Meteorological Conditions for Europe and North-East Spain and Report on Aviation Routes. 1.30, Afternoon Concert of Light Trio Music. 2.45 to 6.0, No Transmission. 6.0, Weekly Agricultural Report on Grain and Cattle Market Prices. 6.10, Programme of Dance Music by the Station Orchestra. 6.30, Recital of Songs. 7.0, Weekly Talk for Agriculturists, organised by the San Isidro Catalan Institute for Agriculture. 7.15, Musical Programme by the Station Orchestra: Romance from the Fourth Symphony (R. Schumann). 7.50, Programme of Vocal Selections. 8.20, Selections by the Orchestra of the Station. 8.40, Review of Sport. 9.0 (approx.), Close Down.

BERGEN (365.9 metres); 1.5 kW.—10.30 a.m., Relay of Church Service. 12.30, Weather Report and Forecast and General News Bulletin. 8.0, Selections of Orchestral Music. 8.50, Talk on Topics of the Day. 9.0, Talk by Mrs. von der Lippe Konow: "Vinje." 10.0, Weather Report and Forecast, followed by General News Bulletin and Time Signal. 10.15, Programme of Dance Music. 12.0 Midnight (approx.), Close Down.

BERLIN (Königswusterhausen) (1,649 metres); 40 kW.—8.55 a.m., Relay of Chimes from the Potsdam Garrison Church. 9.0 a.m., Morning Festival of Church Music with Vocal and Instrumental Numbers and Sermon, relayed from Voxhaus, followed by Chimes from Berlin Cathedral. 11.30 a.m., Morning Concert. 1.15, Notes for Chess Enthusiasts, by E. Nebermann. 1.45 to 2.15, Experimental Transmission of Pictures. 2.30 to 3.30, Three Talks for Farmers. 3.30, Programme of Fairy Stories. 4.30, Programme of Light Music. 6.0, Talk. 8.0 (approx.), Concert or Play, followed by Late News and Announcements and Dance Music Programme. 12.30 (approx.) (Monday), Close Down.

BERLIN (Voxhaus) (475.4 metres); 4 kW.—8.55 a.m., Relay of Chimes from the Garrison Church at Potsdam. 9.0 a.m., Morning Recital of Religious Music with Address and Vocal and Instrumental Items, followed by Chimes from Berlin Cathedral. 9.30 a.m., Musical Selections. 1.15, Hints for Chess Players by E. Nebermann. 2.30, Practical Hints and Communications for Farmers. 2.45, Weekly Review of Market Conditions and Weather Report and Forecast. 2.55, Lecture on an Agricultural Subject. 3.30, Programme of Fairy Stories. 4.30, Programme of Orchestral Music. 6.30, Talk. 7.0, Talk. 8.0 (approx.), Musical or Dramatic Programme, followed by Time, Meteorological Report, General News Bulletin, Sports Intelligence and Programme of Dance Music. 12.30 (approx.) (Monday), Close Down.

BERN (406 metres); 1.5 kW.—10.30 a.m. Musical Matinée by the Artistes: Vasco Gardini (Violin), Lucio Succi (Clarinet), Leopoldo Casella (Piano) and Nelly Burkhardt (Soprano). 1.0, Time Signal and Weather Report and Forecast. 1.5, Concert of Instrumental Music. 7.29, Time Signal and Weather Report and Forecast. 7.32, Talk. 8.15 (approx.), Musical or Dramatic Programme. 10.0 (approx.), Late News and Announcements, Weather Report and Forecast and Selections by the Kursaal Orchestra. 10.40 (approx.), Close Down.

BRUSSELS (511.9 metres); 1.5 kW.—7.30 a.m., Hourly Programme for Pigeon Fanciers and Information regarding Pigeon Flights at Quévrain, Sobres sur Sambre, Mominny, Noyon, Arras and Breteuil. 6.0, Matinée for Children, organised by the Children's Theatre, directed by Léon Leroy, with the collaboration of the Clowns, Bonzo and Sylvia. 6.30, Programme by the Station Trio. 7.30, "Le Journal Parlé de Radio-Belgique." 8.15, Concert by the Orchestra of the Station. 10.15, General News Bulletin. 11.0 (approx.), Close Down.

COLOGNE (263.2 metres); 4 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Langenberg (462.2 metres), and Münster (267.8 metres).—7.45 a.m., Lesson in Self Defence. 8.5 a.m., German Shorthand Lesson by Hans Molitor. 8.25 a.m. to 8.55 a.m., Esperanto Lesson and Survey in Esperanto of Forthcoming Programmes. 9.5 a.m. to 10.0 a.m., Morning Festival of Sacred Music. Soloist Numbers and Sermon. 1.0, Concert of Orchestral Music. Conductor: Eysoldt. 2.30, Literary Talk by Arnold Stecher. 2.50, Talk for Chess Enthusiasts by Doctor A. van Nüss. 3.15 (approx.), Talk. 4.5 (approx.), Talk. 4.30, Concert of Light Music. 6.0, Talk. 6.25, Talk. 8.0, "La Finta Giardiniera"—Opéramique in the Italian Style (W. A. Mozart), conducted by Kuhn and produced by Anheisser. Followed by Late News and Announcements, Sports Chronicle and Orchestral Concert and Programme of Dance Music. 12.0 Midnight (approx.), Close Down.

CORK, Call 6CK (222 metres); 1.5 kW.—8.30 to 11.0, Concert of Vocal and Instrumental Selections, Mezzo-Soprano Solos rendered by Maura O'Connor. 11.0, National Anthem, followed by Meteorological Report. 11.15 (approx.), Close Down.

CRACOW (314.1 metres); 1.5 kW.—10.15 a.m. to 11.45 a.m., Morning Service relayed from a Cathedral. 11.56 a.m., Relay of Fanfare from the Church of Notre Dame, followed by Time Signal. 12.5, Weather Conditions and Forecast. 12.10, Musical Selections. 2.0 and 2.20, Talks for Agriculturists. 2.40, Agricultural Chronicle by Mr. Wasnievsky. 3.0, Weather Report. 3.15, Concert from the Philharmonic Hall relayed from Warsaw. 5.30, Programme from Warsaw. 5.55, Talk. 6.20, Popular Programme from Warsaw. 7.0, Miscellaneous Items. 7.56, Relay of Time Signal from the Astronomical Observatory. 8.0, Fanfare from the Church of Notre Dame, followed by Sports Intelligence. 8.30, Concert of Orchestral Music by the Warsaw Station Orchestra, conducted by J. Oziminsky: Overture to The Nuremberg Doll—Opera (Adam). Literary Programme during the interval. Followed by General News Bulletin and Concert of Light Music relayed from Warsaw.

DUBLIN, Call 2RN (411 metres); 1.5 kW.—8.30 to 11.0, Programme of Vocal and Instrumental Music relayed from Cork. At 9.0, Songs for Baritone rendered by Mr. J. N. Barry. 11.0, National Anthem and Report on Meteorological Conditions. 11.15 (approx.), Close Down.

GENOA, Call 1GE (336.9 metres); 1.2 kW.—5.0, Relay of a Concert from somewhere in Genoa. 8.20 (approx.), Press News and Announcements and the Stefani Agency and Sports Notes. 8.25 (approx.), Talk by Leandro Vaccari: Events of the Day in Sport. 8.35 (approx.), Programme of Vocal and Instrumental Music by the Station Orchestra: Wotan's Farewell from The Valkyrie—Opera (Wagner), rendered by P. M. Zennaro (Baritone) with Pianoforte Accompaniment. 8.45 (approx.), Late News Bulletin from the "Giornale di Genova," and Close Down.

HAMBURG, Call HA (in Morse) (392 metres); 4 kW.—Programme relayed by Bremen (273 metres), Flensburg (219 metres), Hanover (566 metres), and Kiel 250 metres, 8.20 a.m., Ice Report. 8.25 a.m. (approx.), Weather Report and Forecast, Press News and Announcements. 8.40 a.m., Talk on Contemporary Economic Problems. 9.0 a.m., Talk. 9.15 a.m., Morning Recital. 10.55 a.m., Church Service. 12.55, International Time Signal from Nauen. 1.5 (for Hamburg, Kiel and Flensburg), Morning Concert by the Wireless Orchestra. 1.5 (for Hanover), Concert of Gramophone Records. 1.5 (for Bremen) Popular Concert by the Station Orchestra. 2.0, Programme for Children by Funkheinzelmännchen. 3.0, Popular Concert. 7.0, Talk. 10.30, Talks extraneous to the Programme and Topical Lectures, Press News and Announcements, Weather Report and Forecast, Political and Various Communications, Sports Intelligence, Local Announcements and Police Communications. 11.30, Musical Selections. 11.50 (for Bremen, Flensburg, Hamburg and Kiel), Meteorological Report for North Sea and Baltic. 12.0 Midnight (approx.), Close Down.

HILVERSUM (1,071 metres); 5 kW.—12.40, Talk: "How to play Bridge." 1.10, Musical Selections by the Wireless Orchestra conducted by Nico Treep. 2.40, Talk: Dramatic Criticism. 3.10, Musical Programme. 4.40, Gramophone Selections with Sports Intelligence in the intervals. 8.40, Time Signal and Press News and Announcements. 8.55, Relay of The Vice-Admiral: Musical Comedy (Millocker). 11.40 (approx.), Gramophone Records. 12.10 a.m. Monday (approx.), Close Down.

HUIZEN (339.8 metres); 4 kW.—Transmits from 6.40 to 1,852 metres. 9.5 a.m., Religious Service and Address. 11.0 a.m., Relay of Morning Service from the Evangelical Lutheran Church at Amsterdam, including Selections of Organ and Choral Music and Sermon. 1.10, Programme by the Station Trio. 3.10, Musical Programme. 6.30, Relay of Evening Service (on 1,852 metres). 10.10, Press News and Announcements. 11.25, Epilogue by the Choir, under the direction of Mr. Jos. Pickkers. 11.40 (approx.), Close Down.

KALUNDBORG (1,153 metres); 7 kW.—Programme also for Copenhagen (339.8 metres).—10.0 a.m., Divine Service relayed from Copenhagen. 11.30 a.m. to 11.40 a.m., (Kalundborg only), Morning Weather Bulletin issued by the Copenhagen Meteorological Institute. 12.0 Noon, Time Signal and Town Hall Chimes. 12.5, Press News and Announcements. 1.0, Lesson in the German Language. 1.30, Lesson in the French Language. 6.50 (For Kalundborg only), Evening Weather Bulletin issued by the Meteorological Institute at Copenhagen. 7.0, General News Bulletin. 7.15, Time Signal. 7.16, News from the World of Sport. 7.30, Talk. 8.0, Introductory Talk, followed by Relay of Programme of Danish History in Literature and Music: Niels Ebbesen and Hans Tid.

KATOWITZ (416 metres); 10 kW.—10.15 a.m., Relay of Morning Service. 11.56 a.m., Time Signal, followed by Weather Conditions and Forecast. 12.10, Concert of Popular Music. 2.0, Talk: "The Silesian Gardener" by W. Wlosik. 2.20 and 2.40, Talks for Agriculturists. 3.0, Weather Report and Forecast. 3.15, Concert of Organ Music relayed from the Warsaw Philharmonic Hall: Improvisation on a theme by Brückner (Messner) for Organ, Two Violas, Two Trombones and Two Trumpets, rendered by the Rev. J. Messner, Musical Director at Salzburg Cathedral. 7.0, Miscellaneous Announcements. 7.20, Talk. 7.56, Time Signal. 8.0, Talk. 8.30, Orchestral Concert relayed from Warsaw. 10.0, Weather Report and Forecast, General News Bulletin and Sports Results. 10.30, Dance Music Programme. 12.0 Midnight (approx.), Close Down.

KÖNIGSBERG (280.4 metres); 4 kW.—Programme relayed by Danzig (455.1 metres).—9.0 a.m., Morning Festival of Religious Music and Address. 10.56 a.m. (Danzig only), Weather Report and Forecast. 11.0 a.m. (Königsberg only), Meteorological Report. 11.55 a.m., Relay of the Nauen International Time Signal, followed by Weather Report and Forecast. 1.0, Concert of Popular Music. 8.5, Relay from Danzig of The Dancing Princess: Operetta in Three Acts by Richard Kessler; Lyrics by Willi Kollo; Music by Walter Kollo, produced by Otto Normann and conducted by Otto Selberg. Followed by General News Bulletin and Sports Results. 9.30, Programme of Light Dance Music.

LAHTI (1,500 metres); 35 kW.—Programme also for Helsingfors (375 metres).—9.0 a.m., Relay of Church Service in Finnish. 10.30 a.m., General News Bulletin. 11.5 a.m., Musical Selections. 11.50 a.m., Meteorological Report followed by Time Signal. 12.0 Noon, Relay of Morning Service in Swedish. 4.0, Programme of Light Music by the Wireless Orchestra conducted by Erkki Linko. 5.30, Talk. 5.57, Time Signal and Meteorological Report. 7.35, Selections by the Station Orchestra: Finale from the Sixth Symphony (Tchaikovsky). 8.45, General News Bulletin in the Finnish and Swedish Languages. 9.15 (approx.), Close Down.

LANGENBERG (462.2 metres); 20 kW.—Programme also for Aix-la-Chapelle (455.9 metres), Cologne (263.2 metres), and Münster (267.8 metres).—7.45 a.m., Self Defence Lesson by Doctor L. Bach. 8.5 a.m., Lesson in German Shorthand. 8.25 a.m., Lesson in Esperanto by Alfred Dormanns. 8.45 a.m., Review in Esperanto of the Week's Programmes. 9.5 a.m. to 10 a.m., Morning Festival of Church Music with Sermon in the interval. 11.0 a.m., Philological Talk on the German Language. 1.0, Concert of Popular Music conducted by Eysoldt. 2.30, Literary Talk by Arnold Stecher. 2.50, Hints for Chess Players by Doctor A. van Nüss. 3.15 (approx.), Talk. 4.5 (approx.), Talk. 4.30, Concert arranged by the Cologne 1905 Mandoline Society and the Eupen Solo Quartet; Quartet Selection: Mutterliebe mein Trost und Stern (Werth). 6.0, Talk. 6.25, Talk. 8.0, Relay of an Opera, followed by General News Bulletin, Sports Intelligence and Programme of Popular and Dance Music. 12.0 Midnight (approx.), Close Down.

LEIPZIG (361.9 metres); 4 kW.—Programme relayed by Dresden (317.1 metres).—8.30 a.m., Programme of Selections for Organ relayed from one of the Leipzig Churches. 9.0 a.m., Morning Recital of Vocal and Instrumental Selections. 11.0 a.m., Talk. 11.30 a.m., Talk. 12.0 Noon, Musical Programme. 1.0 and 1.30, Talks for Agriculturists. 2.0, Press News from Abroad. 3.0, Musical Selections. 7.0, Relay from the Opera House, Chemnitz, of Il Seraglio—Opera in Three Acts (Mozart), with the assistance of Soloists from the Vienna State Opera House, followed by Time Signal, News from the Press, Announcements of Sports Results and Dance Music Selections. 12.30 a.m. (approx.) Monday, Close Down.

LYONS (Radio Lyon) (291 metres); 1.5 kW.—12.0 Noon, Concert of Orchestral Music. 7.30, "Le Journal Parlé," consisting of General News Bulletin, Theatre and Amusements Notes and Agricultural Bulletin. 8.0, Concert of Orchestral Music. Dance of the Will-o'-the-Wisps from The Damnation of

Sunday, April 21st.

All Times are reduced to British
Summer Time and are p.m. except
where otherwise stated.

Programmes from Abroad.—

Faust (Berlioz). 9.0, Recital of Vocal Music. 10.15, Latest News and Announcements.

MADRID (Union Radio), Call EAJ7 (428.7 metres); 3 kW.—2.0, Chimes relayed from the Gobernación followed by Time Signal. 2.5, Musical Selections by the Station Orchestra. 3.30 to 7.0, No Transmission. 7.0, Relay of Chimes, followed by Dance Music Programme. 8.30 to 10.0, No Transmission. 10.0, Relay of Chimes from the Gobernación and Time Signal. 10.5, Evening Concert of Selections by the Orchestra of the Station: The Nut-Cracker Suite (Tchaikovsky), (1) Overture, (2) Characteristic Dances, (a) March, (b) Witch's Dance, (c) Russian Dance, (d) Arab Dance, (e) Chinese Dance, (f) Reed-pipe Dance. 10.30, Relay of Band Music Programme from the Hotel Nacional. 12.0 Midnight, Chimes Relay. 12.5 a.m. (Monday), Continuation of the Band Music. 12.30 a.m. (approx.), Close Down.

MILAN, 1MI (504.2 metres); 7 kW.—10.0 a.m., Opening Signal, followed by English Language Lesson. 10.30 a.m., Interpretation of the Gospel. 10.40 a.m., Programme of Vocal and Instrumental Church Music. 11.30 a.m., Time Signal. 4.0, Opening Signal. 4.2, Comedy relayed from the Arcimboldi Theatre. 4.45, Programme of Light Music by the Station Quintet and Soloists: Soprano Solos, Due stornelli toscani (Pieraccini), rendered by F. Frattini. 8.30, Opening Signal. 8.32, Miscellaneous Announcements. 8.40, Talk by C. A. Bianche on a Historical Subject. 9.0, Relay of an Opera from the Scala Theatre. In the intervals: Talk, Town and Country, by Ulderico Tegani, Sports Chronicle and Late News and Announcements from the Stefani Agency. 11.30 (approx.), Close Down.

MOTALA (1,351 metres); 30 kW.—Programme also for Stockholm (438 metres), Boden (1,200 metres), Göteborg (346.8 metres), Hörby (260.9 metres), Östersund (770 metres), and Sundsvall (545.5 metres).—11.0 a.m., Relay of Morning Service from a Church in Stockholm. 12.45, Meteorological Report. 5.0, Children's Programme. 5.55, Chimes relayed from Stockholm Town Hall. 6.0, Relay of Church Service. 7.15, Play. 7.45, Concert of Choral and Orchestral Music: Overture to Dido and Aeneas—Opera (Kraus). 9.15, General News Bulletin and Weather Report and Forecast. 9.45, Musical Selections. 11.0 (approx.), Close Down.

MUNICH (536.7 metres); 4 kW.—Programme relayed by Augsburg (566 metres), Kaiserslautern (272.7 metres) and Nürnberg (240 metres).—11.0 a.m., Chimes relayed from Munich Town Hall. 11.10 a.m., Transmission of the Bavarian Weather Chart. 1.5, Time, Weather Conditions and Forecast and Review of Programmes for the Coming Week. 4.0, Musical Selections. 9.30, Die eiserne Jungfrau—Comedy in One Act by Ladislaus Bekessi. 10.0 (approx.), Relay of Concert. In the interval at 10.20, General News Bulletin. 11.30 (approx.), Close Down.

NAPLES, Call INA (333 metres); 1.5 kW.—9.30 a.m., Lesson in the French Language by Professor Etienne Verdier. 10.0 a.m., Programme of Church Music. 4.45, Programme for Children. 5.0, Programme of Vocal and Instrumental Music. 5.30, Time Signal. 8.30, Il Radio giornale. 8.50, Chronicle of the Neapolitan Port Authorities. 9.0, Time Signal. 9.2, Programme of Vocal and Orchestral Opera Music and Recitations: Duet from Poliuto; Opera (Donizetti), Il pui lieto dei viventi, rendered by E. Blandi (Soprano) and R. Aliciano (Baritone). In the Interval, Recitations of Prose and Verse from his repertoire by E. Murolo. 10.0, Sports Intelligence. 10.55, Calendar and Survey of Programmes of the Week. 11.10 (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT (458 metres); 0.5 kW.—Programme relayed at intervals by the following Stations: Bordeaux PTT (275 metres), Eiffel Tower (1,485 metres), Grenoble (416 metres), Lille (267 metres), Limoges (285 metres), Lyons PTT (478.2 metres), Marseilles (303 metres), Rennes (280 metres), Toulouse PTT (260 metres).—8.0 a.m., General News Bulletin and Time Signal. 9.25 a.m., International Time Signals and Weather Report and Forecast. 1.30, Programme of Orchestral Music arranged by the General Association of French Wireless Amateurs: Rigaudon from Dardanus; Opera (Rameau). 6.30, Industrial Notes and Communications. 8.15, Talk. 8.30, Concert arranged by the General Association of Wireless Listeners followed by Time, Weather Report and Forecast and Dance Music Programme from the Colisée de Paris. 12.0 Midnight, Close Down.

PARIS (Eiffel Tower), Call FL (1,485 metres); 5 kW.—8.56 a.m., Time Signal on 32.5 metres. 10.26 a.m., Time Signal on 2,650 metres. 6.45, "Le Journal Parlé," including Police History, Sports Chronicle and Racing Results. 8.10, Weather Report and Forecast.

8.20, Festival of Modern Italian Music and Poetry. 8.56, Time Signal on 32.5 metres. 11.26, Time Signal on 2,650 metres.

PARIS (Petit Parisien) (336.3 metres); 0.5 kW.—8.45, Programme of Gramophone Selections. 8.50, Talk. 8.55, General News Bulletin. 9.0, Orchestral Programme with the collaboration of artistes of the Opéra and the Opéra-comique. 9.25, Press News and Announcements. 9.30, Concert of Symphony Music under the direction of M. Estlye, Professor of the Paris Conservatoire. 10.0, Latest News Bulletin. 10.10, Programme of Symphony Music continued. 11.0 (approx.), Close Down.

PARIS (Radio Paris), Call CFR (1,744 metres); 15 kW.—8.0 a.m., General News Bulletin and Press Review. 8.30 a.m., Daily Lesson in Physical Culture directed by Doctor Diffre. 12.0 Noon, Religious Address by the Reverend Father Lhande, followed by Concert of Church Music with Choral Items. 12.30, General News Bulletin. 12.45, Programme of Dance Music by the Grand Vatel Jazz Orchestra. In the interval: Humorous Interlude by Bilboquet. 4.30, "Odeon" Programme of Gramophone Records organised by "L'Industrie Musicale." In the intervals: General News Bulletin. 6.30, Pathé Half-Hour of Gramophone Music. 7.0, Agricultural Bulletin. 7.30, Press News and Communications. 7.45, Radio-Paris Circus. 8.15, Radio Concert organised by the Newspaper "Le Matin" with the collaboration of the Orchestra of the Henri Poincaré Lycée at Nancy. During the intervals, Evening Press Review and General News Bulletin. 10.30 (approx.), Close Down.

PITTSBURGH, Call KDKA (63 and 27 metres); 25 kW.—5.0, Sessions Clock Chimes. 5.01, Church Service Relay. 7.29, Telechron Time Signal. 7.30, The Allegheny County Memorial Park Programme. 8.0, The Roxy Symphony Concert Programme relayed from New York. 10.0, Programme of Organ Music by Dr. Charles Heinrich, Director of Music at the Carnegie Institute. 10.30, Programme by the McKinney Musicians relayed from New York. 11.0, Relay of Evening Service from the Shadyside Presbyterian Church. Pastor, Rev. Hugh Thomson Kerr. 12.0 Midnight, Telechron Time. 12.1 a.m. (Monday), Orchestral Selections relayed from the William Penn Hotel. 12.30 a.m., The Whittall Anglo-Persians Programme relayed from New York. 1.0 a.m., Sessions Clock Chimes. 1.1 a.m., Relay of Evening Service from the Calvary Protestant Episcopal Church. Pastor, E. J. Van Etten. 2.0 a.m., Euna Jettick Melodies relayed from New York. 2.15 a.m., Relay of the Collier's Radio Hour from New York. 3.15 a.m., The Utica Jubilee Singers' Programme relayed from New York. 3.45 a.m., El Tango Romantico Programme relayed from New York. 4.15 a.m., Longines Time relayed from New York. 4.16 a.m., Champion Weather Reports. 4.20 a.m. (approx.), Close Down.

POSEN (336 metres); 1.5 kW.—10.15 a.m. to 11.45 a.m., Relay of Church Service. 12.10, Time Signal. 12.15 and 12.35, Two Talks for Farmers. 12.55, Talk for the Housewife. 3.15, Concert relayed from Warsaw. 5.30, Talk on Various Topics by Mr. Winiewicz. 5.50, Programme for Children. 6.20, Concert of Vocal Music. 6.0, Report of the Polish Association of Catholic Youth. 6.45, Talk by Mr. B. Busiakiewicz ("Silva rerum"). 8.30, Evening Concert: Fair Ballads (Brahms). In the interval at 9.0, Literary Programme from Warsaw; during the other intervals, Review of Theatre and Cinema Programmes and General News Bulletin. 10.0, Time Signal followed by Sports Results. 10.20, Programme of Dance Music relayed from the Café Wielkopolanka. 12.0 Midnight (approx.), Close Down.

RABAT, Call PTT (414 metres); 2 kW.—1.30 to 3.0, Programme by the Station Orchestra. 5.0 to 6.0, Concert of Military Music. 9.0, Transmission of "Le Journal Parlé," including General News and Information. 9.30, Programme of Vocal and Instrumental Music by the Station Orchestra and Soloists: Callirhoé (Chaminade), (a) Introduction, (b) Danse des écharpes, (c) Danse de Callirhoé, (d) Andante, (e) Valse. At 10.30 (approx.), in the interval, Sports Talk and Results. 11.30 (approx.), Retransmission of European Broadcasting Stations. 12.0 Midnight (approx.), Close Down.

ROME, Call IRO (443.8 metres); 3 kW.—8.30 a.m., Opening Signal. 10.0 a.m. to 10.45 a.m., Recital of

Church Music, including Vocal and Instrumental Items. 11 a.m., Transmission from the "Casa di Dante"; Talk on the Works of Dante. 1.0, Opening Signal. 1.5 to 2.0, Programme by the Station Trio. 2.0 to 5.0, No Transmission. 5.0, Opening Signal. 5.5 to 6.30, Variety Concert. 7.51, Press News and Announcements and Talk for Farmers. 8.15, Sports Intelligence and Miscellaneous Communications. 8.29, Time Signal. 8.45, Transmission of Othello; Opera in Four Acts (Verdi) rendered by Soloists with the collaboration of the Station Choir and Orchestra. During the intervals: Talks. 10.50, General News Bulletin. 11.0 (approx.), Close Down.

SCHENECTADY, Call 2XAD (19.56 metres); 30 kW. 12.0 Midnight, Relay of Stetson Parade and American Legion Band Programme from Boston, Mass. 12.30 a.m. (Monday), Musical Programme relayed from New York. 1.0 a.m., The Old Company's "Songalogue," relayed from New York. 1.30 a.m., Capitol Theatre Programme relayed from New York. 3.0, Talk by David Lawrence, Editor of "The United States Daily" on "Our Government," relayed from Washington D.C. 3.15 a.m., Atwater Kent Programme relayed from New York. 4.15 a.m., The Studebaker Champions Programme relayed from New York. 4.45 a.m. (approx.), Close Down.

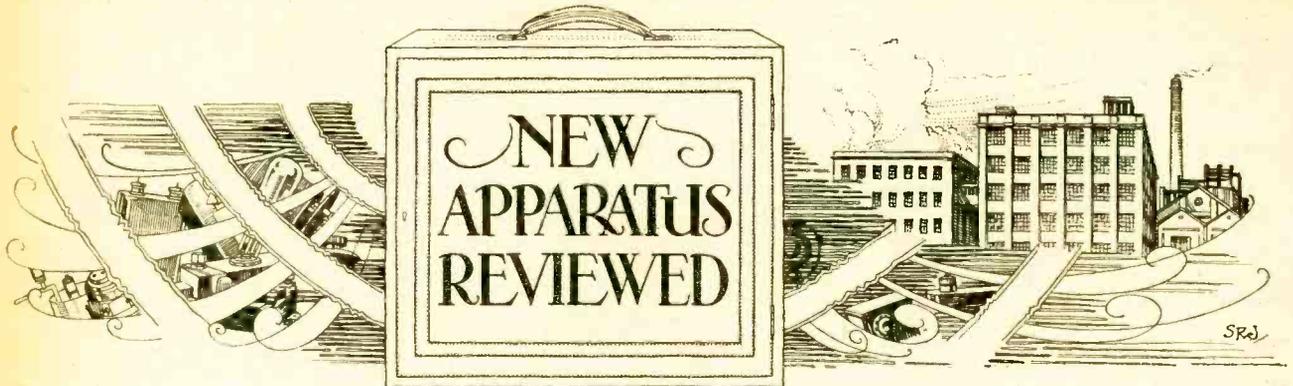
TOULOUSE (Radiophonie du Midi) (339.6 metres); 8 kW.—12.45, Concert of Orchestral Music. 1.0, Time Signal. 1.5, Concert (continued). 1.45, News and Announcements supplied by the Local Press, 2.0, Religious Address. 7.0, Stock Exchange Quotations, Money and Grain Market Prices from Paris, followed by News and Announcements from "La Dépêche" and "Le Petit Parisien." 8.30, Programme of Popular Music. 9.0, Time Signal. 9.15, Concert of Light Music arranged by the Lawrence Wright Musical Publishing House: I'm looking over a four-leaf clover. Followed by North African News and Communications. 11.15 (approx.), Close Down.

