# THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

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# THE ALL-BRITISH WIRELESS EXHIBITION

By THE EDITOR.

IT is only within the last two years that scope has arisen for holding an Exhibition exclusively devoted to wireless, for previously interest in wireless was practically confined to governments, shipping companies, and the proportion of the public representing the amateur fraternity.

Now, however, there are few members of the public who have not some interest in the subject, and consequently an Exhibition of wireless interest may naturally be expected to draw many thousands of persons directly interested, who visit the Exhibition with a view to selecting a wireless set for the first time, or in search of component parts or accessories for building their own sets ; whilst in addition there are, of course, many who will attend the Exhibition on account of their commercial interests, to study developments and design, since an exhibition of this kind affords a unique opportunity for seeing apparatus of all manufactures and of all types so arranged that comparisons can be made and new developments studied in comfort and with the minimum of loss of time.

From general indications it is probable that this Exhibition represents the first of regular yearly exhibitions which will, no doubt, be held about the same time each year, in much the same way that the Motor Show has become an annual fixture. One or two wireless exhibitions have been held during the past two years, but these have served only to pave the way for the institution of a regular annual exhibition.

Perhaps one of the most pleasing aspects of an exhibition of this nature is that it serves to indicate the stability of the industry, whilst the fact that all the exhibits are to be of British manufacture, shows a unity of policy on the part of the manufacturers and the general exhibitors which is unusual in so young an industry.

At this stage, before the opening of the Exhibition, it is not possible to comment on new apparatus and developments which may appear for the first time on this occasion. It is, however, possible to mention the tendency in design towards simplification both of the maintenance and control of receivers for broadcasting. We have instances in some new types of sets of a reduction in the number of controls, although this trend is not nearly so marked as might have been expected. Another noticeable point is the extended use of dull emitter types of valves which, on account of their low current consumption, are particularly applicable where facilities do not exist for accumulator charging. Developments which have been instigated through the more general adoption of dull emitter valves in broadcast receivers are apparent in special types of accumulators, and even new types of primary cells introduced by manufacturers particularly for this purpose.

From information already to hand, it is apparent that very few complete sets will be shown except those specially designed for broadcast reception in this country, but on the other hand, a great deal of attention has been paid by manufacturers during the past year to the design and manufacture of component parts, from which the amateur can build his own apparatus. Many of these component parts introduce novel and ingenious features which simplify the work of building up by the amateur of both experimental and broadcast apparatus.

Readers are reminded that, apart from the commercial stands, space will be devoted to the interests of amateur wireless societies, a special stand having been set apart by the Exhibition organisers for the use of the Radio Society of Great Britain and Affiliated Societies.

A number of exhibits of amateur interest will be in evidence on this stand, whilst apparatus entered for the Radio Society's competition recently announced will also be there for inspection.

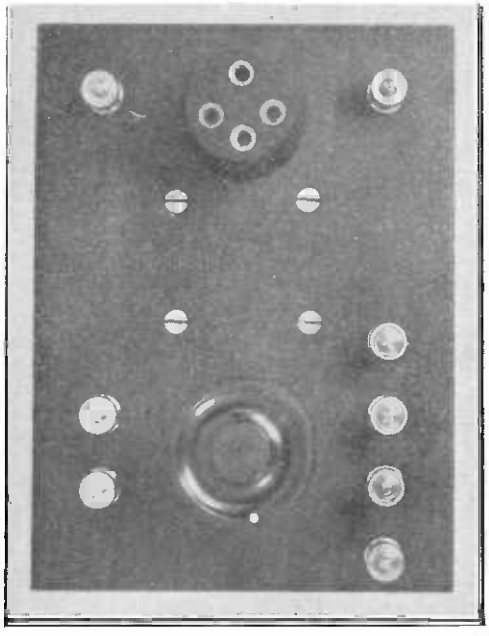
The Exhibition, as already announced, will be opened on Thursday, November 8th, by H.M. Postmaster-General, Sir Laming Worthington-Evans, and will remain open until November 21st.

# A SINGLE-VALVE NOTE MAGNIFIER

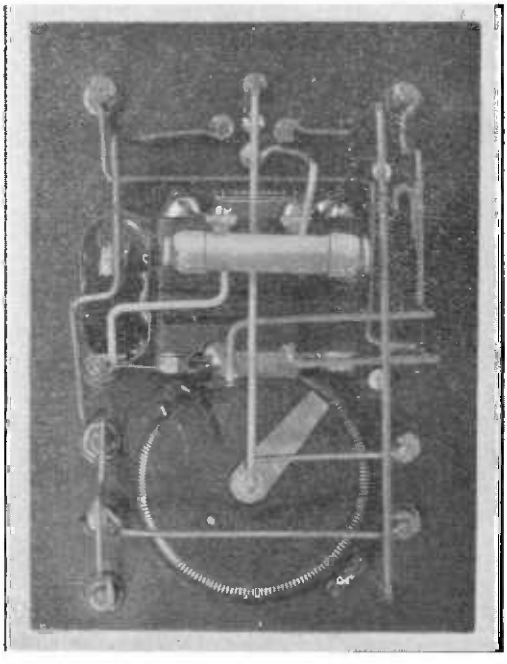
The most useful of units is probably a single-valve low frequency amplifier. It can be added to a crystal receiver for operating a loud speaker and for reception up to a distance of ten miles from a broadcasting station. This combination produces excellent results, particularly as distortion can scarcely be introduced by a crystal detector and its tuning circuit.

By F. H. HAYNES.

WITH a view to reducing distortion to a minimum, certain features are introduced. A high resistance leak is connected across the secondary winding of the transformer, a small condenser is joined across the primary winding, whilst grid cells are used to correct the grid potential. It has been common practice, particularly in low frequency amplifiers, to connect the filament resistance in the negative lead from the battery, which has the effect of giving an additional negative bias to the grid when one end of the transformer is connected to the L.T. minus, as is customary. An objection to this arrangement, however, is that the grid potential is appreciably changed as adjustments are made with the filament resistance, and consequently one is not adjusting the filament current to the best value when turning the resistance, but regulating the grid potential. The difficulty may be overcome by connecting the filament resistance in the positive filament lead, and making up for the loss of negative grid bias by connecting a pair of small dry cells in the grid lead, not actually to the grid itself, where some loss might be occasioned by the capacity to earth or poor insulation of the cells, but between the other end of



*View of the top of the panel. The terminals can be identified by carefully enamelled lettering, or the panel can be put out for engraving before assembling.*



*Underside of the panel showing the layout of the components.*

the transformer secondary winding and the L.T. minus. As the set may be used for amplification of signals delivered from a crystal receiver, it is necessary to procure a transformer having an ample number of turns on its primary winding, particularly when a crystal of the galena and wire contact type is used, and thus a high step-up ratio is not required.

A list of parts is given in order that the reader may, should he wish, work precisely to the drawings given :—

Polished ebonite panel which, when carefully trued up, will measure 4½ ins. by 6 ins. by ¼in.

" Burndept " filament resistance.

Dubilier type 600 A condenser, 0·003 mfds.

3-volt " Ever Ready " dry battery, type No. 1678.

" Burndept " new pattern low ratio transformer.

Dubilier ½ megohm resistance (grid leak type).

Valve holder.

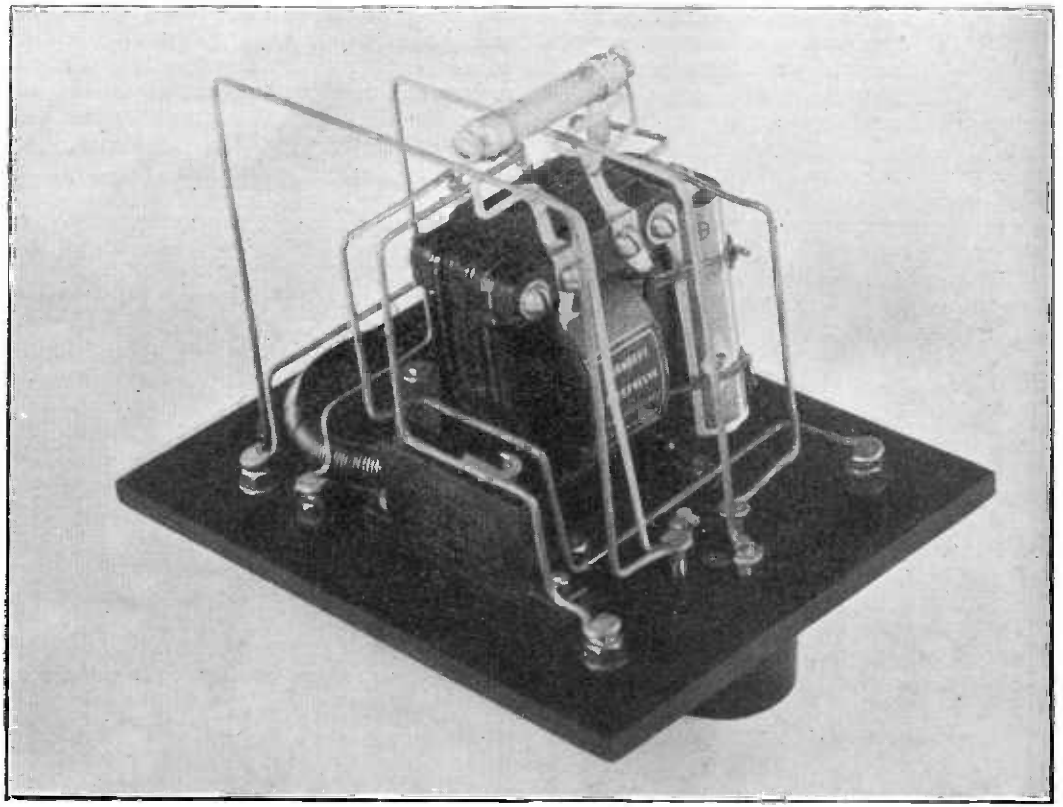
Eight 4BA terminals with nuts and washers.

Four 4BA by ½ in. brass screws with countersunk heads, and four 4BA nuts for attaching the transformer.

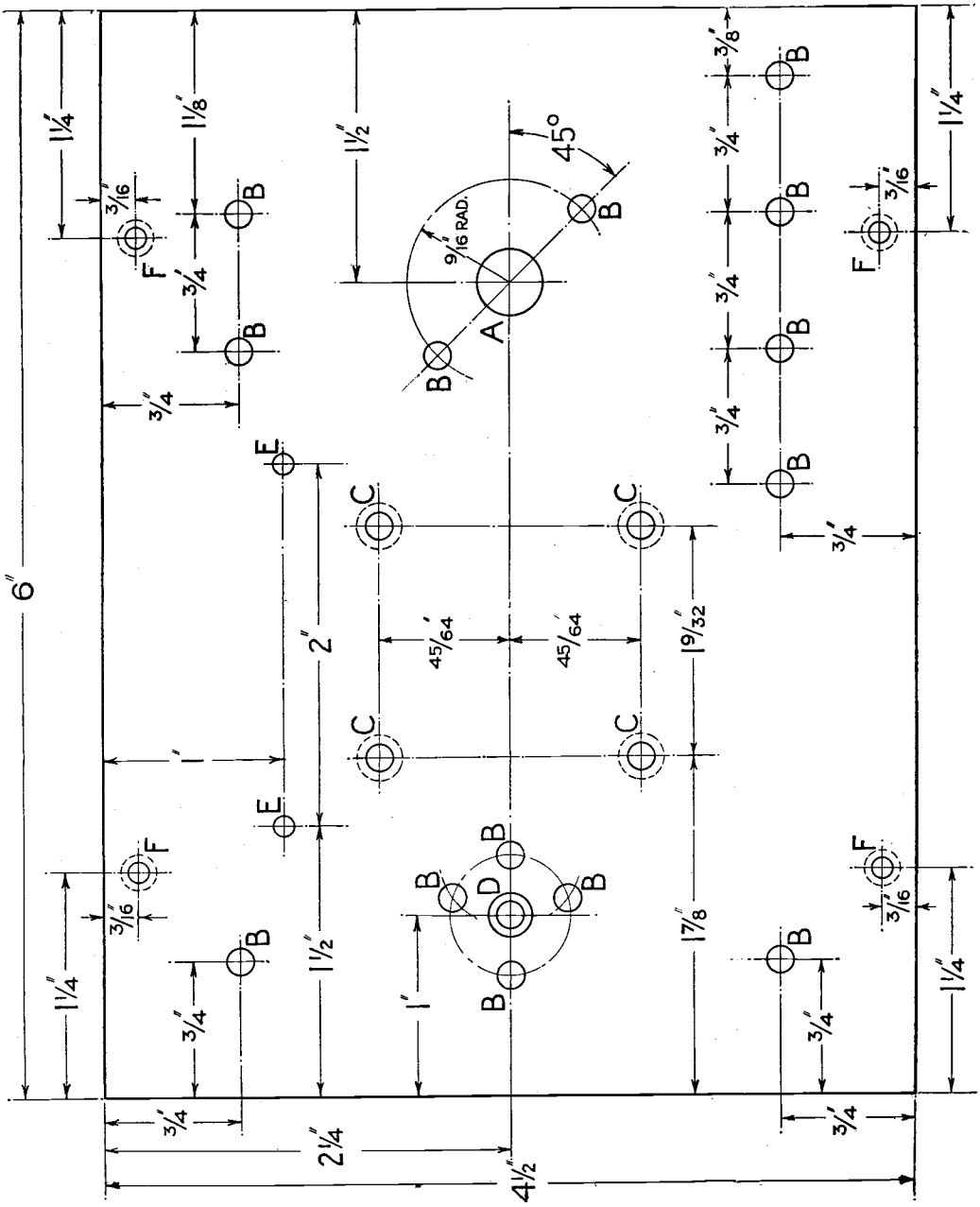
Two No. 5 by ⅜ in. brass screws with round or cheese heads for attaching the small fixed condenser.

Four ounces No. 16 S.W.G. tinned copper wire.

If all these components are obtained, the reader may go ahead, working precisely to the drawing of the panel (which is shown exact full size) without further considering



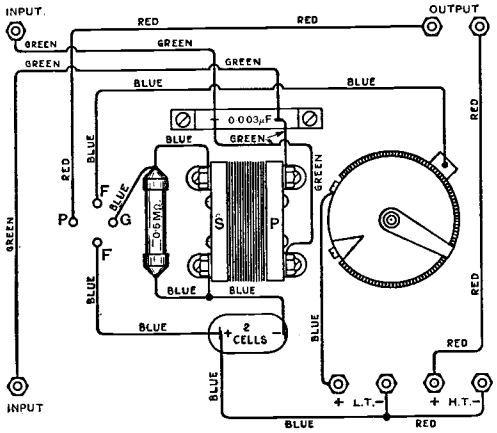
*View of the underside. The method of wiring is clearly shown. The tinned ends of the high resistance (grid-leak type) can be easily soldered to loops to avoid the fixing of brackets on to the panel, but care must be taken not to overheat the resistance.*




*The location of the holes on the ebonite panels, and for the purpose it will be sufficiently accurate if the centres are pricked through on the panel. Size of holes : A, 3/8 in., B, 5/32 in., C, 5/32 in. and countersunk on top side. D, 5/32 and countersunk on underside ; E, ⅛ in. blind holes 3/16 in. deep ; F, ¼ in. and countersunk on the top side for No. 4 wood screws.*

how the spacing of the components will work out.

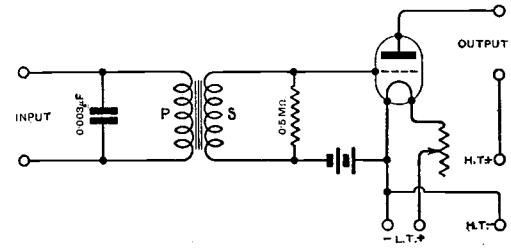
The ebonite panel must be perfectly squared up, making use of a steel square, which is an indispensable tool to the home instrument maker. The edges are trued by filing while holding the panel low in the vice, and finished by rubbing with medium carborundum cloth wrapped round a block of wood. The setting out of the location of the holes must be done with the aid of a pair of steel spring dividers and steel rule, taking the utmost care to ensure accuracy and making intersecting scratch lines to denote drilling positions. A sharp centre-punch must be used to indent a mark to prevent the point of the drill from wandering. If the required drills are not available, the reader can purchase them to the sizes given for quite a small sum. If it is feared that the panel surface may break away when the drill passes through, one should firmly clamp a piece of scrap ebonite or hard wood against the back of the panel when drilling.




*Practical wiring diagram showing the actual points between which leads are connected. If the leads are enamelled in various colours, the tracing of the circuit is simplified.*

To let the heads of the four countersunk screws into the panel, a small drill, exactly equal in size to the screw heads, should be used (about $\frac{1}{4}$ in.), and drilling carried just far enough to allow the screw head to come flush with the face of the panel. The panel may now be rubbed down, and as a change from the usual uniform matt finish, the block of wood wrapped with the carborundum cloth may be taken in straight lines up and down the panel. This produces a very good appearance, scratches being of no concern as they lie parallel.

Before proceeding with assembling, all terminals and screw heads should be treated




*Circuit diagram of single valve low frequency amplifier. A small condenser bridges the primary and a resistance bridges the secondary of the transformer for the purpose of minimising distortion. The filament resistance is connected in the positive battery lead in order that the grid potential is not varied with charges of filament current. Two grid cells provide the necessary negative grid bias. In the case of a single valve L.F. amplifier, it is not essential for the H.T. battery to be shunted with a condenser.*

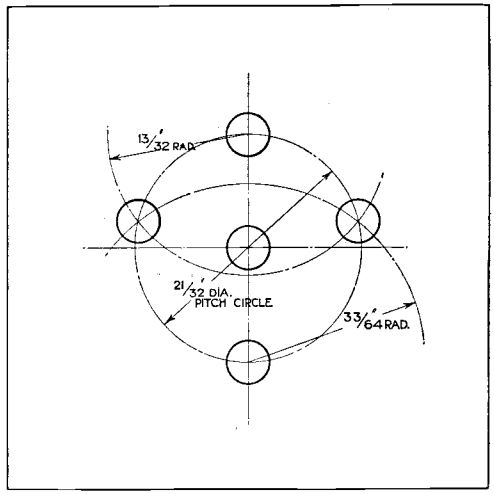
after polishing, with pale gold lacquer, dried off in a non-smoky flame, and slightly warmed, taking care when putting them aside to cool that they do not rest on the lacquered surface.

The first step in assembling is to secure the small grid battery to the right-hand side of the transformer as viewed from the side where the secondary winding terminates. This can be done quite well with thin string, passed between the core and the bobbin, binding in two places. All of the components can now be attached to the panel. It will be found that the two 5 BA screws will cut their own threads in the $\frac{1}{8}$ in. blind holes, and hold the small fixed condenser very securely.

The wiring up must receive special attention, for it requires no special tools, only care and patience, and in this simple instrument should serve as a good introduction to the methods of "stiff wiring." The wire must be carefully prepared, and entirely freed from kinks by pulling on some ten feet of it, after careful unwinding, until it can be felt to appreciably stretch. It then acquires rod-like stiffness, and can be cut into sections about two feet in length to avoid bends while handling. The routes to be taken by the various leads should be carefully considered and right-angle bends made with a small pair of pliers. Soldering requires some skill, yet, with care

and remembering that a clean, hot, well-tinned iron is half the battle, the most elementary worker can make a good job of it. A minute trace of "Fluxite" facilitates soldering, but any excess that may have been applied must be completely washed off by methylated spirits applied with a small stiff brush. Avoid overheating any of the terminals, valve legs, etc., or they may become loose, and do not be satisfied with a joint until the solder "runs" well. Use only soft tinman's solder such as can be obtained in thin strips. When fixing the high resistance leak to loops twisted in the ends of the leads which pass through holes in the transformer connecting tabs, one must be careful not to overheat the small metal caps or a disconnection may take place inside the leak and its wax filling may become melted. A good appearance is obtained if the leads are enamelled to the colours indicated in the practical wiring diagram which serves to identify them when tracing faults.

A box container must be built, measuring $4\frac{1}{2}$ ins. by 6 ins. inside, and of $4\frac{1}{2}$ ins. inside depth. The panel rests along two filets run along the long sides and $\frac{3}{16}$ in. below the top of the box so that when finished the face of the panel is raised above the wood.



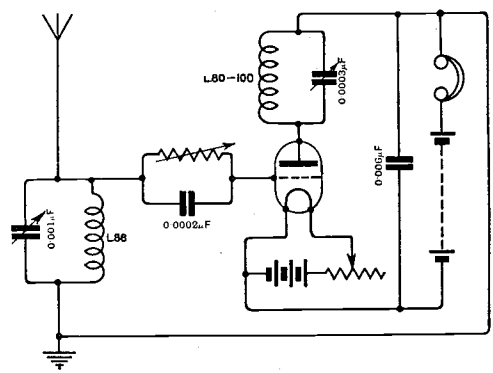

*An enlarged drawing giving the exact setting out of the positions of the valve pins.*

# A New Super Circuit.

By KENNETH KIRK, D.S.O.

Circuits of the Flewelling type making use of an oscillating circuit and a separate damping circuit, have been described in this journal from time to time, but they mostly possess the disadvantage that, in order to build up self-oscillation to a high amplitude in a reasonably short time, it is not found possible to connect them up to the usual elevated aerial, and consequently, when an aerial of only small dimensions is employed, the range of reception is so limited that very little advantage is obtained

Having experimented with the Flewelling arrangement, and appreciating this disadvantage, I have evolved the circuit shown in the accompanying figure, in which is given the values of coils and condensers suitable for operating over the broadcast range of wavelengths. It will be seen that the grid circuit is coupled back into the plate circuit at the junction between the telephone receivers and the tuned anode coil. As a result the grid potential may become unstable unless critically controlled by an adjustable grid leak. The coupling between the aerial and the anode coils must be fairly tight, depending of course upon the constants of the aerial to which the set is connected, and provision must




be made for critically adjusting it. Using this arrangement 35 miles north of London, it is possible to receive all the British broadcasting stations with good strength, far better, in fact, than can be hoped for with the single reacting valve arrangement.