VIENNA (519.9 metres); 15 kW.—Programme relayed by Graz (354.2 metres), Innsbruck (455.9 metres), Klagenfurt (455.9 metres) and Linz (250 metres).—10.20 a.m., Recital of Organ Music. 11.0 a.m., Musical Selections by the Viennese Symphony Orchestra. 4.0, Concert of Light Music. 8.15, Wiener Blut—Operetta in Three Acts by Victor Léon and Leo Stein; Music by Johann Strauss; Producer: Victor Flemming; Conductor: Otto Feit.

VILNA (456 metres); 1.5 kW.—10.15 a.m. to 11.50 a.m., Relay of Morning Service from a Cathedral. 11.56 a.m., Time Signal, followed by General News Bulletin relayed from Warsaw. 2.0 to 3.0, Three Talks for Agriculturists relayed from Warsaw. 3.15, Musical Programme from the Warsaw Philharmonic Hall. 5.30, Talk from Warsaw. 8.30, Orchestral Concert relayed from Warsaw, organized by the Wireless Orchestra, conducted by J. Oziminsky. Cracovienne fantastique (Paderewsky). 10.0, Notes on Aerial Route Conditions, Meteorological Report, General News Bulletin, Police Communications and Sports Chronicle. 12.0 Midnight (approx.), Close Down.

WARSAW (1,385.7 metres); 10 kW.—10.15 a.m., Religious Service relayed from a Cathedral. 11.56 a.m., Time Signal and Relay of Fanfare from the Church of Notre Dame at Cracow, followed by Route Notes for Aviators and Weather Report and Forecast. 12.10, Matinée Concert of Symphony Music arranged by the Department for Education and Culture of the Magistracy of Warsaw: Pianoforte Concerto in B flat Minor (Tchaikovsky), rendered by Mme. A. Wohliman, accompanied by the Station Orchestra, conducted by J. Oziminsky. 2.0, 2.20 and 2.40, Agricultural Talks. 3.0, Weather Conditions and Forecast. 3.15, Musical Selections from the Philharmonic Hall. 5.30, Talk for Graduates on Polish Literature. 6.20, Light Music and Literary Programme. 7.20, Talk. 7.45, Press News and Announcements. 7.56, Time Signal. 8.0, Intellectual Entertainment by C. Jablonovsky. 8.30, Concert of Light Music. In the interval at 9.0, Literary Selections. 10.0, Time Signal, Late News and Announcements, Aerial Route Notes, Weather Report and Forecast, Police Communications and Sports Results, followed by Musical Programme from a restaurant. 12.0 Midnight (approx.), Close Down.

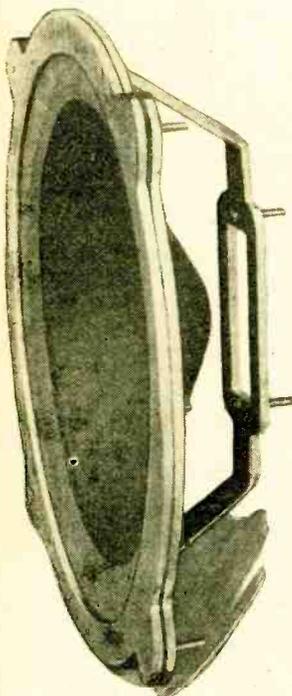
ZÜRICH (489.4 metres); 1 kW.—11.0 a.m., Programme by the Station Orchestra. 12.29, Meteorological Report. 12.30, Gramophone Selections. 4.0, Programme by the Carletti Orchestra relayed from the Carlton-Elite Hotel. 7.30, Time Signal. 7.33, Religious Address. 8.0, Recital of Chamber Music from the Works of Tchaikovsky by the Station Orchestra: Quartet for Strings rendered by Erwin Gilbert (First Violin), Max Scherbaum (Second Violin), Viktor Chmelik (Viola), and Jul Bächli (Cello). 10.0, General News Bulletin supplied by the "Neue Zürcher Zeitung."



Latest Products of the Manufacturers.

GILMAN FLOATING CONE.

Prospective purchasers of the "Blue Spot" loud speaker unit will doubtless be interested to learn that Messrs. J. S. Gilman, 73, Basinghall Street, London, E.C.2, have put into production a complete cone assembly designed for use with these particular units. The cone is 7½ in. in diameter, and is provided with a surround of pure para rubber. An aluminium frame supports the cone, the unit being carried by a bracket cast as one piece with the back ring. Fixing the unit should be a simple matter, as the holes in the bracket are the same distance apart as the fixing holes on the "Blue Spot" unit.



Gilman cone designed for the "Blue Spot" loud speaker unit.

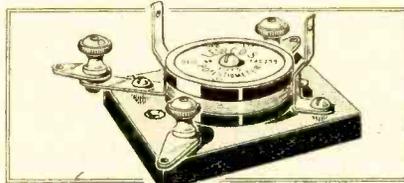
It is left to the constructor to decide the method of mounting the completed assembly, and either a baffle or a cabinet

can be used. In either case fixing will be a simple matter, as the chassis is provided with four lugs, each drilled with clearance holes to pass 4 B.A. screws.

On the whole it is a sound and workmanlike job, and at the reasonable price of 13s. can be regarded as good value for money.

LEWCOS FIXED POTENTIOMETER.

This device, which occupies a baseboard space of 2 in. x 1½ in. only, is intended for



Lewcos fixed potentiometer.

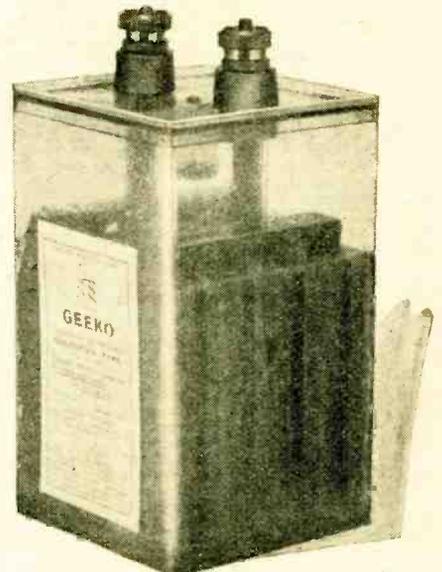
use in place of the adjustable potentiometer generally fitted when the leaky grid method of rectification is adopted. The component consists of a 600-ohm (nominal) wire-wound resistance provided with a fixed tapping, a condenser of 0.0015 mfd. capacity and two grid leak clips. One clip is internally connected to the tap on the winding, the other being provided with a small terminal for attachment of the grid wire. Two other terminals are fitted for connecting the resistance across the filament battery.

The resistance of the specimen tested was found by measurement to be 730-ohm total and between the tapping and the L.T. + terminal 510 ohms. The tapping point is, therefore, a little more than two-thirds from the positive end. The built-in fixed condenser shunts that portion of the resistance between the tap and L.T. negative. With an adjustable potentiometer this condenser would normally be fitted as an extra component.

The method of connecting the device in the circuit is clearly explained by means of a diagram supplied with each component. This potentiometer is made by the London Electric Wire Co. and Smiths, Ltd., Church Road, Leyton, London, E.10, and the price without grid leak is 5s. 6d.

"GEEKO" UNSPILLABLE ACCUMULATOR, SOLIDIFIED TYPE.

There is no doubt that the portable wireless set has established itself, and, if present indications show the true state of affairs, this type of receiver is going to take a prominent part in summer entertainment. The question of filament current is therefore a pertinent one, and all those interested in these particular sets will be on the look out for anything new in unspillable accumulators. The latest addition to the range of cells offered by the General Electric Co., Ltd., cannot fail to attract considerable interest, as it is, for all practical purposes, as dry as the so-called dry cell, no loose liquid whatsoever being employed. The plates are embedded in an absorbent jelly holding in suspension an adequate quantity of the usual electrolyte; the cells are of the lead-plate type. The 2-volt size illustrated has an actual capacity of



"Geeko" unspillable accumulator with jelly electrolyte.

20 ampere hours, and sells at 25s. The makers are The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

IGRANIC TYPE "J" TRANSFORMERS.

These transformers are made in two ratios: viz., 3:1 and 6:1, the price in each case being 17s. 6d.

The 3:1 transformer is for use following valves of between 10,000 and 20,000 ohms A.C. resistance, while the best results will be obtained from the 6:1 ratio when this is preceded by a valve having an A.C. resistance of between 5,000 and 10,000 ohms.

The dimensions of the transformers are only 3x1½x2in. high, so that they are particularly suitable for use in portable sets and where space is restricted. Used in conjunction with a 20,000-ohm valve preceding the transformer and a suitable output stage, an amplification of 60 is attained with the 3:1 transformer between 500 and 5,000 cycles. At 200 cycles this falls to about 55, and over 5,000 cycles tails off to just under 40 at 10,000 cycles. A 40,000 ohms valve gives fairly constant amplification from 100 up to 10,000 cycles, but the maximum gain is of the order of 40 times only.

Under similar conditions the 6:1 transformer will enable an amplification of approximately 20 to be attained from



The small dimensions of the Igranic Type "J" Transformer are emphasised by comparison with a packet of cigarettes.

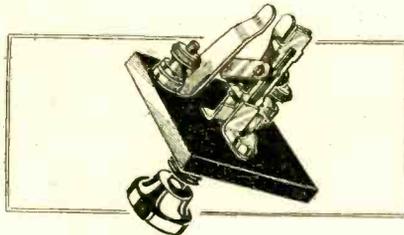
150 cycles up to 10,000 cycles when the preceding valve has an A.C. resistance not greater than 6,000 ohms.

The makers are the Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.4.

BULGIN QUICK-BREAK SWITCH.

This is a single-pole filament on-and-off switch embodying an ingenious quick-break action. The body of the switch consists of a small rectangular piece of ebonite carrying two fixed contact springs, a single-hole fixing bush made of insulating material, and a "U"-shaped moving contact actuated by a compression spring. The moving contact is pivoted at the open ends of the "U" to a vertical support, which also acts as a guide for the stem of the plunger. When the plunger is pushed in, the stem moves along the guide, and in its travel compresses a spring which bears against the inside

of the "U" contact. At the moment the arm carrying the spring passes the fulcrum of the "U" contact, the spring forces this from between the contact springs with a snap action. The movement is somewhat similar to that adopted in certain makes of tumbler switches used for lighting circuits.



New Bulgin filament switch.

The insulated fixing bush enables the switch to be mounted on metal panels and used in circuits at a higher potential than the panel.

The makers are Messrs. Bulgin and Co., 9 to 11, Cursitor Street, Chancery Lane, London, E.C.4, and the price is 2s. 3d.

JELECTRO.

Jelectro is a pink limpid liquid which, when added to accumulator acid and allowed to stand, forms a firm jelly saturated with acid. The advantages are obvious; any accumulator can be made unspillable by adding the requisite volume of liquid and even so-called unspillable accumulators can often be treated with advantage where it is found that the acid trap is not functioning satisfactorily.

The correct proportion for mixing is one part by volume of Jelectro to three parts of acid. The instructions emphasise that acid of 1.250 specific gravity must be used, the reason being that some of the acid is used in forming the jelly. It is therefore advisable to discard the acid in the battery after giving a full charge and to mix the solution with fresh acid. The solution remains liquid for some hours and can be poured into the cells, where it will solidify within five or six hours.

In some cases a final specific gravity of 1.250 on full charge is required. To obtain this, the initial density of the acid before adding Jelectro must exceed 1.250. In practice it is a simple matter to measure and adjust the acid density, even after the jelly has been formed. A quantity of fresh acid of known specific gravity is floated on the surface of the jelly and allowed to stand for ten or fifteen minutes. During this time diffusion takes place and the density of the acid on the surface is the same as that of the acid absorbed in the jelly. It is quite a simple matter to adjust the acid density in this way to any required value either by the addition of distilled water or stronger acid. In practice it has been found possible to work with an acid density as high as 1.240 on full discharge, the reason being that the Jelectro contains compounds which prevent sulphating.

The pink coloration disappears when the Jelectro is added to the acid, which suggests that phenol phthalein is the colouring matter. This substance is a well-known indicator and is used in volumetric analysis. It is pink in alkaline solution and colourless in acid. A rough analysis of the solution showed that it is inorganic and the jelly—probably a silicate—will therefore keep indefinitely.

A test of ampere-hour capacity carried out on a new 7 ampere-hour accumulator has shown that after three initial forming charges and discharges the ampere-hour capacity (discharge) reaches 6.7 A.H., the cut-off being taken at 1.80 volts per cell. The input charge was 7.9 A.H., which gives an efficiency of 85 per cent., thus showing that the jelly does not seriously interfere with the functioning of the cell.

The solution is made by Messrs. Jelectro Laboratories, 179, Edgware Road,



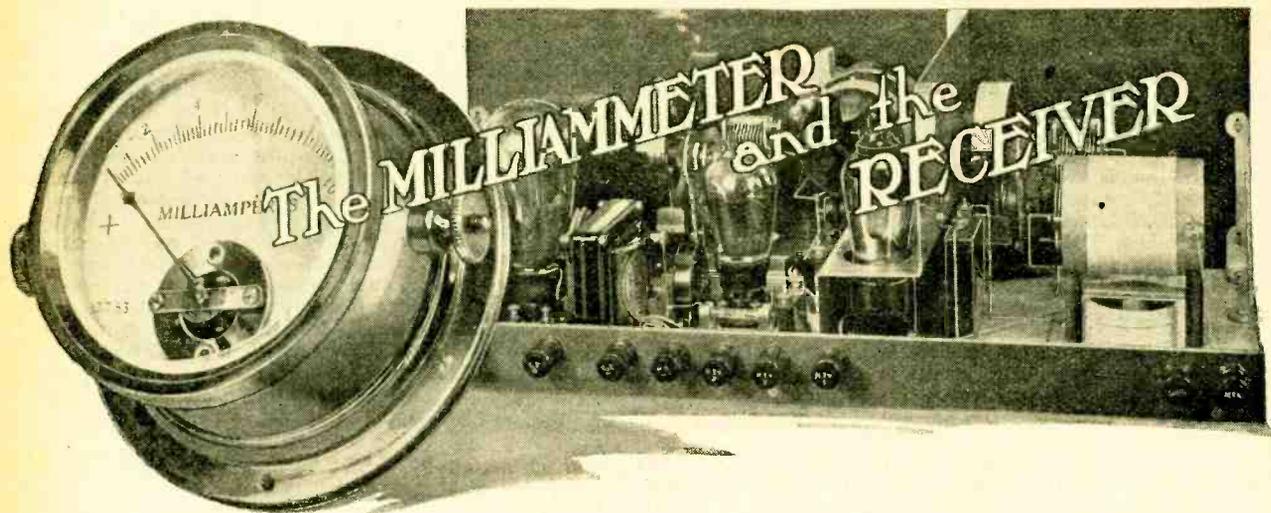
London, W.2, and is obtainable in three sizes at 6d., 1s. 9d. and 3s. 6d. The smallest size is sufficient for a 20-ampere-hour cell, and the other sizes contain four and ten times the quantity respectively.

Catalogues Received.

The Trelleborg Ebonite Works, Ltd., 4, Union Place, Wells Street, London, W.1. —Descriptive leaflets of lead-in tubes and a price list of stock size ebonite panels.

The London Electric Wire Co. and Smith's, Ltd., Church Road, Leyton, London, E.10.—A 48-page catalogue of "Lewcos" 1929 products, well illustrated and containing many pages of circuit diagrams. The wire tables should prove particularly useful to experimenters.

The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, London, E.C.4.—A 12-page illustrated booklet dealing mainly with A.C. battery chargers and eliminators. A few pages are devoted to rectifying valves and accumulators.



The Choice of an Instrument of Universal Application.

By A. L. M. SOWERBY, M.Sc.

THE amateur who wishes to keep an eye on the behaviour of his receiver and to be able to trace faults, should they occur, easily and quickly, will find a milliammeter almost indispensable. The average valve-user is deeply concerned with his filament circuits, and takes no more interest in his plate circuits than to look occasionally at the (very nominal) voltage inscribed upon his high-tension battery. Whether this state of affairs is due to the fact that the advertisements of the valve-makers are perpetually harping upon filaments, or whether it is due to the persistence of the hydra-headed superstition that the duty of a high-tension battery is to provide voltage without current, it is equally to be regretted. It should never be forgotten that the plate current, and the plate current *only*, works the set; the filaments are no more than the servants of the plate circuit, and exist solely to provide electrons for their superiors.

Bearing this in mind, it is rather remarkable that the possession of a milliammeter should be considered the outward and visible sign of the real wireless expert, while the average listener is the owner of nothing more pretentious than a filament voltmeter. No one, be he technical expert or plain listener, who has experienced the sense of complete mastery over a receiver that is conferred by the ability to read the cur-

rent in each plate circuit with a suitable milliammeter would ever willingly face a misbehaving set, or undertake to adjust valve voltages to their best values, without the aid of such an instrument. If one attempts to do so, one feels as "fumbly" as when trying to play the piano in fur gloves—one cannot, so to speak, get into touch.

The Low-range Meter with Shunts.

That point, then, is settled; a milliammeter must be added to our equipment, so that those unknown plate currents shall be unknown no longer. On consulting a catalogue, we are faced with the information that milliammeters are available in all ranges—some read

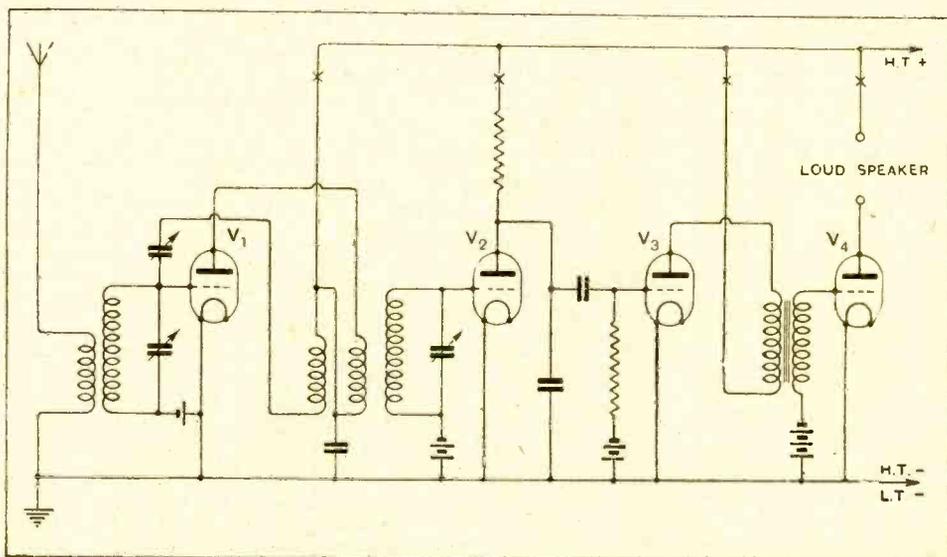


Fig. 1.—In a receiver such as this the plate currents might be as follows: $V_1 = 3 \text{ mA.}$; $V_2 = \frac{1}{2} \text{ mA.}$ or less, depending on signal strength; $V_3 = 5 \text{ mA.}$, and $V_4 = 18 \text{ mA.}$

The Milliammeter and the Receiver.—

only up to one milliamp., others read up to fifty or more. One, however, is all we intend to get, for meters are too expensive to buy by the dozen; which are we to choose?

Left to himself, the non-technical man would probably conclude that as he would never be likely to want to read anything over fifty milliamps., he had better get a 50-mA. meter and read everything on that. He would realise, of course, that the meter would not show much of a deflection for one milliamp., but, after all, one can read 1 mA. on a 50-mA. meter, while reading 50 mA. on a 1-mA. meter looks suspiciously like trying to get a quart into a one-ounce measure.

Performing this miraculous feat, however, is so easy that anyone with some electrical or laboratory experience would go at once to the opposite extreme, and buy a meter that would give a good big deflection for the *smallest* current he would ever be likely to read, and then make arrangements so that when he wanted to read larger currents than the meter could deal with unaided a *part* only of these heavier currents would flow through the meter, the rest going through a subsidiary circuit connected in parallel. In this way any and every current that needs to be measured gives a

considerable deflection to the needle of the meter, and so can easily be read.

We may take as a sample receiver that of which the circuit is shown in Fig. 1, which incorporates one stage of high-frequency amplification, an anode-bend detector, a low-frequency amplifier, and an output stage—one valve is used in each of the common ways. The plate currents to be expected vary from some half a milli-

amp. for the detector up to perhaps twenty milliamps. or so for the output stage. A meter reading up to one or one-and-a-half milliamps. should be chosen for such a receiver as this, in order that we may be able to make something of the small plate-current of the detector—which has, incidentally, the most interesting plate circuit of all. If a grid detector, which draws a larger plate current, is in use, a meter reading to three milliamps. will probably be more suitable, provided that it is certain that the change to an anode detector will never to made.

One Meter Many Ranges.

Having chosen a meter that will read satisfactorily the small plate current of the detector, how is it to be handled to make it suitable for the output stage, where the current flowing is far more than it can read? If high accuracy is wanted, there is nothing for it but to undertake a series of laboratory operations, and make up a carefully calibrated set of shunts. The present writer has recently described a reasonably simple method of doing this, and his more ambitious readers are referred to that account. ("One Meter, Many Purposes," *The Wireless World*, January 23rd, 30th, and February 6th, 1929.)

For work in connection with a receiver there is no need for any but quite approximate measurements, for one really only wants to observe *changes* in current, whether these be immediate changes due to tuning in a signal or overloading a valve, or slow changes due to ageing valves or batteries. It is also helpful to know if a valve is taking about the right current, but owing to the inevitable, and very considerable, variations between individual valves there is no great point in knowing the precise value of the current to a greater accuracy than some 5 per cent. or so.

The range of the meter is extended in an upward direction by connecting a resistance of low value across its terminals, as shown in Fig. 2. Most of the current then flows through the "shunt" as the resistance is called; the balance operates the meter. In making a shunt to accommodate the meter to a new range we have only to ensure that the right proportion of the current passes through the meter, and this in turn means that the relative resistances of the meter and the shunt-wire must be correctly adjusted. It will be necessary for this purpose to know the resistance of the meter; the figure for this, if not marked on the instrument itself, will be furnished on request by any reputable maker, either direct or through the dealer from whom the instrument was purchased. This information, together with an ounce or less of 32-gauge insulated Eureka wire made by some well-known maker (it must be strictly to gauge) provide all the equipment we shall require.

Meter Shunts Incorporated in Receiver.

The method adopted is to work out, by a little straight-forward arithmetic, the resistance that will be needed to convert the meter from its original range to the new range desired. Since the resistance of a yard of 32-gauge Eureka wire is known, it is then only necessary to cut off an appropriate length of this wire to give the resistance required, solder tags to the ends for the sake both of convenience and accuracy, and to connect this wire, coiled up in any convenient way, across the terminals of the meter as in Fig. 2.

The resistance that will be needed is found thus: Suppose the meter normally reads up to 2 mA., and it is wanted to read (in the plate circuit of V_3 , for example) up to 10 mA.

Divide new maximum reading (10) by maximum reading of original meter (2)—the answer is 5. Subtract 1 from this, which gives 4. Divide the resistance of the meter (say it is known to be 20 ohms) by this figure; the answer to this is 5 ohms. This is the resistance required for the shunt. Now one yard of 32-gauge Eureka wire has a resistance of 7.35 ohms, so that 1 ohm has a length of 4.9 inches. As we want 5 ohms, we must measure off a length of 5 times 4.9 or just $24\frac{1}{2}$ inches.

This is done by soldering a tag to the end of the wire and undoing from the reel and cutting off a little more

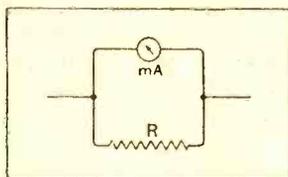


Fig. 2.—For increasing the current-range of a meter, a resistance R is connected across the terminals. The bulk of the current flows through R, leaving a known small fraction of the total to operate the meter.

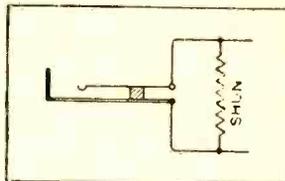


Fig. 3.—When the meter is withdrawn the shunt carries the whole current of the circuit.

The Milliammeter and the Receiver.—

than the required length. The last inch or so of the length is bared of its covering, and a second tag is slipped over the wire. Then the measurement is made carefully, and the length of wire actually *between the tags* is adjusted accurately to that worked out, the wire is twisted round the second tag to hold it in position, and then is soldered. That completes the shunt, which may now be coiled up round a scrap of wood or ebonite and marked "10 mA. Shunt."

With this connected across the terminals of the meter we know that whenever the instrument points to "2" the current flowing is really 10 mA. Similarly for every other indication; if 1 mA. is indicated, the current is 5 mA. The "multiplying factor" of the shunt is thus five.

In the same way shunts may be made up to enable the meter to read still higher currents—say, up to 20 milliamps. for the last valve. Here the "multiplying factor" will evidently be 10 if the original meter read to 2 mA.; subtracting 1 gives 9, so that the shunt-resistance will in this case be one-ninth that of the meter by itself. The appropriate length of wire can be measured off and equipped with tags exactly as described earlier in this article.

If we are building a new receiver, or rebuilding an old one, we can adopt a simple but little-known trick for doing away with the petty annoyance of having to connect up the right shunt for each plate circuit before inserting the meter to read the current. The trick in question consists in leaving the appropriate shunt permanently in position in each plate circuit, simply connecting across it the meter, with no shunt attached, when making the measurement. In this way the meter can be moved instantly from one circuit to another without

taking any precautions or bothering with any shunts, and it will, automatically, adjust itself to the right range each time.

For this, jacks are convenient, and may be inserted at the points marked X in Fig. 1; a lead of twin flex terminating in a plug is attached to the meter. In any circuit where a shunt is required, a "single open" jack (which is the cheapest) may be used, for on withdrawing the meter the circuit will still be completed through the shunt, as in Fig. 3. If no shunt is wanted, as in the detector circuit, a "single closed" jack must be employed, which has extra contacts which, as shown in Fig. 4, are so arranged as to close the circuit automatically behind the meter when it is withdrawn. The meter itself may be mounted on the panel of the receiver, with a flex lead, long enough to enable the plug to be inserted at will into any jack, coming through a hole in the panel. Or, if it is intended to make use of the meter

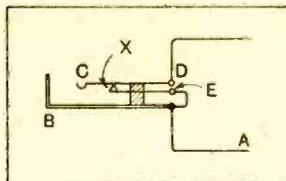


Fig. 4.—When the meter-plug is inserted, the current flows along the path ABCD, the contact X being broken. On removing the plug, the arm C springs down and makes contact at X, the path of the current now being AEXD.

in directions other than those connected with the set itself, the meter may be kept apart from the set and brought out for use when wanted. In the latter case, duplicate shunts should be made for uses outside the receiver.

The work of fitting up and wiring the jacks will take a little time to carry out, but, once done, the convenience of being able to push the meter-plug straight into any circuit without first finding and connecting up a shunt is so great that the time spent is amply repaid. Since sooner or later a loose shunt would be forgotten, or perhaps one end of it might slip unnoticed from beneath its terminal, the time spent in fitting the shunts into the set itself will probably be repaid in hard cash as well as in convenience, for either of the mishaps suggested would result in damage to the meter.

German Amateur Welcomes Reports.

The German station D 4YT, near Stuttgart, is carrying out tests on approximately 29 megacycles (10.3 metres) every Tuesday, Thursday, and Friday, calling "CQ" from 0730 to 0740 and from 1330 to 1345 G.M.T., afterwards listening for replies.

The power input will be between 100 and 500 watts. The station wishes to get into communication with British amateurs and reports will be welcomed, which should be sent via D.F.T.V., Blumen-thalstr. 19, Berlin, W.57.

Nationality Prefixes.

We give below a list of the nationality prefixes recommended under the Washington Convention, or actually adopted by various countries for their amateur stations.

Some of the wireless authorities have not yet formally accepted the prefixes proposed for their respective countries, and others have chosen letters differing from those in the first provisional list, a copy of which we published last June. We indicate with an asterisk (*) the

**TRANSMITTERS' NOTES
AND QUERIES.**

countries which, as far as we know, had definitely adopted a nationality prefix up to the time of writing.