# AN INTERESTING CONTROL DEVICE FOR RADIOTELEPHONY.

By ALAN L. M. DOUGLAS.

THIS unusual application of a four-electrode valve to control the oscillatory circuits of a valve transmitter should be of interest to all experimenters in radiotelephony.

The experimenter who has established a satisfactory valve oscillating system of efficiency and stability will very soon turn his mind to the question of modulating the H.F. output so as to be able to effect radiotelephony. His final circuit will embody one of the following principles, as they represent broadly the only possible effective method of modulation.

A. Absorption control, *i.e.*, the microphone coupled directly or by means of an absorbing element such as a two or three-electrode valve to the aerial circuit.

B. Methods in which the potential of the grid of the oscillating valve is controlled by the voice directly through a transmitter; and

C. Constant current or voltage control, in which the anode supply current is made to fluctuate with the impressed speech.

Of these, as has often been pointed out, method A is only practicable for very short distances or damage will be done to the microphone. B is fairly successful with very careful adjustment of the grid coil coupling, but is a wasteful method like type A. C is the most widely used and the most practical general method of control. It is generally known to the experimenter as "choke" control.

Method A is, however, an extremely simple arrangement, and possesses the advantage of great stability. An ingenious method of overcoming the wastefulness attendant on the usual circuit as given in Fig. 1, is to use a four-electrode control arranged as sketched in Fig. 2. Fig. 3 shows a view of the complete modulating unit ready for attachment to any existing valve oscillator. The action of this device is as follows:—

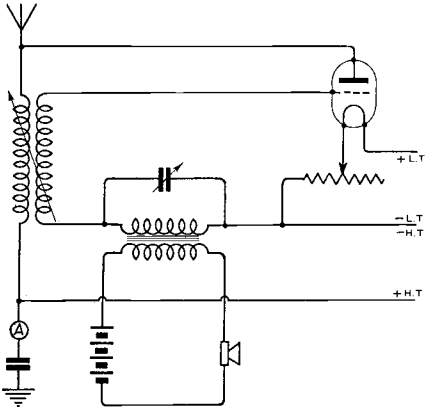



*Fig.* 1. *A grid control valve transmitter.*

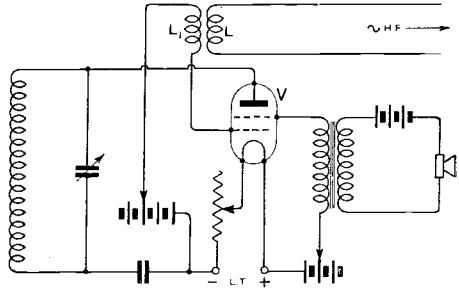



*Fig.* 2. *Four-electrode control.*

If we examine Fig. 2, it will be seen that locally-generated H.F. oscillations of the necessary amplitude are introduced into the modulating device by the inductive coupling afforded by coils L and $L^1$. These oscillations are applied to the first grid of the four-electrode valve V, and the oscillations are induced into the anode circuit of this valve, which may be inductively coupled to the aerial circuit so as to transfer thereto the final H.F. waves. The microphone and its attendant circuits acts, however, on the auxiliary or outer grid in such a manner that the plate circuit oscillations are modulated in accordance with the impressed speech. Herein lies the advantage

of the device, as quite considerable aerial currents can be thereby handled and the system gives very complete control over the total output to the aerial.

This method of control is greatly preferable to the second system B, in which the microphone directly affects the potential of the grid of the actual oscillating valve; in this case, even with careful adjustment, the range of grid potential which will allow the anode current to oscillate over the full range, from zero to saturation, without distortion and without instability setting in, is very small indeed.

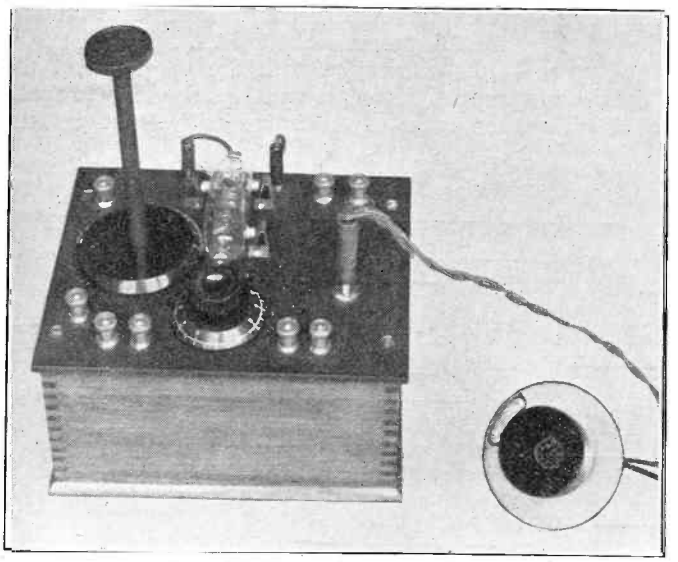


*Fig. 3. Complete modulating unit for attachment to existing valve oscillator.*

The control device described in this article will be of further use to the reader if a few practical details as to constructional arrangements for experimental telephony are given. The photograph, Fig. 3, serves to show the general appearance of the device, the long handle on the aerial coupling coil condenser being of note. This is very necessary on the shorter waves. Fig. 4 shows a practical wiring scheme of the underside of the panel, and illustrates the best general lay-out. Fig. 5 illustrates a complete transmitter employing the system, where it will be seen that all the advantages of a master oscillator system are obtained.

In connection with practical details, the following values for the apparatus shown in Fig. 5 for 440 metre transmissions are as follows:—

For the oscillating system, coil $L^2$ can consist of 70 turns of No. 20 D.S.C. copper wire wound on a $2\frac{5}{8}$ ins. former, the reaction coil $L^3$ being wound over the low potential end of this, and consisting of 36 turns of No. 26 D.S.C. copper wire. A layer of empire cloth should be placed between this winding and the aerial coil. The coupling coils L and $L^1$ may consist of 20 turns of No. 18 D.S.C. copper wire wound on a 3 in. tube and a ball $2\frac{1}{2}$ ins. diameter rotating therein having 12 turns on each side of the same wire. This latter is the coil L.

Coils $L^4$ and $L^5$ should be of flat or "pancake" construction, and consist of 12 turns each of No. 10 S.W.G. copper wire spaced about $\frac{1}{4}$ in. between turns. The variometer VR can conveniently have a fixed winding of 12 turns of No. 10 S.W.G. copper wire spaced $\frac{1}{4}$ in. and a rotary winding of 6 turns of the same wire, spaced in an exactly similar manner. The outside diameter of coils $L^4$ and $L^5$ should not exceed 6 ins., and that of the variometer stator should also not exceed that figure. The rotor may be $3\frac{1}{2}$ ins. to 4 ins. in diameter.

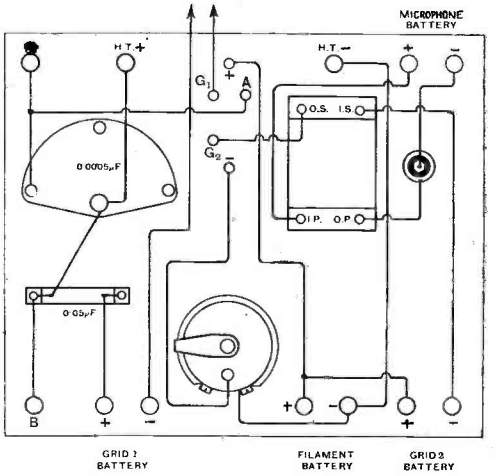



*Fig. 4. Practical wiring on underside of the modulating panel.*

Turning now to other parts of the circuit, the condensers (which should all have mica dielectric and low losses) may have the following values: $C^1$ 0·002 $\mu$F; $C^2$ 0·005$\mu$F; $C^3$ 0·0005$\mu$F, but this is an air dielectric variable condenser; $C^4$ 0·05 to 0·5$\mu$F, again with mica dielectric.

The resistances in circuit may have the following values: $R^1$ 10,000 ohms; $R^2$ 6 ohms; $R^3$ 6 ohms; $R^4$ 6 ohms.

The necessary batteries should consist of dry cells for $B^2$ and $B^4$, the value of which is very critical; 1½ volt cells should be used up to about 15 volts in each case, the proper value being found by trial only.

$B^1$ is an accumulator of 6-12 volts, and $B^3$ is another accumulator of 6 volts. The filament circuit may, however, be tapped off $B^1$, in which case the connections indicated in dotted lines are to be used. These connections may not be attached to the battery feeding the oscillating valve filament.

The H.T. supply to the main oscillatory circuit is applied through the H.F. choke coil X, which may be a No. 250 Igranic or similar coil; alternatively, 300 turns of No. 28 S.W.G. D.S.C. wire can be wound on a 1½ in. cardboard or paxolin tube. The same source of supply can be tapped off to A, B, to feed the control circuit. The condenser $C^4$ and its associated circuits must therefore be capable of withstanding the full pressure of the H.T. supply.

In connection with the operation of the control device, it will be necessary to make the value of the battery $B^4$ about 3 volts, and that of $B^2$ about 6-7½ volts, or about twice the value of $B^4$, to begin with. A small metal filament lamp inductively coupled to the coil $L^5$ will be found of great use to the experimenter to determine the *degree* of modulation; speech is clearly reproduced on the lamp. The whole arrangement constitutes a simple but most efficient method for application to a valve oscillator, and ensures consistently good results with a minimum of waste. The reproduction of music is especially good.

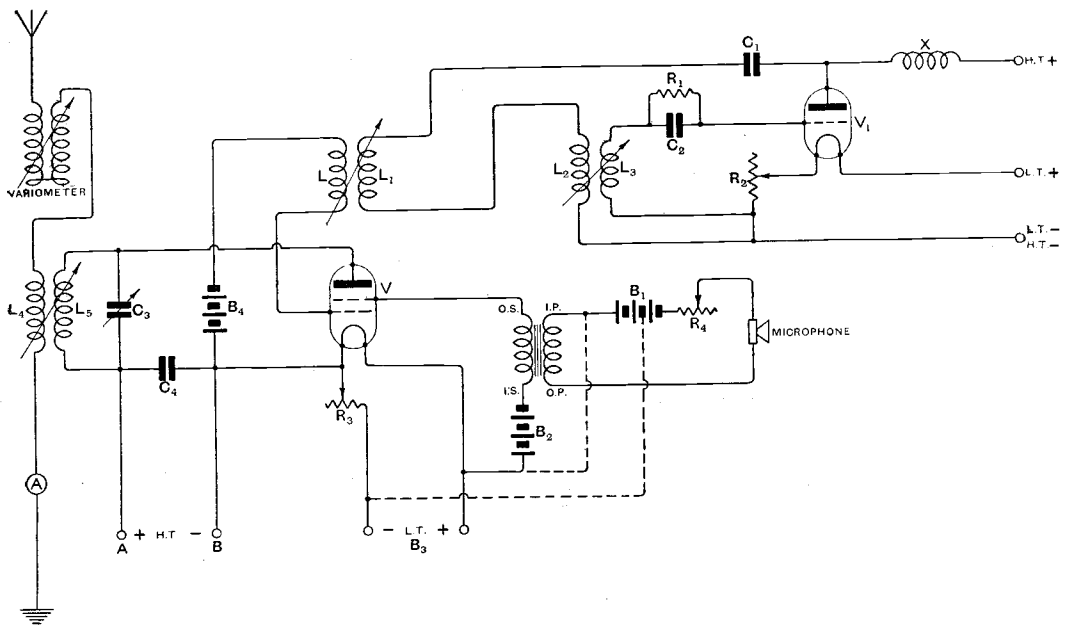



*Fig. 5. Circuit of the complete transmitter.*

"DESIGN FOR A CABINET RECEIVER" Owing to pressure on our space we regret having to hold over the continuation of this article until next week.

# THE USE OF HAND-SCREWING TACKLE.

## PRACTICAL POINTS ON CUTTING SIMPLE SCREW THREADS.

In these days of easily obtained component parts for wireless constructional work, one is apt to imagine that most forms of apparatus can be assembled without paying very much attention to the matter of forming screw threads, but experience proves that a carefully graded selection of screwing appliances is practically essential, even for the amateur who is content to build up his own sets from ready-made components.

By RICHARD TWELVETREES, A.M.I.Mech.E.

AS soon as real experimental work is commenced, the need for adequate screwing tackle is particularly obvious; for, as has been mentioned previously in these articles, individual initiative is very much hampered if one's energies are confined to working up apparatus from designs that are accepted as standard.

Even when one relies entirely upon bought components, the necessity for easing or extending the threads on screwed parts soon becomes apparent, and many an earnest worker has been compelled to lay aside some interesting piece of constructional work for the want of suitable tools to correct or alter certain threaded portions of the work.

### Standardising Threads in Instrument Work.

Although for reasons of economy in production the sizes of threads used in wireless work are not very numerous, it is somewhat remarkable to notice how many sets are built up by using an unnecessary variety of dimensions in screws, studs and tapped holes. This happens more particularly in the smaller sizes, and obviously calls for a wiser selection of screwing tackle than would otherwise be the case.

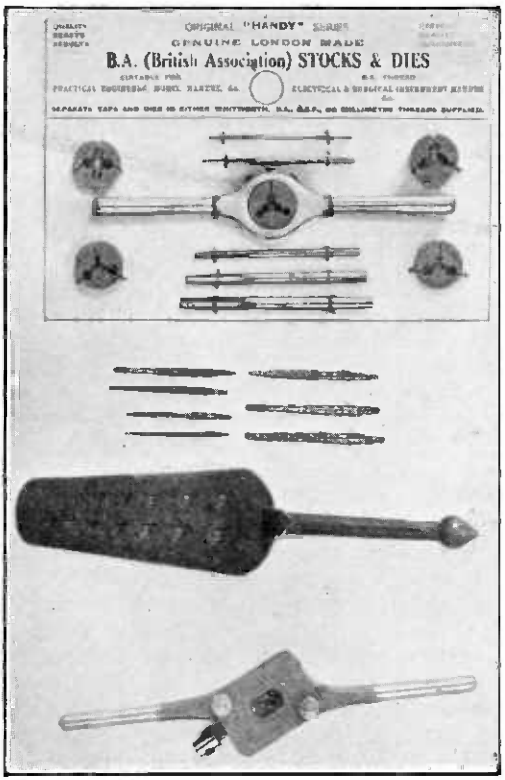



*Fig. 1. Circular stocks and dies, screw plate and taps, and adjustable screw plate.*

In designing their apparatus, amateurs should be careful to prepare their drawings so that two or three sizes of threads only are required, instead of employing as many as five or six. This precaution not only limits the expense of the tools required, but also effects a considerable saving of time in the workshop.

Another very important point to bear in mind is that the liberal use of screwed parts enables one to increase the general accessibility of the apparatus, which is, of course, highly desirable in all forms of experimental apparatus. Soldered joints will, if properly made, provide good electrical connections, but where apparatus is to be tried out to compare the results obtained by using different circuits, an easily detachable mechanical connection is of

greater importance. Accessibility should be regarded as the keynote for successful experimental sets, and this obviously demands the free use of screwing tackle.

**Screw Plates for Easing Threads.**—In cases where it is decided to build up sets with the aid of screwed stick, it will probably be found that this form of material is apt to vary in diameter, owing to the wear on the dies used in the machines on which it is made. The variation may not be very serious, but nuts which should fit with ease may have to be strained right along the thread before they come to the position where the grip is required, and in such a case the trouble can be corrected by using the simple form of screw plate shown in the group of tools in Fig. 1. These plates can be purchased to cut standard BA. sizes and are usually supplied in sets, together with corresponding taps. It should be remembered, however, that they are not designed to cut full threads from round stock, and if so used will last for a very short time. Furthermore, owing to the fact that they are not adjustable in any way, misuse in the direction mentioned will cause them to wear and thus fail to cut, or ease, full threads when required to do so.

At a later stage, when dealing with methods of making simple tools, it will be explained how these screw plates can be made by the amateur himself from old files.

When purchasing this simple form of screwing tackle, it may be noticed that the taps supplied are only of the taper variety; which means that they will not cut full threads in blind holes, such as are often required for fitting components to ebonite panels. If this is found to be the case, an extra set of plug taps must be bought at the same time.

**Cutting Full Threads.**—Unless one has had some experience in the use of stocks and dies, it is advisable to select those of the full adjustable pattern, by means of which the cutting edges of the dies can be regulated to cut the thread very gradually. This has two advantages, first the threads can be cut true with the axis of the material, and second, there is little danger of stripping the thread by forcing the dies too deep into the metal at the first attempt. There is nothing easier than to cut crooked threads if the dies are not used properly, and this kind of fault detracts very much from the workmanlike appearance of any set, besides impairing its efficiency. Crooked threads prevent studs from standing upright in panels and cause nuts to lie unevenly when tightened up. The form of full adjustable stock and die shown in the illustration is therefore recommended for the beginner at constructional work.

Now just a few hints as to the use of dies. As has been mentioned already, it is a mistake to attempt to cut a full thread

*Fig. 2. BA. Tapping gauge, set of BA. stocks and dies, and tee tap-holder.*

straight away, and therefore the pressure on the dies provided by the adjustable screw should be very slight when they are first worked down the metal. In this way the die will follow the rod and thus take up an even path, and enable a straight thread to be cut. The depth of cut may then be gradually increased, until the edges of the threads assume the correct vee form. At this stage a standard nut should be tried on the thread, and if necessary further cuts should be made until the nut runs easily down the thread for its entire length. When long threads are being cut, the metal removed from the rod may have the tendency to clog the dies and thus cause the threads to jamb and strip. At the first sign of clogging the direction of movement must be reversed, and if this fails to remove the obstruction, the dies must be withdrawn from the stock and cleaned out thoroughly. No lubrication is necessary for cutting threads in brass, but thin oil must be used with dies employed on steel.

The form of circular die shown in the holder is adjustable within rather fine limits, and is very useful for those who have passed the stage of crooked threads. This kind of tool is quicker to use than the full adjustable type, as different sizes of dies can be fixed in position very rapidly.

For all round experimental work it is advisable to obtain a complete set of B.A. stocks and dies, including all sizes from No. 10, the smallest thread likely to be required, up to No. 0, above which size nothing is likely to be needed; except special threads that have to be cut in the lathe.

**Forming Threads by Tapping.**—Every wireless amateur is familiar with the taps used for making threads in drilled holes, but the proportion who can rely upon tapping holes truly vertical is somewhat small. This failing is not confined to amateurs, for the work of professional instrument makers often bears traces of a similar kind of defect.

The smaller sizes of taps are extremely delicate tools, and have to be handled with a corresponding amount of care, otherwise one finds the bill of replacements somewhat heavy, to say nothing of the jobs that get scrapped owing to the presence of a broken tap that cannot be extracted.

If difficulty is experienced in cutting threads square with dies, the operation of making tapped holes perfectly vertical is even more difficult, except when one takes proper precautions in beginning the job. Many people fall into the error of starting the tap in an incorrectly drilled hole, which may either be too large, too small, or else out of the vertical. In either of these cases the tapping will not be easy, but for the moment we will assume that we are sufficiently practised to drill the holes accurately. Next comes the important matter of selecting the proper sized drill for a given size of tap, for which purpose a tapping drill gauge (shown in Fig. 2), is used. By dropping the drill through the hole corresponding to the size to be tapped, it is easy to determine the correct diameter to use, which will leave just sufficient material to allow of a full thread being formed.

If the hole is to be tapped right through a piece of material, a start is made with the taper tap, which drops part of the way into the hole and thus centres itself, more or less accurately, in a vertical direction. It is only when one becomes thoroughly accustomed to tapping that the eye alone can be relied upon for making the threads square, and in any case it is a very good plan to test the shank of the tap with a try square, when commencing to cut the thread. It is necessary, too, that the tap be tried in both vertical planes, for it can be square when looked at from the front and very much the reverse when viewed from one side. Having run the taper tap through the hole it is followed by the plug tap, which cuts the thread to the full depth.

As in the case of the dies, the direction of movement of the tap should be reversed occasionally to prevent jambing, as when the tap sticks there is a great danger of it snapping off. Tapping blind holes in ebonite panels needs very careful handling, because the taper tap is useless, and the full thread has to be cut at once with the plug; or, if one is available, a second tap, which comes halfway between a taper and plug tap. In this operation squaring the tap up assumes very great moment, as any misjudgment may result in scrapping the entire panel. All work to be tapped must be held firmly in the vice, and the wrench used for twisting the tap round handled very lightly. It is not necessary to exert any

downward pressure on the tap when it is cutting a thread, because the action of the tool is sufficient to work its way through the material being tapped, and for this reason the lighter the wrench the better. For the small sized taps it is best to use a light tee wrench (shown in Fig. 2), which grips the tap in a chuck jaw and permits of very delicate use.

**Broken Taps.**—When one has had the misfortune to break a few taps in making up components, it becomes easy to realise the need for taking great care, for the business of extracting a broken tap is often more difficult than making up a complete receiving set. Should the tap break off when one end projects right through the work, it can be worked out fairly easily, but the real trouble begins should a plug tap break off in a blind hole. The offending part can sometimes be extracted by carefully unscrewing it with a fine pointed punch, which is used in conjunction with a light hammer. In other cases the metal in which the broken tap is fixed can be heated, which softens the tap to permit of its being drilled out; though this is a very difficult process. Failing all other attempts to get the tap out by fair means, it must be punched right through the metal or other material, and the damaged hole drilled out to the next tapping size, which is afterwards tapped out with an increased amount of care.

Broken taps can sometimes be ground down and used again, but by far the best plan is to take very great precautions with the object of preventing such breakages.

# "BLIND SPOTS" and "FADING OF SIGNALS."

*Investigation being undertaken by the Radio Research Board with the co-operation of Amateurs.*

By S. R. CHAPMAN, B.Sc.

IN the issue of May 12th, 1923, an article was published stating that the Radio Research Board were, through the Radio Society of Great Britain, inviting the co-operation of amateurs in an investigation into the occurrence of "blind spots" and "fading signals" observed during the reception of broadcasting and signals from other transmitting stations.

Pads of forms for recording observations have been forwarded to over 200 observers who are willing to assist in this investigation.

The following article should be of interest to them and serve as a guide when preparing future reports, but it can be easily understood that no attempt can be made as yet to give any analysis of the reports received, as only two months' results have come to hand from a few observers.

Before going into the question of recording observations it would be as well to make a few remarks concerning the distribution of these 200 observers.

In an investigation of this type it is very important that information should be obtained from all parts of the country, as, unless this is the case, the value of any conclusions drawn from the analysis of reports received will be greatly diminished, consequently the Radio Research Board will be very glad to hear from any readers willing to help in this investigation, who reside in the districts mentioned in which no observers are as yet taking part.

Generally speaking half the Midlands and the North of England are very well represented, but in the East, South and West there are some large districts which are not.

So far there is nobody taking observations in Cornwall; Devonshire has only produced two observers, one at Appledore, one at Princetown; Dorsetshire and Wiltshire are unrepresented, and between Bristol and Southampton there are only two.

Another big district where there are very few observers comprises nearly all the East, and part of the Midlands. Within the district enclosed by an imaginary line joining Grimsby, Bawtry, Nottingham, Birmingham, Cheltenham, Oxford and Ipswich there are only four towns where there are observers, namely Loughborough, Cambridge, Sudbury and Norwich. If this line be traced out on a map, it will be seen that it is quite a large part of England.

With regard to Wales, there are several observers in and around Swansea, but the rest of the country is only represented by two observers. It would be a matter of interest when making analysis of reports from all districts received, to make comparison between results obtained in this mountainous district, and in the Fenn district where the Board hope to get some more helpers.

For similar reasons they would be glad to have more observers in Ireland. There are a few observers in Ulster, but none south of Belfast. Any observations from here taken on the British Broadcasting Company's Stations will be extremely useful in noting any effect the intervening 80 miles or more of sea may produce.

Before concluding the remarks on the distribution of observers, it should be noted that Cumberland is unrepresented as yet, also Hampshire and Berkshire are only represented at Southampton, Portsmouth and Newbury.

EXAMPLE I.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Date. | Standard time. | Station Transmitting. | Wave Length | Type of emission. | Signal Strength at time indicated. | Remarks. |
| 1.7.23 | 10.36 | **GFA** | 1,680 | C.W. | 9 | |
| | 11.10 | **FNB** | 1,400 | C.W. | 6 | |
| | 11.20 | **GKU** | 2,100 | C.W. | 8 | |
| | 11.45 | **FFB** | 600 | Spk. | 7 | |
| | 11.52 | **OST** | 600 | Spk. | 7 | |
| | 11.56 | **FFH** | 600 | Spk. | 7 | |
| | 12.15 | **GED** | 900 | Speech | 8 | |

EXAMPLE II.

| | | | | | | |
|---|---|---|---|---|---|---|
| 26.7.23 | 15.30 | **5 IT** | 420 | Speech | 3–5 | Strength varying from 3–5. No X's. |
| 30.7.23 | 20.30 | **2 ZY** | 385 | Speech | 4–0 | Strength varying from 4–0. Faint X's. |
| 17.7.23 | 11.30 | Croydon | 900 | Speech | Fair | At 11.39 signals were much plainer, and sun was shining. At 11.30 no sun. |
| 19.7.23 | 13.00 | **2 ZY** | 385 | Speech | Strong | |
| 24.7.23 | 17.30 | **SRF** | 1,780 | Speech | Fair | Occasionally faded for about $\frac{1}{4}$ min. |
| 28.7.23 | 21.29 | **2 LO** | 369 | Music | 8 | Decreased to 1 for about 15 secs., then returned to normal alternately. |

EXAMPLE III.

| | | | | | | |
|---|---|---|---|---|---|---|
| 22.8.23 | 22.25 | **2 LO** | 369 | Speech | 7 | 3 valves. No fading. |
| | 22.26 | ,, | ,, | ,, | 4 | |
| | 22.29 | ,, | ,, | ,, | 6 | |
| | 22.29½ | ,, | ,, | ,, | 8 | |
| | 22.30 | ,, | ,, | ,, | 8 | No fading noticed. |
| | 22.31½ | ,, | ,, | ,, | 8 | |
| | 22.33 | ,, | ,, | ,, | 9 | Audible across the room. |
| | 22.34 | ,, | ,, | ,, | 7 | 3 valves used with no reaction. |
| | 22.38 | ,, | ,, | ,, | 6 | |
| | 22.40 | ,, | ,, | ,, | 6½ | |
| | 22.40½ | ,, | ,, | ,, | 7 | Fading very gradual. |
| | 22.41 | ,, | ,, | ,, | 7 | |
| | 22.41½ | ,, | ,, | ,, | 7 | |
| 23.8.23 | 21.46 | ,, | ,, | ,, | 6 | Using 3 valves with no reaction. |
| | 21.46½ | ,, | ,, | ,, | 5 | |
| | 21.47 | ,, | ,, | ,, | 7 | |
| | 21.47¼ | ,, | ,, | ,, | 4½ | Fading very marked and every 15 seconds. |
| | 21.47½ | ,, | ,, | ,, | 8 | |
| | 22.01 | ,, | ,, | ,, | 7 | |

After considering the reports already received, there are one or two remarks the author would like to make for the guidance of those who are preparing reports to be sent in in the future.

In a few cases the observations recorded were of very little value, and the reports had to be disregarded. In order to explain the reason for this, it will be best to give some examples, and readers will easily understand why this had to be done.

The forms issued by the Radio Research Board required the following particulars: (i) details as to name, address, local surroundings of station, etc., which we will leave for the moment, and (ii) observations recorded in tabular form, of which examples are given on this page.

Let us now consider these examples :—

*In Example I.*—There is no data of any use in an investigation on "Fading." All one can learn from this observer's report is that he is able to hear a good number of stations (there were many more similar notes on different dates), and that the strength of signals received were good in the majority of cases.

In the "Remarks" column there is not even an indication that "fading" ever takes place. It can easily be seen why such a report has to be disregarded, there being no observation on any one station for any length of time.

*In Example II.*—The author has included abstracts from three different types of reports received from three other stations. In the case of each of these, the same fault as explained in Example I occurred, *i.e.*, too many stations observed for very short periods of time, combined with other errors. In all these types the remarks in columns 6 and 7 are too vague. In the first case the observer has noted that the signal strength was "3-5, 4-0." We can see from this that fading does occur at this station, but there is no indication as to whether it is periodic, *i.e.*, once every one, three or ten minutes, or only occasional. In the second case the signal strength has not been recorded in the manner asked for in the notes on the pad of forms supplied, *i.e.*, by the numbers 0-9, but by such remarks as "Weak, Fair, Not bad, etc." Confusion can easily arise here as to whether "Weak" written opposite two stations means the same strength, or weaker than usual for that station.

The third case is rather similar to the first, although we are given an approximation as to the time the fading lasts.

The observations in Example II, therefore, are really too vague to allow one to use them in the analysis which is contemplated.

*Example III.*—Having considered the cases which had to be disregarded, this example will give an indication as to the type of report that is of greatest use in this investigation.

It can be seen that here we have a continuous observation on one station for 20 minutes or so, actual times of the "fading" are recorded, and how soon the signal has regained its normal strength. The example given is only one picked out at random, and better ones could have been cited where more than one transmitting station has been under observation for a quarter of an hour at a time on the same evening.

This example will suffice as a general guidance to those who are making reports, and indicates the most useful lines along which observers can work.

The author hopes that before very long, observations will be able to be organised along still more ideal lines, and the following brief outline on some general points should be of use.

In quite a large number of cases, observation forms have been sent out to members of a Wireless Society, which means that all those observers are known to one another and in the same district.

It would greatly facilitate the analysis of reports that are being sent in, if observers would arrange amongst themselves to observe the same transmitting stations on the same day or night, at the same time. A letter is being sent to the Secretary of the Radio Society of Great Britain, with the request that he would be good enough to circularise the Secretaries of the affiliated Societies with regard to this matter, and the ideal case will be when not only are the members of one district observing the same stations, but those of another district in a different part of the country are observing them at the same time.

There is one other remark that should be included concerning the pads of forms supplied, and that is with regard to the information required about the "Situation of Station." One paragraph to be filled in is headed "Local Surroundings of Station—(Town, Country, Woods, Hills, etc)." One or two observers have been rather concentrating on the particulars required in the next paragraph, *i.e.*, stating distances to nearest buildings, isolated trees, etc., but have not given us information of the general surroundings asked for in the preceding paragraph, *i.e.*, presence of woods, hills, valleys or other geographical features in the near vicinity.

In closing, observers are reminded that when taking observations the receiving apparatus should remain unaltered. The author knows full well the temptations that always assail one to adjust this or that part, but in investigating a matter of this type, the strength of a signal received, it will be seen that the result of making such alterations will be to make the records bear no relation to one another, and therefore should not be indulged in unnecessarily. Any such adjustments that one is forced to make should be carefully noted in Column 7, *e.g.*, any alteration made to filament current, batteries, any change of wavelength that may have been noticed or whether the bearing of the transmitting station, if observed, varied during the fading period.

However, there is another point to be borne in mind. If one has been forced to make some adjustments it does not follow that the records are useless, as they can be used as a check on other results from the same district, for in this investigation it is important to discover if fading occurs simultaneously at two different receiving stations in the same district, or if it is only a local influence that is producing fading at one spot and not another a quarter of a mile away. Therefore observations should still be recorded provided a note is made in Column 7 as mentioned.

One should add that up to the present not many reports have been received, but one must blame the holidays a good deal, as the reports in question were for the months of July and August. Out of the 200 pads of forms sent out only 48 reports have been returned.

With regard to the districts mentioned, from whence the Radio Research Board would be glad to hear from others willing to help us in this investigation, forms for recording observations may be obtained from the Secretary, Department of Scientific and Industrial Research (For Radio Research Board), 16, Old Queen Street, London, S.W.1. (If so addressed, no postage stamp is necessary.)

# LOOSE COUPLERS—II.

By W. JAMES.

(*Continued from page 143 of previous issue.*)

**Loose Couplers.**

(*B*) The type of loose coupler shown in Fig. 7 is still a favourite with many amateurs, in spite of its several disadvantages. It is, however, fairly simple in construction. The coil showing on the left of the figure is the secondary winding, and it is tapped, the connections being made with the contacts of a stud switch. The coil is moved by turning the knob which is attached to the end of the screwed rod. The primary winding has a larger diameter than the secondary, and in the construction illustrated is boxed in. The contacts of the large stud switch are connected with the tappings taken from this coil. Both coils have a single layer winding, although when larger inductances are required, multilayer windings are used.

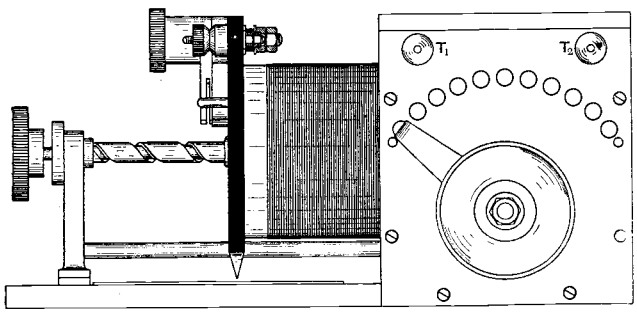



*Fig. 7. An excellent short wavelength loose coupler.*

Referring to Fig. 8, the outside winding consists of a number of basket coils of small radial depth threaded on a circular former; alternatively, the former may be provided with a number of pegs and the wire wound in a suitable manner to give a multilayer coil with well-spaced turns. The secondary coil may be wound with a bank form of winding, or if preferred, the turns may be spaced with ebonite strips between the layers.

It is desirable that these coils be short and of large diameter rather than long and thin. This follows from the consideration of coil efficiency discussed in earlier sections.

(*C*) It has been found that fairly good results may be obtained by fixing the primary and secondary coils so that the coupling is permanently loose. The construction of a coupler which will provide a large variation of inductance in this case is a simple matter.

Referring to Fig. 9, the windings consist of a number of air-spaced multilayer coils.

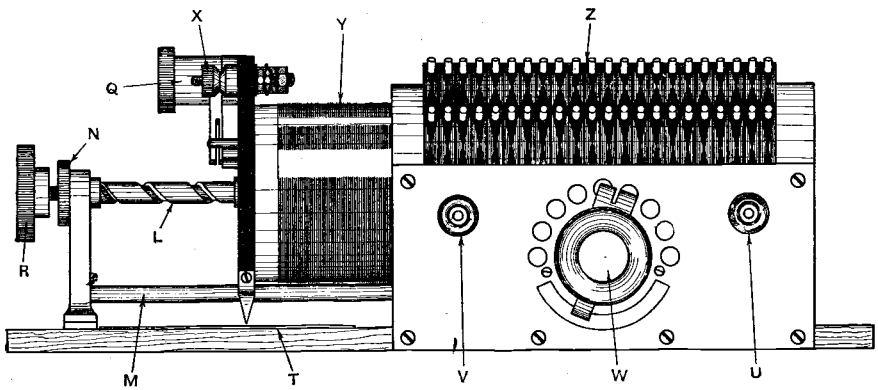



*Fig. 8. Another type of long wavelength loose coupler with multilayer windings. The primary winding is Z, which is tapped by switch W, and connection is made with terminals V,U. The secondary winding is Y, which is tapped by switch Q; the connecting terminals are X. The secondary coil is moved by turning knob R and rod L. N is a lock nut, and slides along bars M. The pointer moves over the scale T.*

Those on the side marked 5 are tapped and connected to the stud switch 1, and form the primary winding. The circuit connections are made with the terminals 3. The coils on the side marked 6 form the secondary

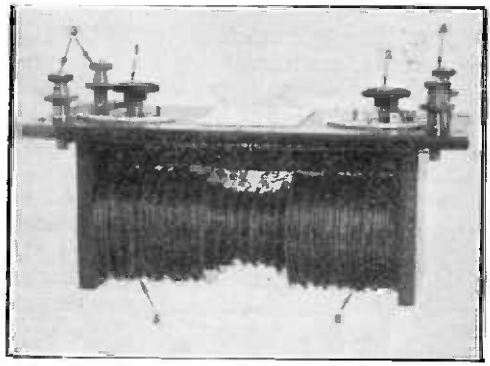


*Fig. 9. A tuner with multilayer coils. The coupling is fixed. (H. W. Sullivan, Ltd.)*

winding, and tappings are taken off to the switch 2. The circuit connections are made at the terminals 4. The centre coils are switched into circuit first, and as the knobs of the switches are rotated, the outer coils are connected. The switch blades are wide enough to make contact on two studs at the same time. This reduces losses due to end effects by short-circuiting one coil section between the coils in use and those which are not used.

(*D*) A good method of coupling one circuit with another is by using a piece of apparatus called a vario-coupler. A usual construction is illustrated in Fig. 10. Here the tapped stator coil is marked 2, the rotor 4, and rotor winding 5. The rotor is carried on the shafts 6 and 3. The knob and dial are fixed to the end of 6. The vario-coupler may be fixed with screws passed through the feet 1.

It will be observed that a vario-coupler is constructed something like a variometer, but because very tight coupling is in general not required, there is no need to shape the stator and rotor with the object of bringing the windings very close together. In those cases where a tight coupling is required, for instance, when the rotor winding is connected in a circuit to provide reaction effects in the circuit associated with the stator, the rotor may be wound with several layers of wire.

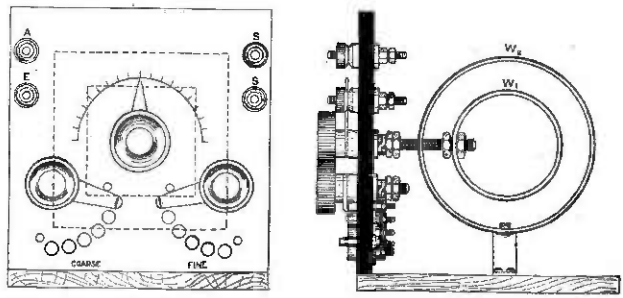



*Fig. 11. Showing the construction of a tuner. The fixed coil $W_2$ has two sets of tappings for rough and fine tuning respectively. The rotor $W_1$ is connected in the secondary circuit.*

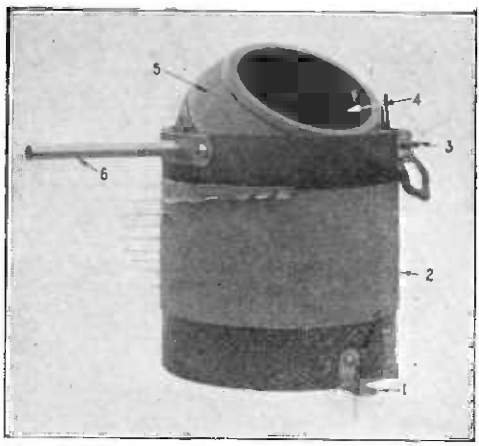



*Fig. 10. A vario-coupler. (Igranic Electric Co.)*

This form of coupling is very suitable for a tuner. The stator winding may be tapped, for example, at groups of turns and single turns, as shown in Fig. 11. The tappings are taken to stud switches, one being used for rough tuning and the other for fine tuning. The rotor winding is connected in series with another tapped coil, which is fixed where it has no coupling with the vario-coupler and forms the secondary circuit.

(*E*) When a large tuning coil is required, which is partly self-tuned, and variable in steps, the turns of wire may be wound in grooves provided in an ebonite former. This sort of coil is often used in the anode circuit of a valve which operates as an amplifier of high frequency currents. It

is then generally called a reactance coil, because it is designed to offer a large effective resistance to the high frequency currents. If the coil is tuned to the high frequency currents, its effective resistance will be very high—in fact, infinitely great if it had no ohmic resistance.

A very good example is illustrated in Fig. 12. Here, 1 is a knob which is attached to the spindle 7. When the knob is turned, the contact brush 6, which is fastened with lock nuts to the spindle, turns with it, making contact with the studs. The turning movement is limited by the pins 5. The wire is wound in the grooves of the ebonite former 4, and tappings are taken to the metal tags. The connecting wires are clearly shown in the figure, lying along the surface of the former. They are soldered to the tags, which are held in place and therefore make contact with the switch studs. The pointer which is fastened to the knob is marked 2. To fix the reactance unit to a panel, only one hole is required to take the screwed bush 3.

When two distinct reactance coils are required for connecting in different circuits, it is convenient to have a switch which will

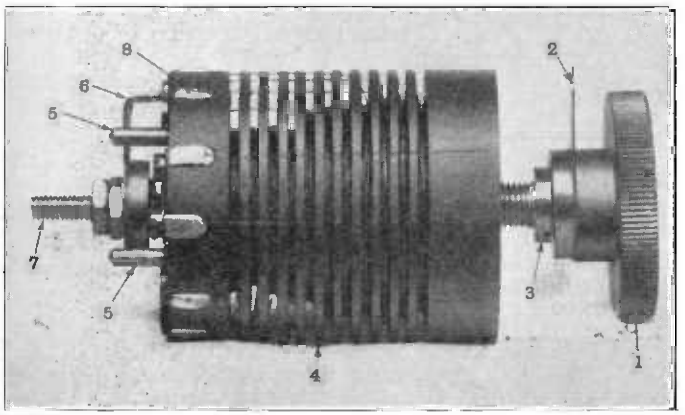



*Fig.* 12. *A reactance unit, which consists of a tapped winding.* (*Lissen, Ltd.*)

connect equal portions of both coils into the circuits at the same time.

A unit of this description is illustrated in Fig. 13. The two coils are marked 1 and 2. Each is tapped and the connections brought to contacts. The switch carries two blades, which are insulated one from the other, 3 and 4. When the knob is turned, an equal part of each reactance coil is connected in the circuits completed from the terminals.

(*F*) It is often desirable to couple a tapped coil, such as described in the last

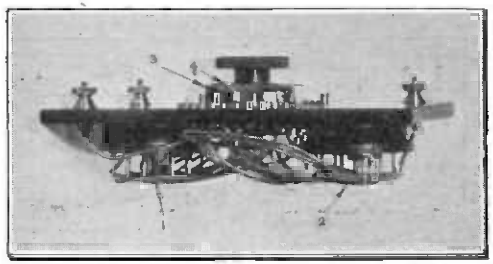


*Fig.* 13. *A reactance unit consisting of two distinct coils, with one two-point switch for switching equal parts of each coil in circuit.* (*H. W. Sullivan, Ltd.*)

section, with another coil. For example, the tapped coil may be connected in the plate circuit of a valve, to operate as a high-frequency amplifying unit. The amplification obtained, in general, increases as the effective resistance of the plate circuit coil. Consequently, if the effective resistance is increased, an increase in amplification may be expected. The coil may be self-tuned; that is, the self-capacity of the coil may be such that it is tuned to the frequency of the signal to be amplified, or it may be tuned with a variable condenser. In any case, the losses of the circuit are large, because the coils are wound with fine wire, and through end effects. Tuning may be made sharper, and therefore the effective resistance of the plate circuit to the signal greater, if the losses are partly neutralised. The desired results are obtained by coupling a coil, which is connected as a reaction coil, with the anode circuit winding. The coupling should be variable for best results.

A simple but skilful design is illustrated in Fig. 14. The unit consists practically of the tapped coil of Fig. 12, with a second coil. Referring to the figure, 1 is the knob which is fixed to the spindle 7. The spindle carries the switch contact arm 11, which moves over the contact studs. The coil 8 is tapped, and connections are made with the metal tags 9, which are held by the contact

studs. To prevent the switch turning too far, the stopping pins 10 are fitted. The coil 8 has a central hole, so that when the knob 1 is pulled away from the end plate, knob to serve as an indication of the position of the tappings switch. The moving coil slides along the rods 6, and the end movement is limited by the block 12.