AU	Asiatic Russia.*	FM	French Morocco* and Northern Africa.
CE	Chile.*	G	Great Britain.*
CM	Cuba.*	GI	Northern Ireland.*
CN	Morocco. (See also French Morocco.)	HA	Hungary.*
CP	Bolivia.	HB	Switzerland.*
CR	Portuguese Colonies.	HC	Ecuador.*
CT	Portugal,* Madeira and Azores*	HG	Siam.
CW	Romania.*	HI	Haiti.
CZ	Uruguay.*	HI	Dominican Republic.*
D	Monaco.	HJ	Colombia.
EAR	Germany.*	HR	Honduras.
E	Spain.*	I	Italy.*
EL	Irish Free State.*	J	Japan.*
EL	Iberia.	K1	Philippine Is.*
ES	Estonia.	K4	Porto Rico and Virgin Is.*
ET	Ethiopia.	K6	Hawaiian Is.*
EU	European Russia.*	K7	Alaska.*
F	France.*		

LA	Norway.*	TI	Costa Rica.
LU	Argentina.*	TS	Saree.
LZ	Bulgaria.	UH	Hedjaz.
OA	Peru.*	UL	Luxemburg.*
OH	Finland.*	UN	Yugo-Slavia.*
OK	Czecho-Slovakia.*	VO	Austria.*
ON	Belgium* and Colonies.	VE	Canada.*
OZ	Denmark.*	VK	Australia.*
PA	Holland.*	VO	Newfoundland.*
PJ	Curacao and Surinam.	VP	English Colonies.
PK	Dutch East Indies (Java* and Sumatra).	VQ	Fanning Island.*
PY	Brazil.*	VS	Malay States.*
RV	Persia.	VT	India.*
RX	Panama (Canal Zone*).	W	U.S.A.*
RY	Lithuania.*	X	Mexico.*
SM	Sweden.*	XN	China.
SP	Poland.*	YA	Afghanistan.
SU	Egypt.*	YH	New Hebrides.
SV	Greece.	YI	Iraq.*
TA	Turkey.	YL	Lettonia.*
TF	Iceland.	YM	Danzig.
TG	Guatemala.	YN	Nicaragua.
		YS	San Salvador.*
		YV	Venezuela.
		ZA	Albania.
		ZL	New Zealand.*
		ZS-ZU	South Africa.*†

† Some Belgian amateurs are still using the old prefix EL.

‡ The present system of South African call-signs, with only one letter following the district figure (e.g., ZS1A), necessitates a change of the nationality prefix with each successive 26 amateur stations in any particular district. We understand that South African amateurs are petitioning their authorities to allot two letters after the figure to obviate this difficulty.

BROADCAST BREVITIES

Exodus.

Staff resignations at Savoy Hill are not likely to be confined to the dramatic department. Since R. E. Jeffrey and his lieutenant, K. V. Wright, found brighter prospects awaiting them in the talking film business, ambitions have been stirred in other quarters of the B.B.C. stronghold.

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New Opportunities.

This is not surprising. In the last six years the B.B.C. has not been blind to the fact that its specialised staff has had no other outlet for its talents, and the cruel laws of economics have ruled accordingly. In the last two or three weeks, however, I have come across several cases in which members of the B.B.C. staff have received offers of employment in the "talkies" business at salaries commensurate with their talents. Those who control the future of talking films realise that the public demands music as well as talk, and here is a field in which several brilliant B.B.C. folk can coruscate to greater advantage than in their present environment.

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Promotion for Geneva Bureau?

The conferment of a semi-official status on the Bureau Internationale de Radiophonie will be a probable outcome of the Prague Wireless Conference, which concluded its sittings on Saturday last. Despite its industry and persistence in trying to ease the European wavelength situation, Geneva has always been hampered by a total lack of any authority behind its recommendations. From being a sort of nursemaid the Bureau will now, it seems, be able to rule its children with the authority of a governess, if not of a parent, being empowered to make authoritative decisions in consultation with the Post Office administrations of the different countries.

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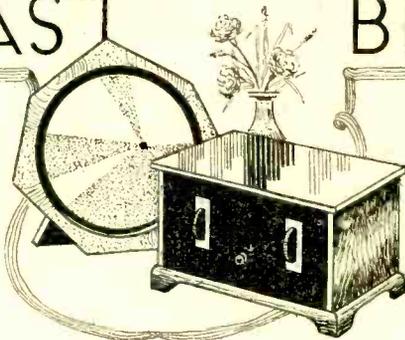
Broadcasting an Auction.

The first auction to be broadcast will take place on the occasion of the Newspaper Press Fund Dinner at the May Fair Hotel on Tuesday next, April 23rd, when Sir Herbert Morgan will auction the manuscript of Sir James Barrie's "Twelve Pound Look" on behalf of the fund. Included in the broadcast will be the Prime Minister's speech proposing the toast of "Journalism."

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More Election Broadcasts.

I hear that a further series of political broadcasts will follow the present "pre-Dissolution" series and will extend from May 10th to 29th. In view of protests by the Opposition parties regarding the present allotment of opportunities, it is probable that each party will be granted an equal amount of microphone time during this follow-up series.



By our Special Correspondent.

Application for broadcasting facilities have been received from other than the leading parties, but, for some reason or other, the authorities have deemed it necessary to draw the line at Conservative, Labour and Liberal. It is evidently forgotten that a one-man party may make up in entertainment value what it lacks in numbers.

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Talks for Hot Days.

In a "Foreword" to the new Summer Talks booklet the B.B.C. states that the Central Council for Broadcast Adult

the discussion of events at home as distinct from Mr. Vernon Bartlett's commentaries on happenings abroad.

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Debates Lasting an Hour.

Names new to broadcasting include those of Mr. E. N. Fallaize and Sir John Russell, who will discuss rural problems, and of Mr. R. H. Gretton, formerly of *The Manchester Guardian* and lately Tutor of Keble College, who will treat of modern politics.

During the summer months there are to be several debates of one hour in length, so listeners will be well advised to see that the batteries of their portables are fully charged before starting out for the picnic.

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Moving Scenes at Manchester.

Last week saw a house-warming party at Broadcasting House, Piccadilly, Manchester, which is now the home of the North Regional studios and offices.

The new premises give considerably more elbow room than the old headquarters at Orme Buildings, which contained only two studios. Broadcasting House is situated on the north side of Piccadilly, overlooking the Municipal Gardens; the stranger will discover it most easily by looking for the Manchester and County Bank, which occupies the ground floor of the building.

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The Very Latest.

There are three studios. The largest, 54 ft. long by 35 ft. wide, two stories in height and containing a gallery for an audience of about eighty people, is used for big orchestral and operatic performances. The second studio is for dramatic performances, and is 33 ft. long by 16 ft. wide. In addition, there is a small talks studio.

Attached to the dramatic studio are an echo room and a sound effects studio.

I understand that the control room bristles with the very latest apparatus, some of it so late that it was delivered only just in time.

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Domestic Drama.

It has often been suggested that the Savoy Hill staff is becoming an inhuman machine. The best proof to the contrary is found in the existence of the private dramatic society which from time to time produces a thriller so devastatingly thrilling as to be positively "unbroadcastable."

The staff nights are, of course, strictly private affairs, but murder will out!

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Society Jottings.

Atmospherics will return in time for the summer season.

Oscillators are remaining in town.

Unlicensed sets are a feature at some receptions.

Latest arrivals include summonses.

FUTURE FEATURES.

London and Daventry.

APRIL 22ND.—Covent Garden Opera.
APRIL 23RD.—St. George's Day Programme.

APRIL 25TH.—"St. Joan," by George Bernard Shaw, Part 1.

APRIL 26TH.—"St. Joan," by George Bernard Shaw, Part 2.

Daventry Experimental (5GB).

APRIL 23RD.—"A Mad Mummer's Bright Dream," by Charles Brewer.

APRIL 25TH.—B.B.C. Orchestral Concert, relayed from the People's Palace.

APRIL 26TH.—Covent Garden Opera.

Cardiff.

APRIL 26TH.—"Springtime in Bath," relayed from the Pump Room, Bath.

Manchester.

APRIL 23RD.—St. George's Day Programme on Shakespearean Themes.

Newcastle.

APRIL 26TH.—A Durham Programme.

Aberdeen.

APRIL 26TH.—A Scottish Programme.

Belfast.

APRIL 22ND.—"The Dragon's Bride," a Musical Comedy En Casserole, by Mabel Constanduros.

Education is now an established fact, and that we are now to have the first programme containing courses arranged under its supervision.

"Interest in talks," says the writer, "is growing rapidly and attempts are being made to increase their variety and scope to meet the widening demands."

Several innovations are promised, notably a long series on "China" by different authorities, including two Chinese speakers. These talks are to be given on Thursday evenings between 7.25 and 7.45, beginning on May 2nd. On Saturday evenings there will be a new series of talks under the general title of "The Week in London," which will provide an opportunity for



The WIRELESS CAMP

Summer with the Territorial Signals.

EARLY in the morning of a certain Sunday in July the headquarters of the 47th (2nd London) Divisional Signals becomes a hive of activity. The advance party have gone ahead to prepare the camp by the sea, and the main body are about to follow. Wireless sets, accumulators, charging dynamos, engines, and all the hundred and one things which a signal unit requires during its training are being loaded into lorries. To add to the complexities of the situation, seventy horses arrive. After the animals have been rapidly classified into draught horses and riding horses, they are harnessed up and hooked into the cable and telephone wagons. The column then moves off to the en-training station, while the lorries take the road to the seaside. The loading of the wagons on to trucks and the horses into boxes is always productive of amusement, and the train finally moves off to cheerful, if mixed, singing.

is to get in touch with brigades of the division, which are usually situated some distance away from divisional headquarters, while the Brigade Signal Sections must get in touch with their battalions.

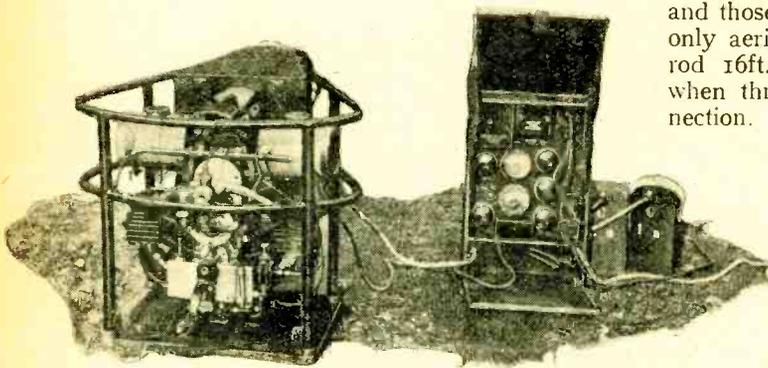
Two types of wireless station are used, according to the distance which has to be covered. The larger, the "C" station, shown in the title illustration, works on a waveband of 1,000 to 2,000 metres, and has a range for practical purposes of fifteen miles. The aerial is supported on collapsible masts, and is 15ft. high by 120ft. long.

As will be seen from the second photograph, the power is supplied by an engine and dynamo through a switchboard on which provision is made for charging accumulators.

The smaller of the two stations, known as the "A" station, is a more easily portable set with a range of four miles on a waveband of 150 to 400 metres. It is designed to work between the headquarters of brigades and those of the battalions composing the brigade. The only aerial used with this set is an aluminium alloy rod 16ft. in length, mounted on a bayonet, which, when thrust into the ground, provides the earth connection. One such set has been actually made by members of the 47th Divisional Signals as a result of a very interesting course of experimental work.

During the camping period the wireless section is engaged in maintaining communication with brigades and units, sharing in the activities of the infantry and artillery. Great interest is added to the work and training of the Royal Corps of Signals by the fact that it is carried out in close conjunction with the other arms of the Service, thus providing opportunities of seeing and studying the work of the Army as a whole. During camp, on at least one day, a mimic battle is carried out under, as nearly as possible, war conditions. This is a splendid test for the Wireless Section.

Wireless transmitters and receivers are carried in motor vehicles, as they would be in war, and it is the



The power plant of the "C" field station used by the Territorial Signals units.

Training in camp occupies only part of the day; afternoons and evenings are to a large extent free for bathing and the pleasures of the nearest seaside resort.

The most important side of the training, and that which will interest readers of *The Wireless World* most, is the use made of wireless during the fortnight which the training lasts. The first task of the Wireless Section

The Wireless Camp.—

task of motor cyclist despatch riders to deliver the messages received to their proper destinations.

There is always experimental work to be done, and the Wireless Section is thoroughly discredited if its loud speaker is not audible throughout the camp!

A Territorial Signals Camp is perhaps, to the wireless enthusiast, one of the most enjoyable and healthy ways of spending a holiday, combining, as it does, good-fellowship with the practice of his hobby in the open air

with no expense to himself; in fact, he is money in pocket, because he gets Army rates of pay during the training. The only regret ever expressed is that the camp lasts but a fortnight.

Any readers of *The Wireless World* will be welcome at the headquarters of the 47th Divisional Signals at Fulham House, Fulham High Street, S.W.6 (fifty yards from Putney Bridge Station), and will be given full particulars by the commanding officer if they think of joining.

LETTERS TO THE EDITOR.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

POST OFFICE INTERFERENCE.

Sir,—I wonder if others of your readers in the North-West London area have been experiencing an annoying background to the London station programmes by the Post Office Experimental Station, Dollis Hill (G5DH), working telephony on short waves during the broadcast programmes.

The Post Office forbid amateurs to work during broadcasting, while they themselves fill the ether with tuning notes, station descriptions, and newspaper readings of long duration.

Our licence money is demanded promptly and regularly by them, and when I pay to receive the broadcast programmes I don't think I should have to listen to an unwelcome Post Office experimental programme as well; surely their ruling should be just as binding to themselves as to the amateur.

N.W.2.

"LISTENER."

OLD LAMPS FOR NEW?

Sir,—May I reopen what was a subject of correspondence in *The Wireless World* prior to last year's Exhibition? The question then had not only your sympathetic support, but I understand you submitted the matter to the appropriate quarter, in this case the B.V.M.A., since when I have very keenly awaited developments.

I refer to the contemptible "business" of a certain type of retailer who deliberately uses a valve for demonstrating purposes for a few weeks—possibly longer—later returning the valve to the carton to be sold as new.

Cossors confirmed my suspicion in connection with a purchase of one of their valves and dealt with me very handsomely—but I am more concerned with the helpless position of the average buyer who is the victim.

At the moment I require some valves, but under existing circumstances what guarantee have I that I shall receive what I pay for, namely, a new article?

London. S.W.12.

FREDERIC HAWKINS.

5SW IN SOUTH AFRICA.

Sir,—As one of the Dominion listeners to 5SW might I, through the medium of your paper, make a suggestion? Between 5SW's call and the time signal there is generally a pause of about three minutes. Now, during that period would it not be possible for the Chelmsford announcer to tell overseas listeners what the evening programme is going to be? American stations give us their programmes a week ahead.

Claremont,

C. R. SLINGSBY.

South Africa. March 1st, 1929.

5SW IN NYASALAND.

Sir,—I have just seen the letter by "Radiox" about 5SW in your paper. I should like to add one other point. In all the African and Asiatic Colonies listeners have either had dinner or are having it at the time of the transmission, and, as the B.B.C. has already realised, after-dinner listeners prefer either music or "light" entertainment. But we get the 7 o'clock talks from London. Could we not have the alternative programme, which, I suppose, is music of

some sort, from 5GB? If the "land of shopkeepers," as "Radiox" so politely calls them, cannot afford to ask the Marconi Company to run their dynamos on Saturdays and Sundays, I for one am quite prepared to subscribe towards it. But if I do, when I buy a car I shall buy an American one.

Nasonia Estate, Luchenza,

C. FELLOWES.

Nyasaland. February 26th, 1929.

5SW IN DUTCH WEST INDIES.

Sir,—With reference to correspondence that has appeared in *The Wireless World* respecting 5SW and the question of its maintenance, may I, as an enthusiast to whom the transmissions should be of particular interest, offer my remarks.

I think it is quite evident that the whole question depends entirely on what 5SW is worth to the Empire, and, although I am not situated in a British Colony, can quite safely give the answer as being practically nil. For two very good reasons. In the first place the programme radiated is decidedly unsuitable, the most interesting portion of the relay, i.e., the News Service, being omitted, and secondly, it is arranged entirely without regard to the fact that G.M.T. is very different indeed from, shall we say, Indian time or Canadian time or Australian time. In fact, the only portion of the British Empire that can listen regularly, if it could and wanted to, is a portion of the African possessions. These are statements of fact, not merely "hot air," and prove how ridiculous is the B.B.C.'s assertion that the station is run to form a link with the Empire. Operated merely to suit the convenience of the 2LO regular programme, no attempt has ever been made to cater for the requirements of the overseas listener. Supposing, for instance, 2LO were to run its existing evening service from midnight until 5.0 a.m. or from 1.0 to 6.0 p.m., or from 7.0 a.m. until noon, how many Londoners, do they estimate, would continue to license their sets for such a service. Answer this question, and you have, nearly enough, the percentage of Empire listeners who would be willing to contribute towards the upkeep of 5SW.

Situated on a small Dutch island in the Tropics, everything radiated on more than about 50 metres completely spoiled by static, and surrounded with interfering telegraph signals, the short-wave broadcasts are the only ones I can listen to, the nearest being 2,300 miles away, and there are thousands of listeners situated in similar and even worse positions. But, although I can receive Chelmsford until 7.15 p.m. local time, all I get is dance music and gramophone records, after the many months that the station has been operating. Even if I pick the station up in the middle of the day, there is nothing interesting to hear. even if you manage to get it at all across 4,500 miles, so what is the use? Besides, working from 7.0 a.m. until 5.0 p.m., we only have the evening free in the same way as the listener at home, and the same thing applies pretty well everywhere, so what can be the benefit of 5SW to the Empire? Fortunately I do not have to rely on 5SW for a programme. Just a fraction lower down the scale CJRX comes in well (a Dominion station, please note), and tells me how the Tests are going in Australia, or the condition of King George, or other information of an interesting nature, while I also have 8XK's "Ne-

casting" feature within another degree or so, and if I care to turn to one of the WGY relays I can usually hear something worth while.

Of course, I know that the B.B.C. are not the only ones to use the cheap and nasty relay system. They all do. But then it must be remembered that the other countries who are running powerful short-wave stations have no Empire anything like the size of the British to cater for. Experiments on the lines of those commenced by PCJ are the only ones which are likely to lead to anything, and what we should like to see is a 5SW operating at different times each day to suit different parts of the Dominions, the programmes being suitably designed in each case.

In this way the B.B.C. would have something on which to base their claim for repayment, but under the present system they are only holding themselves up for ridicule. In any case, it seems very difficult to me how the Dominions would find means to tax listeners to 5SW, because I do not think that those situated in populated areas would ever give much support to the station on account of their being already well catered for by local stations, and the comparatively poor entertainment value of long-distance, short-wave transmissions. That is why I should like to emphasise the necessity of providing a programme built up around a nucleus of items of interest, sports events, etc., and talks, garnished with suitable musical items, primarily designed for the listener in tropical and/or remote parts of the Empire, to which the short-wave signals are the only ones which can successfully penetrate. I refer to the type of enthusiast who spends pounds on the best of component parts and material, knowing full well that in the end they will only give him indifferent results, and who operates his set under the worst possible conditions, both physically and statically, in order to obtain some small measure of entertainment to while away spare hours, and above all hear news and the voices of his fellow-countryman; who spends, in many cases, more on radio in a week than the average listener at homes does in twelve months, whose people at home almost invariably contribute to the income of the B.B.C., and who, but for the enterprise shown by the big broadcasting concerns in running short-wave stations, would be compelled to give up this most fascinating means of contact with the outside world. The B.B.C. have frequently pointed out how their policy ensures the excellence of 2LO—to the Londoner, and they are quite right. Why not extend this practice to 5SW, and design programmes for the primary benefit of its would-be most enthusiastic supporters, the men to whom the short-wave station is the beginning and end of radio reception?

Knowing the principal short-wave stations as I do by more or less regular reception, I have tried to represent the position from what appears to me to be the logical point of view in order to renew interest in the matter, because a 5SW, as at present operated, is just no use to anybody. I also hope that *The Wireless World* will lose no opportunity of stirring the matter up, because you can rest assured that by doing so you will be rendering a great service to a type of enthusiast who takes his radio very seriously, expects very little, and because of his unenviable position is doubly thankful for anything that is done for him.

IVAR THYDEN.

Aruba, Dutch West Indies.
March 2nd, 1929.

5SW IN EGYPT.

Sir,—We, overseas Britons, are very pleased to be able to get 5SW here regularly, both during the afternoons and evenings. The B aerial seems to give the best results, and there is not much fading; perhaps an addition of power would cut out all fading.

I think this station could become a very useful means of propaganda for British trade if more power was put into it and the trade items furnished as news to keep foreigners well informed: of course, without over-doing it. The very fact that we can get 5SW without interference from ships and the local wireless telegraph station is a very important consideration locally.

Egypt presents quite a good future market for British-made wireless goods. Local amateurs are finding out that they are far superior to French, German, and Italian parts and sets. The American sets will only work with American valves; several people have brought over American kits, but results have not

been up to expectations, although some of the American parts find a good market here, and can be considered as the only competitors of England. Let us hope that manufacturers will be awake to the opportunity and not let the Americans get ahead as they have done in the motor trade (Egypt is flooded with American cars, and not merely the low-priced ones; they give service, and there is the key to the situation).

Alexandria,
Egypt. March 20th, 1929.

C. W. D. V.

5SW 60° WEST.

Sir,—In your number of February 20th there is a letter on this subject with which all listeners in the Empire must be in general agreement.

As I have received a letter from the Director, Foreign and Dominions Dept. of the B.B.C., on this subject, dated February 22nd, I think the gist of it will not be without interest to your readers at home and in the Empire.

The B.B.C. contend that a service cannot yet be started as their engineers are not satisfied that one is justified without a great deal of further experimenting. The answer to this is, of course, that no one expects such a service as can be ensured from a main B.B.C. station at forty miles or so. If, therefore, the directorate of the B.B.C. consider that it is more important that their engineers should be satisfied than the listeners, actual and future, in the Empire, they may be quite certain that the said listeners are not satisfied either with the directorate or their engineers.

The B.B.C. also recognise that a 24-hour service, or nearly so, would be necessary, and state that it is difficult to find a suitable wavelength. Quite so, but why try to find one only, and why spend twelve months on the first one tried? They have since tried 24.9 metres and now 25.53 metres, and must already know how both worked or work in all portions of the Empire for the present hours of transmission. How many 24-hour tests have they made with adequate notice of such tests to all portions of the Empire?

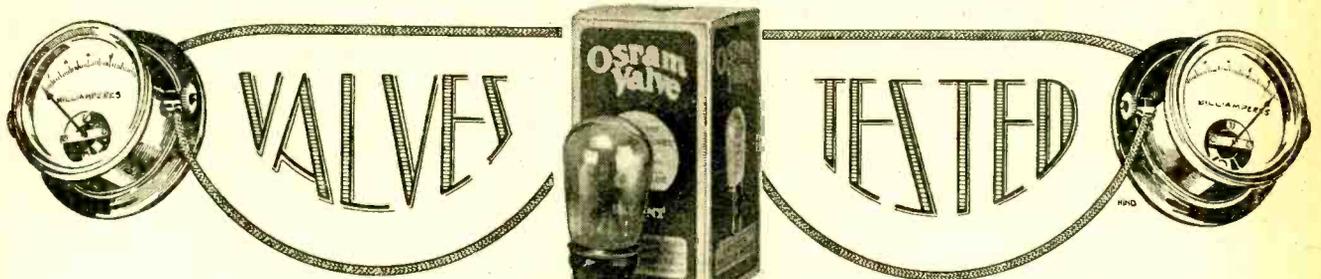
Surely enough is known on general lines to ensure good results for any sector of zone time already; minor adjustments would no doubt be necessary, but so they will whether the delay in making a start be long or short.

A reasonable basis to work on would be to divide the Empire into certain sectors, e.g.: (1) New Zealand and Eastern Australia, (2) Western half of Australia and Straits Settlements, (3) India and Ceylon, (4) Africa, (5) Eastern Canada, West Indies, Demerara, and British Honduras, (6) Western Canada. Suppose that they then try to give a four-hours' service to each sector, say, from 19.00-23.00 hours local (zone) time. The corresponding times of G.M.T. would show at once whether the route was all darkness, all daylight in England, with darkness at receiving end, or a mixed state of affairs at the transmitting end; in the case of Northern Canada, whether east or west, there would, of course, be sometimes daylight, sometimes darkness at the receiving end, but the number of listeners in the higher latitudes, though needing such service as much or more than anyone else in the Empire, is certainly small. The correct wavelength to use under such conditions are sufficiently well known to be able to make a quite satisfactory start. Instead of experimenting on such lines, they appear to be looking for one wavelength to satisfy all conditions and to be doing it very leisurely indeed.

Now I am quite sure that when at home I have heard the news from 5GB Daventry Experimental. This astonishing answer, therefore, provides a variant to a very ancient riddle—its new form is, "When is an experimental station not experimental?" The logical conclusion can only be that the B.B.C. consider that it depends on the wavelength; they must be case-hardened optimists if they imagine such an answer will satisfy anyone else.

It is, therefore, evident that the B.B.C. is still—as it has always shown itself to be—hostile to a really efficient short-wave station, in spite of such activity as experiments with "Antenna A" and "Antenna B," which may be regarded under the circumstances as what is generally known in the service as "eyewash." Perhaps it is to reduce the range?—*vide Experimental Wireless*, February, 1929.

PCS must have a most efficient aerial—why not copy it?
60° WEST.



Three Directly Heated A.C. Valves.

THE three valves under review have been designed especially for use in receivers operated entirely from the A.C. supply mains, and they appear in both the Osram and Marconi lists as the "Point 8" series. They are fitted with short, thick filaments, and have the rather unusual characteristics that they require 0.8 amp. at 0.8 volt. It has been found that a filament of this type can be supplied direct with A.C. from the secondary of a suitable step-down transformer, and, unlike the "K" type, are not fitted with a special heater element.



These valves can be used, therefore, in practically all positions of a receiver where valves of similar characteristics, but of the battery-fed type, are specified. There is, however, one exception, this being in the detector stage, when the leaky grid method of rectification is employed. Under these conditions one of the "K" type (indirectly heated cathode valves) should be used.

H. Point 8.

This valve has a high amplification factor, and falls within the resistance-capacity amplifier class, but it is suitable for use also as an anode-bend detector, and will probably give the best results when followed by a resistance-capacity coupling to the first L.F. stage. Used in this manner a negative grid bias of 3 to 4½ volts, according to the H.T. used, will be required. Transformer coupling may be employed when this valve is used as an H.F. amplifier, provided a suitable primary winding is adopted.

CHARACTERISTICS AT ZERO GRID BIAS AND 100 VOLTS H.T.

H. Point 8.	Amplification factor.	A.C. Resistance ohms.	Mutual conductance mA./volts.
Makers' Rating	40	55,000	0.73
Specimen 1	50	57,000	0.88
Specimen 2	56	67,000	0.83

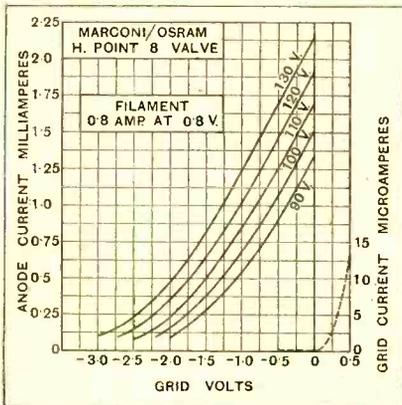
We consider that the principal function of this valve is either an anode-bend detector or a resistance-capacity coupled L.F. amplifier, as owing to its high A.C. resistance side-band cut-off will undoubtedly follow if it is employed for H.F.

Marconi and Osram "Point 8" Series.

amplification in conjunction with a transformer. The average constants under normal working conditions were found by measurement to be: A.C. resistance, 57,500 ohms; amplification factor, 44.5; and mutual conductance, 0.78 mA. per volt.

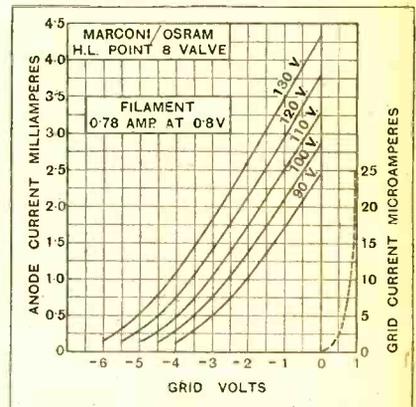
H.L. Point 8.

This may be regarded as the general purpose valve of this class, since it has a medium A.C. resistance, and, according to the makers' rating, an amplification factor of 17. As leaky grid detection is not advised with any valve in this group, its usefulness is narrowed down to two



Average values under working conditions: A.C. resistance, 57,500 ohms; amplification factor, 44.5; mutual conductance, 0.78 mA./v.

The designers claim that the electron emission from the filament, which depends on the heating effect of the A.C., is not affected materially by rapid changes in the current, due to the alternating nature of the supply, as owing to the thickness of the filament the temperature does not rise and fall in sympathy with the growth and decline of the current.



Average values under working conditions: A.C. resistance, 22,200 ohms; amplification factor, 16.6; mutual conductance, 0.75 mA./v.

positions in a modern set. These are, respectively, the H.F. stage and the first L.F. position. Under normal conditions of working—that is to say, with about 120 volts H.T. and the grid given a negative bias of -3 volts—the anode current will be in the order of 1.5 milliamp., and as this is well within the safety figure given for many of the better

Valves Tested.—

class L.F. transformers, it will be admissible to adopt transformer coupling following this valve in an L.F. amplifier.

CHARACTERISTICS AT ZERO GRID BIAS AND 100 VOLTS H.T.

H.L. Point 8.	Amplification factor.	A.C. Resistance ohms.	Mutual conductance mA./volts.
Makers' Rating	17	17,000	1.0
Specimen 1	19	24,200	0.8
Specimen 2	17.5	25,300	0.7

Under working conditions the average constants were found to differ only very slightly from those measured at 100 volts H.T. and zero grid bias. With 130 volts on the anode and the grid bias to -3 volts, the average A.C. resistance was 22,200 ohms; the amplification factor 16.6, and the mutual conductance 0.75 mA. per volt. The maximum anode potential is 150 volts, and the optimum grid bias under these operating conditions would be -4½ volts. Grid current started in both specimens tested at zero grid volts, and as there was not the slightest trace of reversed grid current the valves are dead hard.

P. Point 8.

This is the power valve of the series, and should be used in the output position followed by either a transformer coupling to the loud speaker or a choke-capacity feed circuit of the type most likely to ensure immunity from "motor boating" or other L.F. troubles. The anode current will be in the order of 10 mA. with an anode potential of 150 volts,

BOOK REVIEW.

The Physical Principles of Wireless, by J. A. Ratcliffe, M.A. (pp. 102+viii., with 37 figures; Methuen; 1929; price 2s. 6d.).—This little book, which is one of a series of monographs on physical subjects, deals essentially with first principles. By strict economy of statement and concentration on fundamentals, the author has succeeded in presenting the whole field of wireless problems in such a way as to show that though the variations in wireless apparatus may be endless, the principles on which they rest are few and simple.

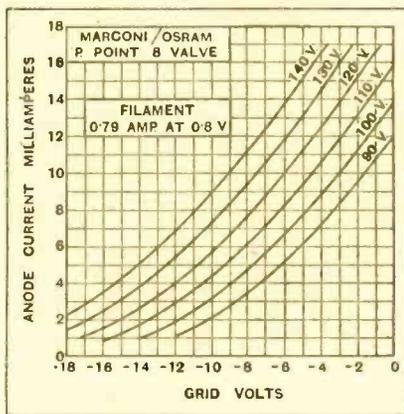
The properties of oscillatory circuits and valves are first dealt with, and the reader who has mastered these two chapters will find the third chapter on wireless transmitters easy to follow. An elementary account is given of the propagation of waves from a transmitter aerial, and the

and it is hardly wise to pass a current of this magnitude through the windings of the average loud speaker.

CHARACTERISTICS AT ZERO GRID BIAS AND 100 VOLTS H.T.

P. Point 8.	Amplification factor.	A.C. Resistance ohms.	Mutual conductance mA./volts.
Makers' Rating	6	6,000	1.0
Specimen 1	6.6	5,100	1.2
Specimen 2	6.4	6,675	0.96

The measured constants at 100 volts H.T. and zero grid volts were sensibly in agreement with the makers' rating, and under normal working conditions the average



Average values under working conditions: A.C. resistance, 5,700 ohms; amplification factor, 6.6; mutual conductance, 1.15 mA.v.

values showed little change from these figures. Measured at 140 volts H.T. and -10½ grid bias, the average A.C. resistance was found to be 5,700 ohms; the amplification fac-

tuning-fork drive and the quartz oscillator are explained.

The action of rectifying crystals and detector valves is then treated in a particularly lucid manner, and the few formulæ obtained are enough to carry one through the chapter on reception, which traces the received signal through all its stages from the receiving aerial to the ear.

The last three chapters deal with wireless telephony, amplifiers, and miscellaneous applications, including the production of ultra-short waves, the measurement of frequency, and the disturbance of waves by the configuration of the earth's surface and the atmosphere.

BOOKS RECEIVED.

J'ai Compris la T.S.F. By E. Aisberg. With preface by R. Mesny. A series of

tor 6.6 and the mutual conductance 1.15 mA. per volt. Careful tests failed to reveal the slightest trace of reversed grid current, showing that the valves have been satisfactorily evacuated.

Although particular attention has been given to the design of these valves, some minor additions must be made to the set when using the Point 8 series in a receiver of the conventional type. It is usual practice to return the grid circuit to the negative leg of the filament, generally through the bias battery. With the A.C. valve, however, it becomes necessary to make these connections to the electrical centre of the filament, and this is best arranged by fitting a potentiometer of a hundred or so ohms across the filament pins and bringing the grid return connection to the slider. It is only in connection with the H.F. stage and first L.F. valve that this precaution is really necessary. Possibly a single potentiometer connected across the filament supply leads would answer in most sets, but in certain cases a separate potentiometer for each stage, likely to be affected by the alternating nature of the filament supply, may be found necessary. The H.T. negative should be connected to the slider of the potentiometer if one only is used, and to the L.F. potentiometer if two are fitted.

In wiring up a set fitted with three Point 8 valves, the filament leads must be of sufficient thickness to carry the total current of 2.4 amps. without any appreciable voltage drop.

imaginary conversations between "Curiosus," a boy of 16, and his uncle "Radiol," in which the elementary principles of wireless are explained in a popular manner. Pp. 146, with 240 marginal sketches by H. Guilac, and 83 diagrams. Published by Etienne Chiron, Paris. Price 15 francs.

Verstärkermesstechnik Instrumente und Methoden (Amplification, Apparatus, and Practice). By Manfred Von Ardenne. Pp. 235, with 246 illustrations and diagrams. Published by Julius Springer, Berlin. Price RM22.50 in paper cover, or RM24 bound in cloth.

The Wireless Licence Ramp. "A lesson in bureaucracy." By R. M. Ford. Pp. 192, with numerous illustrations. Published by St. Giles Press, London. Price 6s. 6d.

READERS'
?
PROBLEMS

ANSWERED

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves.

A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

"The Wireless World" Supplies a Free Service of Technical Information.

Extending Wavelength Range.

My aerial is a fairly large one, and I think that it is due to this fact, that Hilversum cannot be tuned in on my "Europa III" set. Short of altering the coil, is there any method of modifying the set so that this wavelength can be received? N. D. L.

The simple way of counteracting the effects of your high aerial capacity is to insert a small fixed condenser (of 0.0001 or 0.0002 mfd.) between the aerial lead-in and the aerial terminal of the set.

o o o o

Switching Over.

To avoid the necessity for interchanging long- and short-wave coils, I should like to introduce a switch change-over scheme. My set is the "Standard Four." Have you described a method of making this alteration?

T. F. P.

We have not published specific instructions for modifying the set in this way, but would suggest that you follow the methods adopted either in the "Two-Range Four" or the "Switch-over Three." Both these sets included a neutralised H.F. amplifier similar to that in your present receiver; they were described, respectively, in our issues of September 12th, 1928, and July 4th and 11th, 1928.

o o o o

The Lightest Portable.

I am thinking of making a single-valve portable receiver for reception at short ranges, and in order to keep down both bulk and weight it is proposed to use a 4-electrode valve with a few volts of H.T. Will you please criticise my circuit diagram of the projected receiver, bearing in mind that the maximum possible sensitivity is desired, in view of the fact that the set will mainly be used under difficult receiving conditions.

A. C. P.

Your circuit diagram shows a conventional "Hartley" detector valve with centre-tapped frame aerial, and we think that this arrangement is to be recommended for your requirements. Our only suggestion is that you should attempt to improve detector efficiency by fitting an anode by-pass condenser, which will, of

course, be in addition to the 0.0001 mfd. reaction control condenser which you show.

This extra capacity may conveniently be in the form of a semi-variable condenser with pressure screw adjustment;

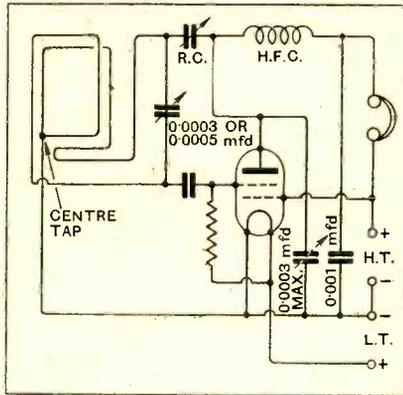


Fig. 1.—Circuit diagram of four-electrode valve portable set with semi-variable anode by-pass condenser.

your aim should be to set it at the maximum capacity which will allow full reaction effects over the whole of the tuning scale.

Your circuit diagram, with the addition of our suggested modification, is reproduced in Fig. 1.

RULES.

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
- (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
- (3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
- (4.) Practical wiring plans cannot be supplied or considered.
- (5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.
- (6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufactured receivers. Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

A Soft Valve.

I notice that there is a pronounced blue glow between the electrodes of one of my valves, and presume that this indicates "softness." What will be the effect of continuing to use the valve in this condition? L. C. B.

Softness in a valve is undesirable for several reasons; its effects are determined by the position of the valve in the receiver. It may cause (a) an unduly high consumption of H.T. current; (b) distortion, poor selectivity, or reduced H.F. amplification, by loading the preceding circuit; (c) the working life of the filament will almost certainly be decreased; (d) if the valve is used as an L.F. amplifier with a condenser and leak in its grid circuit, there may be a very considerable falling-off in its effective negative bias, due to a drop in voltage through the leak.

o o o o

The "Radio-Gramophone Combination."

I live nearly a hundred miles from the nearest broadcasting station, and although I am attracted by the possibilities of the "Radio-Gramophone Combination" described in "The Wireless World" for March 6th, I am afraid that it would be insufficiently sensitive for use in this locality. If you agree, would you tell me if it is possible to add an H.F. stage? I realise that considerable modification would be necessary to the layout of the receiver; would it be necessary to alter any part of the existing circuit? D. G. B.

At your very considerable distance from the nearest station, we doubt if signals would be sufficiently loud with the set as it stands, unless reaction were applied to such an extent as to impair quality. To be on the safe side, we certainly think that you would be well advised to precede the existing arrangement by an H.F. stage, which incidentally need not be of the highest efficiency, unless you wish to receive a number of stations.

From the detector valve onwards, the present circuit may remain unchanged, but we think that, with an added H.F. valve, it would be as well to abandon reaction altogether. If this is done, a small by-pass condenser of from 0.0001 mfd. upwards should be joined between anode and filament of the detector valve.

Double Volume Control.

I have had a good deal of trouble in devising a satisfactory amplifier to follow an anode bend detector preceded by two H.F. stages, and am thinking of modifying the L.F. side of my receiver in the manner shown in the diagram I am sending you. Experience leads me to believe that it is quite unnecessary to aim at high magnification per stage, and as you will see from the diagram, I am using a low value anode resistance in the anode circuit of the detector. This component has only two tapings, and the variation in strength obtainable by altering the position of the first L.F. grid connection is not sufficiently close. I therefore propose to use this adjustment for rough control, and to fit a variable resistance across the primary of the L.F. transformer in order to obtain fine control. This latter addition, I understand, will have the effect of raising the tone, which seems to be necessary, in view of the fact that there must be loss of the higher frequencies in my sharply-tuned H.F. circuits. Will you please criticise my diagram?

S. L. N.

We have examined your circuit diagram, and have little but favourable comment to offer, except for the fact that you show no provision for keeping H.F. voltages from the grid of the first L.F. valve. Your diagram, with the addition

sort is itself in a state of self-oscillation it radiates just as badly as any other type. You will realise that it is in this condition only when the associated circuits are improperly designed or out of adjustment. When oscillation is produced by reaction between the detector valve anode circuit and the H.F. coupling coil, radiation from the aerial is almost negligible.

o o o o

Anode Bend or Leaky Grid?

I am rather puzzled as to the comparative merits of the anode bend and leaky grid condenser methods of detection. It seems to be generally agreed that the latter is by far the more sensitive, but, in spite of this, several of the most sensitive receivers described in your journal include the former method. This seems to be illogical. Can you give me a direct answer to the question of relative sensitivity?

D. M.

This is a difficult question to answer briefly and in general terms. For a given small input there can be no doubt that the grid circuit scheme is far more sensitive than the other, but when circuits of extremely low resistance are used, damping introduced by this method may cause a falling off in applied signal voltage, with the result that the extra sensitivity tends to disappear.

We recommend you to read an article on this subject which appeared in our issue of March 21st, 1928.

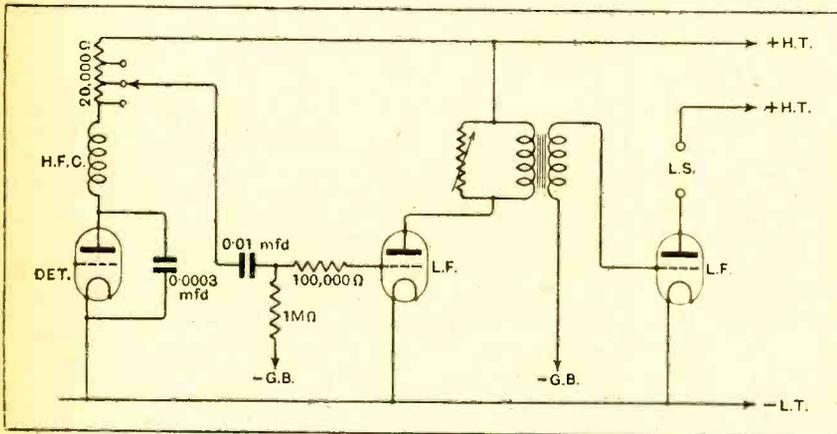


Fig. 2.—Regulating input to first and second L.F. amplifying valves.

of an H.F. choke and a stopping resistance of 100,000 ohms, is reproduced in Fig. 2.

With certain transformers, the connection of a resistance across the primary will give a rising characteristic, and, up to a point, will have the desired effect in increasing amplification of the higher frequencies.

o o o o

S.G. Valve and Radiation.

Is it a fact that a screen-grid H.F. valve cannot radiate and so cause interference with neighbouring listeners?

J. S. P.

If an H.F. amplifying valve of this

A Microphonic Valve.

My detector valve, which has pronounced microphonic tendencies, has been responsible for a good deal of trouble, which has been overcome by transferring it to the first L.F. stage. Is it likely to do any harm in this position?

H. J. R.

By transferring the offending valve, its effects become less noticeable, because fluctuations in anode current due to movements of the electrodes are now receiving very much less magnification than before, but it is still possible that trouble may arise. If the valve is suitable, you would probably do better to use it as an H.F. amplifier.

WHO'S WHO IN THE ETHER.

Additions and Alterations to Previous Lists.

GREAT BRITAIN.

STATION.	METRES.	KC.
Daventry (5XX)	1562.5	192
Stoke-on-Trent	294.1	1020
Swansea	294.1	1020

CZECHO-SLOVAKIA.

Bratislava	298.7	1004
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DENMARK.

Kalundborg	1156	259.4
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FRANCE.

Eiffel Tower	1480	202
Grenoble (PTT)	427.7	701.5
Lille (PTT)	245	1224
Marseilles (PTT)	305.6	981.6
Montpellier	253.1	1185
Petit Parisien (Paris)	336	892
Radio Flandres (Lille)	430	697
Radio Vitus (Paris)	309.1	970.6
Rennes (PTT)	254	1180
Toulouse (PTT)	254	1180

GERMANY.

Aachen (Aix-la-Chapelle)	458	654
Berlin (Witzleben)	476.3	630.5
Dresden	317.5	945

HOLLAND.

Hilversum	1073	279.5
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HUNGARY.

Buda-Pest	548.5	547.9
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ITALY.

Naples	333	900
Turin	277	1084

JUGO-SLAVIA.

Ljubljana (Laibach)	582	515
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LATVIA.

Riga	530	567
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NORWAY.

Porsgrund	459	653
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POLAND.

Warsaw	1393	215
Vilna	456	658

PORTUGAL.

Lisbon (CTIAA)	317.5	945
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RUSSIA.

Kharkov-Narkompotshtel	1685	178
Leningrad	1002.4	299.2

SPAIN.

Barcelona (EAJ13)	277.8	1080
Seville (EAJ5)	369.9	811.1

SWEDEN.

Falun	333	900
Motala	1324.6	223.4

TURKEY.

Stamboul	1210	248
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AND
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(17th Year of Publication)

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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A NEW ERA IN H.F. AMPLIFICATION.

FROM time to time one may be tempted to believe that finality in the degree of amplification which can be obtained with a H.F. stage has been reached, but sure enough something new turns up to pave the way for the development of H.F. stages of greater and still greater efficiency.

In July, 1926, *The Wireless World* set a standard by describing a receiver, the "Everyman Four," which incorporated a H.F. stage giving what was undoubtedly the greatest high-frequency amplification practically possible with the valves then available. Since then the improvement in valves has made it possible to increase the amplification obtainable with a single H.F. stage following the same design by fully fifty per cent.

Then came the screen-grid valve, for which great things were hoped, but it was found in practice that a single stage could not appreciably improve upon the performance of a well-designed H.F. stage employing the three-electrode valve, but great possibilities in the way of high-frequency amplification were obtainable

with the screen-grid valve when two stages were used, and *The Wireless World* "Kilo Mag. 4" has set the pace along these lines. But still the possibilities with two stages of amplification employing a three-electrode valve were not beaten, although the use of screen-grid valves simplifies construction and, more important still, simplifies initial adjustments to a very large extent.

In articles which have been published dealing with the theory of the screen-grid valve it has been indicated that the utmost efficiency in the way of amplification cannot be obtained until the effects of the small residual capacity of the valve which still remains have been eliminated or otherwise taken care of, and the only practical way of doing this at present is by neutralisation. But that is only the beginning of the story; having come to that conclusion, the next step must be to decide how to neutralise and what should be the design of the coupling to be associated with the neutralised screen-grid valve.

Practical Results.

In this issue this subject is dealt with in an article by Mr. A. L. M. Sowerby under the title, "More Amplification from Screen-grid Valves," and a practical method is evolved for utilising the screen-grid valve under these conditions, whereby it is possible to obtain a H.F. stage magnification of over 100, whilst maintaining stability over the tuning range, nor is this the last word, for by special choice of valves and circuit this figure can be brought up to 300 times, representing a H.F. stage gain of at least some five times that obtainable with the "Everyman Four" design with which our readers are so familiar.

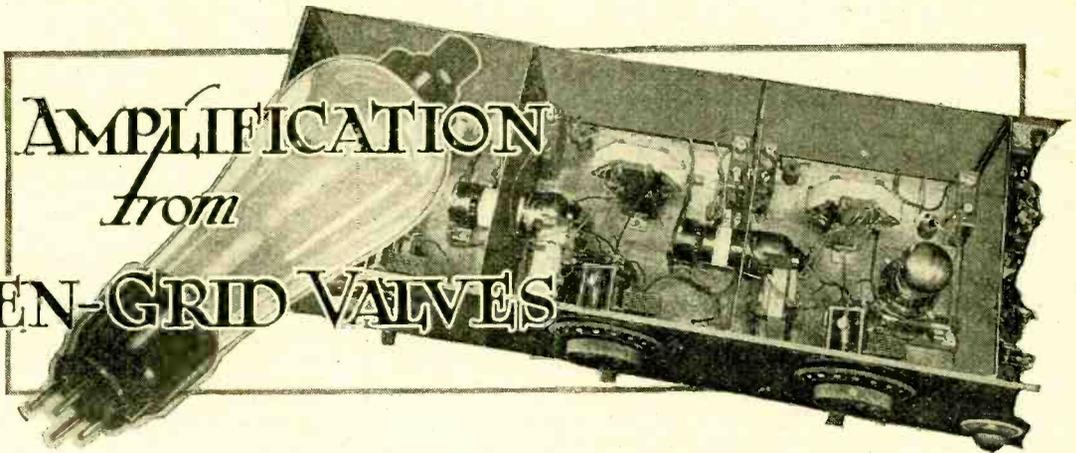
It might be thought that such a degree of amplification could only be obtained by "peaking," and so producing side-band cut-off with consequent loss in quality of reproduction. But no such troubles need be encountered, for the design of the H.F. stage as a whole takes this point into consideration, and very liberal allowance is made for side-bands in the figures given.

o o o o

FOREIGN PROGRAMMES.

COINCIDING with the commencement of summer-time we have decided to suspend the publication of the four pages of Foreign Programmes, believing that during the summer months, when the interest in distant listening is less than in the winter, the majority of our readers would prefer to see those pages devoted to technical articles and other matter with a wider appeal.

MORE AMPLIFICATION From SCREEN-GRID VALVES



Doubling the Stage Gain and Maintaining Stability.

By A. L. M. SOWERBY, M.Sc.

THE screen-grid valve, which was ushered in with a flourish of trumpets something over a year ago, has not, from the point of view of the amateur set-builder, completely fulfilled its early promise. In support of this statement, let us recall some of the promises made on behalf of this valve, and see how far they have been fulfilled in solid fact.

First of all, a new simplicity and a new certainty were to be imported into the business of designing and making a high-frequency amplifier. The simple tuned-anode circuit was to be all that was required as coupling between the screen-grid valve and the detector, and no kind of neutralising device was to be necessary. It is already becoming known that the tuned-anode circuit, although it is quite satisfactory when accumulators are used for the high-tension supply, and even with dry batteries so long as they are new, does not work well when the mains are pressed into service in their place. The reason for this is that the connection of the grid of the detector through a tuned circuit to "H.T.+" is simply asking for trouble from "motor-boating," while its isolation behind a grid-condenser ensures the very maximum receptivity of the set to any stray "hum" that may remain in the output from the eliminator. Already, therefore, the simplest coupling is found to be not altogether adequate, and there is a tendency to replace it by a high-frequency transformer.

A Dream which did Not come True.

The second, and the greatest, attraction that the new valve promised was the achievement of a new and higher standard of high-frequency amplification. We were told that now, for the first time, high-frequency amplification would really work, and that a higher amplification per stage than had ever before been attained would easily be reached. A golden dream, in which every station in Europe became "local," took shape before our dazzled eyes. What is the truth? The greatest amplification that can be attained from an ordinary screen-grid valve is not very much more than forty times per stage, for if any attempt is made to

exceed this figure by any notable amount the residual anode-grid capacity of the valve takes a hand in the game, and oscillation ensues. However adequate the screening used to prevent interaction between circuits, one has only to connect one low-loss coil in the grid-circuit of a screen-grid valve and another in the plate circuit to be in possession of a set as utterly unmanageable as any of the untamable horrors with which we used to wrestle in the days before neutralising was brought in.

Now forty times in one stage perhaps sounds a good degree of amplification; it is undoubtedly quite useful, but it is not at all difficult to do better than that with

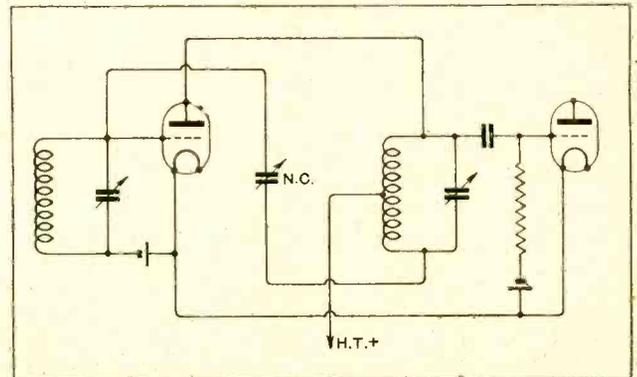


Fig. 1.—Neutralisation of a tuned-anode circuit in this or a similar manner is perfectly suitable for a three-electrode valve, with which it is shown, but not for a screen-grid valve. Neutralisation takes place when the balancing condenser N.C. is set to the same value as the interelectrode capacity of the valve, and this capacity, in the case of a screen-grid valve, is far below the minimum of any neutralising condenser.

an ordinary three-electrode valve. As long ago as July, 1926, full constructional details of the "Everyman Four" receiver were published in these columns, and the high-frequency stage in this set attained an amplification of forty times. This, be it remarked, with valves that have since been superseded by others of considerably higher efficiency, so that the same receiver,

More Amplification from Screen-grid Valves.—

equipped with modern valves, can now be made to give an amplification of over sixty times. This is enough to make the average modern single-stage screen-grid receiver look a bit weak by comparison.

Taking two-stage receivers, we have recently seen in these columns a description of a screen-grid valve set giving an amplification of a thousand times in two stages; and that, on the unimpeachable authority of a table of square roots, implies an amplification of a little under thirty-two times per stage. A similar performance can be obtained from two neutralised triodes, but the amplifier would be more bulky and difficult to construct, especially with waveband switching.

Residual Interelectrode Capacity.

Remembering these facts, it is not too much to say that the screen-grid valve has not improved the attainable standard of amplification, but has merely offered a new method of attaining results which have been within reach for years.

The basic reason for the shortcomings of the screen-grid valve lies, as has been mentioned already, in the fact that the screening is quite inadequate to prevent oscillation when low-resistance circuits are employed. If we take into consideration the amplification factor and the A.C. resistance of the valve, and work out on paper the amplification theoretically obtainable with low-loss coils, we find that we ought to be able to get something well over a hundred times from a single stage, while the best that can be obtained from a three-electrode valve is at most some sixty-five times. (Indirectly heated valves are, for the moment, excluded; in both categories alike they can be made to yield much higher figures.) The difference is that the theoretical figure for amplification can be realised quite easily in practice when the three-electrode valve is in use, because the interelectrode capacity which it possesses can be *completely* nullified by neutralising; the higher theoretical amplification of the screen-grid valve, on the other hand, cannot even be approached in practice, because the interelectrode capacity has only been *partially* removed by screening.

Why not Neutralise the Screen-grid Valve ?

This analysis of the position makes the next step so clear as to be obvious; we must finish the job that screening has only begun, and remove by neutralisation what is left of the anode-grid capacity. Then the realisation of the theoretical amplification that the valve should yield becomes perfectly easy, for we are at last able to take full advantage of the very remarkable figures with which the fourth electrode has endowed the screen-grid valve.

Neutralising the residual capacity of the screen-grid valve is not quite so simple and straightforward a matter as it looks. If any attempt is made to do this by employing a circuit originally designed for three-electrode valves, such as that of Fig. 1, it will be found that oscillation is even more persistent than when no attempt at all is made to add stability in this way. A few moment's thought will show the reason for this.

The anode-grid capacity of the ordinary valve runs into quite a respectable number of micromicrofarads, and the condition of neutralisation is attained when the neutralising condenser is adjusted to the same value of capacity as that within the valve itself. The residual capacity of the screen-grid valve is very small indeed—a fraction only of a micromicrofarad—and there is no neutralising condenser on the market with a minimum that is not many times too high for the purpose for which we now require it. Nor would it be at all an easy task to design or make a condenser of low enough minimum. Neutralisation by the usual means is thus out of the question, and we must adopt some special device by which we can overcome the difficulty of balancing out so minute a capacity as that still remaining in the valve.

It is not very hard to surmount this obstacle. If the smallest condenser known to the wireless market passes

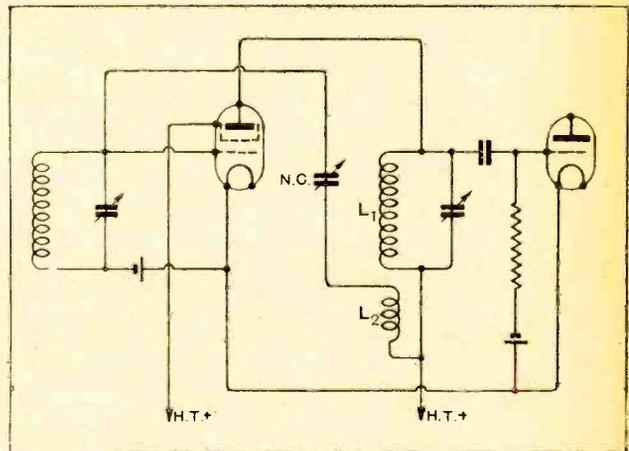


Fig. 2.—Here L_2 is a two-turn coil coupled to L_1 . The voltage induced in it is so small that neutralisation can be attained while still employing an ordinary neodyne condenser in the position N.C. Both here and in Fig. 1 the tuned-anode circuit is shown for the sake of simplicity; in practice an equivalent transformer could be used.

too large a current when there is applied to it a voltage derived from a coil of normal dimensions, we must decrease the voltage by the very simple expedient of treating our high-frequency signals like any other alternating current, and introduce a step-down transformer. If the neutralising condenser is connected to a coil of from one to three turns, coupled to the tuned circuit on the output side of the valve, a suitable step-down is attained, and the current that then flows through the comparatively large capacity of the neutralising condenser can be made equal to the current driven by the signal-voltage across the whole coil in the plate circuit, through the tiny residual anode-grid capacity of the valve. The circuit of this arrangement is shown in Fig. 2.

It may be remarked at once that this circuit does not provide theoretically perfect neutralisation, but needs resetting every time the receiver is tuned to a new wavelength. In practice, owing to the fact that the capacity being balanced out is small, this defect passes completely unnoticed, and the neutralisation appears to hold over the whole tuning range. If (with a larger neutral-

"The Kilo-Mag Four," Oct. 24th and 31st, 1928.