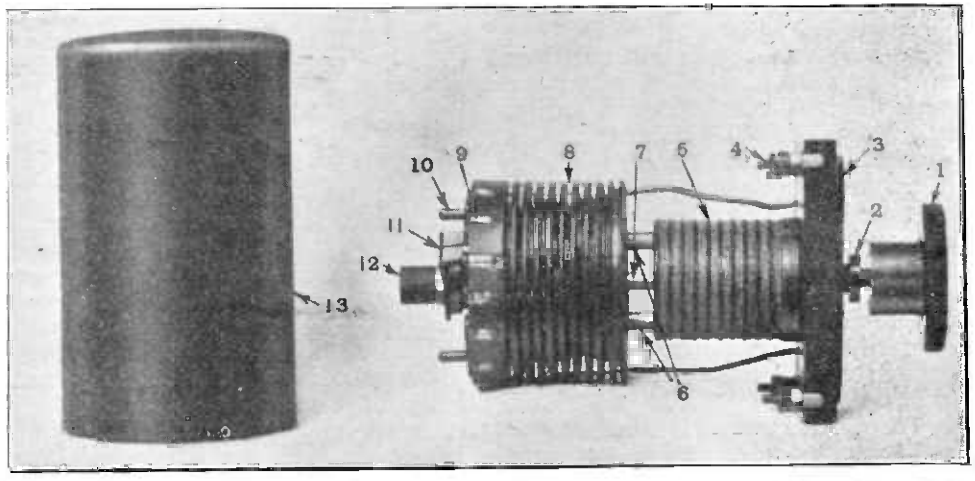



*Fig.* 14. *A tapped reactance unit with a coupling coil for providing reaction effects.* (*Lissen, Ltd.*)

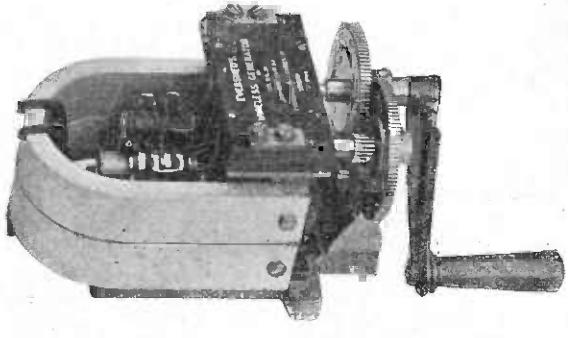
coil 8 is moved over the fixed coil 5. The windings of 5 are connected as a reaction coil. Connections are taken from the terminals 4, and the unit is fastened to a panel by the screwed bush 2. The scale is marked 3, and a pointer is screwed to the

The whole instrument is enclosed in a metal case 13, which shields the windings.

With an instrument of this sort, very close adjustment of coupling is easily obtained.

# A HAND GENERATOR FOR TRANSMITTERS.

Those experimenters who are interested in wireless transmission will no doubt be pleased to learn that a generator capable of delivering 1,000 volts has been designed and may be purchased from Messrs. Evershed & Vignoles, Limited.



The hand-driven generator is illustrated. The generator may be obtained with a pulley for belt driving if preferred. Special attention has been paid to the design, so that the direct current obtained is free from objectionable ripple, and therefore from the humming which is set up by many ordinary generators. The instrument is built something on the lines of the famous Evershed "Megger." Special attention has been given to the bearings and the brush gear, and the machine may be run for considerable periods without requiring attention.

When the handle is turned at the rate of eighty revolutions per minute, the output is of the order of 1,000 volts. A current up to 40 milliamperes may be taken from the machine. This is quite sufficient for supplying power to two 10-watt valves connected in parellel.

# A NEW DUAL CIRCUIT.

By JAMES STRACHAN, F.Inst.P.

NUMEROUS experiments with dual magnification circuits, on account of the difficulties attending the control of extra H.F. or L.F. circuits applied to the dual valve, have led me to concentrate on getting the best out of a single valve circuit with crystal rectification.

The accompanying diagrams show a circuit that gives extraordinary results for long distance reception, sharp tuning, selectivity, and quiet working. With proper setting of the crystal rectifier the control is easy and in the hands of a careful worker there is no risk of energising the aerial to cause interference.

There is no novelty in the valve circuit, which has a tuned anode for H.F. amplification, crystal rectification, and L.F. magnification through a transformer. Neither is there any novelty in the application of reaction by the anode coil C to the extra untuned coil B between the aerial and the grid, Fig. 1. Reaction has also been obtained in other circuits by coupling the coil D between the secondary of the transformer and the aerial in other ways.

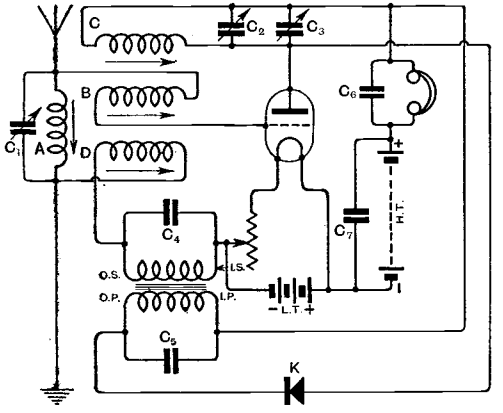



*Fig. 1. Theoretical diagram of the dual amplification circuit described.*

The novelty in this circuit consists in the mode of applying reaction by the two coils C and D of equal value or very approximately equal value to the extra coil B in the grid circuit.

The method of operating the circuit for distant stations is to remove coils B and D from the three-coil holder and replace them with short-circuiting plugs while the crystal, is set by buzzer or Morse stations. The filament is then dimmed, coils B and D replaced, and the three coils C, B and D coupled closely—parallel, but not touching. Tune in the usual way with the aerial condenser $C_1$ and the tuned anode condenser $C_2$ and $C_3$ (the latter a two or three plate vernier). When a station is heard, coils C and D should be opened outwards away from B very slowly until the best position is found. Very exact and slow movement of these coils is essential by means of a rack or micrometer action, as in, for example, Burndept or Polar holders. The anode tuning is critical and the vernier essential, final tuning being obtained with the latter.

The aerial tuning is broad, generally extending over 10–15 degrees of the 0·0005 condenser, but the optimum point is quite sharp. The weakest point in this, as in all dual circuits, is the crystal rectifier. I find galena (or synthetic crystals of the type such as hertzite, markonite and talite) much better than perikon or carborundum. When the crystal contact is too hard, only the loudest station is heard, and that not too strongly. A very slight reduction of pressure in contact brings in satisfactory reception. Too loose a contact gives first microphonic noises, then a crackling like bad atmospherics, and finally, when the cat-whisker is just off contact, complete instability of the circuit with oscillation. For this reason the cat-whisker should not be lifted from the crystal during reception or tuning.

A crystal detector in which the cat-whisker is held rigidly and capable of micrometer movement is essential. With a stable setting of the crystal, broadcasting stations may be received without the slightest risk of oscillation, as the reaction is not applied directly to the A.T.I., but to the extra coil in the grid circuit. Such circuits are not to be played with, however, by the

amateur with the average cheap crystal detector fitted with a fine hair-like cat-whisker. Given a stable, easily-set crystal rectifier, this circuit would be at once the ideal one-valve set, capable of receiving all the B.B.C. stations at any place in the British Islands.

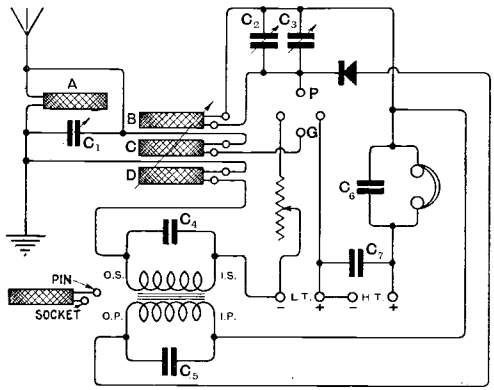



*Fig. 2. Simplified practical wiring diagram. The references B,C should be read as C,B to correspond with Fig 1.*

At Aberdeen, which is about 500 miles from London, under the best atmospheric conditions, **5 NO, 2LO** and **2 ZY** may be heard six feet from the phones on the table; **5 SC** and **5 IT** are quite good, but **5 WA** is weaker. With a No. 35 Igranic coil in the A.T.I. No. 50 in B and two No. 75's in C and D, I find it impossible to tune in **2 LO** and **5 WA** while all the other stations may be received. With No. 35 in B and two No. 50's in C and D, the converse is the case. The L.F. transformer used was an Elwell, and both primary and secondary were shunted with fixed condensers as indicated.

I have not had any opportunity of experimenting with this circuit close to a B.B.C. station. It would be advisable to use a frame aerial in commencing such experiments. I am hopeful, however, that this circuit may be developed in two ways. First, to receive distant stations while cuting out a local station, and secondly, by improving the crystal rectification. I hope in the future to give some results on these points. Meanwhile I may state that the results obtained with the circuit are the most promising of any single-valve circuit tried. Reception on my aerial (45 ft. long, 25 ft. high) is about the same strength as that on a neighbouring amateur's set of four valves (without reaction) working off a 100 ft. aerial fully 5 ft. higher.

The direction of the coil windings should be carefully noted. Coils C and D both react on B to increase signal strength, but as C and D approach each other there occurs mutual neutralisation of their reaction on B. When C and D are parallel, reaction is at a minimum, and when at right angles to each other, at a maximum, but the latter position is not generally possible. There is a critical angle however, between the planes of C and D for a particular frequency of a given strength where the reaction on the coil B, included in this angle, is at a maximum strength, without oscillation of the valve.

In this position coils C and D restrain each other's reaction on B, but at the same time give jointly stronger reaction without oscillation than is possible with a single reaction coil. This balance of inductance between the two coils C and D, one in the anode circuit and the other in the grid circuit, is peculiarly sensitive to the reception of weak signals. This method of obtaining reaction may be aptly termed "balanced reaction." It will be observed that reaction in this way is not obtained by moving the reaction coils towards B as in ordinary reaction, but by moving them away from B. When C and D, however, are opened out to an angle, the movement of one of them in either direction about the balancing position will produce oscillation, or tend to do so.

The results mentioned above were obtained with the components of the circuit lying on the table, the only efficient wiring being that of a small home-made experimental valve panel. The valve used was an ordinary Cossor with about one-third of the filament resistance in circuit, but good results were also obtained with a hard French "R" valve. L.T. 6 volts and H.T. 90 to 100 volts.

## A NEW TYPE OF

# PRIMARY BATTERY.

IT is well known that primary cells of the ordinary type are not able to supply a continuous load, such as, for example, the filament current of a valve receiver. The new Darimont battery, however, appears to be an exception in this respect, as it is claimed that it is capable of giving a considerable current of steady voltage over much longer periods than cells of other types. It is well known that a two-fluid cell has marked advantages over one-fluid cells, in that the current is more constant because the depolarisation is generally more effective and more rapid. The cell, therefore, has a porous pot. The plates are of carbon and zinc, and the liquid depolariser around the carbon consists largely of ferric chloride. The electrolyte around the zinc consists of a paste made up of sodium chloride, calcium carbonate, and other materials, so that the electrolyte is always maintained neutral, consequently local action is negligible. The zinc chloride which is formed when the cell is in action remains in solution, and the ferric chloride becomes reduced. Both liquids are inodorous. The cell generates an E.M.F. of 1·6 volts, and there is very little change in internal resistance during discharge.

The accompanying illustration shows a type 15 cell, which is rated at 0·75 ampere intermittent discharge for two hours daily. The cell usually consists of a container made of glass, in the centre of which is the porous pot. The space between the top of the container and the top of the porous pot is filled in with a sealing compound which holds the carbon plates and porous pot in position.

*The Darimont Primary Battery.*

The curve Fig. 1 shows the average voltage of the cell during periods of discharge. When the cell is discharged down to one volt, the average output obtained is 85·5 ampere hours or 92 watt hours. It will be noticed the voltage during discharge is remarkably steady until practically the end of the useful discharge.

The cell is recharged by renewing the electrolyte and depolariser.

It is thought that the type T.15 cell, having a nominal capacity of 75 ampere hours, will be suitable for supplying the filament current of valves, especially when the receiver is located where it is difficult to have an accumulator properly cared for.

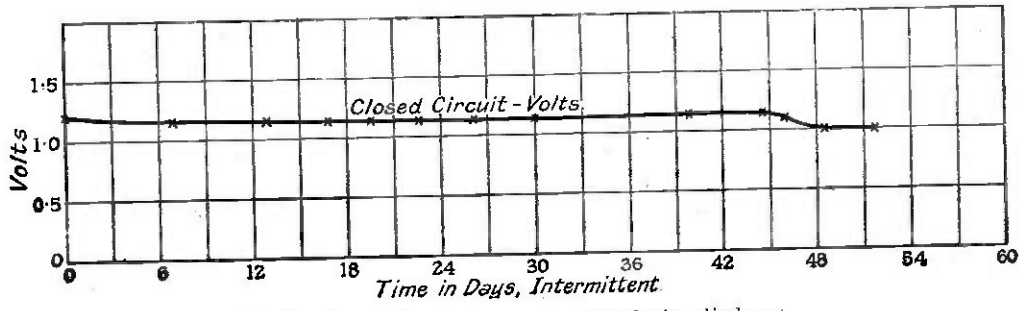



*Fig. 1. Curve showing average voltage during discharge.*

# CORRESPONDENCE

## Legal Points for the Amateur.

*To the Editor of* THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I have read with interest the article headed "Legal Points for the Wireless Amateur" by your Legal Authority, and thoroughly appreciate all he has to say with regard to the position of the amateur and his landlord.

He, however, seems to have overlooked one or two points, and takes rather an optimistic view of some of the chances where a landlord may take advantage of imposing penalties on a wireless tenant. Could he give me some information with regard to the following questions:—

(1) Assume damage is done to a roof when fixing an aerial, and further, that a storm of rain attacks the house before the repairs take place, and damages the ceiling; who pays?

(2) Supposing a gale attacks the aerial mast and the pole falls, breaking the slates, tiles or spouting; who foots the bill?

(3) In dismantling an aerial, damage is done to the chimney or wall to which it is attached; what is the position? particularly if the damage is only found out after the tenant has left.

(4) A mast or pole in a common garden may not be a nuisance, but if it should fall and injure any person or property, who is called upon to pay under such circumstances?

Your legal correspondent seems to discredit the danger of lightning, yet recently a leading daily paper reported considerable lightning damage to a house at Royston in Hertfordshire.

Again, the question of insurance. Several insurance companies have provided the amateur with a special policy to cover his set, and one insurance company, who were the pioneers of this class of business, has now brought out a policy to cover any difficulty with the landlord. Has your legal correspondent had any correspondence with the experts of this Company, because if so, there are numbers of your readers who would like to have his opinion on these policies.

ENQUIRER.

Bishop's Stortford.

## Broadcast Reception in Cornwall.

*To the Editor of* THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I was interested in reading of the results obtained with a four-valve receiving set in West Cornwall, but was surprised at the writer stating that this was probably the first time broadcasting had been heard "in this remote part of Cornwall." Although remote, it possesses several keen amateurs who picked up the early transmissions of **PCGG, 2MT, 2LO,** and of more recent date, American broadcasting on a single valve! It is interesting to recall that some time ago Senator Marconi, hearing of their efforts, gave them a special telephony transmission from his yacht, then off the coast, and on a wavelength which he kindly allowed them to choose for themselves.

While agreeing that the strength of certain broadcasting stations is at times extraordinary, considering their distance, results are extremely variable in this locality, and there is no consistent service for the public, as is found in other parts of the country within working range of the eight stations. Cardiff has proved a complete failure in serving the West, and the new Bournemouth station is little better. In my opinion, broadcasting will not go ahead in West Cornwall until a satisfactory relay station is established at Plymouth, or even further west.

GEO. LAITY.

Launceston.

## Long Range Reception with Crystal.

*To the Editor of* THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—Reading this week's issue of *The Wireless World and Radio Review*, I see under the "Notes and News" heading a report of long distance crystal reception, and I should very much like to know if anyone has equalled the following achievement.

I have been experimenting for some time with a crystal set, and have heard the following list of telephony stations. I will place them in order of strength received:—

**5IT** Birmingham, very good, distance approximately 54 miles.

**5WA** Cardiff, very good, distance approximately 80 miles.

**2LO** London, very good, distance approximately 77 miles.

**6BM** Bournemouth, not quite so good, distance 80 miles.

**5SG** Glasgow, quite good, distance 340 miles.

Croydon Air Station, quite good, distance 77 miles.

L'Ecole Supérieure, Paris, quite loud at times, but fades for long periods, distance 290 miles.

**2ZY** Manchester, readable, but very faint, distance 140 miles.

**5NO** Newcastle, readable, but very faint, distance 260 miles.

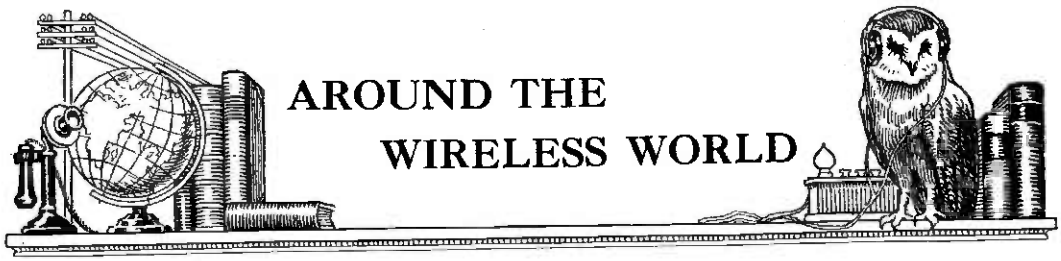
**2BD** Aberdeen, speech quite readable at times, music always heard faintly, distance 420 miles.

(This station I heard the second night it was working.

"Rectarite" is the crystal used, with a very rough home-made set. For the tuning coil I used a frame aerial with 0·0005 condenser in parallel, outside aerial is twin 40 ft., about 25 ft. high.

R. C. OAKEY.

Clanfield, Oxon.




### Clearing the Air.

In our Editorial of the last issue we announced that the Postmaster-General had agreed that by payment of 15s. annually instead of 10s. the experimenter need not sign a declaration to the effect that he would not use Broadcasting programmes for entertainm nt.

A further welcome statement which satisfies the point of principle raised in our Editorial of the issue of October 3rd last has been received from the Post Office dated November 1st. In this communication it is made clear that those who held Experimental licences prior to the date of issue of the new licence regulations, may continue to enjoy full privileges of their licence and to renew such licence at the present rate of 10s. per annum. no restricting declaration nor additional fee being required from them.

### The MacMillan Arctic Expedition.

A freak reception from the *Bowdoin*, Captain Donald MacMillan's exploration ship, has been reported by the United States Army Signal Corps at Santa Catalina Island (California).

On October 26th the vessel was 11 degrees from the North Pole, and from this point she was in direct communication with Santa Catalina, 3,700 miles distant. The *Bowdoin* reported heavy snow and temperature well below zero. The sun had come up for a few minutes that day for the last time before the winter.

On Sunday, October 28th, a service was specially broadcast to the expedition from the Bethany Presbyterian Church at Omaha (Nebraska). Regarding a service broadcast on a former occasion, the *Bowdoin* reported perfect reception and declared that the transmission had been highly appreciated.

### Wireless for Lonely Outposts.

The trading posts provided by the Hudson Bay Company for communication with the Eskimos, and situated within the Arctic circle, are to have their usual six months of monotony relieved by listening-in sets. Two steamers engaged in collecting furs are proceeding to the six principal trading posts, each of which will be equipped with a wireless receiving set.

### School Radio Apparatus.

At the All-British Wireless Exhibition, the Radio Society of Great Britain has kindly allotted a part of their stand for the exhibition of radio apparatus made by pupils from schools which are members of the Schools Radio Society. This feature should prove very attractive as it should give the public some idea of the advanced state of wireless knowledge in many schools.

Members of the above Society can obtain admission tickets at the reduced fee of ninepence each, by applying to the Hon. Sec., Mr. R. J. Hibbard, M.Inst., R.E., Grayswood Mount, Haslemere.

### The Late Dr. Steinmetz.

The death at Schenectady, New York, on October 26th, of Dr. Charles Proteus Steinmetz, removed one of the most prominent figures in the sphere of modern electrical research. Born in Germany in 1865, he studied mathematics, electrical engineering and chemistry at Breslau, Berlin and

*The late Dr. Steinmetz (on right) and T. A. Edison examining a broken insulator.*

Zurich. Proceeding to America he was, in 1893, appointod consulting engineer of the General Electric Company, a position he held until his death. In 1902 he undertook the Professorship of electro-physics in Union University, New York, which gave him the degree of Ph.D.

Dr. Steinmetz was an indefatigable research worker, and the results of his investigations were embodied in a series of books published between 1897 and 1917. He was a past-president of the American Institute of Electrical Engineers and the Illuminating Engineering Society, and at Schenectady, New York, he took part in local educational and administrative affairs.

### An American Amateur Test.

We have been informed by Mr. J. V. Newson (**2 GF**), of 139, Ormside Street, London, S.E.15, that American **5 AKQ** will be calling him at 3 a.m. on 200 metres on the following dates :—November 11th, 17th and 25th, December 2nd, 9th, 16th, 23rd and 30th. The transmissions will be on C.W. at the rate of ten words per minute. He will close down at 4 a.m. G.M.T.

Mr. Newson would be grateful for any reports on these transmissions.

## FORTHCOMING EVENTS.

**WEDNESDAY, NOVEMBER 7th.**

**The Institution of Electrical Engineers (Wireless Section).** At 6 p.m. Address by Mr. E. H. Shaughnessy, O.B.E. (Chairman).
**B.T.H. Radio Society.** At 7.30 p.m. Musical Evening at Caldercott Girls School, Church Street, Rugby.
**East Ham and District Radio Society.** At 7.30 p.m. at the Church Army Social Centre, Barking Road. Informal Meeting.
**Stockport Wireless Society.** At 7.30 p.m. At Mersey Chambers, King Street, East. Lecture: "Wireless Calculations." By Mr. S. G. Leigh.
**Edinburgh and District Radio Society.** At 117, George Street. Business Meeting and Informal Meeting.
**Clapham Park Wireless and Scientific Society.** At 8 p.m. At 67, Balham High Road. Lecture: "Short Wave Reception." By Capt. H. S. Walker.