More Amplification from Screen-grid Valves.—

ising coil, of course) this circuit is adopted for a three-electrode valve, and the neutralising condenser is adjusted for stability in the middle of the wavelength range of the tuned circuits, the receiver will oscillate both at the upper and at the lower ends of the range. With the screen-grid valve this does not happen, and there is stability over the tuning range.

A Stage Magnification of over 100.

This difference between the two cases is most simply explained by a numerical example. If the neutralisation is carried out at 400 metres, then for that wavelength the anode-grid capacity is exactly balanced out. The balance ceases to be exact as we tune up or down from the wavelength mentioned, so that we can think of the valve-capacity as being only partially balanced out over the rest of the range from 220 to 550 metres. The unbalance will be at its worst at the ends of the range, and may result in perhaps ninety-nine-hundredths of the anode-grid capacity being balanced out at these limits, the remaining hundredth being left to cause oscillation. Now one-hundredth of the anode-grid capacity of an ordinary valve is more than enough to send the amplifier into the most violent oscillation, so that for three-electrode valves the circuit is unserviceable. One-

hundredth of the residual capacity of a screen-grid valve, however, is a very small capacity indeed, and provides so small a coupling between anode and grid circuits that the natural losses of even extremely low-resistance tuned circuits are sufficient protection against oscillation. The apparent paradox of using a method of neutralisation that is not perfect enough for a stage giving an amplification of forty times, and finding it completely satisfactory for a stage giving at least three times the magnification, is thus seen to be less unreasonable than it looks.

Using the circuit of Fig. 2, or simple modifications of it, the writer has found no difficulty whatever in attaining perfect stability while using tuned circuits with very low losses. With standard coils, an amplification of some 100 times is theoretically attainable with an ordinary screen-grid valve heated from an accumulator, while with the Cosmos indirectly heated screen-grid valve this figure rises to some 200 times. High as they are, these figures can be considerably exceeded if special precautions are taken to decrease the losses of the tuned circuits below the usual values, and particulars of the special coils that the writer has developed for this purpose will be given in the second part of this article.

(To be concluded.)

KING'S COLLEGE CENTENARY APPEAL.

Funds Needed to Meet Requirements for Buildings and Endowments.

IN connection with the centenary commemoration this year of the establishment of King's College, University of London, an appeal is being made for £350,000 to meet requirements for buildings and endowments. The College is now acquiring a 200-years lease of an area of nearly 5,000 sq. ft. above the Aldwych station. Plans have been prepared for the erection on this area of a new building to accommodate several departments which are now inadequately housed. The attention of our readers is drawn to the special arrangements which are being made to secure endowments for the Chair of Physics, now occupied by Prof. E. V. Appleton, F.R.S., and the Chair of Electrical Engineering which, since the untimely death of Prof. J. Hopkinson, F.R.S., in 1898, has been held by Prof. Ernest Wilson, Wh.Sch.

History in the Making.

Some of the discoveries, inventions and investigations made in the laboratories of the College during the last hundred years are: Electric telegraph, Prof. Sir Charles Wheatstone, F.R.S., and W. F. Cooke; invention of Daniell cell, J. F. Daniell, F.R.S.; discovery of existence of electromagnetic waves, Prof. James Clerk Maxwell, F.R.S.; quantitative basis of the design of the filament of the thermionic valve, Prof. O. W. Richardson, F.R.S.; investigations on waveform of atmospherics and the effects of thunderstorms on radio-telegraph receivers, measurements of the height and investigations on the influence of the Heaviside Layer in causing signal fading, Prof. E. V. Appleton, F.R.S.; properties of selenium now utilised in selenium cells, Prof. W. Gryll-Adams, F.R.S.; invention of continuous-current dynamo and invention of shunt-wound dynamo, Prof. Sir Charles Wheatstone, F.R.S.; theory of parallel running of alternators, differential method of testing dynamo, electrical machines and invention of three-wire system, Prof. John Hopkinson, F.R.S.; and investigations into the corrosion of metals for overhead wires, Prof. Ernest Wilson, Wh.Sch., M.Inst.C.E., M.I.E.E.

To-day the two departments are annually supplying trained

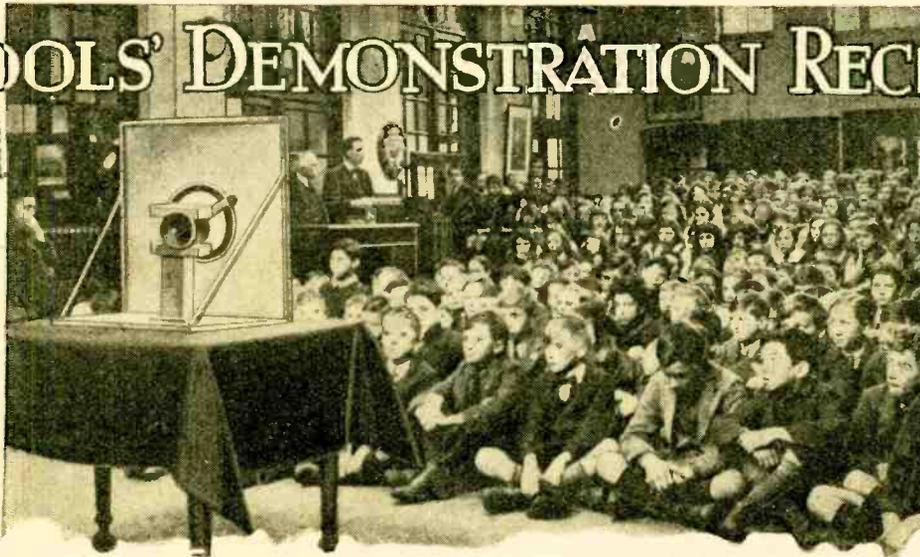
workers to meet the demands of modern industry, while, in addition to their work of teaching, all members of the staff are actively engaged in the prosecution of research. For example, among the subjects now being investigated in the Wheatstone Laboratories, under the general supervision of Prof. O. W. Richardson, F.R.S., and Prof. E. V. Appleton, F.R.S., are: Wireless wave propagation, investigations on soft X-rays, and generation of electrical oscillations by gas discharges.

Lack of Endowment.

The Engineering School, founded in 1838, has always been in the forefront, both in the teaching of the scientific principles of engineering and in the pursuit of original research. Yet it has been from the first without endowment. Indeed, unlike most other institutions of the kind, King's College has, throughout the century, been seriously hampered by its pronounced lack of endowment. In contrast with the provincial and older Universities of England, which owe so much to the generous support of benefactors, King's College receives an annual sum of only £4,800 from endowments out of a necessary expenditure of £130,000. This financial embarrassment is emphasised by the ever-increasing number of students.

To-day, the number of full-time day students has reached nearly 2,000, of whom about 350 are studying for engineering or science degrees and diplomas. This influx of students is putting a severe tax on the available accommodation; and the need of larger premises is becoming more imperative every year. The centenary appeal is being issued to enable the construction of new buildings to be undertaken, for the endowment of professorial chairs in physics, physical chemistry, electrical engineering and in other faculties, and for the provision of scholarships and bursaries. The building scheme, besides including the erection of college premises above the Aldwych station, also contemplates the rebuilding and modernisation of the south-east block, which overlooks Temple Station and the Victoria Embankment.

SCHOOLS' DEMONSTRATION RECEIVER



Points in the Design of a Quality Receiver Amplifier.

(Concluded from page 375 of April 10th issue.)

by F. H. HAYNES.

CONSTRUCTION will now be dealt with progressively, taking the receiver item by item with the addition of observations on operating. All the essential woodwork should be undertaken first, during which time the various components are got together. Baseboard and elevated valve platform are of nine-ply $\frac{1}{2}$ in. wood sawn almost down to size so that the edges can be finished by planing or filing. Planed $\frac{3}{4}$ in. wood can be used as an alternative to the heavy ply for the baseboard, while the valve platform may be of $\frac{5}{8}$ in. wood. The uprights and cross pieces are constructed of $\frac{3}{8}$ in. wood, and the details of construction can be seen from the illustrations, the actual dimensions not being important. It should be noted that the cross pieces under the platform are stepped into the uprights. Iron screws are used throughout for holding the pieces together. A pair of battens each 2 in. x 1 in. run the entire length of the baseboard in order to prevent bending or twisting, though this is not likely, as practically all the weight is at one end.

Next the front panel, which involves little work,

assuming it is procured with finished edges and exact to size. Some patience is needed if the milliammeter is fitted in making the 2 $\frac{7}{8}$ in. hole. In the absence of better facilities this hole is cut by joining up a circle of small holes. When working a bakelite panel take every precaution to avoid scratching the polished faces. A scratch will spoil the job and cannot be removed.

Coil Winding Data.

Turning attention to the preparation of the screening box, make up the piece carrying the three small terminals and the valve-holder bracket. Fixings for these parts are made from $\frac{3}{8}$ in. or $\frac{1}{2}$ in. ebonite tube with $\frac{3}{8}$ in. or $\frac{1}{4}$ in. hole, using screws and nuts. The bridging piece on the valve-holder support is of bakelite, and the valve holder is of the rigid type. Protection around the sharp edge of the hole in the screening box is provided by slipping on a piece of sleeving which should have been cut open along its length. If the use of a neutralised triode only is preferred then the valve is placed inside the screening box where there is plenty

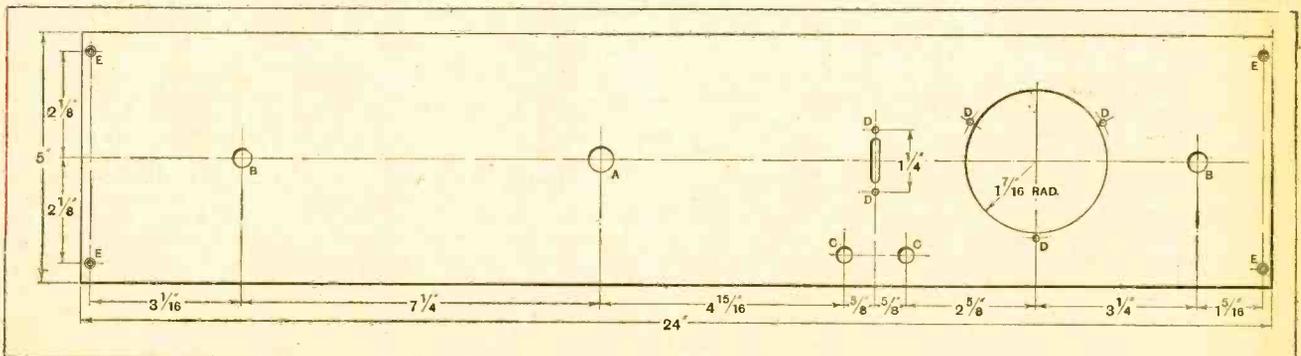


Fig. 1.—Drilling details of the panel. A, $\frac{1}{2}$ in.; B, $\frac{3}{8}$ in.; C, $\frac{1}{2}$ in.; D, $\frac{1}{4}$ in.; E, $\frac{3}{8}$ in., and countersunk for No. 4 wood screws. Thickness $\frac{3}{8}$ in.

Schools' Demonstration Receiver.—

of space. Like the coil-holder base and the neutralising condenser, a sub-base of wood at least $\frac{1}{2}$ in. in thickness must be provided under the valve holder if accommodated in the bottom of the box. These wooden bases are essential so as to provide for generous spacing between terminals which carry H.F. potentials and the screen. It should be noted that the variable condenser is insulated from the screening box by means of a washer, this being necessary to avoid short circuiting the grid biasing battery.

Coil winding is not difficult, but requires care. The $9/40$ S.W.G. Litzendraht wire has a single silk covering on the strands and a double silk covering overall. The bakelite formers are of a new type, and possess a minimum of insulating material. Suitable spacers for carrying primary and neutralising windings having 40 slots to the inch are obtainable from manufacturers. To avoid drilling the spacers, terminations are made by winding the wire once round the end of the spacer, contact with the secondary wire being avoided by first making a small slot on the underside. It is worth while seeing that no wire rests against another at any single point. Complete winding data accompany the constructional drawings of the coils. Ten slots $\frac{3}{8}$ in. wide and $\frac{1}{8}$ in. apart must be carefully filed in the formers

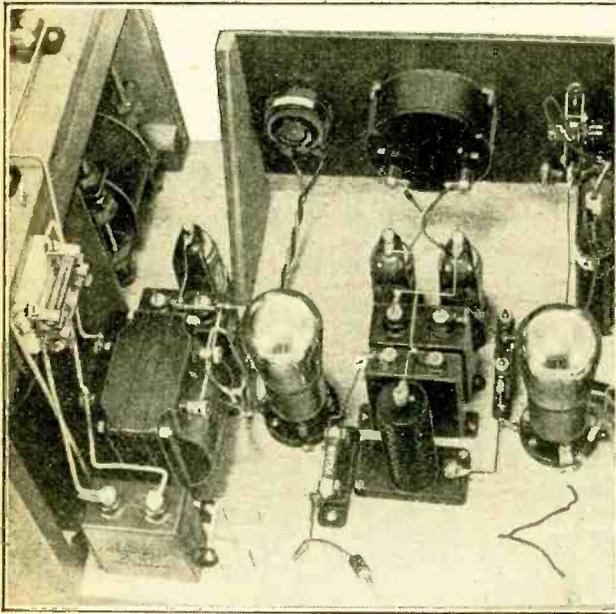


Fig. 2.—The arrangement of the components provides for easy wiring. This view shows the layout of the apparatus associated with the detector and first L.F. amplifier.

for accommodating the long-wave windings. Primary and neutralising windings are carried on ebonite strips of just sufficient thickness to prevent the turns touching. It is the neutralising winding which is on the outside, and all are wound in the same direction. If the construction of the coils is thought to be troublesome then procure suitable high-efficiency coils on Paxolin formers such as were referred to earlier in this article.

Assembly is proceeded with by temporarily bringing

together all the eliminator equipment and drilling the necessary bolting down holes for securing these heavy components. Condensers C_{11} and C_{14} not being provided with base pieces are held down with a strap of bent aluminium. These two condensers together with C_{13} are arranged to separate the mains transformer from

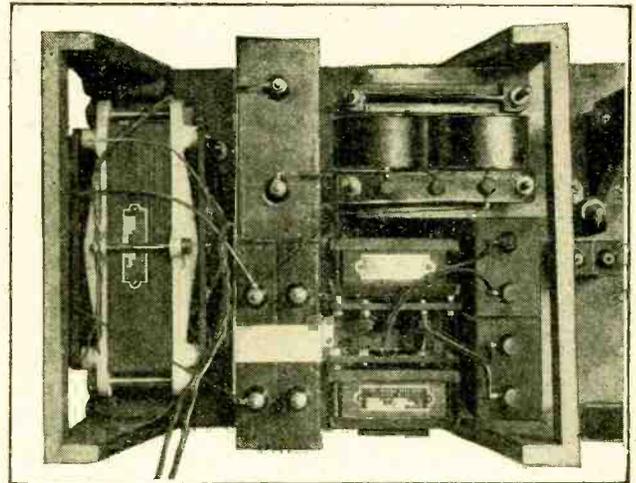


Fig. 3.—The eliminator wired ready for securing the valve platform.

the smoothing equipment. The eliminator components are so assembled that complete box screening can be introduced, and although such a step may be thought desirable, practice proves it to be quite unnecessary. An important point is the use of a mains transformer possessing negligible external field, while leads carrying alternating currents must be run as twisted pairs and kept well away from those leading to the early stages of the amplifier. That the various frames and cases of the eliminator equipment have not been earthed may be commented upon. Such a step, while unnecessarily increasing the potential differences existing between the components, in no way serves as a remedy for mains noise in instances where this occurs. On the other hand, the capacity coupling with the mains thus provided will be conveyed *via* the earth connection of the set to the early valves. It is in this connection also, that no attempt has been made to provide mains operation for the first three valves as an alternative to the use of an accumulator. As less than 0.5 ampere is taken from the 6-volt accumulator, it is doubtful if the complication of mains-operated valves is worth while in this instance, introducing as it does the danger of a slight mains hum arising in individual cases.

Wiring Hints.

The first parts to be permanently fixed down are those in the centre of the board associated with the detector and first L.F. stage. These are wired up as far as possible before the screening box and panel are introduced. Under-base wiring is shown dotted, and this particular arrangement of leads provides short tidy connections. The few wires inside the screening box are easily run. As a guide to the wiring of the

Schools' Demonstration Receiver.—

eliminator a view of the wired components is given together with the underside of the valve platform. The latter shows the preparation of the platform before placing it in position, and indicates the twisting of the A.C. carrying leads. Take care that leads on the underside of the platform do not fall into contact with the high potential connections of the condensers. To avoid the possibility of shock when the mains are switched off and arising from the condensers holding a charge, one may adopt the precaution of bridging the terminals of C_{14} with a grid-leak resistance of 0.25 megohm.

How the Meter Checks Quality.

When delivering the normal load of 100 mA. the potential at the anodes of the output valves is 320 volts. The maximum anode voltage of the low-potential rectifier is some 160 volts. For deriving the output grid bias a pair of series connected grid leaks are provided of 0.1 and 0.25 megohm. These should be interchanged to determine the most suitable bias, while for other values a resistance can be borrowed from one of the grid leads of the output valves temporarily bridging the clips with a wire. A milliammeter reading to 150 mA. is useful while making this test, though it is scarcely worth while fitting this meter as a permanency. When a moving-coil loud speaker is connected to the output a perfectly steady meter reading should be obtained with a full output.

It is the purpose of the anode circuit meter associated with the detector valve to take charge of overloading. The following figures are based on the assumption that a P.M.6D valve is used for detection.

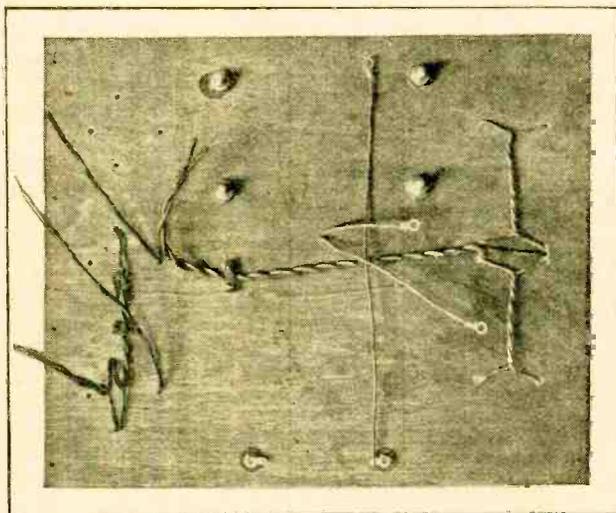


Fig. 4.—Underside wiring of the valve platform. The A.C. carrying leads are twisted as pairs.

This valve when biased to 9 volts negative as an anode bend detector and used with an anode resistance of the value stated will give an anode current of 0.15 mA. as indicated by the meter. The test should be made with the aerial disconnected, taking care, of course, that

the H.F. stage is not oscillating, and that no signal is reaching the grid of the detector. Signals from a local station when correctly tuned in will very probably give a full-scale reading on the meter, showing an anode current of more than 1.5 mA. Tests with a micro-

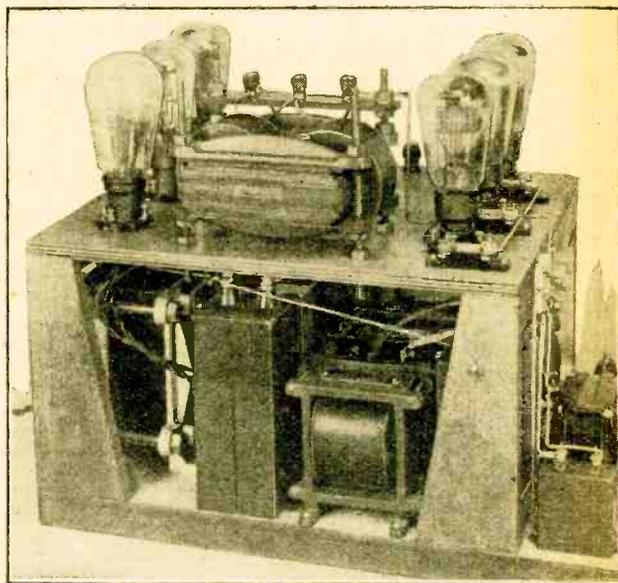
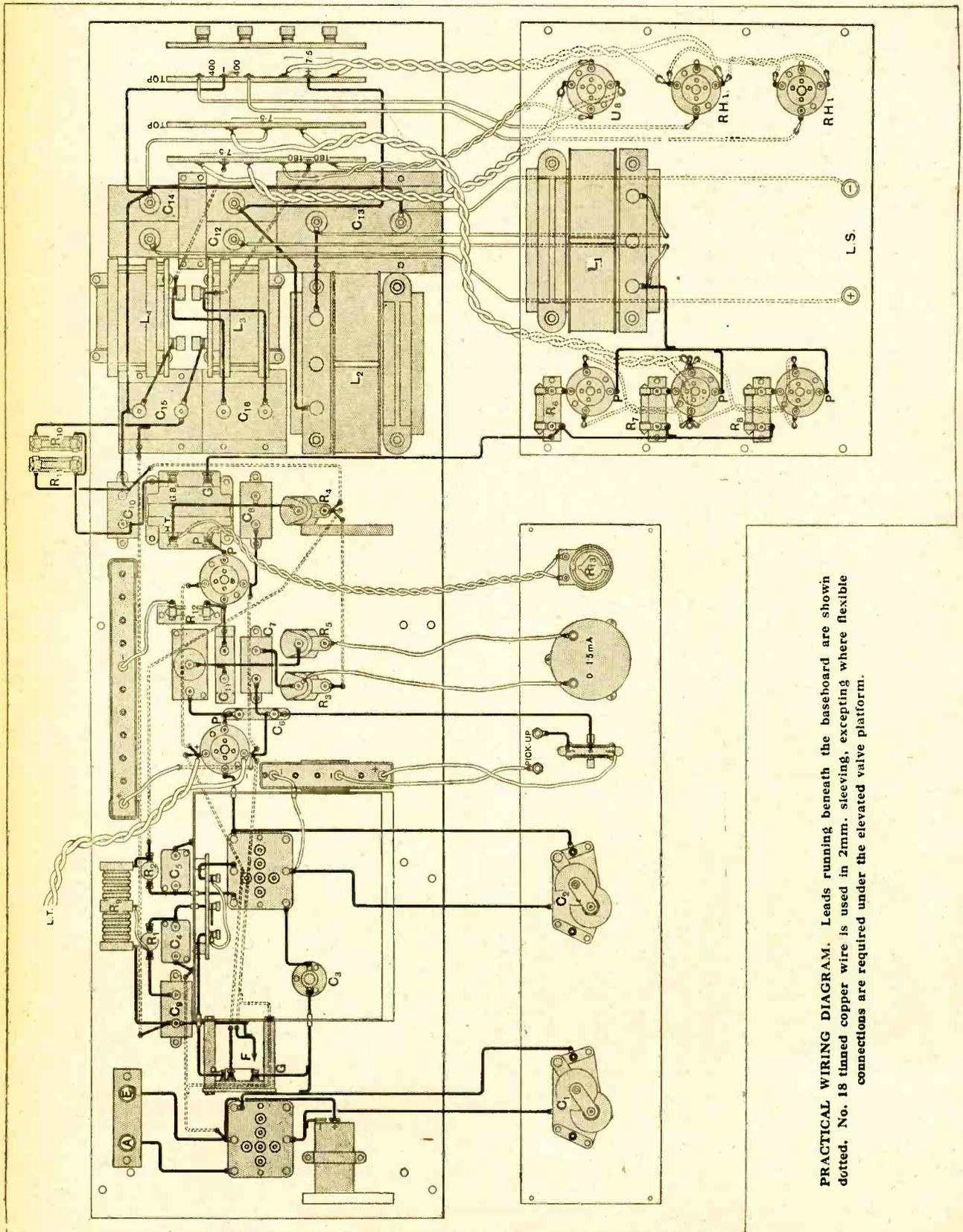


Fig. 5.—The eliminator section. For D.C. supply the three output valves together with the output choke and condenser are accommodated on the baseboard. High voltage D.C. is best obtained by means of an accumulator battery connected in series with the mains.

ammeter in the grid lead of this valve reveal, however, that grid current starts to flow as soon as 1.0 mA. is exceeded in the anode circuit, indicating overloading of the detector.¹ With the aerial disconnected the grid bias should be set to give an anode current reading of 0.1 to 0.2 mA. On restoring the aerial the signal should be adjusted to bring the reading up to about 1 mA. We are thus assured that the valve is neither underloaded nor overloaded, by which we mean that the modulation is falling on the steeper and essentially straight part of the characteristic curve while flow of grid current is avoided. The modulated carrier wave will not give a perfectly steady reading on the meter, while change in the degree of modulation will slightly modify the maximum permissible meter reading; these observations may for our purpose be neglected. Flattening and spreading out of the valve characteristic by the anode resistance also ensures that the modulated fringe of the carrier wave falls on the straight portion of the curve.

Checking the performance of the detector is not the only important function of this meter. In that it serves as a measure of signal strength, it is quite easy to assess a maximum reading beyond which we know that the subsequent valves will be overloaded. It is obvious, therefore, that the amplification introduced between

¹ The advantages of using a milliammeter in the anode circuit of the detector are fully explained on p. 326, March 27th, 1929, "The Valve as an Anode Bend Detector," by W. I. G. Page.



PRACTICAL WIRING DIAGRAM. Leads running beneath the baseboard are shown dotted. No. 18 tinned copper wire is used in 2mm. sleeving, excepting where flexible connections are required under the elevated valve platform.

Schools' Demonstration Receiver.

detector and output stage must not result in overloading of the output valves, or it will be necessary to make use of the post detector volume control to maintain quality. While a generous gain is derived from the penultimate stage when using a P625 valve, this valve exactly suits our ruling of 1 mA. maximum meter reading. Beyond this reading the output valves commence to overload, not audibly for small increases, but as revealed by a microammeter in the grid circuit and milliammeter in the plate circuit. When the 1 mA. anode meter reading is exceeded the microammeter starts to move off from the zero, showing that the grid is becoming positive, while movement on the milliammeter reveals that the grid potential is being swept across to the more horizontal part of the curve.

Considered numerically, the detector valve being biased to 9 volts will accommodate about 9 volts peak potential. In the recent article to which reference has

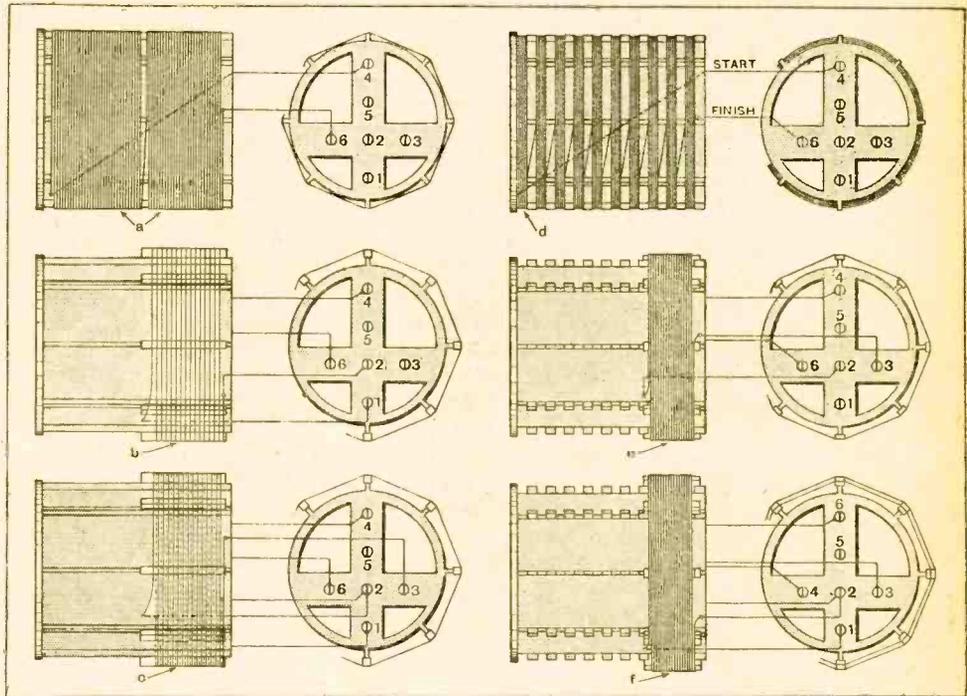


Fig. 6.—Coil winding data. The primary and neutralising windings (b and c) of the broadcast band coil each consist of 20 turns of No. 40 S.S.C. The secondary (a) consists of 90 turns of 9/40 Litzendraht. The aerial coil carries a primary winding of 20 turns of No. 28 D.S.C. wound in alternate grooves on the spacers and connected to pins 1 and 3. The long wave secondary winding (d) comprises 10 sections each of 32 turns of No. 34 D.S.C. Primary and neutralising windings (e and f) are each 40 turns of No. 36 D.S.C. For the aerial a lead is taken from between the second and third coils and joined to pin 1. These windings suit an H.F. valve such as the P.M.5X.

been made, it was shown that about two-thirds of this value represents L.F. signal swing, giving 6 volts. Now the output stage is biased to nearly 100 volts, and therefore presumably accepts a total voltage swing of 200. This potential divided by the transformer ratio (3.5) as well as the magnification given by the P625 valve (5) reveals a grid swing of about 12 volts passed to the first L.F. valve by the detector with its resistance-coupled output. This value of 12 volts is derived from the 6 volts signal potential of the detector, and represents

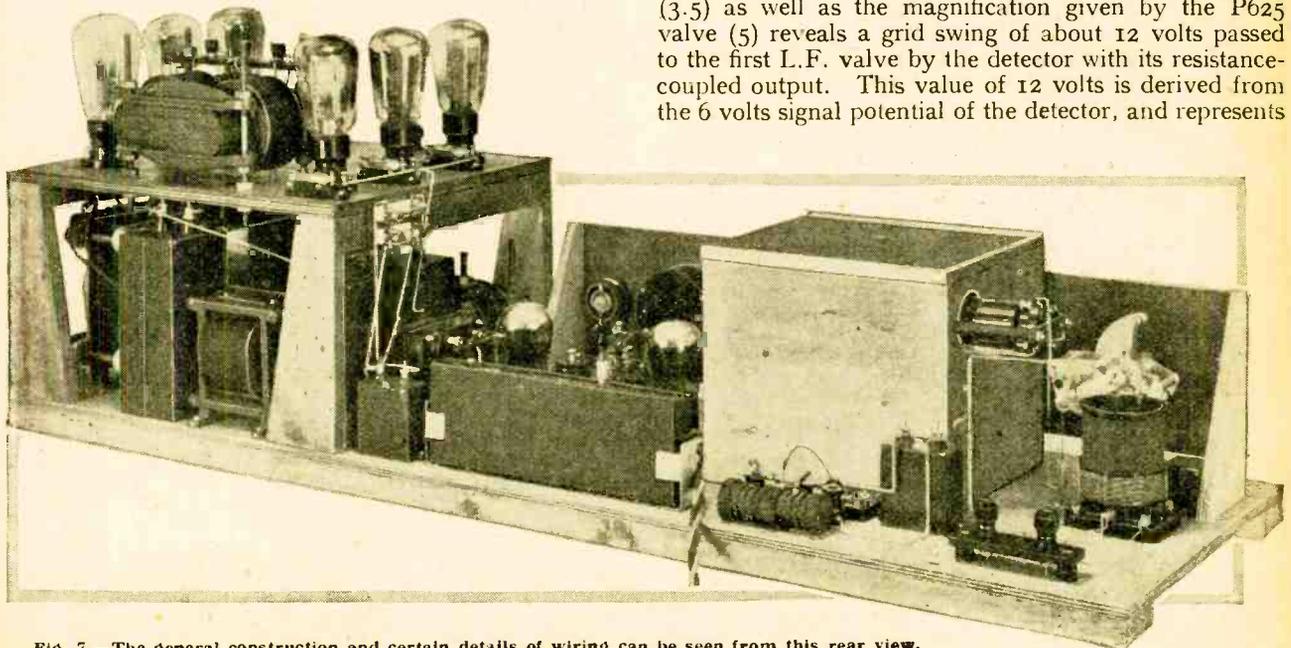


Fig. 7.—The general construction and certain details of wiring can be seen from this rear view.

Schools' Demonstration Receiver.—

the customary gain for a detector stage with the associated resistance coupling. In setting the "red line" at 1 mA. (or, say, 1.0 to 1.2) one must guard against the false reading resulting from self-oscillation in the H.F. stage. Oscillation will cause the meter needle to swing swiftly off the scale so that the reading can therefore serve a further useful purpose in that it is a guide to the correct setting of the neutralising condenser.

A few points concerning the loud speaker for use with this set may prove helpful. Some readers may have queried as to why a higher anode voltage was not arranged so that the loud speaker winding might derive current by being connected in the anode circuit of output valves. This was not adopted, first, because of the danger of the high voltages to be encountered in the eliminator; secondly, and most important, because leads carrying this high and dangerous potential must run between set and loud speaker; thirdly, to use a thermionic rectifier for this purpose is extravagant, and only affords quite a small energising wattage; and lastly, the method necessitates the possible troublesome use of loud speaker with a very narrow gap. As mains are available it is obviously better to use a separate low voltage arc rectifier to energise a loud speaker which may in these circumstances have the generous gap width of the order of $\frac{5}{32}$ in. In such a gap a high-resistance

coil can be easily accommodated, thus avoiding an output transformer as a possible source of distortion, while the diaphragm can be set up without centring device and without the possibility of the coil fouling the poles.² A winding of 650 turns of No. 44 enamelled wire is required.

Reception with this equipment is remarkably realistic. Enormous volume suitable for school or large public hall is obtained. The output amplifier meets moving coil loud speaker requirements generally, using perhaps only one or two output valves though advisedly providing for three. To those whose special need is for a set of this class, and there seem to be many, the moderate cost combined with the best quality components and the modest amount of labour involved by this form of design will no doubt recommend its adoption. Those having access to D.C. mains in abandoning the rectifier and biasing equipment can provide by means of a two-pole change-over switch for charging an accumulator battery through a lamp and discharging it in series with the mains potential thus producing the necessary high anode voltage.³

² For complete constructional details of loud speaker and mains rectifier refer to the "Moving Coil Loud Speaker," Iliffe and Sons Ltd.

³ Advice concerning special requirements will be furnished if needed by the Information Department.

BOOKS RECEIVED.

Radio. A Collection of Articles by American Writers on the History and Development of Wireless Telegraphy and Telephony, including Broadcasting in All Parts of the World, Commercial, Navigational, and Meteorological Uses of Wireless, and its Part in International Affairs. Edited by Irwin Stewart, Ph.D., LL.B., of the University of Texas. Pp. 107. Published by the American Academy of Political and Social Science, West Philadelphia, Pa. ○○○○

An Investigation of the Interference Caused by Transmissions from Radio Stations (Department of Scientific and Industrial Research, Radio Research, Special Report No. 8), by R. L. Smith-Rose, D.Sc., Ph.D., A.M.I.E.E., and F. M. Colebrook, B.Sc., D.I.C., A.C.G.I. Part I, The Measurement of the Equivalent Decrement of Various Types of Radio Transmission. Part II, The Study of the Interfering Properties of Radio Transmissions (pp. 40+vi., with 10 diagrams, published under the authority of H.M. Stationery Office; price 1s. net). ○○○○

Discussion of the United States National Electric Safety Code, 1928. Handbook Series of the Bureau of Standards, No. 4. (Washington: U.S. Government Printing Office. Pp. 334. Price (in U.S.), 1 dollar.)

The Practical Electrician's Pocket Book. Although the "Pocket Book" has been published annually for thirty years, the 1929 edition is in many respects a new publication, having been entirely revised under new editorship. A radio section is included. (London: "Electricity," 93, Long Acre, London, W.C.2. Pp. 596, with many illustrations. Price 2s. 6d. nett, 2s. 10d. postage paid.) ○○○○

The Radio Manual, for radio engineers, inspectors, students, operators and experimenters, by Geo. E. Sterling, edited by R. S. Kruse, B.S., formerly technical editor, QST. Pp. 666, with 273 illustrations and diagrams. (London: The Library Press, 83, Southwark Street, S.E.1. Copyright, 1928, by D. Van Nostrand Co., Inc. Price 30s. nett.) ○○○○

Practical Primary Cells, by A. Mortimer Codd, F.Ph.S. Pp. 127, with 53 illustrations and diagrams. (London: Sir Isaac Pitman and Sons, Ltd. Price 5s. nett.) ○○○○

Rundfunk Jahrbuch, 1929.—The year book of broadcasting in Germany. Description, historical and technical articles on matters connected with broadcasting. pp. 432, profusely illustrated. Compiled by the Reichs-Rundfunk Gesellschaft, and published by Union Deutsche Verlagsgesellschaft, Berlin ○○○○

Streifzüge durch die Empfangstechnik, by Manfred von Ardenne. A text-book on the theory and practice of wireless reception; pp. 99 with 106 illustrations and diagrams. Published by Rothgiesser and Diesing, A.G., Berlin. Price R.M. 3.50.

WIRELESS PICTURE TRANSMISSIONS.

THE following current schedule of picture broadcasts corrects and supplements that published on page 293 of our issue of March 13th:—

MONDAY.	
Daventry, 5XX, and London, 2LO	12.0 midnight to 12.15 a.m.
Berlin (1,049 metres)	12.45 p.m. to 1.15 p.m.
Vienna (518 metres)	2.15 p.m. to 2.45 p.m.*
Rome (443.8 metres)	10.0 p.m. to 10.18 p.m.
Radio Paris (1,775 m.)	about 6.15 p.m.
TUESDAY.	
Daventry, 5XX	2.0 p.m. to 2.25 p.m.
Berlin	9.45 p.m. to 10.15 p.m.
Vienna	2.15 p.m. to 2.45 p.m.*
Radio Paris	about 6.15 p.m.
WEDNESDAY.	
Daventry, 5GB	11.15 p.m. to 11.45 p.m.
Berlin	12.45 p.m. to 1.15 p.m.
Vienna	2.15 p.m. to 2.45 p.m.*
Radio Paris	about 6.15 p.m.
THURSDAY.	
Daventry, 5XX	2.0 p.m. to 2.25 p.m.
Berlin	12.45 p.m. to 1.15 p.m.
Vienna	2.15 p.m. to 2.45 p.m.*
Rome	6.38 p.m. to 6.49 p.m. and 10.0 p.m. to 10.18 p.m.
Radio Paris	about 6.15 p.m.
FRIDAY.	
Daventry, 5XX, and London, 2LO	12.0 midnight to 12.15 a.m.
Berlin	9.45 p.m. to 10.15 p.m.
Vienna	2.15 p.m. to 2.45 p.m.*
Radio Paris	about 6.15 p.m.
SATURDAY.	
Daventry, 5GB	11.15 p.m. to 11.45 p.m.
Berlin	12.45 p.m. to 1.15 p.m.
Vienna	2.15 p.m. to 2.45 p.m.*
Rome	10.0 p.m. to 10.18 p.m.
Radio Paris	about 6.15 p.m.
SUNDAY.	
Berlin	12.45 p.m. to 1.15 p.m.
Vienna	2.15 p.m. to 2.45 p.m.*
Radio Paris	about 6.15 p.m.
* Vienna also transmits two pictures after each evening programme.	
Berlin and Vienna transmissions are regular.	
Daventry, 6XX, and 5GB; London, 2LO, Paris and Rome, transmit experimentally at present.	



The Ferranti Screened Grid Three.

THE Ferranti firm has acquired such an enviable reputation in the world of wireless as makers of low-frequency transformers that their incursion into the ranks of "kit" set producers has naturally been watched with more than common interest. Beyond introducing a couple of simple and unambitious detector-L.F. sets and sponsoring a modified version of the "Everyman Four," they have so far left this field to others. When a preliminary announcement as to the introduction of an "H.F." set was made, some of us began to see visions of a receiver perhaps on revolutionary lines. But fancies in this direction must be dispelled at the outset by saying that revolutionary features are not embodied in the set to be discussed in this article; what is more to the point is the fact that it includes those recent developments that have been proved as effective in preventing instability and distortion. Further, it is no mere figure of speech to say that the sponsors have done a public service in introducing their set with extremely modest claims as to its abilities and in stressing the effects of the user's local conditions on its performance. The average constructor will be all the more gratified to find that he gets

better results than the designers' statements would lead him to expect.

Although the design is inherently simple and straightforward, the circuit diagram has a fictitious air of complexity, due mainly to the inclusion of decoupling devices, and so, to help towards a proper understanding of its essentials, a simplified diagram is given in Fig. 1, which shows that the set is a combination of S.G. high-frequency amplifier, grid circuit detector, and one transformer-coupled L.F. stage. The aerial is connected through a double-wound transformer with "untuned" primary, and, more important, coupling between H.F. and detector valves is effected by a similar device. There is a growing appreciation of the fact that the alternative and simpler "tuned anode" method is not altogether adequate when H.T. current is derived from an eliminator or even from a battery which has (or may develop) appreciable internal resistance.

Three-electrode Reaction Condenser.

Reaction is controlled by a differential condenser, which ensures that the anode by-pass capacity will remain constant, irrespective of its setting. The action is not difficult to understand with the help of the diagram; the condenser consists of two sets of fixed vanes and one moving plate, the latter being connected to valve anode; as it is rotated clockwise and consequently engaged more closely with the set of vanes connected to the reaction winding, a larger proportion of the total oscillatory energy in the circuit is deflected through that coil. At the same time, capacity between moving plate and the remaining earthed fixed vanes is reduced, and a lesser proportion of the current is by-passed to earth.

Fig. 2 is the complete circuit diagram. Starting at the "input" end, we see that an alternative aerial terminal is provided, in order that connection may be made directly to the primary coil, or, for greater selectivity, via a small fixed condenser.

A scheme for switching over from medium to long waves is included; the simple method by which it is carried out is interesting. In the case of both aerial-grid and intervalve transformers, the long- and medium-wave primary and secondary are connected in series, and the long-wave windings are short-circuited by plain

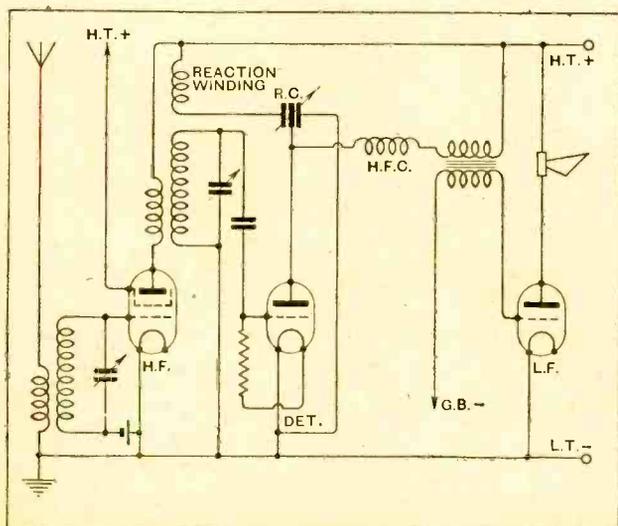


FIG. 1.—Basic circuit diagram, omitting subsidiary devices.

Kit Constructors' Notes.—

Wearite valve holders, Pye or Polar differential condensers, and a McMichael H.F. choke. With regard to the last mentioned, it is reasonable to assume that it would be unsafe to replace it by a winding having a considerable external field. Tuning condensers of 0.00035 mfd. are listed; a lower value would not be permissible, but those already having these components with a value of 0.0005 could safely use them, assuming their minimum capacity to be reasonably low and their dimensions suitable.

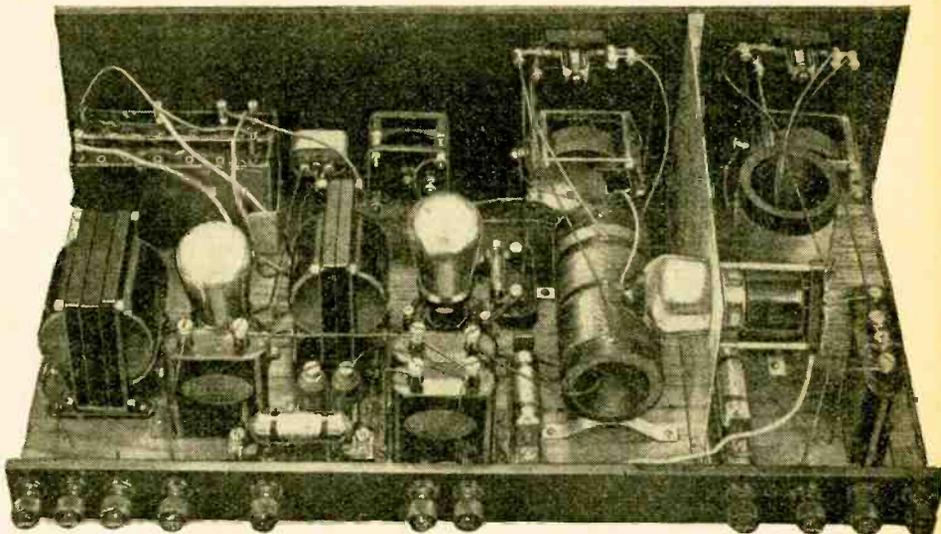
The special Ferranti H.F. kit includes the aluminium screen, on which is mounted, by means of metal distance pieces, a neat holder for the H.F. valve; the constructor's task is lightened by the fact that some of the wiring is already done. The H.F. transformers are perhaps the most interesting components; both aerial-grid and intervalve couplings are of similar construction, the secondaries being piled in section on an insulating tube of about 2 $\frac{3}{4}$ in. dia. These coils are fine examples of machine winding. The medium-wave sections are straightforward coils occupying a winding length of some $\frac{1}{10}$ in. only, but the long-wave secondaries are astatic and in two sections wound in opposite directions. Inside the cylinder supporting these secondaries is another tube on which, respectively, aerial and primary and reaction windings are carried. Leads of distinctive colours are fitted ready for external connections.

Compromise in Design.

Apart from drilling the panel and terminal strip, building of the receiver calls for nothing more than assembly and wiring, as all component parts are, of course, obtainable in a finished form. Even this simple task can generally be avoided if desired, as many dealers are able to supply drilled panels. The instruction sheet supplied contains admirably clear instructions and a number of full-sized diagrams and templates, together with a comprehensive list of suitable valves; constructional difficulties, even for the beginner, should be non-existent, and the position of almost all terminals is so arranged that they are easily accessible for wiring.

The transformer windings have a fairly high H.F. resistance, particularly on the long-wave side, but, while it is possible to devise couplings giving considerably more H.F. amplification, they can only be used with safety (from the point of view of stability) when fairly complete shielding is included. This is not altogether practicable in a set intended to have a wide appeal to the home constructor. In any case, the performance of the set, in the matter of sensitivity, is well up to the average

standard, and, thanks to a good and effective system of reaction control, range is probably slightly in excess of that obtainable from a similar valve combination with coils of much lower resistance, anode bend detection, and no reaction. One must not lose sight of the fact that the designers are unlikely to tolerate any appreciable attenuation of the higher audible frequencies, which would probably take place in circuits with excessively sharp tuning; this factor has undoubtedly received care-



Rear view, showing H.F. transformers and mounting of H.F. valve supported on screen. Wave-changing switches are immediately over the tuning condensers.

ful consideration in arriving at a satisfactory compromise.

Inductance and disposition with respect to the secondaries of the "untuned" aerial coils seem to have been extremely well arranged; there is practically none of that particularly annoying spreading of medium-wave local signals over the lower part of the long-wave band. General selectivity might with advantage be of a higher order, particularly on the long waves, but it is sufficient for average present-day requirements, and in any case could only be improved at the expense of some complexity and—probably—high-note loss.

Thanks partly to the fact that the tuning dials run practically "in step," and that reaction control, while not especially constant, is evenly progressive as wavelength is increased, ease of operation is well above the average standard. After dark signals at good loud speaker strength could be tuned-in at every few degrees.

It is almost needless to add that the decoupling scheme is completely effective. Insertion of artificial battery resistance (with a compensating increase in applied volts) makes no difference whatever to quality or intensity.

KIT CONSTRUCTORS' PROBLEMS.

The Information Department service has been extended to deal with problems encountered by builders of "kit" sets discussed in these pages. Receivers already dealt with are the "New Cossor Melody Maker," G.E.C. "Music Magnet," Mullard "Master Three Star," Six-Sixty "Mystery Receiver," and the Ferranti "Screened Grid Three" discussed above. The service is subject to the rules printed in the "Readers' Problems" section.

CURRENT

TOPICS

News of the Week

MUZZLING THE LOUD SPEAKER.

Cirencester has passed a bylaw prohibiting the use of loud speakers in such a way as to create a nuisance to residents or passers-by.

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MOROCCO'S RADIO RALLY.

A radio rally for motorists and cyclists is being organised for May 5th by the Radio Club of Morocco. Enthusiasm for wireless has greatly increased in Morocco since the establishment of Station *Radio-Maroc*, Casablanca, described in our issue of February 20th. The local paper, *La Vigie Marocaine*, devotes a weekly page to wireless matters.

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"RADIO FERIBY."

The above is the official title of Czecho-Slovakia's new broadcasting station at Bratislava. In a letter to a *Wireless World* reader, the authorities state that a power of 12 kilowatts is used, the wavelength being 277.8 metres.

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TWO AERIALS: 118 RECEIVERS.

The 118 flats in the new Kehaya Apartment Building in New York are each connected to a radio distribution system installed by the Radio Corporation of America. The tenant "plugs in" to one of two single wire aerials and is able to tune his set to any desired station.

RUSSIA'S LATEST RADIO PURCHASE.

The world's largest high voltage rectifier, now nearing completion in the G.E.C. laboratories, New York, has been sold to Russia, says *The Wireless Age*. The rectifier operates on the mercury vapour principle and is capable of a power output of 750 kilowatts and a voltage of 15,000. Eighteen rectifying valves are employed, and these will be used to supply current to the plate of a radio transmitter.

The sale is part of a contract calling for many items of radio equipment, including a 20-kW. short-wave telephony transmitter and several high-power rectifiers.

Russia's keenness to keep abreast of modern wireless developments is shown by the arrival of a delegation of Soviet engineers in New York to exchange technical information with the engineers of the Radio Corporation of America. A return visit is to be paid to Russia by American engineers in 1930.

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DR. FERRANTI'S NEW APPOINTMENT.

Dr. Ferranti, the active head of the Ferranti Company, has been elected

in Brief Review.

president of the Electrical Development Association.

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BRITISH WIRELESS FOR SWEDEN.

The Swedish Government has placed an order with the British Marconi Company for the supply of a 60-kW. (aerial energy) broadcast transmitter for Stockholm. The low-power modulation system will be employed, similar to that in use at Daventry, 5GB.

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SAFETY OF LIFE AT SEA.

The indispensability of wireless in all efforts to promote the safety of life at sea was the keynote of the speeches made by delegates at the International Conference on Safety of Life at Sea, which opened at the Foreign Office on Tuesday, April 16th. Sir Philip Cunliffe-Lister, in welcoming the delegates from eighteen countries concerned with maritime traffic, said: "Wireless not only insures the greater safety of the ship which carries it; it makes her the potential saviour of her sister ships."

A formal protest on behalf of the Soviet Government was lodged by M. Arens, who spoke of "the extreme abnormality of the fact" that Russia, being a signatory to the International Radio Convention, was not invited to take part in the work of the Washington Conference.

M. Arens added that the Soviet delegation, although being in no way bound by the Washington Acts, would use its best endeavours to assist the work of the present conference.

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SHORT WAVES FROM ITALY.

The Italian Broadcasting Company has authorised the Marconi Company to proceed with the manufacture of a short-wave broadcasting transmitter for communication with the Italian Colonies.

The Italian station will to a large extent follow the design of 5SW.

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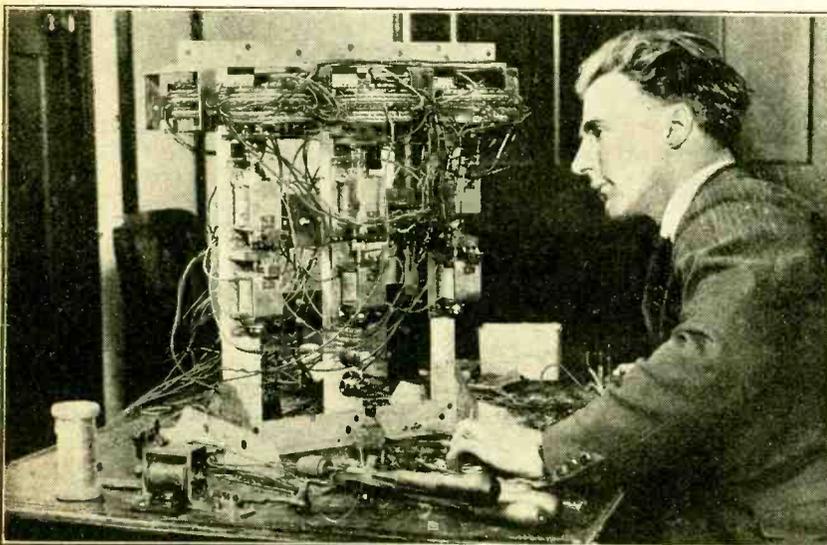
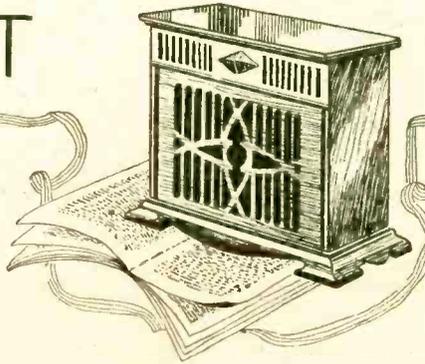
"LIGHTNING."

The twentieth Kelvin lecture, on the subject of "Lightning," will be delivered by Dr. G. C. Simpson, F.R.S., at the meeting of the Institution of Electrical Engineers, Savoy Place, W.C.2, tomorrow evening (Thursday), commencing at 6 o'clock.

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SHORT-WAVE GEAR FOR BELGIUM.

An order for a short-wave telegraph-telephone transmitter has been placed with the Marconi Company by the Société Belge Radioélectrique, on behalf of the Belgium Government. The apparatus is to be used for communication between Belgium and the Belgian Congo and Belgium and South America.



THE "TOTE" ARRIVES. An organisation closely associated with wireless development from the early days, viz., Graham Amplon Limited, has secured a £100,000 contract for installing the first Totalisator at Hurst Park racecourse, to be ready in August next. The photograph shows one of the indicators in course of construction. The work calls for the specialised knowledge which familiarity with automatic telephone operation has given to the Amplon engineers.

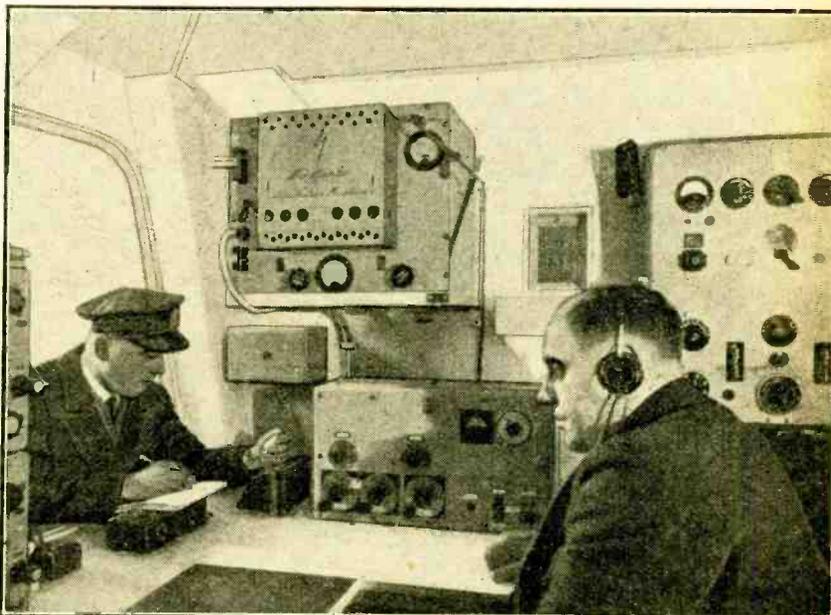
AMERICAN BROADCAST CHIEF.

Mr. M. H. Aylesworth, president of the National Broadcasting Company of America, is spending a "busman's holiday" in Europe. He is at present in this country and intends to pay a visit to the headquarters of the B.B.C. Later he will cross to the Continent and study the broadcasting methods of France and Germany.

We understand that Mr. Aylesworth is anxious to develop schemes for the interchange of British and American programmes.

THE PRAGUE WAVELENGTH PLAN.

THE first broadcast wavelength plan to receive the collective assent of the European Governments was formulated at the Prague conference which terminated on Saturday, April 13th. Known as the Prague Plan, the new measure follows upon the decisions at the Washington Convention, which provided that broadcasting wavelengths should be dealt with by Government action. The Plan, which is notable for the inclusion of Russian stations, is due to come into operation on June 30th next. In the following list of new allocations it will be seen that minor wavelength changes will take place at all the British stations.