**THURSDAY, NOVEMBER 8th.**

**The Hackney and District Radio Society.** At the Y.M.C.A., Mare Street. Lecture: "Hart Accumulators: Their Maintenance and Manufacture." By Mr. F. J. Holmes, A.M.I.E.E. (Manager Hart Accumulator Co.).
**Ilford and District Radio Society.** Informal meeting.
**Luton Wireless Society.** At 8 p.m. At Hitchin Road Boys' School.
**Battersea and District Radio Society.** At 8 p.m. At Clapham Social Club. Lecture: "1½ k.w. Ship Set." By Mr. A. E. Duffield.

**FRIDAY, NOVEMBER 9th.**

**The Wembley Wireless Society.** At 8 p.m. At Park Lane School. Lecture: "Comparative Results in Reception." By Mr. W. R. Mickelwright, A.M.I.E.E.
**Sheffield and District Wireless Society.** At 7.30 p.m. At the Dept. of Applied Science, St. George's Square, Elementary Class. Conducted by Mr. S. G. Jackson, M.Sc.
**Leeds Radio Society.** At 7.30 p.m. At Woodhouse Lane, United Methodist Church Schools. Lecture: "Experimental Station, **5 US.**" By Mr. J. Croysdale.
**Sale and District Radio Society.** At 8 p.m. At 27, School Road, Annual Meeting.
**Norwich and District Radio Society.** Lecture: "Rejector Circuits." By Mr. Taunton.
**Radio Society of Highgate.** At 7.45 p.m. At the 1919 Club, South Grove. Lecture: "The Growth of a Transmitter." By Mr. F. G. S. Wise.

**TUESDAY, NOVEMBER 13th.**

**Plymouth Wireless and Scientific Society.** At 8 p.m. At the Y.M.C.A. Building, Old Town Street. Sales Night.

**WEDNESDAY, NOVEMBER 14th.**

**East Ham and District Radio Society.** At 7.30 p.m. At the Church Army Social Centre. Lecture: "Low Frequency Amplifying."
**Streatham Radio Society.** Lecture: "Polarised Light." By Dr. J. J. Fox, O.B.E., F.I.C.
**Stockport Wireless Society.** At 7.30 p.m. Lecture: "The Development of the Exchange Telephone System." By Mr. A. Roberts.
**Edinburgh and District Radio Society.** Lecture: "Theoretical Principles of Radio Transmission." By Mr. M. G. Scroggie, B.Sc.
**Royal Society of Arts.**—(Ordinary Meeting.) Monsieur Edouard Belin. "The Electric Transmission and Reproduction of Writing, Designs and Photographs Without Wires." Mr. Alan A. Campbell Swinton, F.R.S., will preside.
**Barnet and District Radio Society.**—At 8 p.m. at the Radio Club Room, Bell's Hill, Barnet. Lecture and Demonstration by a representative of Messrs. S. G. Brown, Ltd.

## Radio Society of Great Britain.

An informal meeting of the Society will be held at the Institution of Electrical Engineers on Wednesday, November 21st, at 6 p.m., when a paper will be read by Mr. G. P. Mair, entitled "Aerial Construction and Design."

An ordinary general meeting of the Society will be held at the Institution of Electrical Engineers on Wednesday, November 28th, at 6 p.m. (tea at 5.30). A lecture, illustrated by lantern slides, on "Leafield Imperial Wireless Station" will be delivered by Mr. E. H. Shaughnessy, O.B.E., M.I.E.E., M.I.R.E.

### Reduced Entrance Fees to Wireless Exhibition.

Hon. Secretaries of Societies affiliated to the Radio Society of Great Britain are reminded of the special reduced rates of admission to the All-British Wireless Exhibition which are to be allowed to their members. Reduced rate tickets (at 9s. per dozen) can be obtained from Mr. H. L. McMichael, 32, Quex Road, West Hampstead, N.W.6. The number required should be definitely stated, as no refund can be made on unused tickets. Hon. Secretaries should write at once for an application form.

## CATALOGUES, PRICE LISTS, ETC., RECEIVED.

**Sterling Telephone and Electric Co., Ltd.** (210-212, Tottenham Court Road, W.1.). Illustrated pamphlets of their No. 2 Crystal Receiving Set, No. R1201 Crystal Receiver with Low Frequency Amplification and various Variable Condensers. An illustrated Price List of Sterling and Magnavox Loud Speakers. A reduction in prices is noted.

**The Chloride Electrical Storage Co., Ltd.** (Clifton Junction, near Manchester). Illustrated Catalogue "P" of Exide Batteries (portable). We note a special range of accumulators (Type HZ) for use with "dull emitter" valves.

**The Hightensile and Ebonite Mfg. Co., Ltd.** (Normandy Works, Custom House, E.16.). Trade Price List of Ebonite Accessories.

**W. J. Hillier** (3, Beaufort Gardens, Lewisham, S.E.13). Illustrated Pamphlet describing a Compound Coupled Variable Condenser with lead or lag adjustment. Recommended for use where reaction to H.F. coupling is employed.

**The Telephone Manufacturing Co., Ltd.** (Hollingsworth Works, Martell Road, West Dulwich, S.E.21). A new Autumn Catalogue and Price List, well illustrated, under the title of "True Music Radio Sets, Components and Accessories." A special section contains useful information on methods of getting the best results from your sets and the remedies for common faults.

**The Edison-Swan Electric Co., Ltd.** (123-5 Queen Victoria Street, E.C.4). A 50-page Catalogue of Complete Sets and all Accessories, illustrated and complete with index.

# Broadcasting.

**REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS:**

### GREAT BRITAIN.

**LONDON 2 LO,** 363 metres; **MANCHESTER 2 ZY,** 370 metres; **BIRMINGHAM 5 IT,** 423 metres; **CARDIFF 5 WA,** 353 metres; **NEWCASTLE 2 NO,** 400 metres; **GLASGOW 5 SC,** 415 metres; **ABERDEEN 2 BD,** 497 metres; **BOURNEMOUTH 6 BM,** 485 metres. Regular daily programmes. Weekdays, 11.30 to 12.30 p.m. (**2 LO** only). 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 to 5 p.m., 8.30 to 10.30 p.m.

### FRANCE.

**PARIS (Eiffel Tower), FL,** 2,600 metres. Daily, 6.40 to 7 a.m. Weather Forecasts; 10.5 a.m. (Thursday and Friday), 11.15 to 11.30 a.m., Time Signal and Weather Forecast; 12.0 noon, Live-stock prices; 3.40 p.m. (Saturday excepted); Financial report. 5.30 p.m. (Saturday excepted) Bourse Closing Prices; 6.10 p.m., Concert or Address; 7 p.m., Weather Forecast; 7.20 p.m. (Sunday), Concert and Address; 10.10 p.m., General Weather Forecast.

**PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), SFR,** 1,780 metres. Daily, 12.30 p.m., Cotton, Oil and Café Prices, News, Concert; 1.45 p.m., First Bourse Report; 4.30 p.m., Bourse Closing Prices; 4.45 p.m., Concert; 5.45 p.m., News and Racing Results; 8.30 to 9.30 p.m., News; 9.10 p.m., Concert; 10 p.m. to 10.45 p.m., Radio Dance Music.

**ECOLE SUPERIEURE des Postes et Télégraphes,** 450 metres 3.30 to 4 p.m. (Wednesday and Friday), 7.45 p.m. to 10 p.m. (Tuesday and Thursday), Tests (Music, etc.); 2.30 p.m. to 7.30 p.m. (Saturday), Tests (Music etc.).

**LYONS, YN,** 3,100 metres. Daily, 9.45 a.m. to 10.15 a.m., Gramophone Records.

### BELGIUM.

**BRUSSELS, BAV,** 1,100 metres. 1 p.m. to 5.30 p.m., Meteorological Forecast; 9 p.m. (Tuesday), Concert.

### HOLLAND.

**THE HAGUE, PCGG.** Temporarily suspended.

**THE HAGUE (Heussen Laboratory), PCUU,** 1,070 metres. 9.40 to 10.40 a.m. (Sunday), Concert; 9.40 to 10.40 p.m., Concert; 7.45 to 10 p.m. (Thursday), Concert.

**THE HAGUE (Velthuisen), PCKK,** 1,070 metres. 8.40 to 9.40p.m. (Friday), Concert.

**IJMUIDEN (Middelraad), PCMM,** 1,050 metres. Saturday, 8.40 to 9.40 p.m., Concert.

**AMSTERDAM, PA 5,** 1,100 metres (Irregular). 10 to 11 a.m., Concert; 5 to 6.30 p.m., Concert; 8.10 to 9.10 p.m., Concert.

### DENMARK.

**LYNGBY, OXE,** 2,400 metres. Daily, 9.30 a.m., 3.40 p.m. and 8.45 p.m., Meteorological Report in Danish; 7.30 p.m. to 8.45 p.m., Concert (Sunday excepted).

### GERMANY.

**BERLIN (Koenigswusterhausen), LP,** 4,000 metres. (Sunday), 10 to 11 a.m., Music and Lecture; 2,700 metres 11 a.m. to 12 noon, Music and Lecture. Daily, 4,000 metres, 6 to 7 a.m., Music and Speech; 11.30 a.m. to 12.30 p.m., Music and Speech; 4 to 4.30 p.m., News

**EBERSWALDE,** 2,930 metres. Daily, 12 to 1 p.m., Address and Concert; 7 to 8 p.m., Address and Concert; (Thursday and Saturday), 5.30 to 6.30 p.m., Concert.

### CZECHO-SLOVAKIA.

**PRAGUE, PRG,** 1,800 metres. 7 a.m., 11 a.m. and 3 p.m., Meteorological Bulletin and News; 4,500 metres, 9 a.m., 2 p.m., and 9 p.m., Concert.

**ZIKBEL (near Prague),** 1,000 metres. Daily, 6.20 p.m., Concert, Meteorological Report and News.

### SWITZERLAND.

**GENEVA, HB 1 (Radio Club de Genève).** Temporarily suspended.

**LAUSANNE, HB 2,** 1,100 metres. Tuesday, Thursday, Saturday, p.m., Concert; Monday, Wednesday, Friday and Saturday, p.m., Concert.

### SPAIN.

**MADRID,** 1,650, 2,200 metres (Irregular). 12 to 1 p.m., Tests.

**MADRID, PTT,** 400 to 700 metres. 4 to 5 p.m., Tests.

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## Gambell Bros.' Wireless Apparatus.

Messrs. Gambell Bros. are to be represented in the West End of London by Messrs. Eustace Watkins, Ltd., who have a completely equipped showroom on the first floor of 91, New Bond Street.

# Calls Heard.

Walthamstow, E.17.

**2 AC, 2 BO, 2 FP, 2 FQ, 2 HD, 2 JX, 2 KF, 2 KT, 2 LO, 2 LZ, 2 MF, 2 MJ, 2 MT, 2 NM, 2 OD, 2 ON, 2 OM, 2 PB, 2 PX, 2 QQ, 2 SF, 2 SH, 2 VW, 2 XP, 2 XR, 2 XX, 2 XZ, 2 ZO, 2 ZY, 5 AG, 5 CB, 5 DT, 5 HI, 5 IC, 5 IO, 5 IT, 5 OA, 5 OP, 5 PU, 5 NO, 5 SC, 5 UL, 5 VD, 5 VR, 5 WA, 5 WR, 6 IM. 6 JM, 6 LS, 6 NF.**
S. D. Ison (**6 PJ**).

Golder's Green, N.W.11.

**2 AH, 2 AJ, 2 BZ, 2 DC, 2 DZ, 2 FP, 2 FQ, 2 KF, 2 LT, 2 MK, 2 MS, 2 OD, 2 OM, 2 ON, 2 OS, 2 QQ, 2 SF, 2 SZ, 2 TI, 2 TV, 2 UV, 2 VW, 2 WD, 2 WJ, 2 XB, 2 XI, 2 XZ, 2 YR, 2 ZO, 2 ZZ, 5 BT, 5 BV, 5 C8, 5 CK, 5 DI, 5 CP, 5 HW, 5 HY, 5 LF, 5 LP, 5 LZ, 5 PU, 5 SU, 5 VD, 5 VR, 6 IM, 6 JX, 6 LJ, 6 NI, 6 NF, 6 KI, 6 QZ, 6 TM, 8 AQ, 8 AW, 8 BM, 8 CM, 8 BA.** (1 H.F.—D).
(P. L. F. Jones).

Kingston-on-Thames.

**2 AA, 2 AD, 2 AF, 2 AH, 2 AJ, 2 AM, 2 AN, 2 AO, 2 AQ, 2 AU, 2 AW, 2 AX, 2 AZ, 2 BM, 2 BZ, 2 CZ, 2 DC, 2 DF, 2 DX, 2 FG, 2 FN, 2 FP, 2 FQ, 2 FU, 2 FX, 2 ID, 2 HR, 2 HS, 2 HT, 2 HX, 2 IF, 2 IL, 2 JF, 2 JL, 2 JM, 2 JU, 2 JX, 2 JZ, 2 KF, 2 KT, 2 KW, 2 KX, 2 KZ, 2 LP, 2 LT, 2 LV, 2 LW, 2 LZ, 2 MA, 2 MF, 2 MI, 2 MK, 2 MM, 2 NA, 2 NH, 2 NM, 2 NQ, 2 OD, 2 OM, 2 ON, 2 OU, 2 PA, 2 PB, 2 PL, 2 PU, 2 PW, 2 PX, 2 PZ, 2 QD, 2 QI, 2 QL, 2 QS, 2 QU, 2 RB, 2 SF, 2 SH, 2 SI, 2 SX, 2 SZ, 2 TA, 2 TB, 2 TI, 2 TO, 2 TV, 2 UC, 2 US, 2 UV, 2 VJ, 2 VK, 2 VS, 2 VW, 2 WA, 2 WD, 2 WJ, 2 XB, 2 XI, 2 XL, 2 XP, 2 XR, 2 XZ, 2 YA, 2 YG, 2 YH, 2 YJ, 2 YQ, 2 YR, 2 ZK, 2 ZO, 2 ZT, 2 ZZ, 2 KV, 2 QQ, 2 PY, 2 MO, 2 PN, 2 JA, 2 KK, 2 KR, 2 WK, 2 LD, 2 FJ, 2 TP, 2 SL, 2 LU, 2 MS, 2 IK, 2 KO, 5 AT, 5 AU, 5 BT, 5 BV, 5 CB, 5 CF, 5 CP, 5 CV, 5 DN, 5 DT, 5 HY, 5 IO, 5 IS, 5 KO, 5 LF, 5 LP, 5 MA, 5 MS, 5 MT, 5 NN, 5 OX, 5 PU, 5 PV, 5 QB, 5 SU, 5 UQ, 5 VD, 5 VP, 5 VT, 5 XR, 5 XT, 5 WS, 5 WR, 5 GJ, 5 VR, 5 DK, 5 HI, 5 CX, 6 IM, 6 JS, 6 JX, 6 LJ, 6 KI, 6 HY, 6 OP, 6 OY, 6 NF, 6 IY, 6 QZ, 6 RM, 6 RJ, 8 AA, 8 AB, 8 AQ, 8 BF, 8 BM, 8 BN, 8 BV, 8 BA, 8 AW, 8 CS, 8 CZ, 8 XY, 8 XX, 8 GF, 8 DP, 8 CD 8 DA, 8 CM, 0 MX, 0 YS, 0 BQ, 0 AA, 0 NY, 0 RD, 0 XA, PC 11.**
(1 and 2v.). (W. J. Thompson).

Ashford, Middlesex.

**2 AA, 2 AH, 2 AO, 2 AQ, 2 AW, 2 AZ, 2 CA, 2 CH, 2 DC, 2 DF, 2 DT, 2 DX, 2 FN, 2 FP, 2 FQ, 2 FU, 2 GW, 2 IJ, 2 IN, 2 IT, 2 JF, 2 JO, 2 KF, 2 KP, 2 KT, 2 KW, 2 KX, 2 LK(?), 2 LO, 2 LT, 2 MF, 2 MO, 2 NA, 2 NM, 2 OD, 2 OM, 2 ON, 2 OP, 2 OX, 2 QQ, 2 SF, 2 SH, 2 TM, 2 UV, 2 VP, 2 WK, 2 WR, 2 WS, 2 XI, 2 XR, 2 YE, 2 ZO, 2 ZS, 2 ZZ, 5 AN, 5 AX(Spk.), 5 BV, 5 AO, 5 CP, 5 CX, 5 DI, 5 GB, 5 EV(Spk.), 5 HI, 5 HY, 5 IO, 5 LP, 5 NO, 5 OX, 5 PO, 5 SC, 5 VP, 5 YR, 6 HD, 6 IM, 6 BV, 6 NF, 6 NI, 6 OY, 6 IY, 6 TM, 6 QZ, 7 FP, 8 AA, 8 AB, 8 AN, 8 AQ, 8 ARA, 8 BV, 8 CF, 8 CM, 8 CN, 8 CS, 8 CZ, 8 QZ(?), 0 AA, 0 BQ, 0 DV, 0 FN, 0 MX, 0 NY, 0 NY, 0 PO, 0 YS.** American, **1 ARL, 1 ZZB, 1 AUC, 1 ACU, 1 ARF, 1 AJN, 1 ALH, 1 ACM, 1 MY, 1 BLN, 1 CMP, 2 II, 2 ZL, 2 CPD, 3 ACY, 3 BG, 3 GE, 4 GX, 4 FT (R-8), 6 TM, 8 AQO 8 GA, 8 BCI, 9 CW, 9 AAW, 3 BFU.** (1 H.F.—D.). (G. Rogers).

Bury St. Edmunds.

**2 AB, 2 AJ, 2 AM, 2 AO, 2 AW, 2 AZ, 2 BM, 2 BT, 2 BZ, 2 CH, 2 CP, 2 CW, 2 DF, 2 DU, 2 DX, 2 FC, 2 FH, 2 FL, 2 FN, 2 FM, 2 FQ, 2 FR, 2 FT, 2 FZ, 2 GG, 2 GL, 2 HD, 2 HF, 2 IF, 2 IM, 2 JF, 2 JX, 2 KD, 2 KF, 2 KL, 2 KM, 2 KN, 2 KO, 2 KQ, 2 KT, 2 KV, 2 KZ, 2 LD, 2 LG, 2 LO, 2 LT, 2 LW, 2 LZ, 2 MA, 2 MC, 2 MD, 2 MT, 2 NH, 2 NM, 2 OD, 2 OF, 2 OH, 2 OI, 2 OM, 2 ON, 2 PB, 2 PG, 2 PL, 2 PW, 2 PY, 2 QN, 2 QQ, 2 QS, 2 RB, 2 RS, 2 SF, 2 SK, 2 SM, 2 ST, 2 SZ, 2 TA, 2 TN, 2 TV, 2 TO, 2 TP, 2 UD, 2 UX, 2 UY, 2 VC, 2 VD, 2 VJ, 2 VQ, 2 VW, 2 WA, 2 WB, 2 WD, 2 WJ, 2 WP, 2 WZ, 2 XB, 2 XD, 2 XI, 2 XR, 2 YE, 2 YQ, 2 ZM, 2 ZO, 2 ZS, 2 ZY, 2 ZZ, 5 BT, 5 CB, 5 CC, 5 CO, 5 CP, 5 CT, 5 CV, 5 CX, 5 DK, 5 DT, 5 FL, 5 FM, 5 GL, 5 HY, 5 IO, 5 IT, 5 KM, 5 KO, 5 MA, 5 MS, 5 MU, 5 NO, 5 NT, 5 PU, 5 QQ, 5 QV, 5 SC, 5 SU, 5 TG, 5 VM, 5 VP, 5 WA, 5 ZW, 6 FQ, 6 HD, 6 IM, 6 NF, 8 AA, 8 AB, 8 AE, 8 AQ, 8 BM, 8 BN, 8 BS, 8 CB, 8 CC, 8 PA, 8 ZZ, 9 CI, 0 DA, 0 DV, 0 FN, 0 NY, 0 YS.** (1 H.F.—D.)
(C. A. Jamblin).

Paris.

**2 AU, 2 DF, 2 FN, 2 FP, 2 FU, 2 GG, 2 GV, 2 HF, 2 JF, 2 KF, 2 KT, 2 KW, 2 KX, 2 LG, 2 NA, 2 NM, 2 OD, 2 OM, 2 ON, 2 RB, 2 UV, 2 VS, 2 WA, 5 BG, 5 BV, 5 CX, 5 FS, 5 HI, 5 KO, 5 NN, 5 OU, 5 QM, 5 RZ, 5 WR, 6 NI, 0 BS, 0DV, 0 NY, 0 YS, PCII, PCMN, 8 AA, 8 AQ, 8 AR, 8 AS, 8 BM, 8 BN, 8 BW, 8 CJ, 8 CM, 8 CS, 8 CZ, 8 DA.** (1 H.F.—D.—1 L.F.). (Y. Perroux) (**8 BV**).

Cambridge.

**2 AH, 2 AO, 2 BF, 2 DF, 2 DU, 2 FN, 2 FQ, 2 FU, 2 IJ, 2 KL, 2 KT, 2 KV, 2 KX, 2 KZ, 2 LW, 2 LX, 2 LZ, 2 NM, 2 NO, 2 NP, 2 OD, 2 OM, 2 ON, 2 PX, 2 QA, 2 QH, 2 QQ, 2 RG, 2 RN, 2 SZ, 2 TB, 2 TO, 2 TV, 2 VJ, 2 VK, 2 VW, 2 WD, 2 WG, 2 WJ, 2 YZ, 2 ZK, 2 ZS, 5 BL, 5 CD, 5 CH, 5 CX, 5 DK, 5 DN, 5 GL, 5 GP, 5 JT, 5 KO, 5 LC, 5 LP, 5 LZ, 5 QV, 5 SC, 5 SU, 5 VM, 5 VR, 5 WR, 5 XR, 6 MO, 6 MZ, 6 NI, 6 OY, 6 TM, 8 AW, 8 BA, 8 BM, 8 BW, 8 CS, 0 XP, 0 DV.** (1 and 2v.)
(G. W. Thomas).