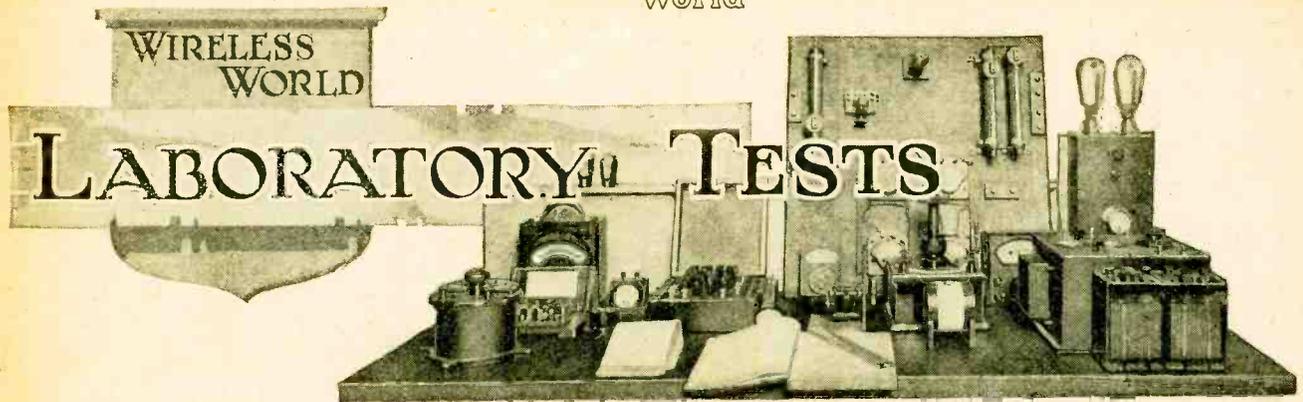


SHORT WAVES FROM THE AIR. The wireless cabin of the now famous "Graf Zeppelin." The New 50-watt short-wave transmitter is mounted above the other apparatus, while on the bench below is the short-wave receiver.

Frequencies in Kilocycles.	Wavelength in Metres (Approx.).	Country.
LONG WAVES.		
160	1,875	Holland.
167	1,800	Finland.
174	1,725	France.
183.5	1,635	Germany.
193	1,553	Great Britain.
202.5	1,481	Russia.
207.5	1,444	Aviation.
212.5	1,411	Poland.
217.5	1,380	Aviation.
222.5	1,348	Sweden.
230	1,304	Russia.
250	1,200	{ Turkey.
260	1,153	{ Iceland.
280	1,072	Denmark.
297	1,010	Norway.
		Switzerland.
MEDIUM WAVES.		
320	930	Russia.
364	825	"
375	800	"
385	778	"
395	760	"
442	680	Switzerland.
527	572	{ Germany.
531.5	565	{ Yugoslavia.
536	560	Russia.
545	550	Germany.
554	542	Hungary.
563	533	Sweden.
572	525	Germany.
581	517	Latvia.
585.5	511	Austria.
590	507	Russia.
599	501	Belgium.
608.5	497	Italy.
608	497	Russia.
617	493	Norway.
621.5	487	Czechoslovakia.
626	483	Russia.
630.5	479	Great Britain.
635	473	Russia.
644	466	Germany.
653	459	France.
666.5	450	Switzerland.
666	453	Russia.
		Common Wave.

Frequencies in Kilocycles.	Wavelength in Metres (Approx.).	Country.
671	447	France.
680	441	Italy.
689	436	Sweden.
698	429	Yugoslavia.
702.5	427	Russia.
707	424	Spain.
716	418	Germany.
725	413	Ireland.
729.5	411	Russia.
734	408	Poland.
743	403	Switzerland.
747.5	401	Russia.
753	399	Great Britain.
761	394	Rumania.
770	390	Germany.
779	385	Poland and Italy.
783.5	383	Russia.
788	381	France.
792.5	379	Russia.
797	377	Great Britain.
806	372	Germany.
810.5	375	Russia.
815	368	Spain.
819.5	366	Russia.
824	364	Norway.
833	360	Germany.
842	356	Great Britain.
851	352	Austria.
855.5	351	Russia.
860	349	Spain.
869	345	France.
878	342	Czechoslovakia.
887	339	Belgium.
891.5	337	Russia.
896	335	Poland.
905	332	Italy.
914	329	France.
923	325	Germany.
932	322	Sweden.
941	318	Bulgaria.
950	316	France.
959	313	Poland.
968	310	Great Britain.
977	307	Yugoslavia.
986	304	France.
995	301	Great Britain.
1,004	298	Holland.
1,013	295	Esthonia.
1,022	293	{ France.
		{ Czechoslovakia.
1,031	291	Finland.
1,040	289	Great Britain.
1,049	286	France.

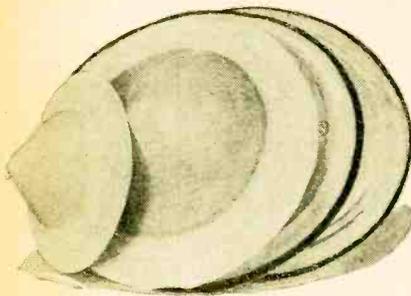
Frequencies in Kilocycles.	Wavelength in Metres (Approx.).	Country.
1,058	283	Portugal.
1,067	281	Denmark.
1,076	279	Czechoslovakia.
1,085	276	Germany.
1,094	274	Italy.
1,103	273	France.
1,112	270	Greece.
1,121	268	Spain.
1,130	265	France.
1,139	263	Czechoslovakia.
1,148	261	Great Britain.
1,157	259	Germany.
1,166	257	Sweden.
1,175	255	France.
1,184	253	Germany.
1,193	251	Spain.
1,202	250	Czechoslovakia.
1,211	248	Italy.
1,220	246	Common Wave.
1,229	244	Albania (provisionally Poland).
		Great Britain.
1,238	242	Norway.
1,247	240	Norway.
1,256	239	Germany.
1,265	237	Divided between Monaco, Nice and Corsica.
1,274	235	Norway.
1,301	231	Sweden.
1,310	230	Spain.
1,319	227	Germany.
1,328	226	Rumania.
1,337	225	Ireland.
1,346	223	Luxembourg.
1,355	222	Ireland.
1,364	223	Luxembourg.
1,373	221	Finland.
1,382	220	France.
1,391	218	Common Wave.
1,400	217	Common Wave.
1,410	216	Common Wave.
1,420	214	Poland.
1,430	213	Italy.
1,440	211	Rumania.
1,450	210	Hungary.
1,460	208	Belgium.
1,470	207	Common Wave.
1,480	206	Common Wave.
1,490	204	Common Wave.
1,500	203	Common Wave.
		202
		200
		Free.



A Review of Manufacturers' Recent Products.

GRANTONA CONES.

A range of semi-free-edged cones have been put into production by Messrs. R. O. Bridges & Co., 88, Goswell Road, London, E.C.1, under the trade name of "Grantona Cones." These are constructed from specially prepared material somewhat resembling buckram in texture, and impregnated to impart stiffening and immunity to atmospheric changes. The periphery is turned over to form a flange for fixing purposes, and between this and the base of the cone



Grantona Cones.

are two annular grooves separated by a flattened portion, referred to by the makers as the "float ring." The instructions supplied state that this ring should be given two thin coats of pure glycerine before mounting, as this will soften the "dope" and provide the cone with a supple surround.

We carefully followed the instructions, but found that two applications of glycerine at the stated intervals were hardly sufficient to soften adequately the preparation. The glycerine took some time to soak well in, but eventually—after about 48 hours—the float ring became sufficiently soft to justify mounting the driving mechanism. These cones are intended only for use with reed or balanced-armature units, and should be found quite satisfactory, but we would not advise fitting a moving-coil drive.

A well-illustrated instructional leaflet is supplied with each cone, and if the makers' advice is followed, the construction of the loud speaker will be found exceedingly simple.

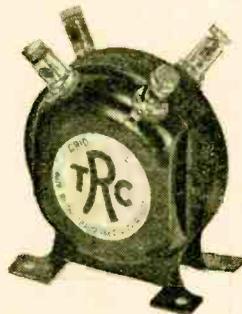
These cones are available in sizes ranging from 10in. overall diameter to 15in., and are offered at prices varying from 1s. 6d. to 3s., according to size. Special anti-resonance fixing bushes are recommended by the designers; these sell at 6d. a set.

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T.R.C. TRANSFORMERS.

These transformers are made in three ratios, 3:1, 4:1, and 5:1, and the small dimensions—2 $\frac{1}{2}$ in. \times 2 $\frac{1}{2}$ in. \times 1 $\frac{1}{2}$ in.—render them particularly suitable for use in portable sets. In spite of the small size, the performance is remarkably good, but it is necessary to give consideration to the choice of the valve preceding the transformer. The 3:1 ratio, which has a primary impedance at 920 cycles of 612,110 ohms measured without D.C. flowing through the winding, may be preceded by a relatively high A.C. resistance valve; one with an impedance of 20,000 or 30,000 ohms would be suitable.

The respective primary impedances of the 4:1 and 5:1 type, measured under the same conditions, were 330,380 ohms and 144,720 ohms, so that the most suitable valves to precede these would be those having A.C. resistances of about 17,000 and 10,000 ohms respectively.



T.R.C. transformer.

A practical test revealed that, used with suitable valves, the reproduction is good over practically the whole musical scale, and while the very high frequencies appeared by ear to be amplified in correct proportion, there was a slight loss on the very low frequencies,

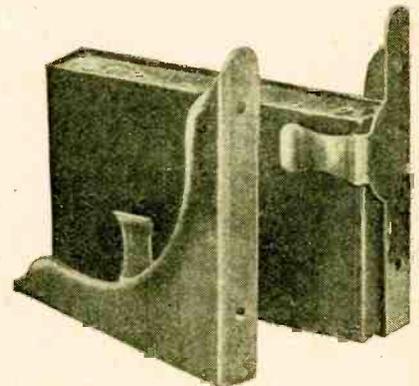
In view of the small dimensions of the magnetic circuit and the large number of turns on the primaries, more particularly in the case of the lower ratio transformers, it might be advisable to over-bias slightly the grid of the preceding valve so as to limit the current passing through the primary, thereby preventing saturation of the iron circuit.

The makers are The Transformer Repair Co., 214, High Street, Collier's Wood, London, S.W.19, and the price in each case is 15s.

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"QUEST" COMBINATION PANEL BRACKETS.

The main point of interest in connection with these panel supports is that one bracket in each pair is provided with clips for holding a grid bias battery. The combined battery support and panel



Quest combined panel bracket and grid battery holder.

bracket is intended to be fitted on the extreme right of the set, thereby bringing the grid battery within easy reach of the L.F. amplifier, and so enabling short grid return leads to be used.

The brackets are stamped from stout sheet iron and finished in oxidised copper. These are being offered at 2s. 6d. per pair, and the makers are The Quest Radio Manufacturing Co., 41, Newcomen Street, London Bridge, S.E.1.

FIRE-SCREEN LOUD SPEAKER Baffle.

The season when fires can be dispensed with in the house, at least for a few months, is now not so very far ahead, so that the present would appear to be an opportune moment to give consideration to the possibilities of rendering the fire-place screen useful as well as ornamental. There are not many real uses to which this can be put, but it does lend itself admirably to adaptation as a baffle-board for a moving coil, or reed-driven



Fire-screen baffle for moving coil, or other type, cone loud speakers.

cone, loud speaker. It becomes possible to employ a baffle of generous proportions without being unsightly, and a design can be chosen which is in keeping with the furnishing scheme adopted. Realising the possibilities of this, Messrs. F. W. Ramsay, 63, Shaftesbury Street, New North Road, London, N.1, have put into production some handsomely finished baffles resembling fire-place screens at very reasonable prices. The sample reviewed measures 24in. x 24in. square, and is provided with a circular grill in the centre approximately 7in. in diameter. The screen is made from

five-ply wood, oak finished, and is offered at £1. A similar screen in mahogany is available at £1 1s.

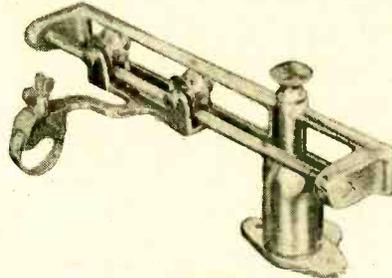
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"RAYTRAK" PICK-UP CARRIER.

The principal feature of this pick-up carrier is that the needle travels tangentially to the groove of the record and describes a true radius from the centre to the circumference. It can be fitted to any type of gramophone without removing the existing tone arm, and when not in use can be swung back to clear the face of the record, thus leaving this free from obstruction and enabling the gramophone to be used in the ordinary manner.

Unlike the majority of carriers, this feature is not secured by link motion but by employing a carriage running on a straight bar adjusted so that the needle in the pick-up moves from the periphery of the record along a line terminating at the centre. This adjustment is obtained by swivelling the carrier arm on its base until the correct alignment is found, and then fixing by tightening the milled screw holding the main arm to the base.

The model illustrated is provided with an adjustable clip which will accommodate most of the well-known makes of pick-ups fitted with side attachment, but special adaptors can be supplied for pick-ups with back stud fixing arrangements.

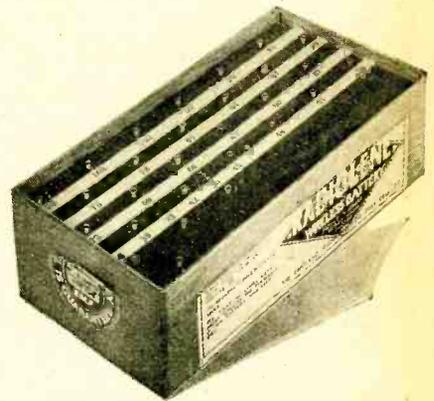


"Raytrak" pick-up carrier. The principal feature is the straight line movement of the needle.

The price of this carrier is 35s., and the makers are The Robinson and Hands Electric Co., Ltd., Barwick Street, Birmingham.

"RADIOLENE" H.T. BATTERY. Type W. 510872.

The battery under review was assembled from parts supplied by The England-Richards Fluid-Free Cell Co., Ltd., 23, London Road, King's Lynn, Norfolk, by one of their licensees. There is no indication that it is not a factory-made article, the general appearance and finish being well up to the standard of the better-class batteries. Provision is made for tapping off intermediate voltages between 30 and the maximum in steps of 3 volts; small brass sockets to accommodate the standard size wander plug being moulded into the composition top and paper strips neatly printed indicate the voltage at each tapping.

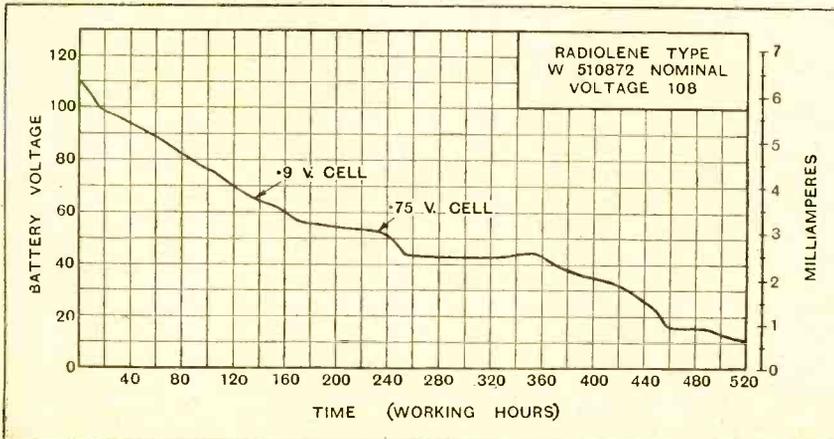


Radiolene dry-cell H.T. battery, Type W. 510872.

The nominal voltage of the sample tested was 108, but, on load, the actual voltage, at the commencement of our test, was 111. In common with all batteries of the dry-cell type, the first few hours saw a rapid fall in the voltage, but when the steady state was reached the current was fairly well maintained for 230 hours. During the following few hours the voltage showed a steep fall, but this was immediately followed by a partial recovery, and the voltage remained unchanged for approximately 100 hours. From thence onward the voltage fell steadily without further signs of recovery until the battery was exhausted. The partial recovery recorded after 230 hours' discharge is no doubt due to the special combination of chemicals used; this, the makers claim, imparts to the battery certain recuperative powers not generally exhibited in batteries of this type.

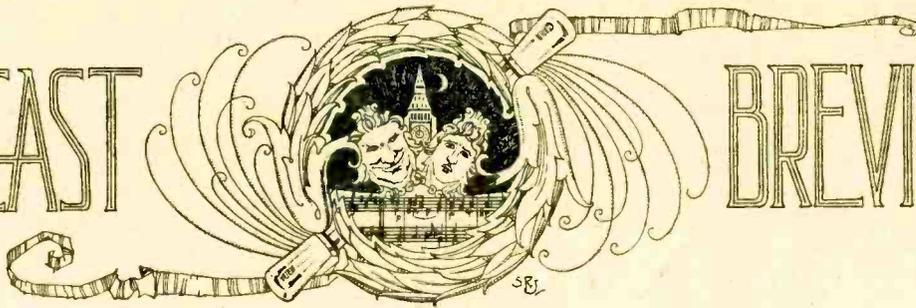
The natural cut-off would appear to be after 230 hours' work, but in view of the partial recovery which follows, the user would be justified in keeping the battery in commission for a further 100 hours, provided another battery was used also to bring the voltage up to that required to operate the set. The voltage per cell drops to 0.9 after approximately 140 hours' use, and to 0.75 volts per cell when the battery has been in use for 230 hours.

The Type No. W. 510872, 108 volts (nominal) is offered at 13s. 6d.; the 60 volts unit at 7s. 9d., and 9-volt grid batteries at 1s. 4d. each.



Discharge curve of Radiolene 108 volts dry-cell battery.

BROADCAST



BREVITIES

2LO Closing Down.—Microphone Tests.—Recording Rehearsals.**Farewell to 2LO.**

The closing of the present London transmitter as regards regular programmes is pretty certain to take place next autumn. Actually the rental of the Oxford Street premises expires in August, but it is possible that the change to Brookman's Park will not be undertaken until the conclusion of the Promenade Concerts on October 6th.

With 2LO's departure, West London will lose one of its best-known landmarks. The masts in Oxford Street are, of course, the property of the B.B.C., but what the Corporation proposes to do with them when they have been dismantled is a matter awaiting decision. If any reader could use them, I advise him to bid quickly!

And Then There Was One.

There is a certain roguish humour in the idea which the B.B.C. has adopted for broadcasting the Cup Final in the face of opposition by the Football Association. No microphone being allowed in the Wembley Stadium, the B.B.C. will use the Post Office lines outside. A number of football experts will watch events within, and one by one they will slip out to the telephones to enable the listening world to hear instalments while the match is in progress.

The diminishing group in the Stadium will suggest the ten little nigger boys.

Microphones.

Until last week no microphone or microphone stand in existence could be regarded as a graceful article of furniture. The straddling trestle arrangement used by the B.B.C. for the last five or six years is nothing less than a monstrosity; in fact, its pouncing appearance has been responsible for many cases of microphone fright.

An Adjustable Device.

The latest microphone stand, which I was privileged to juggle with in No. 7 studio a few days ago, is a beautiful piece of work in mahogany. The microphone cage is supported on a single tapering pillar mounted on a castor-fitted base, the whole appliance being so massive that it could only be upset by people with dishonourable intentions.

An important feature is the arrangement whereby the microphone can be raised or lowered to suit the height of the speaker.

Tests with a Condenser Microphone.

Talking of microphones, the B.B.C. are now experimenting with the condenser type. An experimental model, designed by Captain West, is in use in No. 4 studio. All that the speaker sees of the instrument is a bright metal disc, about the size of a penny. This forms one plate of the condenser, the capacity of which is varied by the movements of this plate in response to the air waves.

An Idea from America.

Sir Thomas Beecham and other orchestral leaders might derive some valuable data by following the example of Walter

Captain West was one of the pioneer engineers of the B.B.C.—probably his best-remembered triumph was the first relay of American broadcasting. This was in December, 1923, when he operated the B.B.C. receiver at Biggin Hill. He has since redesigned all the studios now in use at Savoy Hill, and is responsible for the dramatic control board and the use of the separate echo room.

Zoological Artists.

For the Zoo broadcast on Tuesday next it was first considered likely that the Boat Race short-wave transmitter might be employed, the instrument being transported from cage to cage in the celebrated B.B.C. perambulator, but arrangements have now been made for the use of Post Office lines. From a telephone point in the Reptile House lines will radiate to the various centres of talent in the Gardens. Apparently the animals (particularly the larger carnivora) refuse to regard this as an "outside broadcast," complaining that it is the listeners who are outside.

Jazz Opera.

The missionaries of jazz are carrying on the good (?) work at Belfast by rejuvenating Dr. Arne's opera, "Love in a Village" and calling it "Love in Greenwich Village." I hear that this production, to be given from 2BE on April 30th, retains the original tunes, which have merely been syncopated by George Barker in collaboration with John Watt, who has modernised the plot. And they call it "A New Musical Comedy"!

W. W. Jacobs' Plays.

Two W. W. Jacobs plays will be heard by 5GB listeners on May 11. They are "The Ghost of Jerry Bundler," by W. W. Jacobs and Charles Rock, and "The Boatswain's Mate," by W. W. Jacobs and H. C. Sargent.

Making Their Flesh Creep

The parents of Cape Town are protesting against the inappropriateness of the stories told in the Children's Hour. The other evening, according to the *South African Wireless Weekly*, the announcer gave his little hearers the tale of a doctor who shot his patient through the head, cut open his body, and was about to inspect the victim's lungs when he was interrupted by the butler.

Good-night!

FUTURE FEATURES.**London and Daventry.**

APRIL 29TH.—Covent Garden Opera.

APRIL 30TH.—De Courville's Hour.

MAY 3RD.—"The Eternal Waltz," a musical burlesque, music by Leo Fall, book by R. E. Jeffrey.

Daventry Experimental (5GB).

APRIL 30TH.—An Edward German Programme.

MAY 3RD.—Covent Garden Opera.

MAY 4TH.—"The Prisoner of Zenda."

Cardiff.

MAY 1ST.—"Fashion Plates," an orchestral programme with three sketches.

Manchester.

MAY 3RD.—"Pamela Comes to Town," a play by Constance Enme.

Newcastle.

MAY 4TH.—North of England Musical Tournament, relayed from the City Hall.

Glasgow.

APRIL 30TH.—A One-Man Revue.

Aberdeen.

MAY 1ST.—Song and Story of the Gael.

Belfast.

APRIL 29TH.—"Down in the Cane-brake," a plantation programme.

Damrosch, America's most famous broadcast conductor. After rehearsals Mr. Damrosch listens to a sound film record of the work which has been done, and is able to detect faults in the grouping of the orchestra and many other flaws which would go quite unnoticed in the studio.

Exodus Continued.

Captain West is yet another to join in Savoy Hill's recessionary hymn. His departure in the next month or two will be in response to the call of the "talkies" and the gramophone. In his new sphere he will continue to deal with acoustic problems, this time in relation to gramophone work, though it is likely that radio problems, particularly in regard to radio-gramophone combinations, will continue to occupy his attention.

USEFUL DATA CHARTS. (Nos. 24 (c) & 24 (d).)

The Design of Mains Transformers.

(Continued from page 366 of April 3rd issue.)

IN the previous article the data required to construct the transformer were found, and it is now necessary to find what losses exist due to the resistance of the windings and to hysteresis and eddy currents in the iron.

loss is 1.77 watts, and the total loss is $1.77 + 0.90 + 0.55 + 1.03 = 4.25$ watts, giving an efficiency of $43 / (43 + 4.25) = 91$ per cent.

This is quite satisfactory: it is true that since the

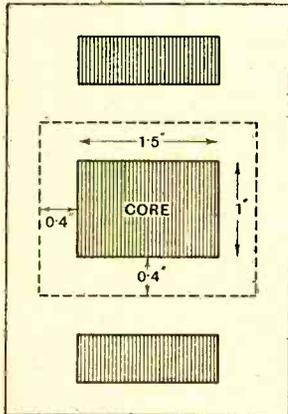


Fig. 1.—The dotted line shows the average length of one turn of wire.

On glancing at abac 24 (c) we see that we still have one quantity to measure, namely, the average length of one turn of wire. From Fig. 1 this length is $2[1.8 + 2.3] = 8.2$ in. For each coil the other quantities required have already been obtained, and the results of working through abac 24 (c) may be tabulated as below:—

Hence the total copper loss is 3.79 watts.

In order to calculate the iron loss we must ascertain the volume of iron in the transformer: owing to the thickness of insulation on each stamping the volume of iron will be only 90 per

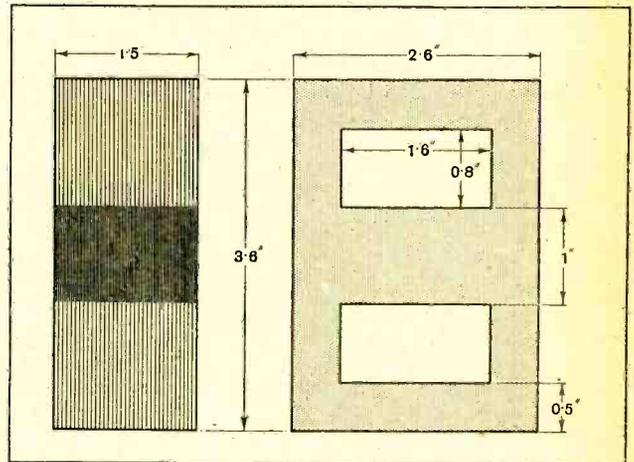


Fig. 2.—Transformer section giving dimensions.

cent. of the actual measured volume for 14 mil. stampings, such as are generally used at 50 cycles. Hence from Fig. 2 the volume of iron is

	Average Length.	Turns.	Total Yards.	Wire Dia.	Ohms.	Amps.	Loss in Watts.
Primary	8.2"	1,440	328	0.0148"	46	0.225	2.34
H.T. secondary .	8.2"	3,000	681	0.0076"	361	0.05	0.90
L.T. secondary ..	8.2"	36	8.2	0.064"	0.0612	3	0.55

$1.5 \times 0.9 [2.6 \times 3.6 - 2 \times 1.6 \times 0.8] = 9.15$ cub. in.

The iron loss is given by the expression watts per lb. \times volume of iron \times density of iron, and is read off from abac 24 (d). We find that at a flux density of 50 kilo-lines per sq. in. the loss is 0.403 watt per lb., and on multiplying this by 9.15 cub. in. (and by 0.28, the density of iron, this multiplier being concealed in the abac), the result is 1.03 watts for the iron loss.

The total loss is accordingly $3.79 + 1.03 = 4.82$ watts, and since the output is 43 watts the efficiency is $43 / (43 + 4.82) = 90$ per cent., which is considerably higher than the assumed value of 80 per cent.

Accordingly the primary requires to dissipate less power than we have assumed, and this result entails a smaller copper loss in the primary, leading to still greater efficiency. Taking 92 per cent. as an estimate we find on reviewing the calculations that the primary

must supply $43 \times \frac{100}{92} = 46.8$ watts, and so the primary current is $46.8 \text{ watts} / 240 \text{ volts} = 0.195$ amp., therefore on going over abac 24 (c) again the primary copper

loss is greater than the iron loss we might do still better by using thicker copper wires and accommodating them in a longer window, thus decreasing the copper loss without increasing the iron loss by an equal amount, but the improvement would be trifling.

The transformer will run quite cool, since the total surface area of iron and copper is about 40 sq. in., so that the surface dissipation is only $4.25 / 40 = 0.106$ watt/sq. in.

The design of the transformer is now finished, except that it is desirable to make sure that the magnetising current is not excessive, as otherwise the efficiency may suffer. This calculation will be carried out in the next article.

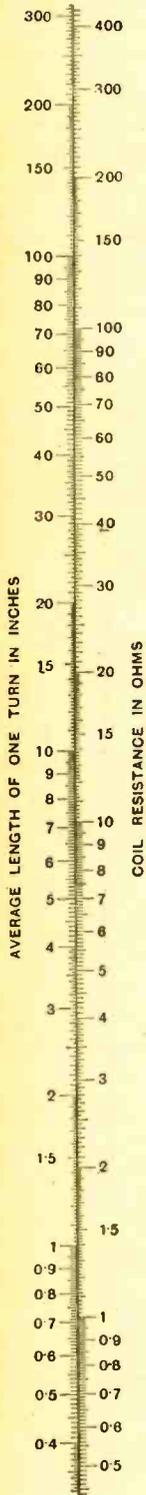
(To be continued.)

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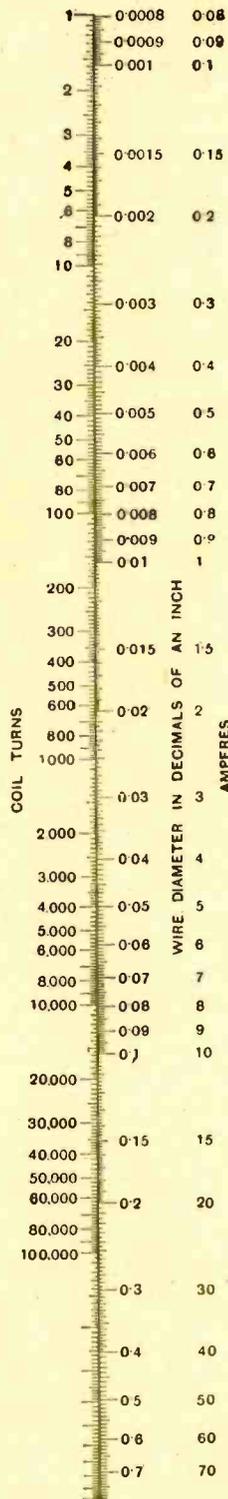
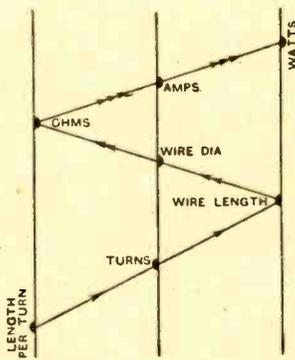
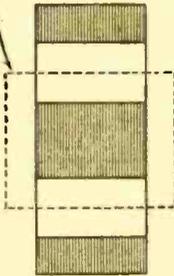
"WIRELESS WORLD" S.G. REGIONAL RECEIVER

IN building the "S.G. Regional" receiver, it is necessary to provide insulation between the metal panel and the body of the Clarostat volume-control resistance. Messrs. Claude Lyons, Ltd., of 76, Old Hall Street, Liverpool, distributors of these components, have submitted specimens of suitable fibre insulating washers for this purpose; they are supplied with any type of Clarostat without extra charge if specially ordered, or may be obtained free on receipt of request accompanied by 1½d. stamp for return postage.

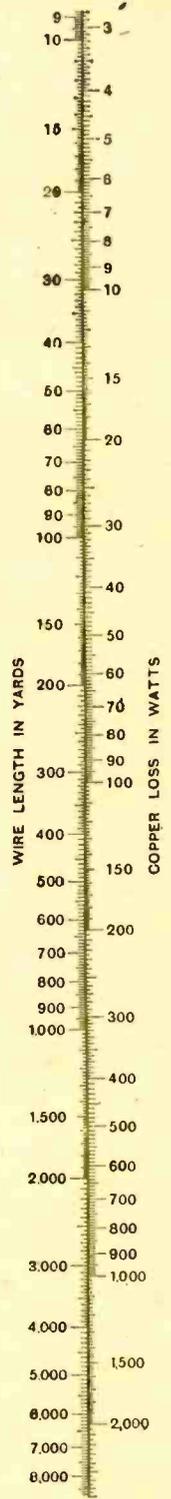
Those who propose to use these bushes should note that the mounting hole should have a diameter of $\frac{3}{16}$ in. instead of $\frac{1}{4}$ in., as given in Fig. 5 of the constructional article.



AVERAGE LENGTH OF ONE TURN

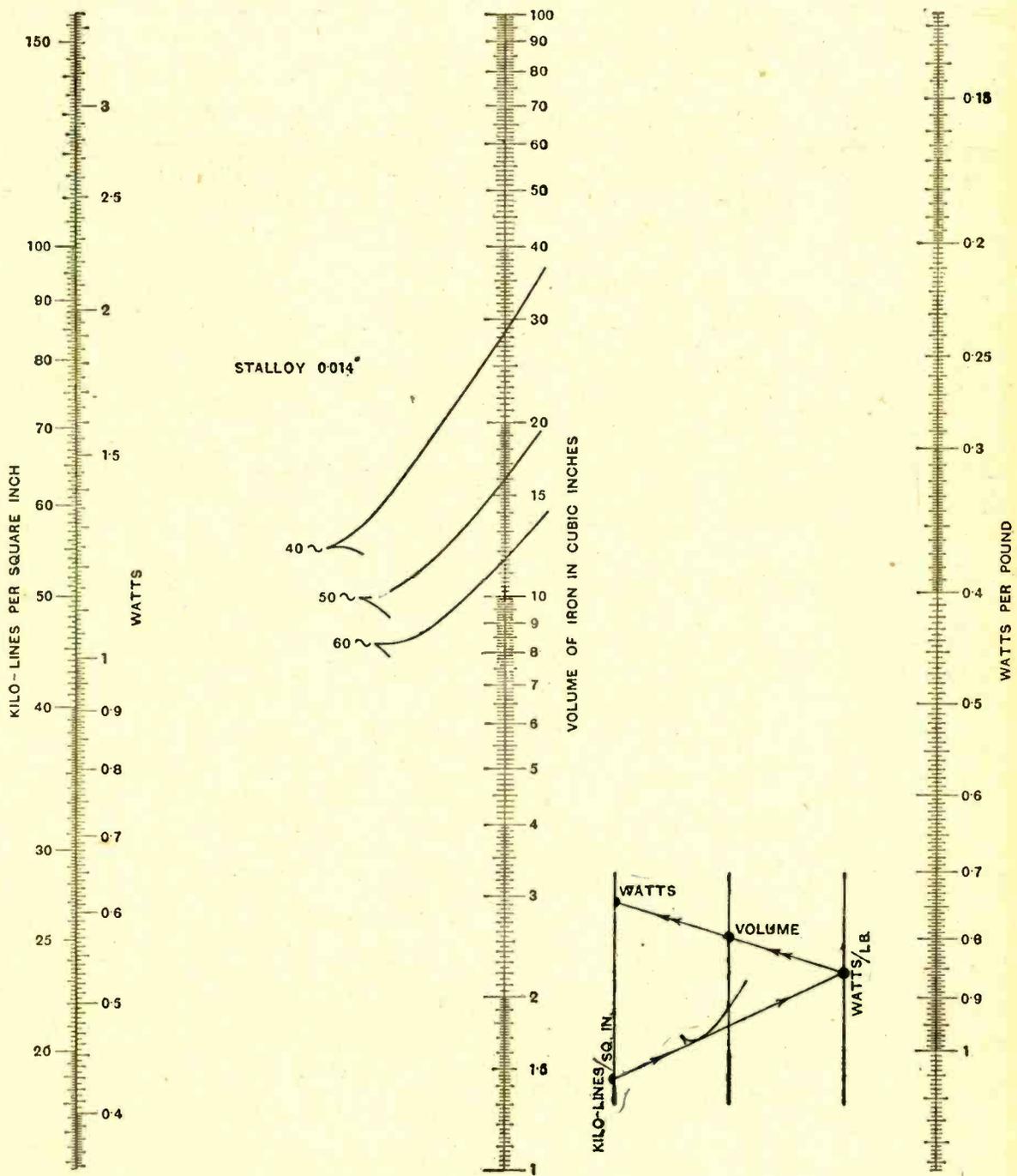


COPPER LOSS



W.W. ABAC

Nº 24 c.



STALLOY 0014°

IRON LOSS

W. W. ABAC

Nº 24 d.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

B.B.C. POLICY AND "SCRAPPY" PROGRAMMES.

Sir,—Thank you for your leaders on the programmes of the B.B.C. You strike just the right note. One simply cannot sit down to an evening's enjoyment. Good music, with good performers, is interspersed with third-rate songs by fifth-rate singers, with snippets of talks, reading of poetry, news, fat stock prices, etc., etc. Why cannot they have the patchwork quilt part of the programme earlier on in the evening? Then have the news at 7 or 10, and a solid *homogeneous* programme in between. You are quite right that very few listeners want to listen every evening, but when they do want to listen, they do not want to keep jumping up and down to shut off some item which does not interest them.

The really hopeless thing is this 9-9.40 interval right in the middle of the evening. The vast majority of listeners go to bed 10-10.30, and this interval cuts right into their evening's enjoyment.

Lastly, I wish they would take a referendum on sopranos: they would find out that 50 per cent. of listeners would like them entirely cut out, 49 per cent. would wish them restricted to one evening per week.

Marlborough, Wilts.

H. C. HONY.

Sir,—I feel compelled to write in support of the letter from Mr. L. Phillips on April 3rd. To my mind he has hit the nail on the head with regard to programmes and times. Before the plan of trying to please everybody in the same evening was adopted, we in this part of the country used to be able to look out a good programme in accordance with our tastes either at Newcastle, Manchester, or Leeds (often all different), and settle down to enjoy it. We could, at any rate, say which evening would suit us best. The evening programmes at present give us such a tantalising mixture that listening-in has lost more than half its pleasure. What ought to be the best part of the day, the evening from 6-10 p.m., is much the worst for being split up, and the times of the news bulletins, and the endless repetitions of the weather from Daventry, just at the best part of the evening for most people, seem calculated to destroy any possibility of ever having good steady enjoyment.

As a typical example of the heterogeneous mixture we have to assimilate at present take Tuesday evening last:—

- 6.—Poetry.
- 6.15.—Weather and General News.
- 6.30.—A little snippet of music, with waits before and after.
- 6.45.—Another pause, then "Foundations of Music."
- 7.15.—Another pause, then another snippet of music.
- 7.25.—From the musical to the serious—a lecture on Ancient Corinth (a good lecture, but delivered too quickly to be useful for serious students).
- 7.45.—Quarter of an hour's concert, but you must not be allowed to settle.
- 8-8.30.—Some Modern Utopias.
- 8.30.—A little snippet of music.
- 9.—Same old news again, and weather.
- 9.15.—Lecture on Music.
- 9.35.—Same old weather again.
- Fat Stock Prices.
- 9.40.—Gay Sparks.
- 10.30.—Dance Music.

To go through this is like living in a kaleidoscope. I am sure that if the fare provided is not always made up into

potted meat, and we are allowed to have good joints, we shall all be much happier.

Busy people will then be able to avoid wasting so much time on what does not appeal to them.

Please Mr. Editor, press on, for I am sure your editorial expresses what is generally felt.

Will it be possible for all in agreement with you and Mr. Phillips to write to you and have the letters forwarded to the B.B.C.? Perhaps other wireless papers will co-operate.

J. A. HUBBARD.

Sir,—Your leading article in April 3rd issue, also the letters from the two correspondents on the question of B.B.C. programmes, have proved very interesting indeed to your Northern readers, and personally one or two remarks in your article and the letters gave me very great pleasure, for it seems that, although we have been told that we are dissatisfied and continually grumbling about nothing, other people have the same kind of grumble.

Mr. Phillips' letter in regard to the policy is distinctly true, whilst his remarks regarding the 1,613 letters is a point that the B.B.C. officials, with all their superior education, have not been able to analyse. The letters to the B.B.C., either critical or appreciative, are of no value whatever to them, and are no justification for their statement that their programmes are satisfying the majority of the listeners. It is quite possible that the B.B.C. will not admit that this attitude of patronising superiority exists, but surely it is very evident to anyone who listens carefully and watches closely one way in which they approach various subjects of the programmes.

Just for instance. The Manchester station on April 2nd were broadcasting a programme which they called "The Return of Persephone." Why was there any objection to giving it a title that anyone could understand? Fortunately, the local papers transcribed this and called it "Spring Music." Something of this kind happens in every day's programme, and we are considered revolutionary, or perhaps fanatical, when we say that the B.B.C. are definitely not in touch with the 90 per cent. of their listeners, or they would not adopt such a snobbish attitude.

I was greatly interested in Mr. Phillips' paragraph regarding the times of transmission. We in the North have hitherto believed that the London listening public desired the late programme, and were given to understand that this was so, and in order to satisfy the London listeners the Northern stations were compelled to accept this ruling, whilst Mr. Phillips' criticism is exactly the point we have been trying to drive home for two years.

There is just one other point that I am sorry was not mentioned in the letters, but no doubt the other correspondents feel the same way about it, and as it is a very delicate subject I ought to first make it clear that I am by no means adverse to religion, but, viewing certain programmes, not only Sunday programmes, it is very evident that the B.B.C. are very tightly grasped in the palm of the religious element. I do not propose that the B.B.C. should give us what is commonly known as a Continental Sunday, i.e., dance music, etc., but I think most of the listeners object to the present dull and deadly Sunday programmes. It is not very long ago that the Sunday programme from the Manchester station consisted of an afternoon of Chamber music, followed by Bach cantata, a religious service, the week's good cause, hymns played by a brass band, items by a Church choir, and the epilogue, and that on the day when most of the industrial people sit at home with the idea of being entertained.

I am quite aware that all this grumbling, criticising, and suggestion is a waste of time. We cannot get through (by ordinary methods) the armour-plating of the B.B.C. charter, so all we can ask your readers is, "What are we going to do about it?" I for one do not feel like sitting down and letting the B.B.C. stand on their pedestal and as good as tell me to go to a warmer place than England, which is practically what their attitude amounts to.

J. E. KEMP.
Fallowfield, Manchester.

Sir,—Mr. L. Phillips, whose letter on the above subject appeared in your issue of April 3rd, writes with refreshing intelligence and vision, but he does not understand the British race. He criticises the "snatchy" nature of the programmes, inferring that this makes them unpopular. In your editorial comment you also object to the "scrappiness" of items broadcast.

But this is precisely where the B.B.C. show that they really do understand their public. Modern civilised (or is it industrialised?) people imbibe "scrappiness" with the same unflagging zest as the butterfly flits from flower to flower. Any attempt by them at sustained effort or prolonged artistic appreciation produces boredom and fatigue. The dailies with the largest circulations bear testimony to this, reaching the climax of scrappiness in the daily picture papers. Half-tone reproductions of murderers, victims, politicians, actresses, floods, earthquakes, society brides, railway disasters, football matches and horse races flick their jaded gazers' minds from spot to spot and person to person without rest or reason. Serials are merely novels served up in highly seasoned scraps; news is treated not from the point of view of its importance but of its popular interest; and "News in Brief" reaches the very pinnacle of fluffiness.

Observe how the readers of these papers scan them for the more tasty morsels. Examine the penny papers with bloated circulations and see how small the machine of popularity minces the meat with which it nourishes its children. Compress a scrap still further, and one has the acme of snatchiness—the mental tabloid known as the slogan. An advertisement without a slogan is valueless; so is a politician's "programme" of national salvation.

It may be that modern industry gives men and women quite enough "sustained effort" in the performance of routine work in factory and office. Off duty, they want a little bit of everything—but nothing in the sustained effort line, please!

The most popular instrument of pleasure (for the owner) and of torture (for the other fellow) is the gramophone. I don't know exactly how long a really raucous jazz record lasts without the motor breaking down, but it can be, actually, only a few minutes—although it may sound ages on a perfect river day. And yet, does the brevity of the uproar—its perfect scrappiness—cause the winder of the machine to exclaim: "I'm fed up with these piffing morsels"? It does not. He winds . . . and winds . . . and winds, with unflagging zeal, from the time he embarks to the time he disembarks. If Mr. Phillips doubts this, let him spend a week-end on the Richmond or Twickenham reach this summer. The persecution of "Ole Man River" will surprise him.

Plays have become shorter—some even being cut sufficiently to allow of two performances nightly; sermons have become shorter (so I am told); skirts have become so short that they are now little better (or more civilised) than kilts; and trousers have shrunk upwards into plus fours. Presently, they may become mere shorts.

Therefore I, for one, will not have it said of the B.B.C. that they have sinned against the British public by mincing their programmes into morsels of music, tabloids of talk, and pillules of puritanism. They have gauged the public taste with a precision that is as accurate as the British wave-lengths.

It is all very well to talk in a superior way of "Continental programmes," but we are not Continental: we are insular. Compared with Europe, even the very land we live in is but a scrap of dirt.

The brains behind the B.B.C. programmes are just right for the job. They are not too big. Which is the essence of popularity.

BERTRAM MUNN.

Twickenham.

TIMING PROGRAMMES.

Sir,—There is one item in connection with programmes which is worth attention. If the B.B.C. are conducting a concert or play they do not hesitate to overrun the advertised time in order to complete the programme—a very proper course, though the ensuing apology is both idiotic and unnecessary—but when an outside band is performing they invariably cut it off in the middle of an item and don't usually apologise to the exasperated listener! Why can't they let it finish?

Woking, Surrey.

G. M. PART.

RE BROADCASTING THEATRES.

Sir,—It has been suggested that these should be opened. I think perhaps the following experience may be of interest. I have control of a public hall in the centre of Portsmouth, and applied to the magistrates for permission to hold concerts on Sunday nights. This was refused, but I was allowed to reproduce the B.B.C. programme between the hours of 8 and 10 p.m. The result was a complete failure.

On the first Sunday about 270 attended. The service came from St. Martin-in-the-Fields, and was followed by a good concert. The set employed was quite a good one. By the end of the evening I formed the opinion that, whatever might be the suitability of the programme for home reception, it was perfectly hopeless for public reception. There are nearly always long intervals between the items, which would hardly be noticed if one is reading a book, but which are very noticeable in a public hall. The charitable appeal, news and weather report are all exceedingly dull.

That my opinion was shared by the audience is proved by the fact that on the second Sunday only about half the number turned up, and on the third and last Sunday the audience had dwindled to forty.

Of course, if I had had the freedom to reproduce any programme I liked, the result might have been different, but I do not think that any public broadcasts are likely to be very popular until the broadcasting authorities realise that people want wireless for amusement, not for education or religion, and also realise that it is desirable to shorten breaks between items and to run the programmes more like they do in the United States.

Southsea.

F. PINK.

RECEPTION IN SCOTLAND.

Sir,—In your issue of March 27th you give particulars of the troubles experienced in Scotland. You state that some first-hand information from Scotland would make "interesting reading." The position in Scotland is briefly as follows:—

On November 22nd there was a public meeting of the whole radio trade with the B.B.C., when the present inadequate Scottish service was gone into in detail. The B.B.C. officials promised to send us a detailed reply to our various complaints. We waited three months in vain for their reply, during which the reception in Scotland got very much worse. We accordingly wrote a further letter, which was reprinted in the *Scottish Radio Dealer Magazine*. We then waited a further month, and, still being without any reply to the various communications, we thought it advisable to give publicity in the local Press. The *Edinburgh Evening Dispatch* accordingly gave a whole column on the subject. We would not have communicated with the Press at all had we got any reasonable reply from the B.B.C.

The present position is that Scotland has two transmitting stations, Glasgow and Aberdeen, with an effective range, according to the B.B.C., of twenty-five miles—two relay stations, Edinburgh and Dundee, with an effective range on *valve sets* of three miles. Daventry, our mainstay, is badly interfered with by other stations. The wireless link transmission sent out from Edinburgh is absolutely impossible. We asked for the pick-up to be changed, and the B.B.C. state that the expense of land lines is prohibitive. In view of the expenditure

of half a million on the new palatial offices in London and a like amount on the London station, less than £100 on a private land line seems to us absurd to quibble about. The B.B.C. also suggest that Scottish listeners should go in for eight-valve superheterodyne sets with directional aerials. We ask why Edinburgh should not have such a set as its pick-up. You will now understand why the traders in Scotland are getting a little bit impatient with the B.B.C., and we think it high time for them to declare what they intend doing to effect an immediate improvement and when they propose making a start on the Scottish regional station.

JAMES PLUCKNETT.

(Chairman of the Scottish Radio Retailers' Association.)
Edinburgh.

BRITISH MANUFACTURERS.

Sir,—As a frequent victim to similar distorted logic, may I point out the fallacy in the enquiry mentioned by Mr. Somerset in his letter appearing in your issue of April 3rd?

As a propagandist for 60 Megahertzen, Mr. Somerset requires a variable condenser, and prefers to buy British, which is very laudable. He would prefer to have 0.00005 μF capacity at maximum, and "double" plate spacing, also that the law of capacity variation should be "S.L.F.," and a single bearing with phosphor-bronze "pigtail" connection to the moving plates, all of which he is fully entitled to specify, though all British manufacturers do not agree with him about the single bearing. So far, the specification is perfectly reasonable, and no doubt several British manufacturers would supply such an article practically from stock at a reasonable price.

Mr. Somerset also specified taper plates. I am not a manufacturer of condensers, but I believe the taper-plate construction to be a very ingenious American way of dodging some American patent. A condenser having substantially semi-circular plates can be made to give a "S.L.F." law if the thickness of both fixed and moving plates varies. So instead of leaving the condenser maker to secure the required law in the ordinary way, by using appropriately shaped plates of constant thickness, Mr. Somerset is really asking the British manufacturer to conclude negotiations with the representative of an American firm for the use of a certain patent, to secure a supply of tapered sheet metal, to alter his press-tools so as to be able to stamp out a single set of plates, and to conduct experiments to get the correct maximum capacity. Probable cost of one condenser, £50, which Mr. Somerset would surely decline to pay, and which could only be recouped by selling many more, and so piling up royalties payable to the American patent-owner.

Our manufacturers are more capable than many others of "delivering the goods" when unhampered by absurd specifications. Why not trust them to know their own business best?
London. SIGH-OR-TWO.

RE NEEDLE TRACK ALIGNMENT.

Sir,—The recent introduction of tone arms designed for the carrying of electrical "pick-ups" and based on what is popularly known as the "straight line" principle, compel me to question whether such design is quite on suitable lines when it is remembered that gramophone records are *not* primarily intended for use with pick-ups—I refer, of course, to the question of needle track alignment.

With the ordinary tone arm, pivoted where it connects with the remainder of the sound chamber, the needle in traversing the record of necessity describes an arc. Perfect alignment under these conditions does not seem possible, for an alignment which is true with the needle at, say, the edge of the record will be destroyed as soon as it is moved from its original position.

I am not fully conversant with the technical details of record manufacture, but presumably this point has attention and is compensated for in the design of the record grooves, etc.

Bearing this in mind, I express doubt, therefore, as to whether tone arms in which the carrier allows the pick-up and needle to traverse the record in a straight line as distinct from an arc are eminently suitable. In theory they would appear to

be ahead of the records in design, but in practice, all other factors being equal, it would seem that they are actually inferior to the ordinary tone arm when used with the records at present available.

J. C. FINGLASS.

Wallasey.

5SW IN THE ARGENTINE.

Sir,—I do not remember having seen anything in your excellent little paper about the reception of short-wave broadcasting stations in the Argentine.

Atmospherics are notably bad in this part of the world, and stations radiating on even the 30-metre band are often badly interfered with. PCJJ is seldom worth listening to, whereas 2XAD on 19 metres has invariably a silent background. Unfortunately this latter station generally fades out some two to three hours after sunset.

Judging by the howls on Mondays and Wednesdays, it would appear that there are thousands who listen in to Chelmsford; actually there are hundreds.

G5SW comes through well; as a general rule there is little fading and signal strength is good, averaging better, in fact, than the North American stations.

The B.B.C. are to be congratulated, and you, Mr. Editor, also, for your share in boosting the idea.

The fact that the station does not radiate on Saturdays and Sundays is disappointing, and with British summer time coming along we shall have to be content with even shorter hours; but we hope that, in the near future, this station may be an Empire broadcasting station in deed as well as in name, and that we Britishers, living and working abroad, may be allowed to listen to the news and longer programmes from the country that few of us forget is our home.

F. C. W.

Buenos Aires.

TELEVISION.

Sir,—In your correspondence columns of April 3rd, Dr. Tierney states that he has "witnessed the image of a boxing match received with remarkable fidelity—put over on the ordinary commercial televisor." Will not Dr. Tierney, as Chairman of the Television Society, discuss a few of the facts and figures relating to such an achievement and consider the technicalities of the apparatus. Such information would be welcomed by readers of a technical journal.

He draws a comparison between the relative educational potentialities of phototelegraphy and television. Surely he is looking a long way ahead. It is like building the top story of a house before the foundations are put in.

Most important is Dr. Tierney's last paragraph in which he recommends the amateur to throw in his support to further the progress of television. It is not "lack of appreciation" but rather lack of information that sets up a barrier in the way of amateur activity. It is extraordinary that so far the amateur has made no claims in the field of television; yet here is a subject, simple in its present form and not beset with obscure mathematical considerations so essential to a study of radio.

Before the time arrives when the B.B.C. will conduct television transmissions, may I suggest that full details be disclosed as to mechanical standards to be adopted in the same way that information has been given out by the B.B.C. in regard to the standards set up for picture broadcasting. We shall want to know the extent of analysis of the picture and the ratio of rate of traverse to dimensions and any other special signals or intervals that may be thrown in as an aid to synchronising. Manufacturers also will need these details.

Television receivers are customarily provided with very generous amplifiers (L.S.5A valves with 350 volts), yet Mr. Baird states in a press interview published in the London *Evening News* that the apparatus can be sold at about £12. Apparently he has something more sensitive than a flashing neon lamp for forming the image.

Listeners may have heard the broadcast talk on television given recently from 2LO and probably S.B. to other stations. In view of the nature of that broadcast the B.B.C. can no longer pretend that they are unsympathetic towards the forthcoming tests.

F. HALSEY.

READERS

THE WIRELESS WORLD SUPPLIES A FREE SERVICE OF TECHNICAL INFORMATION

PROBLEMS

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves.

A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

A Musical Choke.

On disconnecting my loud speaker I can hear quite loud signals, which emanate from the output choke. Does this show that something is wrong with it?

T. M.

This is quite a common effect; it is due to vibration, generally of the choke laminations. It may often be prevented by tightening the cross bolts passing through the frame.

o o o o

Reducing Filament Voltage.

Will you please describe the correct method of setting the filament rheostat of a 4-volt screen-grid valve used in a set in which 6-volt valves are fitted in the remaining positions? I have a good two-range moving coil voltmeter.

E. D. Y.

You must first assure yourself that the rheostat has a suitable resistance range; in all probability a component rated at 30 ohms will be suitable. The first step is to connect the meter directly across the filament terminals of the valve holder, taking care that polarity is correct (i.e., the negative terminal of the meter should be joined to the socket, which is in direct connection with L.T. negative). Now rotate the rheostat very slowly from the "off" position, until a reading equal to the rated filament voltage of the valve is shown. If the meter has an internal resistance which is high in comparison with that of the filament—all good instruments comply with this requirement—it may be assumed that the voltage existing will remain sensibly unchanged when the measuring instrument is removed.

Finally, it will be advisable to mark the rheostat dial, or, better still, to fit a stop so that the contact arm cannot be rotated beyond the point corresponding to maximum rated voltage.

o o o o

Locating Excessive H.F. Resistance.

(Referring to previous correspondence)

You say that my trouble of indifferant sensitivity and selectivity is very probably due to excessive damping in one of the tuned circuits; I have tested for bad connections and leakages by the usual methods, but can find no sign of a fault. Is there any fairly simple way of carrying out a more conclusive test?

C. L. C.

Your receiver includes two tuned H.F. circuits which should have low H.F. resistance, and it is not a difficult matter to obtain a fairly accurate idea as to whether one or both of them have excessive damp-

ing. The simplest way is to insert an artificial resistance in each oscillatory circuit in turn; if this addition results in a considerable falling-off in signal strength, it can fairly be assumed that the added resistance is considerable in comparison with that already existing, and that the circuit is free from blame. If, on the other hand, the extra resistance makes no appreciable difference to intensity you can take it that there is a source of fairly high losses, which must be removed before a first-class performance can be obtained.

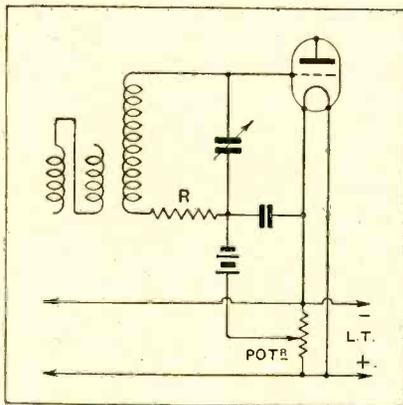


Fig. 1.—Position of artificial resistance (R) in an oscillatory circuit.

With litz-wound coils, some 5 or 6 ohms is a suitable value for the resistance, which should be non-inductive. It may consist of a straight length of No. 45

RULES.

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
 - (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
 - (3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
 - (4.) Practical wiring plans cannot be supplied or considered.
 - (5.) Designs for components such as I.F. chokes, power transformers, etc., cannot be supplied.
 - (6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.
- Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

Eureka wire, which has a resistance of almost exactly 3 ohms per inch.

Needless to say, the test should be carried out when listening to weak signals, such as those emanating from a distant station and, to avoid misleading results due to fading, it is strongly recommended that the work should be done in daylight.

The method of connecting the resistance in the H.F. transformer secondary circuit is shown in Fig. 1. Its position in the grid circuit of the H.F. valve will, of course, be similar.

o o o o

An Artificial Condenser.

I have noticed that signal strength is increased when I touch the anode terminal of my detector valve holder. Why is this, and does it indicate that anything is wrong?

K. G. S.

Without full details of your set and a knowledge of the conditions under which it is used when the effect mentioned is observed, we are afraid it is impossible to be definite. It seems very likely, however, that detection efficiency is improved by the addition of body capacity to that already existing in this part of the circuit. If this assumption is correct, then it may well be that there is insufficient by-pass capacity in this part of the circuit. It might be a good plan to remodel your reaction arrangements, using a coil of fewer turns and a larger control condenser.

o o o o

Kilocycles per Degree.

Can you give me an idea as to the number of kilocycles represented by each degree of the variable condenser which is connected across my H.F. transformer? The capacity is 0.0003 mfd., and the scale is marked in degrees from zero to 180.

A. C. C.

We cannot give an absolutely definite answer to this query, as we do not know the incidental capacities of your circuit or the exact type of condenser used, etc. However, assuming it to be of the modern type, in which the vanes are designed to give a more or less "straight line frequency" tuning curve, we think it can fairly be assumed that a waveband of some 900 kilocycles will be covered on the medium broadcast band, and it is safe to say that each degree will represent approximately a frequency difference of 5 kilocycles. At the lower end of the scale some considerable divergence would be noticeable, but over the greater part of the tuning range you should find that stations with 10 kilocycles separation are tuned in at condenser settings differing by about two degrees.