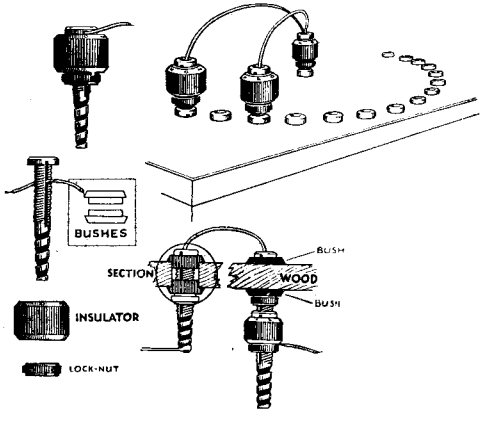
DESCRIPTION OF EXHIBITS

# ALL-BRITISH WIRELESS EXHIBITION

November 8th-21st, 1923.

**Autoveyors, Ltd., 84, Victoria Street, Westminster, S.W.1. Stand No. 16.**

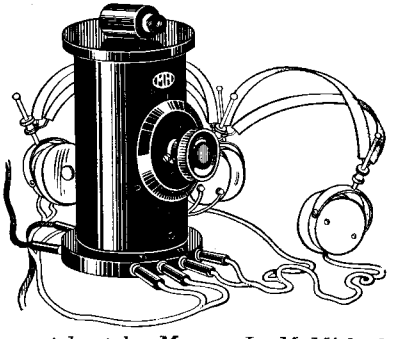
This Company is well known as the manufacturers of the Variable Bridge Condenser (3-E.V.C.) which is obtainable either for a panel mounting or already secured into a box container. There are, as is well known, many applications for this condenser. For facilitating the rapid changing out of circuit connections a new plug connector has been introduced. It consists of a combined plug and socket which provides instantaneous and reliable contact. The "Filtron" Grid Leak, another exhibit, is well known, and it may be pointed out that this instrument can also be used as a potentiometer. A protective device to prevent the receiving apparatus from suffering damage by lightning is known as the "Staticrster," which can be easily fitted in two minutes to protect coils or condensers, and is a new feature of special interest.




*Plug connectors by Messrs. Autoveyors, Ltd.*

**Abbey Industries, Ltd., Abbey Wood Works, Abbey Wood, S.E.2. Stand No. 85.**

A comprehensive range of receiving sets and accessories is exhibited. A miniature crystal receiver of simple design and costing only 10s. 6d., should appeal to those who want an inexpensive set for listening in at distances not exceeding thirty miles from the broadcasting stations. Other models include a new range of valve receiving apparatus so designed as to allow of the full use of reaction. A very compact variable condenser, one-third the size of the usual plate type, is a useful component for building a compact receiver. The Universal Coil Holder is capable of many adaptations. Other components of good design include rheostats, potentiometers, knife switches and other accessories. The "Abbey" Aerial is arranged so that it can be erected in a few minutes, and is quite efficient. A wavemeter built to cover the broadcasting range is another particularly useful instrument.



*Simple crystal set by Messrs. L. McMichael, Ltd.*

**L. McMichael, Ltd., Hastings House, Norfolk Street, Strand, W.C. Stand No. 83.**

Of particular interest are the "M.H." exhibits, which are all entirely British made and of the highest standard both of manufacture and performance. Their stand contains a selection of some of the more important products, and can roughly be divided into Experimental Receiving Sets and Units for the experimenter; Broadcast Sets for the broadcast listener-in; Home Assembly Sets for the home constructor; "M.H." components for the experimenter and constructor; and components and accessories for all purposes. The experimental sets comprise a complete range of high-grade wireless receiving apparatus known as M.H.1, M.H.2, M.H.3, etc., and range from a single detector valve panel to a four-valve series comprising high frequency and low frequency combinations. This series also includes the necessary tuner units such as the M.H.L.C. and M.H.T.A. The unit system provides for the experimenter and general user who has a preference for some system of units. Perhaps the most famous of all the M.H. products are the M.H.B.R.2 and M.H.B.R.2a broadcast receiver and amplifier. It

is claimed for these sets that every British broadcast station can be clearly brought in, as well as Continental telephony. In addition to these, there is the M.H.B.R.3—a three-valve set, and M.H.B.R.4—a four-valve set of similar construction but self-contained. For those who require extra range,

*The McMichael H.F. transformer.*

an additional H.F. panel has been introduced, which, with tuned transformer coupling, greatly adds to the range and selectivity of these sets.

Another M.H. receiver for the broadcast listener-in is the "Everset" Crystal Receiver. This set is designed for variometer tuning, and has a special crystal mounting which, by slight rotation, will definitely reset the crystal.

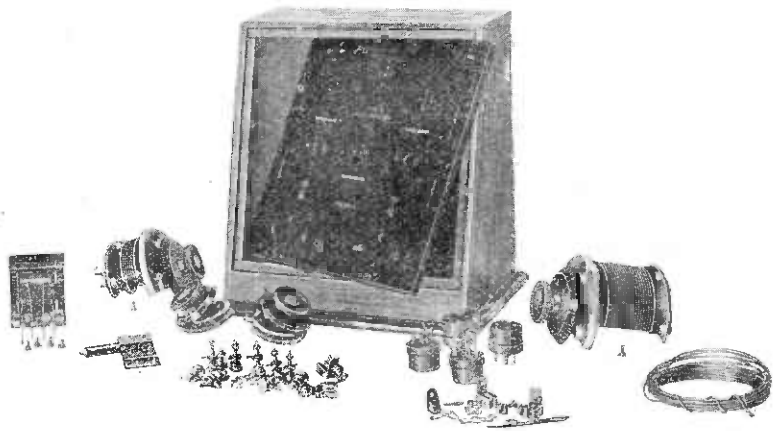
head receivers and loud speakers. A number of components useful to the experimenter may also be seen at this stand, in particular the multi-contact key switches of robust and reliable construction suitable for use in low frequency circuits. Other components are variable condensers, L.F. inter-valve transformers, H.F. transformers, resistances and potentiometers, and connecting jacks, together with well designed lightning protectors.

### J. Burns, Ltd., Wangye Works, Chadwell Heath, Essex. Stand No. 46.

A complete range of receiving apparatus is exhibited here, including four-valve receiving sets, and three-valve sets in cabinet, one-valve receiving panel in box, crystal sets, amplifiers, variable condensers, filament resistances, valve holders, ebonite sheet, engraved ebonite dials and knobs, ebonite handles, condenser vanes, assortments of brass turned work, coil holders of a special type, L.F. transformers special mottled ebonite panels, and Bakolin panels.

### The Bowyer-Lowe Company, Ltd., Letchworth, Herts. Stand No. 6.

No less than fifteen different models of receiving equipment are exhibited by this company, ranging from a very simple crystal receiving apparatus, and advancing step by step to the most elaborate models, which are all particularly efficient and beautifully designed. There is a receiving set to meet



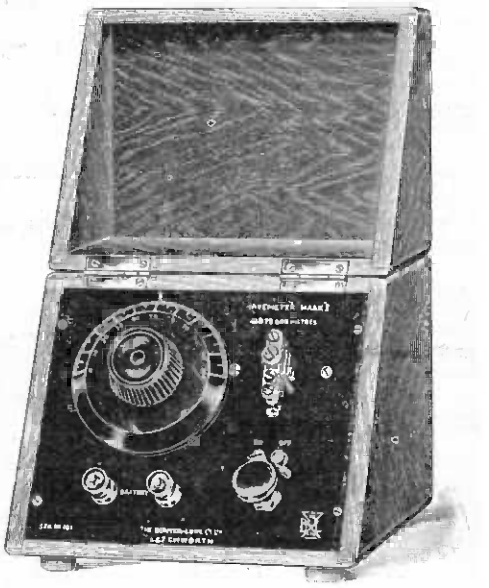
*Complete set of finished parts for building a high grade three-valve set, by Messrs. L. McMichael, Ltd.*

### British L. M. Ericsson Manufacturing Co., Ltd., 67, Kingsway, W.C. Stand No. 104.

The range of broadcasting receivers includes two types of two-valve sets, a crystal set, three and four-valve sets, and a two-valve low frequency amplifier. The instruments are of particularly robust construction, and the number of tuning controls is reduced to a minimum without impairing the receiving range. This company is particularly well known as manufacturers of long standing of telephone equipment and consequently they are specialists in the manufacture of telephone

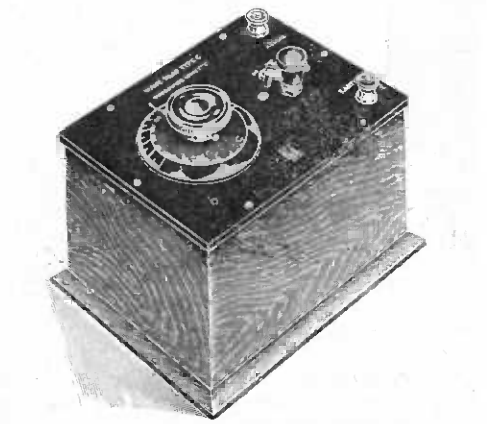
the requirements of every class of purchaser, all of which can be relied upon to function efficiently within the limits of the equipment employed in their construction. A number of other distinctive instruments are also manufactured by this company, and should make a special appeal to the experimenter, such as the Audibility Meter, Universal Testing Bridge, High Resistance Testing Bridge, and apparatus for the calibration of condensers. A Wave-trap rejector unit for the elimination of local interference, of neat design and simple manipulation, is also on view. The use of a wavemeter when

tuning in is becoming almost essential when it is desired to adjust a complicated receiver. The



*The Bowyer-Lowe Wavemeter.*

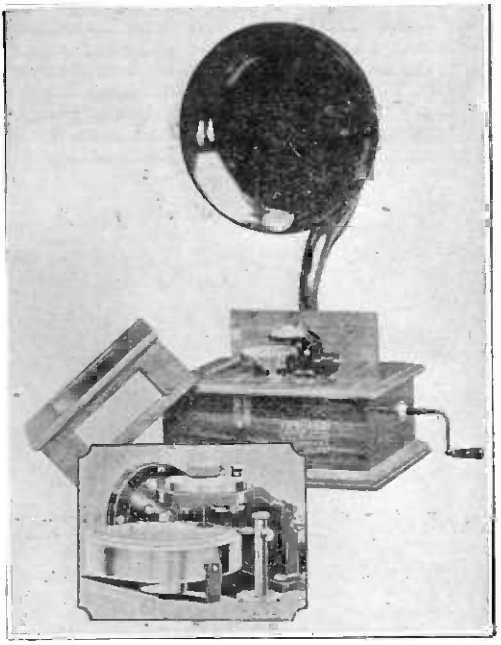
B.L. wavemeter calibrated for use on short wavelengths is therefore an almost indispensable instrument. The home constructor is catered for with a complete set of parts for a two-valve receiver of simple design.



*The wavetrap interference eliminator, by Messrs. Bowyer-Lowe, Co., Ltd.*

**S. G. Brown, Ltd., Victoria Road, North Acton, W.3. Stand No. 102.**

The products of this firm are too well known to need much introduction. A new type of loud speaker, however, is exhibited publicly for the first time which is known as the "Frenophone." This loud speaker makes use of an entirely new principle. It is claimed that it can be employed for the amplification of weak signals to great loudness and without loss of purity, and thus is particularly useful in the reception of broadcasting. It depends for its operation upon the high degree of friction existing between a moving surface of optical glass and a pad of cork or similar substance. The co-efficient of friction, especially when the glass surface has been lightly treated with a tacky compound, is so high that very slight changes in a constantly applied pressure between the pad and glass, produces a tangential drag between them. Speech currents in the receiver coils actuate a telephone reed, to which the pad is attached and correspondingly large changes on the pull of the pad due to the fluctuating friction of the revolving glass disc produce a high degree of mechanical amplification which is applied to a diaphragm at the base of the trumpet.



*The new Frenophone, by Messrs. S. G. Brown, Ltd.*

**Brown Bros., Ltd., Great Eastern Street, E.C.2. Stand No. 12.**

The variety of components and instruments offered by this company is almost as wide as the range of motor parts for which they are well known. A useful little booklet of diagrams which they have prepared shows clearly the application of every component listed therein. These components are well chosen, and represent some of the most efficient varieties. With the large sales organisation possessed by this company they can be relied upon to supply almost any class of radio equipment in their capacity as wholesale agents.

**The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester. Stand No. 7.**

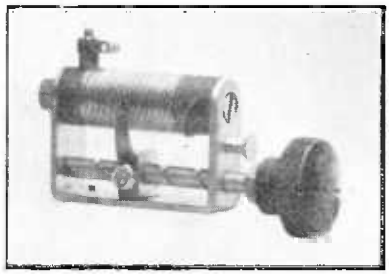
A complete range of high and low tension batteries to suit all requirements are obtainable from this company. A number of new types of accumulators have been introduced to meet the special requirements of the dull emitter valve, and in particular might be mentioned the HZ. type which is capable of discharging at the slow rate required for operating valves of the dull emitter type and retaining its charge under normal working for at least six months. It is supplied in a glass container in a dry-charged condition, and needs only the addition of electrolyte to render it ready for service. A

*The Exide HZ. type 2-volt cell for use with dull emitter valves. It retains its charge for a long period.*

useful little booklet, prepared for distribution by this company, on "How to Choose and How to Use an Accumulator Battery" to suit the particular requirements of the user, should prove of great help when purchasing the battery. A particular feature of the "Exide" battery is that frothing is entirely avoided.

**T. C. Ball, 39, Windsor Road, Ealing, W.5. Stand No. 23.**

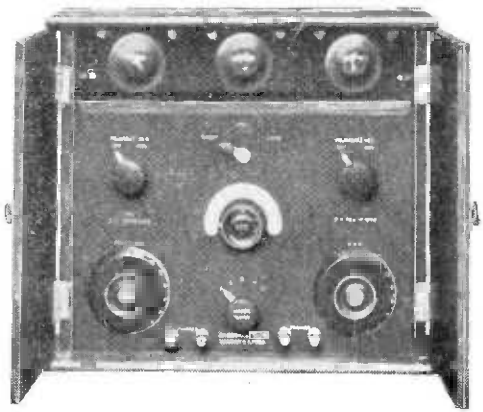
A filament resistance of particularly small dimensions and designed for panel mounting is shown on this stand. It should appeal to all those interested in the building of receiving sets. It has a very smooth movement, and is operated by a simple worm which provides for very critical adjustment. Various types are available wound to resistances up to 300 ohms, and for use as a potentiometer an additional terminal is fitted. The T.C.B. resistance is particularly durable, and owing to its special design a reliable contact is assured.



*The T.C.B. resistance by Messrs. T. C. Ball.*

**J. A. Coomes & Co., Ltd., Connaught Road, Ilford, Essex. Stand No. 91.**

Of special interest at this stand is the three-valve "Aerophone" receiving set, which makes use of a high frequency amplifying circuit on the tuned anode principle, and is provided with reactance coupling. The "Aerophone" amplifier is a two-valve unit for adding to any two-valve receiver, and is intended for loud speaker work. Three types of "Ionophone" sets consisting of a three-valve, two-valve and crystal receivers are on view. A useful form of amplifier is also shown in which a switch is introduced for making use of either one or two valves. A well finished variometer crystal set, together with a number of components, are also worthy of inspection.

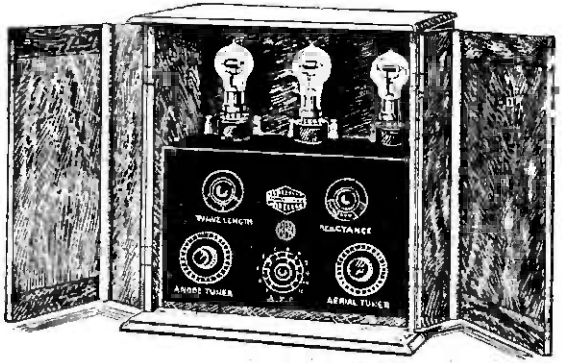


*The "Aerophone" receiver by Messrs. J. A. Coomes & Co., Ltd.*

**C. Davenport Wireless, Ltd., 99, Clerkenwell Road, E.C.1. Stand No. 35.**

These exhibits comprise a complete range of components and sets. Special attention is centred on a new headphone receiver of exceptionally light construction and possessing magnets and windings which it is claimed produce great sensitiveness and the reduction of distortion to a minimum. The range of receivers includes a crystal

set, valve set, and note magnifiers, whilst of special interest is the new D.W.3 regenerative set, which is of unique construction, and is marketed at a very popular price. It is claimed that with




*Three-valve receiver by Messrs. C. Davenport Wireless, Ltd.*

this set all the B.B.C. stations can be received with sufficient strength to operate a loud speaker, whilst the tuning range provides for the reception of Continental telephone transmissions.

component parts. A complete range is offered to meet the requirements of the home constructor.

**The Eagle Engineering Co., Ltd., Eagle Works, Warwick. Stand No. 52.**

The aim in the design of the "Chakophone" receiving set is to produce the highest efficiency in action accompanied by simplicity of operation. The range of receiving equipment shown by this company includes crystal receivers, two-valve receivers of various patterns, two-valve power amplifiers, a four-valve cabinet receiver, and in additon a one-valve set in which a reflex circuit is employed. The instruments are manufactured in a variety of patterns and cabinets according to the taste of the user. The sets are all thoroughly good and can be relied upon to give highly efficient results. The instruments are built in such a manner as to avoid complicated tuning adjustments. Accessories of all varieties are offered, including complete sets of parts and the many minor components required in instrument construction.

**The Economic Car Light Co., Ltd., 6-18, Cromer Street, W.C. Stand No. 10.**

The special interest of this stand is a broadcast receiver complete in every respect with three low temperature valves and dry battery. This set will run for approximately eighty hours before

*Products of Messrs. L. J. Chambers & Co.*

**L. J. Chambers & Co., Victoria House, South Lambeth Road, S.W.8. Stand No. 48.**

This firm specialises in the manufacture of

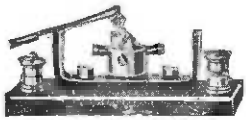
battery renewal is required. The whole apparatus is contained in a polished mahogany cabinet fitted with a loud speaker. The manufacturers

state that within a radius of fifteen miles from a broadcasting station no aerial or earth connection is required, the collection of energy being obtained by the inductances in the receiver itself.

*New loud speaker by the Diamond Wireless Equipment Co., Ltd.*

**Diamond Wireless Equipment Co., Ltd., 184a, Oxford Street, W.1. Stand No. 9.**

One of the latest products of this Company is a new type of loud speaker for use with a specially designed two-valve power amplifier, and for operation from a valve or crystal set according to the distance from the broadcasting station. Another



*Magnetic Crystal Detector by the Diamond Wireless Equipment Co., Ltd.*

interesting device is the "Magnetic Crystal Detector," in which the contacts are held in adjustment by the action of a curved bar magnet. A popular model of crystal receiving set, Type P.X.L., is a well-built instrument offered at a moderate price.

**Ever Ready Company (Great Britain), Ltd., Hercules Place, Holloway, N.7. Stand No. 1.**

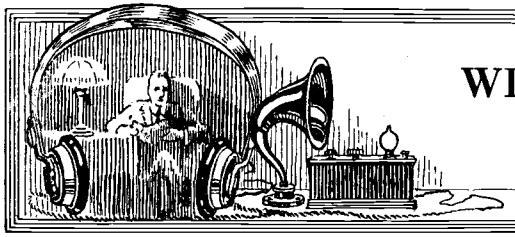
To meet the requirements of users of the new dull emitter type of valve this company, which is so well known as the manufacturers of all types of dry cells, has introduced a special type of battery. Three sizes are available, having voltages on open circuits between 3, 4, and 5, and operating a single dull emitter valve receiver from 500 to 1,000 hours. A wide range of all types of cells are available which are specially useful for use with wireless apparatus. A small type of pocket lamp battery is particularly useful for grid cells. A number of patterns of H.T. units are shown. The small cells (G.W.1. and G.W.2) must not be overlooked by the experimenter interested in transmitting, for where the power is limited these cells can be used economically for the purpose of deriving a high potential. Many types of accumulators of the four and six-volt type may also be inspected, and the portable models enclosed in metal and wood cases are of great interest.


*The "Ever Ready" Hercules L.T. Dry Battery.*

**Fullers United Electric Works, Ltd., Woodland Works, Chadwell Heath. Stand No. 27.**

This well-known firm are making a comprehensive display of wireless apparatus. It includes their celebrated "Block" batteries which, on intermittent discharge, give very long service. The block construction largely eliminates the risk of internal shortening. Their filament resistances and potentiometers are extremely compact, and in fact are designed to occupy panel space similar to that occupied by a valve socket. Coil holders for one, two, or three coils provided with friction adjustment are well worth inspection. A special type of loud speaker is also on view designed to give a good volume of sound consistent with the maintenance of purity of tone. The Fuller apparatus is well finished, and every feature has been carefully studied with a view to obtaining really satisfactory results.

(*To be continued.*)



# WITH THE SOCIETIES

Particulars of Membership of any Society can be obtained on application to the Secretary. Societies marked with an asterisk are affiliated to the Radio Society of Great Britain.

### The Manchester Radio Scientific Society.*

The annual general meeting was held on October 3rd. Mr. C. G. Boullen was in the chair.

The agenda included the election of officers for the ensuing twelve months, the Chairman and Hon. Secretary having expressed a desire to be released from their duties.

Mr. J. E. Kemp was elected Chairman and Mr. G. A. Mercer Hon. Secretary. Mr. J. R. Halliwell was re-elected Hon. Treasurer.

On October 10th, at headquarters, the Society was favoured by a visit of Mr. Dan Godfrey, Jr., the Director of the Manchester Broadcasting Station, who gave a very interesting and entertaining talk on "Broadcasting."

On October 17th, at headquarters, Mr. Bayley read a paper on "Aerials."

Recently the members, by the kind invitation of Mr. Dan Godfrey, Jr., the Director of the Manchester Broadcasting Station, paid an interesting visit to **2 ZY**.

Hon. Sec., G. A. F. Mercer, 116, Burton Road, Withington, Manchester.

### Bromley Radio and Experimental Society.*

The first meeting of the winter session of this Society was held at the Society's headquarters on October 8th, when Mr. Cudden gave a very interesting lecture on "Valve Rectification, Amplification, and the Elimination of Distortion."

Hon. Sec., L. R. Stephens, 73, Masons Hill, Bromley, Kent.

### Sydenham and Forest Hill Radio Society.*

Mr. A. C. Huskinson gave his second lecture and demonstration before the above Society on October 8th, the subject being "Condensers."

Some fixed condensers of different makes were tested, and found to vary 30 per cent. according to the marking on them.

An informal evening on Monday, October 15th, was left open for members to bring up their troubles for discussion.

A Morse practice night will be held every Monday at 7 p.m.

Hon. Sec., M. E. Hampshire, 139, Sydenham Road, S.E.26.

### The West London Wireless and Experimental Association.

At the meeting held on October 9th, Mr. F. E. Studl demonstrated a converted Mark III* set, his subject being "Crystal Reception with Microphonic Amplification."

At the meeting held on October 16th, Mr. Brown, of Messrs. Peto Scott, Ltd., demonstrated and explained their full unit system. Much interest was taken in the various parts, which were minutely examined by members present.

Hon. Sec., Horace W. Cotton, 19, Bushey Road, Hayes, Middlesex.

### South Shields and District Radio Club.*

A meeting of the Club was held on October 10th. A short talk was given by the Secretary on a "Simple Crystal Receiver," embodying the variometer type of tuner.

On Wednesday, October 17th, members of the Club paid a visit to the South Shields Electrical Power Station, by kind permission of Mr. Edgar, the Borough Electrical Engineer.

Hon. Sec., W. Smith, High Dock House, South Shields.

### The Southampton and District Radio Society.*

At the meeting of the above Society held on Thursday evening, October 11th, the speaker was Mr. A. Parsons, A.M.I.R.E., who lectured on "Electro-Magnetic Waves."

On Thursday evening, October 18th, members of the Society were entertained by broadcasting from the newly opened station of the B.B.C. at Bournemouth. The demonstration was in the very able charge of Mr. J. Wansbrough, and the apparatus used consisted of a Gecophone two-valve cabinet set, with a two-valve power amplifier and loud speaker.

Hon. Sec., P. Sawyer, 55, Waterloo Road, Southampton.

### The Leeds Radio Society.*

The 42nd general meeting was held at the headquarters, The Woodhouse Lane U.M. Church Schools, Leeds, on October 12th, Mr. F. Smith presiding. After business had been attended to, Mr. T. Brown Thomson opened a discussion upon "The Dynatron Valve." The discussion was heartily supported, the President, Mr. A. M. Bage, contributing some valuable views upon the theory of the Dynatron.

An instructional meeting was held on October 19th, Mr. F. Smith lecturing upon "A Single Valve Indoor Aerial Set." Some apparatus was exhibited, this including a very serviceable coil winder

Hon. Sec., D. E. Pettigrew, 37, Mexborough Avenue, Leeds.

### Sheffield and District Wireless Society.*

At the annual general meeting held on October 12th, Mr. L. H. Crowther, A.M.I.E.E., who has served the Society so ably since its inception, as Honorary Secretary, was elected President for the coming year.

The retiring President, Mr. F. Lloyd, in reviewing the past year, remarked on the impetus that wireless interest in Sheffield had received from the installation of the relay station.

Hon. Sec., R. Jakeman, "Woodville," Hope, N. Sheffield.

### Manchester Wireless Society.*

On Friday, October 12th, Dr. Stanley Hodgson gave his second elementary lecture on Electricity as applied to wireless. A very clear explanation of the behaviour of the electrons in conductors and non-conductors gave the members the impression that no such things as solids existed.

### Mount Pleasant Radio Research Society.

On Saturday, October 13th, Capt. Atkinson (Radio Engineer to Messrs. Igranic, Ltd.), lectured before the above Society on "Winding Duolateral Coils."

The lecturer concluded with some interesting remarks on tuned anode coupling and aerial screening, and finally ably answered the several questions submitted by the membership.

### The Thornton Heath Radio Society.*

A "test evening" was held at St. Paul's Hall, Thornton Heath, on Monday, October 15th, and much useful advice was given to members on wiring.

A short lecture on "Accumulators, Ancient and Modern," was given by Mr. A. Ford, followed by a discussion on the subject.

At the meeting held at St. Paul's Hall on Monday October 22nd, several members described their sets, which included crystal sets, single-valve reflex circuits, 1, 2, 3 and 4 valve sets. Mr. Harvey kindly brought his four-valve set, which was erected on an experimental panel, and gave a very interesting explanation of the circuit and the various components used.

Hon. Sec., 72, Bensham Manor Road, Thornton Heath.

### The Prestwich and District Radio Society.*

A well-attended meeting of the above Society, together with members of the North West Manchester Radio Society, was held on Monday, October 15th, when Mr. Percival, of Messrs. Edison and Swan, Ltd., gave a lecture on the construction and manufacture of the different types of their well-known valves.

Hon. Sec., H. A. Wood, Spring Bank, Church Lane, Prestwich.

### Midhurst and District Radio Society.*

The monthly meeting took place (by courtesy of the Chairman, Major F. R. Harding-Newman) at Rotherfield House, on Tuesday, October 16th, at 8 p.m., Major-General Sir John Daniell, K.C.M.G., presiding. Mr. S. F. Broadway gave a most helpful talk on "Workshop Wrinkles."

### Sheffield and District Wireless Society.*

At a recent meeting of the Society Mr. L. H. Crowther gave his presidential address and spoke of the aims and functions of a wireless Society, and outlined a few of the more recent developments in wireless, both in transmission and reception.

In conclusion, the President said he would like to see the Society develop the experimental side of its activities a great deal more.

### The Hornsey and District Wireless Society.*

Recently about twenty members of this Society paid a visit to the Research Laboratories of the General Electric Company, Ltd., at Wembley. The members highly appreciated the kindness and courtesy of Mr. Watson, of the General Electric Company, who acted as guide to the party.

On Monday, October 1st, the Hon. Secretary gave an account of his recent experiences in reception of American telephony.

Hon. Sec., Mr. H. Hyams, 188, Nelson Road, Hornsey, N.8.

### Battersea and District Radio Society.*

On Thursday, October 18th, a well-attended meeting conducted experiments on the Club's apparatus at the new headquarters.

If local "howling" continues, the Society are to take steps to trace the offenders.

Hon. Sec., A. E. P. Walters, 31, Holden Street, Grayshott Road, Lavender Hill, S.W.11.

### Wolverhampton and District Wireless Society.

The fortnightly meeting of the above Society, held at headquarters on Wednesday, October 10th, took the form of a lecture and demonstration by Mr. H. Stevens and Mr. H. Taylor on "A.J.S. Sets."

Hon. Sec., J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

### Barnet and District Radio Society.

Several new members were enrolled at the weekly meeting of the Society which was held in the Radio Clubroom, Barnet, on Wednesday evening, October 10th. The greater part of the evening was taken up by an intensely interesting address by the Society's President, Mr. F. W. Watson Baker, who spoke on early experiments in wireless transmission and reception.

On Wednesday evening, October 17th, Mr. C. Randall, the Chairman, read an interesting lecture on "The Evolution of the Thermionic Valve," supplied by the Cossor Valve Co., and slides were shown on the screen by Mr. A. W. Grimmer. Mr. Randall afterwards gave an interesting talk on "Tracing and Rectifying Faults in Wireless Apparatus."

On Wednesday evening, October 24th, the meeting was informal, and a number of members experimented with the Club set.

Hon. Sec., J. Nokes, "Sunnyside," Stapylton Road, Barnet.

### Hackney and District Radio Society.

At our meeting on October 11th, Mr. R. M. H. Lucy, of Messrs. S. G. Brown, Ltd., lectured on "Early Relays, Their Applications and Developments," members being able to examine the actual instruments under reference whilst the lecture was in progress.

The lecturer also dealt with the Brown telephone, and demonstrated a receiver which went down on a warship during the war. This receiver, after being at the bottom of the sea for two years, actually receives telephony quite well.

### The T.O.T. Radio Association.

This Association, inaugurated this year in connection with the staff of the Underground Group of Companies, The London General Omnibus Company and the allied Tramway Undertakings, has, during the course of a few months, enrolled upwards of 300 members.

To cater for the needs of this widely dispersed membership, district branches have been formed to carry on with the working meetings.

The first of the district meetings was held at the London General Omnibus Company's Chiswick Works on October 11th. Upwards of 70 members were present, and an instructive two and a half hours were spent under the chairmanship of Mr. Owen J. Watson, experimental and research engineer to the London General Omnibus Company.

### The Pretoria Radio Society.

In spite of many obstacles in the path of the wireless enthusiast in South Africa, several radio societies already exist in the country, the latest to be constituted being the Pretoria Radio Society, founded in February last. The facilities for experimental work are very meagre, for it must be remembered that there is at present no broadcasting in the country, and Pretoria is 400 miles from the nearest land station. The Society is fortunate, however, in the composition of its governing body; the Patron is H.R.H. the Governor-General, the President is His Hon. The Administrator of the Transvaal, while the list of Vice-Presidents includes the name of the Rt. Hon. J. C. Smuts. With such a distinguished patronage the future prosperity of the Society should be assured.

### The Dulwich and District Wireless and Experimental Association.

The above Society had the pleasure of listening to a most interesting lecture on "Rejector Circuits," by Mr. Harrie King, at their meeting on Monday, October 3rd. Apparatus in the form of circuits constructed by Mr. King for this purpose were then passed round among the members for their inspection.

On Saturday, October 13th, at the new headquarters, the above Association gave a highly interesting exhibition and demonstration. This consisted of a show of apparatus constructed by the members, and a demonstration of an exceedingly unique piece of apparatus known as the "Multi-Circuit," was given and proved most interesting.

Hon. Sec., Mr. L. Pilbeam, 499, Lordship Lane, East Dulwich, S.E.22.

### Honor Oak Park Radio Society.

The first meeting of the above Society at their new headquarters, The Church Parlour, Wesleyan Methodist Church, Brockley Rise, S.E.23, took place on Friday, October 5th. A lecture was given by Mr. Harrie King, the subject of which was "Rejector Circuits."

At a well-attended meeting at headquarters, on October 12th, Mr. Saunders **(6 SF)**, of the South Norwood Radio Society, gave an interesting lecture on "A few considerations of Ether, Electrons and Material Phenomena."

Hon. Sec., G. J. Price, 22, Honor Oak Park, S.E.23.

### Abertillery County School Radio Society.

At the first meeting of the newly-formed Radio Society, held on October 12th, Mr. Ll. Oulton, M.Sc., Senior Science Master, delivered a lecture on "The Theory of Wireless Work."

At the end of the lecture the Head Master (Mr. W. D. Lewis-Evans, M.A.) gave a demonstration with his own set—H.F. plus Flewelling circuit plus L.F.—and the exceptionally loud and pure telephony was much appreciated.

Hon. Sec., Benjamin H. Jones, Bryn Brith, Aberbeeg, Mon.

### Tunbridge Wells and District Wireless Society.

The annual general meeting of the above Society was held at the Mikado Café, Vale Road, Tunbridge Wells, which is, in future, to be the headquarters of the Club.

The Club-room will in future be open to members on Monday evenings, when the aerial and Society apparatus will be available.

Hon. Sec., H. Featherstone, A.M.I.E.E., 3, Cumberland Gardens, Tunbridge Wells, Kent.

### The Guildford and District Wireless Society.

On Monday, October 15th, the Club held their first meeting. The proceedings commenced with an interesting competition, members being invited to get the best possible reception from London on the Club set, with a time limit of two minutes for adjustment. This competition was so popular that many entries had to be refused in order to pass on to the next part of the programme, which consisted of an auction sale of sets and components handed in by members of the Club.

The Chairman, Alderman W. T. Patrick, J.P., gave the opening address of the season, pointing out the advantages of belonging to a wireless club.

The opening speech was followed by a short sketch entitled "Wireless in the Home," written by Mr. R. C. Patrick, and excellently acted by the author and Mr. R. T. Bailey.

During the greater part of the evening Mr. F. A. Love was in charge of a winder for honeycomb coils, on which he was winding coils to order.

### North Middlesex Wireless Club.

A well-attended meeting of this Club was held on October 17th at Shaftesbury Hall, Bowes Park, N. After some informal discussion among the members the chair was taken by Mr. A. G. Arthur.

Mr. Gartland lectured on some of the newer receiving circuits, chiefly reflex circuits, where one valve is made to amplify both at high and low frequency.

At the close of the lecture the Chairman suggested that if Mr. Gartland would keep fairly complete data of his experiments, perhaps he could evolve a circuit for the club panel which would be an improvement on the present arrangement.

Hon. Sec., H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

### Rochdale Radio Society.

On October 17th, a member, Mr. Bannister **(5 BR)**, gave a very interesting and instructive lecture on "Wireless Diagrams and Selective Receiving Circuits."

Meetings are held on Wednesday evenings at 7.30 p.m. at the Society's headquarters, the Yeomanry Drill Hall, Richard Street, Rochdale.

Hon. Sec. F. J. Woolfender **(5 WY)**, 68, New Road, Littleborough.

# Questions & Answers
## Solutions of Readers' Difficulties

*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—*(1) *Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor,* **The Wireless World and Radio Review**, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *All questions will be answered through the post. Those of general interest will also be published.* (4) *Every question, except those under* (5) *below, should be accompanied by a postal order for* 1*s.*, *or* 3*s.* 6*d. for a maximum of four questions, and also the coupon taken from the advertisement pages of the current issue.* (5) *For the benefit of those readers who would rather not pay the charges, a free Questions and Answers Coupon will be placed in the advertisement pages of the first issue of every month. This coupon should accompany the question submitted, together with a stamped addressed envelope. The free coupon is valid for the current week only.* (6) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.* (7) *Four questions is the maximum which may be sent in at one time.*

**"W.A.F." (Oldham)** *asks* (1) *For a diagram of a certain dual amplification receiver, using "tuned anode" instead of transformer coupling for the H.F. valves.* (2) *If he will be able to receive all the British broadcasting stations on an indoor aerial sketched, using a receiver of the type mentioned above.*

(1) The receiver you mention was designed for transformer H.F. coupling and cannot be modified in the manner you suggest. We would refer you to Fig. 8 on page 212 of the issue of May 19th. (2) We think you would have difficulty in doing this on the aerial described.

**"H.F.L." (Fulham)** *refers to the chemical rectifier described in this journal for December* 30*th*, 1922, *and asks* (1) *If the apparatus could be used to supply H.T. to a three-valve receiver.* (2) *and* (3) *For details of a step-down transformer and smoothing chokes.*

(1) Yes, if special care is taken to smooth out the A.C. ripple. (2) Detailed instructions for working out the dimensions of transformers and choke coils are to be found in the "Wireless Theory" section of the issues of July 21st and August 1st respectively.

**"SIRKIT" (Accrington)** *asks* (1) *For the size of wire and number of turns with which to wind an H.F. transformer to give selective tuning from* 300 *to* 600 *metres.* (2) *Why he cannot tune in all the B.B.C. stations, using a three-coil tuner and a tapped H.F. transformer* (150-3,000 *metres*).

(1) Wind the primary with 75 turns of No. 22 D.C.C. copper wire on a cylindrical former 3" in diameter; insulate with one or two layers of empire cloth and wind the secondary as a second layer on top of the primary, using the same number of turns and gauge of wire as for the primary. Tuning should be effected by a 0·0003 $\mu$F variable condenser. The coils in the diagram referred to are "anode tuning" coils. (2) It is somewhat difficult to give an answer to this question, as you do not state the number and arrangement of the valves used. We would point out, however, that efficiency has to be sacrificed in order that a single H.F. transformer may function over the wavelength range mentioned.

**"C.S." (S.E.18)** *sends a diagram of a crystal receiver with note magnifier, and asks* (1) *For criticism of circuit.* (2) *What alterations are necessary to bring in all the British broadcasting stations.*

(1) This arrangement will give good results on stations within a radius of 25 miles. If you increase the number of turns in the variometer you will no doubt be able to dispense with the parallel tuning condenser at present used. (2) We would refer you to the article on "The Construction of a One-Valve Dual and Crystal Receiver" in the issue of August 22nd.

**"E.C.I.L." (Portsmouth)** *asks* (1) *and* (2) *For information about certain condensers.*

The capacity of a fixed condenser depends upon the area of the plates as well as their number. We would refer you to "Wireless Theory," in the issue of April 21st, and to the article on "Condensers" in the issue of June 9th.

**"J.Y.H." (Harrow)** *asks what sizes of Igranic coils are necessary to receive the transmissions from* **NSS** (*Annapolis*).

For the A.T.I. and secondary use numbers 1,250 and 1,500 respectively, and for the reaction coil a No. 500 coil. You might try a 0·0005 $\mu$F variable condenser in parallel with your present anode coil. A separate heterodyne is an advantage, but not a necessity when receiving this station. Use for the grid circuit of the heterodyne a No. 1,500 D.L. coil tuned by a 0·001 $\mu$F variable condenser, and for the fixed reaction coil a No. 750 D.L. coil.

**"H.M." (Manchester)** *has constructed a three-valve receiver according to circuit No.* 53 *of "The Amateurs' Book of Wireless Circuits," and asks* (1) *For a diagram showing the addition of another H.F. valve.* (2) *How to connect a potentiometer in the circuit, if any advantage is to be gained by its use.*

(1) and (2) The diagram is given in Fig. 1. You will find the potentiometer useful in controlling self-oscillation of the receiver.

**"F.A." (Forest Gate)** *referring to the "One-Valve Dual and Crystal Receiver" described in the issue of August* 22*nd, asks* (1) *For the capacity of the reaction condenser "G," as he wishes to purchase one for panel mounting.* (2) *For the values of condenser "A" and "S" in Fig.* 7, *and if any advantage is to be obtained by the use of two tuning condensers.* (3) *The use of the single-way switch to the right of the battery N in Fig.* 7 (4) *The gauge of a sample of wire submitted.*

(1) The zero capacity of the usual fixed and moving vane condenser renders this type unsuitable for use as a reaction condenser. (2) Condenser "A" should have a capacity of 0·001 $\mu$F. When this condenser is in parallel with the A.T.I., tuning will be coarse, and a vernier condenser "S" of 0·0001 to 0·0002 $\mu$F capacity is used to obtain better control over the aerial circuit tuning. In the receivers in which condenser "A" is in the series position only, the tuning range is limited. (3) This switch cuts off the potentiometer current when the set is not in use. (4) The gauge of wire submitted is No. 34 S.W.G.

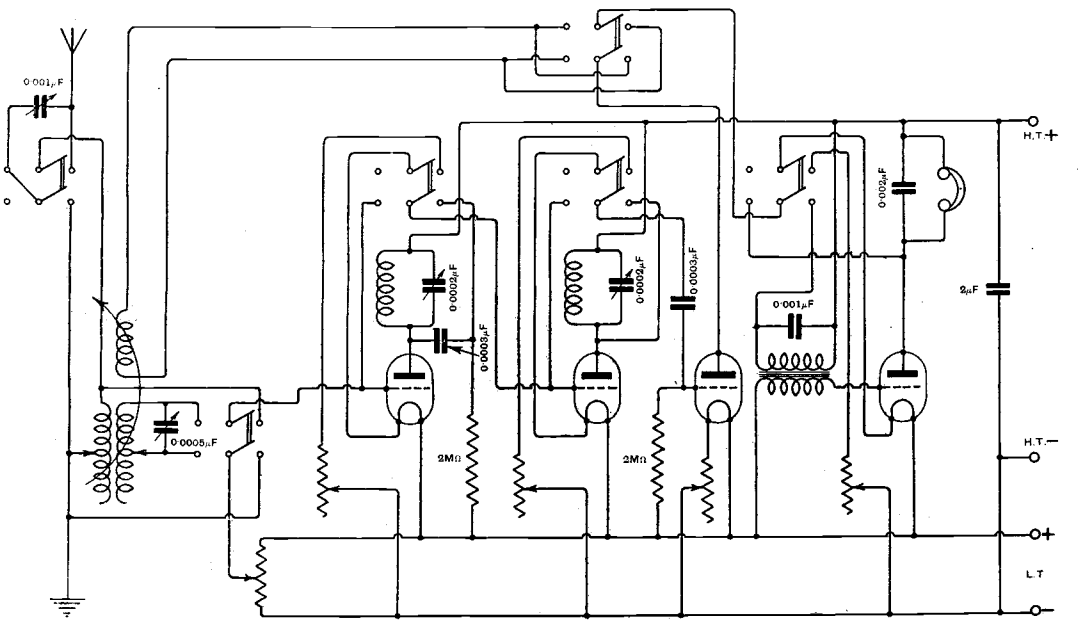



*Fig.* 1. **"H.M." (Manchester).** *A four-valve receiver (two H.F., det., one L.F.,) using tuned anode, and with switch for reversing reaction.*

**"K.I.C." (Elm)** *asks how to construct a former suitable for winding duolateral coils.*

We would refer you to the article on "Lattice-Wound Coils" in the issue of December 11th, 1920.

**"A.H.H." (N.16)** *asks* (1) *For a diagram of a two-valve and crystal dual amplification receiver with certain switching devices.* (2) *Formulae for the inductance values of basket coils and of loaded variometers.* (3) *For particulars of books dealing with the theory of crystal rectification and with the theory of dual amplification.*

(1) The article on a "Double Magnification Receiver" in the issue of July 21st describes a receiver of the type required, incorporating the maximum amount of switching practicable. (2) To calculate the inductance of a basket coil, find the mean diameter and number of turns in the coil and treat as for a cylindrical coil of that diameter. The inductance of a loaded variometer will be the sum of the inductances of the load coil and of the variometer. (3) For the theory of crystal rectification we would refer you to the chapter on "Contact Detectors" in Dr. Eccles' "Handbook of Wireless Telegraphy and Telephony" (Benn Bros., Ltd.,) and for the theory of dual amplification, to articles on that subject in the May 12th and May 19th issues of this journal.

**"W.N.M." (S.W.7)** *asks what length of No.* 30 *S.W.G. D.C.C. is necessary to wind a duolateral coil to tune to* 2,600 *metres.*

The length required will vary according to the number of pegs used, etc. Try winding 250 turns on a former having an internal diameter of $2\frac{1}{4}$ ins. if the coil is to be used as an A.T.I.

# THE WIRELESS WORLD AND RADIO REVIEW

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## CONTENTS



*THE EDITOR will be glad to consider articles and illustrations dealing with subjects within the scope of the Journal. Illustrations should preferably be confined to photographs and rough drawings. The greatest care will be taken to return all illustrations and manuscripts not required for publication if these are accompanied by stamps to pay return postage. All manuscripts and illustrations are sent at the Author's risk and the Editor cannot accept responsibility for their safe custody or return. Contributions should be addressed to the Editor, "The Wireless World and Radio Review," 12 and 13, Henrietta Street, Strand, London, W.C.2.*


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# TRANSATLANTIC BROADCAST TESTS.

By THE EDITOR.

IT is now well known that in this country it is possible to hear American Broadcasting Stations under favourable conditions almost any night, but transmissions of British Broadcasting Stations have hitherto not met with this success as far as reception in the United States is concerned. The reason for this is probably not to be found in any difference in the efficiency of American and British Broadcasting Stations, but principally because, whereas it is possible to listen in on this side to American Broadcast transmissions conducted at normal broadcasting hours when darkness prevails throughout the area to be traversed, American listeners would, if they listened for British evening transmissions, have to do so during periods of daylight on their side.

In order to test the possibility of British broadcasting being received in the United States, and the further possibility of conversational transmission between two broadcasting stations, one on this side and one on the other side of the Atlantic, *The Wireless World and Radio Review*, in conjunction with Mr. Arthur H. Lynch, Editor of the well-known monthly American journal, *Radio Broadcast*, have jointly promoted a series of Transatlantic broadcast tests to be conducted between November 26th and December 2nd. The British Broadcasting Company on this side has welcomed the scheme in the interests of science, whilst in America a number of different broadcasting stations have undertaken to broadcast under a similar arrangement. It is felt that the keenest interest will be taken in these tests by amateurs in both countries, and the readiness to undertake such a programme by the British Broadcasting Company in this country and by various broadcasting stations in America, will be widely appreciated.

In order to ensure that the transmission from England takes place during a period of complete darkness across the Atlantic, it will be necessary for the stations here to be operated in the early hours of the morning, but this has not deterred the Broadcasting Company from taking a whole-hearted interest in the tests.

The programme as provisionally arranged is as set out below, and whilst full details of the American transmissions are not yet to hand, these will be published later.

It must be realised that the tests will be in the nature of a scientific experiment, and it cannot be foreseen what degree of success will be attained. It is hoped, however, that all those who listen in, both here and on the other side of the Atlantic, will forward reports of reception both to *The Wireless World and Radio Review*, at 12/13, Henrietta Street, London, W.C.2, and to *Radio Broadcast*, at Doubleday, Page & Co., 120, West Thirty-second Street, New York, U.S.A.

| Time G.M.T. | Date | Remarks. | | |
|---|---|---|---|---|
| 0300 to 0345 | Nov. 26th | England transmitting from all stations simultaneously. | | |
| | | | Wave-length. | Call sign. |
| 0345 to 0355 | | London | 363 m. | **2 LO** |
| 0355 to 0405 | | Bournemouth | 385 m. | **6 BM** |
| 0405 to 0415 | | Cardiff | 353 m. | **5 WA** |
| 0415 to 0425 | | Glasgow | 415 m. | **5 SC** |
| 0425 to 0435 | | Birmingham | 423 m. | **5 IT** |
| 0435 to 0445 | | Newcastle | 400 m. | **5 NO** |
| 0445 to 0455 | | Manchester | 370 m. | **2 ZY** |
| 0505 to 0515 | | Aberdeen | 495 m. | **2 BD** |
| The wavelengths are provisional. Final details will be cabled to America at the eleventh hour if this is necessary. America will cable to us as to which station is best received in the States. If no station is received, the programme following will be cancelled. | | | | |
| 0300 to 0330 | Nov. 27th | America will transmit to us for test purposes. We will cable to America results of reception in England. | | |
| 0300 to 0400 | Nov. 28th | England will transmit to America. Addresses will be broadcast to America from some notable person or persons from this side. | | |
| 0300 to 0400 | Nov. 29th | America will transmit a reply to the addresses delivered on the morning of the 28th. It is suggested that Mr. Secretary Hughes would be a welcome speaker from the English point of view. | | |
| 0300 | Dec. 2nd | Attempt at two-way communication. England to transmit 0300-0305, 0310-0315 and so on every alternate 5 minutes until communication established. America will conversely transmit 0305-0310, 0315-0320, etc. | | |

# THE SUPERSONIC HETERODYNE RECEIVER.

The reception of short waves in a really practical and efficient manner is rapidly becoming of great importance, and a considerable amount of experimental work has been done towards the solution of this urgent problem. Although the supersonic heterodyne arrangement is considerably used in America it has received but scanty attention from British experimenters, and being a most fascinating circuit to handle, these notes are written in the hope that more interest may be aroused.

By W. S. BARRELL.

IT is of course obvious that in the majority of cases some form of amplification is necessary, but it is unfortunately true that the methods usually employed for medium and long wave reception are very inefficient when applied to waves of 200 metres and under.

It may perhaps be instructive to review the general methods of amplification, and briefly consider their limitations when applied to short wave working.

For long wave reception, radio or high frequency amplification is probably the most satisfactory, and the range of a receiving station can be considerably increased by its use. The loss in efficiency which is experienced when this method of amplification is applied to short waves is in the main due to stray capacity effects which shunt away a considerable amount of energy.

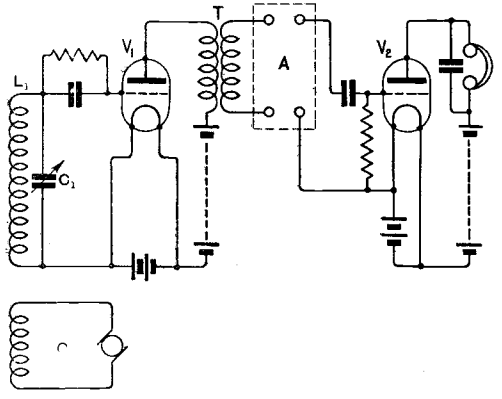


*Fig. 1. Circuit principle of the Supersonic Heterodyne Receiver.*

Parenthetically, this decrease in amplification may have been noted by experimenters when working on the lower limit of their amplifiers, and if a performance curve were drawn it would be found to fall off very rapidly toward the lower wavelengths.

This stray capacity acts as a partial short circuit across the transformers or resistances, according to the type of coupling employed, and as the wavelength is decreased the more pronounced this becomes. This is at once evident if it is borne in mind that a condenser may be considered as having a resistance proportional to $\frac{1}{2\pi nC}$ where for any given condenser the only variable is the frequency "*n*." In addition to the capacity due to adjacent wires (which it may be mentioned can be somewhat reduced by careful design) the valve itself has a definite capacity between its electrodes and leading-in wires, and is greater in valves designed in such a way that the filament, grid and anode wires are led out through one pinch and cap, as in the "R" types. This inter-electrode capacity, though relatively so small that its effect may be neglected in long wave working, becomes quite a serious factor when dealing with short waves. Valves having their leading-in wires arranged as in the "V.24" types have a considerably lower total internal capacity.

The limitations to the use of audio or low frequency amplification are mainly due to two factors; firstly, the inherent noise in the amplifier itself which limits the number of stages which can be used, and secondly, the peculiarities of the rectifier.

The reader is no doubt aware that the rectified current in the anode circuit of the rectifier is very approximately proportional to the *square* of voltage applied to the grid.

It is therefore at once apparent that the efficiency of the rectifier decreases greatly with weak signals until some minimum is reached below which the rectifier ceases to operate as such. Low frequency amplification is of very little use with really weak signals, and in any case will not materially increase the receiving range of a station. It is mainly useful for application to signals which have already been rectified, but are insufficiently loud to read through local noise.

A further difficulty in short wave working which may be mentioned is that due to movements of the hands or body of the operator near the apparatus. Changes in capacity are thus caused, which, although small, are sufficient to change the tuning and thus reduce the received signals.

The method of reception now to be described was first applied to short wave working by Major E. H. Armstrong, and is known as the Armstrong supersonic heterodyne.

The fundamental principles of the Armstrong circuit may be broadly expressed by saying that the frequency of the incoming signal is suitably reduced to some lower *super-audible* frequency which admits of easy amplification. In effect this means that the wavelength of the received signal has been lengthened to some desired value. Having effected this change of frequency the current is then passed through an amplifier and finally rectified and made audible in the usual way.

The first problem with which one is confronted consists then of finding some easy means of changing the frequency of the incoming signals. Fortunately this is quite easy of solution, and can be effected by means of an independent heterodyne and rectifier.

Fig. 1 explains the working of the principles involved. A is a radio frequency amplifier which for preference should be tuned, and which for the purpose of illustration will be assumed to have been so designed as to operate at maximum efficiency on a frequency of, say, 100,000 cycles per second, which of course is equivalent to a 3,000 metre wave. $L_1C_1$ is the usual tuned circuit and is tuned to the frequency of the incoming wave it is desired to receive. For the purpose of illustration this will be given a value of 3,000,000 cycles per second, which is equivalent to a wavelength of 100 metres. O is an independent heterodyne. Now it will be readily seen that when O is arranged to oscillate at a frequency of 2,900,000 or 3,100,000 per second these oscillations will combine with the incoming signals and produce a beat frequency of 100,000 per second. Rectification will be performed by the valve $V_1$, and a 100,000 cycle component is produced in the primary of the transformer T. This current is then amplified to the desired degree and finally rectified by the second detector $V_2$.

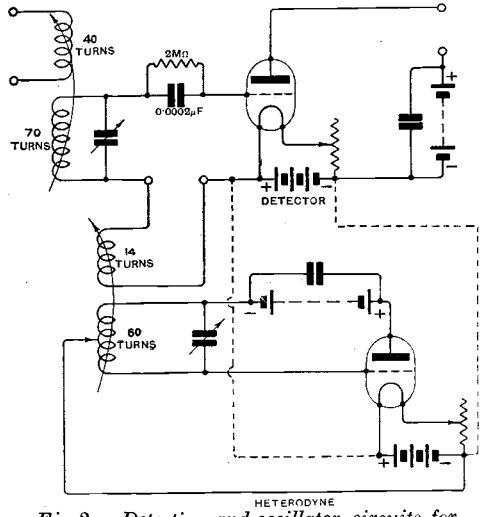


*Fig 2. Detecting and oscillator circuits for frequency changing.*

From this brief review of the principles involved it will be seen that the difficulties associated with short wave reception have been met in an extremely novel and ingenious way, and the method can be applied to the reception of spark, telephony and continuous waves. For C.W. reception, however, a second heteorodyne should be made to act on the last detector $V_2$. It will at once be recognised that the transformation of frequency from a high to a low value has eliminated many difficulties since from this point onward a long wave is being amplified, in the present instance 3,000 metres. In other words the beats are treated as the signal.

This system of reception can be summarised as embracing the following steps.

First. — Heterodyning; producing a combination with the incoming signal and heterodyne such that when rectified a super audible beat frequency is produced.

Second.—Amplification of the beats by a radio frequency amplifier, which for preference should be tuned.

Third.—Rectification.

And if desired, or if a loud speaker is being used, low frequency amplification by the usual means.

Although all this sounds rather formidable when given in detail it is not so terrible, as will be seen later.

It may, perhaps, be somewhat difficult to understand how any system utilising a heterodyne can be used to receive telephony, particularly as the experimenter's previous experience will have taught him that this is associated with hopelessly mutilated speech.

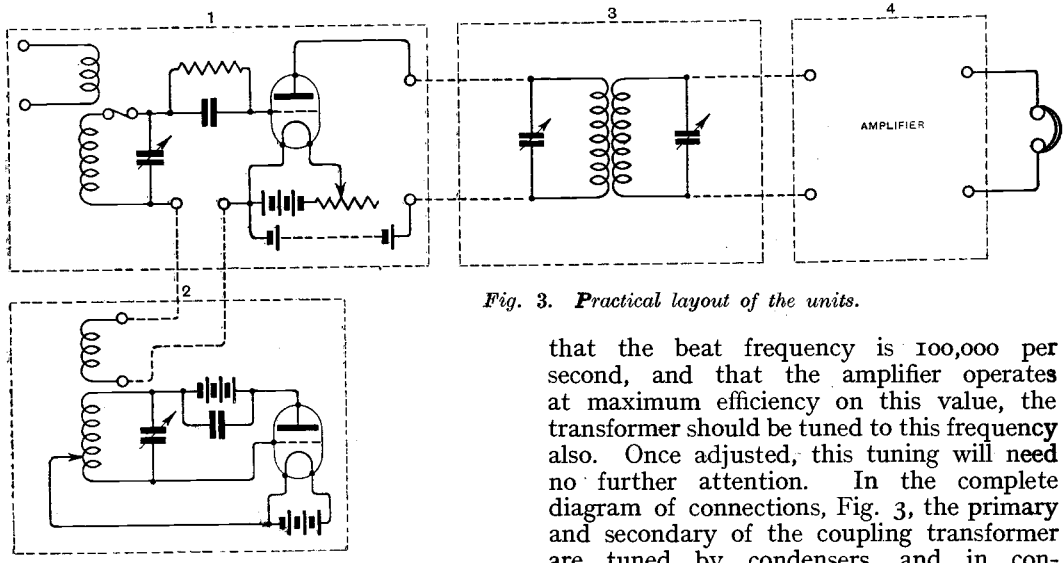


*Fig. 3. Practical layout of the units.*

Simply explained, the reason is that in the system under review the beat frequency is so much higher than is usual in the ordinary circuit, and in consequence several beats per wave train are produced. In practice, provided the beat frequency is maintained above 50,000 per second, the characteristic of the transmitter will be retained.

Throughout these notes a separate heterodyne is shown in use, and speaking generally, this is to be preferred. The reason is that although self-heterodyne may be employed its use involves a certain amount of mistuning, with some consequent loss in efficiency. In Fig. 2 is shown the frequency changing components of the circuit.

As the amplifier has to work on one definite main frequency, resistance couplings will in general be found less efficient than transformers or tuned anodes. The experimenter can please himself as to the number of stages used, but it is recommended that three be the minimum, for it seems that a certain loss is experienced during the process of frequency transforming, and this must be made up in the amplifier.

The next part of the circuit to be considered is the coupling between the rectifier and the amplifier. Assuming as before that the beat frequency is 100,000 per second, and that the amplifier operates at maximum efficiency on this value, the transformer should be tuned to this frequency also. Once adjusted, this tuning will need no further attention. In the complete diagram of connections, Fig. 3, the primary and secondary of the coupling transformer are tuned by condensers, and in consequence of sharp tuning the distance between them can be widened with increased selectivity. Correctly handled this circuit is very selective, and atmospherics are less troublesome than usual.

If the reader has grasped the theoretical considerations so far described, he will at once see what adjustments are necessary should he desire to make use of a radio-frequency amplifier already in his possession. All that is necessary is to adjust the beat frequency to the best value for the particular amplifier, and finally bring the coupling transformer into tune.

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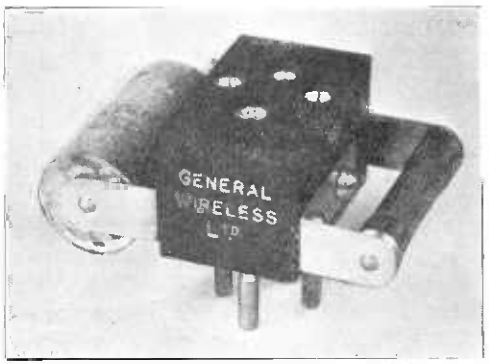
**Complete constructional details for building a Supersonic Heterodyne Receiver will be given in later issues.**

# A USEFUL DEVICE FOR L.F. CIRCUITS

ATTENTION is frequently drawn in this journal to the necessity for correctly adjusting the grid potentials of low frequency amplifying valves, and it is a little surprising that such a large number of instruments are to be seen in which this matter apparently has not received the attention of the designer.

In order to provide the requisite degree of negative potential bias, it is customary to connect the filament resistance in the




[General Wireless, Ltd.

*Fig.* 1. *Attachment for providing grid potential and resistance across transformer winding.*

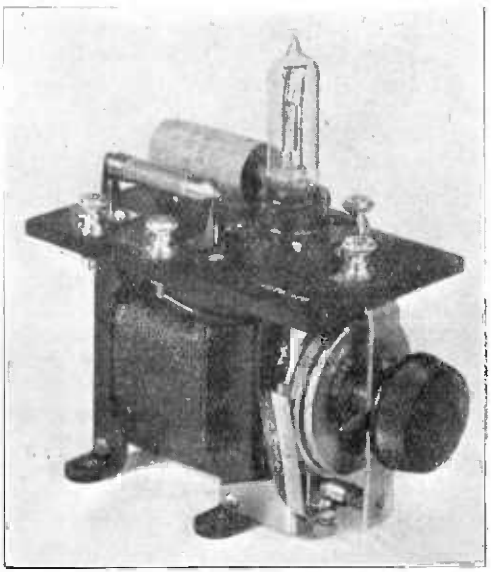
negative lead of the filament heating battery, and although this partly secures the required effect, a serious drawback is that the grid potential is varied with every change of filament resistance setting, and consequently when making adjustments of filament current one is really bringing about considerable changes of grid potential. Whether or not the resistance is in the negative or positive lead, it is as a rule necessary to provide a small cell in the grid lead to give the necessary potential so that the valve is operated on the correct point of its characteristic curve, and distortion minimised.

To meet this requirement, a useful device has recently made its appearance, and is intended for fitting to instruments, where no such provision is made, without tampering with the existing wiring.

Fig. 1 shows the arrangement and its design so that it can be plugged into the valve holder and the valve reinserted in the sockets provided, whilst a small cell of unique clip-in type gives the requisite bias.

Another very distinctive feature of this fitment is the provision of clips to carry a standard leak resistance. This is so connected to the valve sockets that it is in fact across the transformer secondary. It is well known that iron-core transformers do not amplify uniformly on note frequencies, and the fitting of the leak across the secondary, whilst slightly reducing the degree of amplification, greatly reduces distortion due to this cause.

Another component of interest (Fig. 2), is a low frequency amplifying unit completely wired up and carrying a valve which is so built that it can either be attached to an existing receiver or assembled behind the panel when a new instrument is being constructed. This unit is also fitted with transformer secondary leak and grid biasing cell for the purpose of eliminating distortion.



[General Wireless, Ltd.

*Fig.* 2. *One stage low frequency unit providing grid battery and resistance across transformer secondary to minimise distortion.*

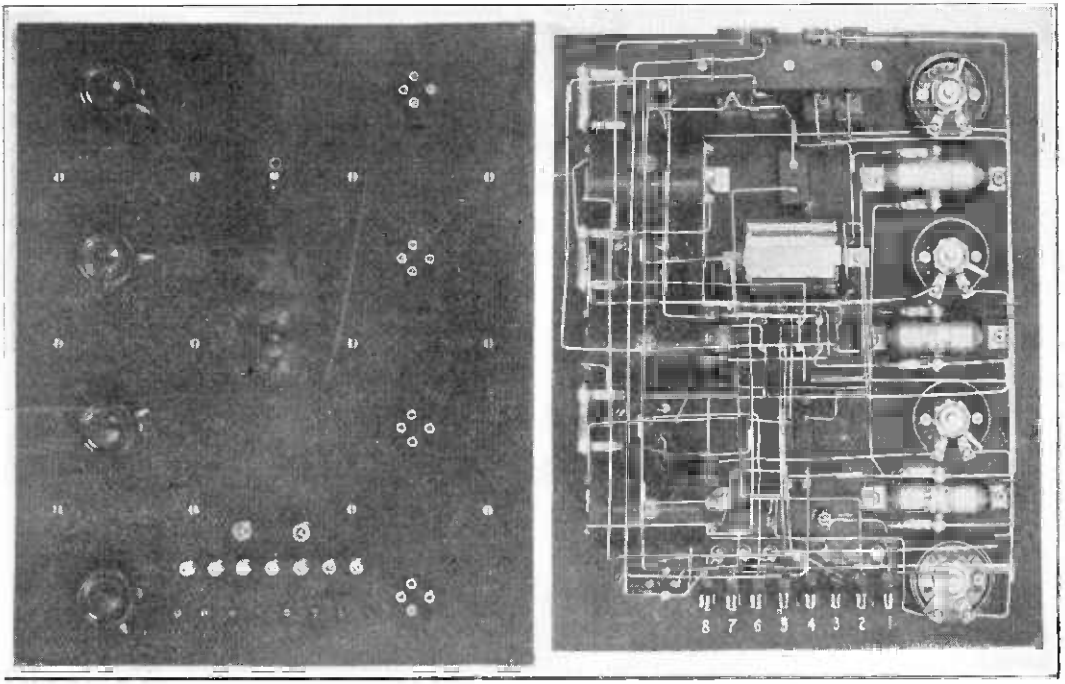
# DESIGN FOR A CABINET RECEIVER.

(*Continued from page* 134, *October* 31st, 1923.)

IT is not necessary to give an exhaustive description of the methods to employ in the workshop for making up the receiver as the detailed drawings convey all the information that is needed to the reader who has acquired a limited amount of skill in the working of ebonite. It might be mentioned at the onset, however, that when attempting a job of this kind the importance of accurate working cannot be over-emphasised, and the most necessary of the few tools required are a steel square, rule and dividers.

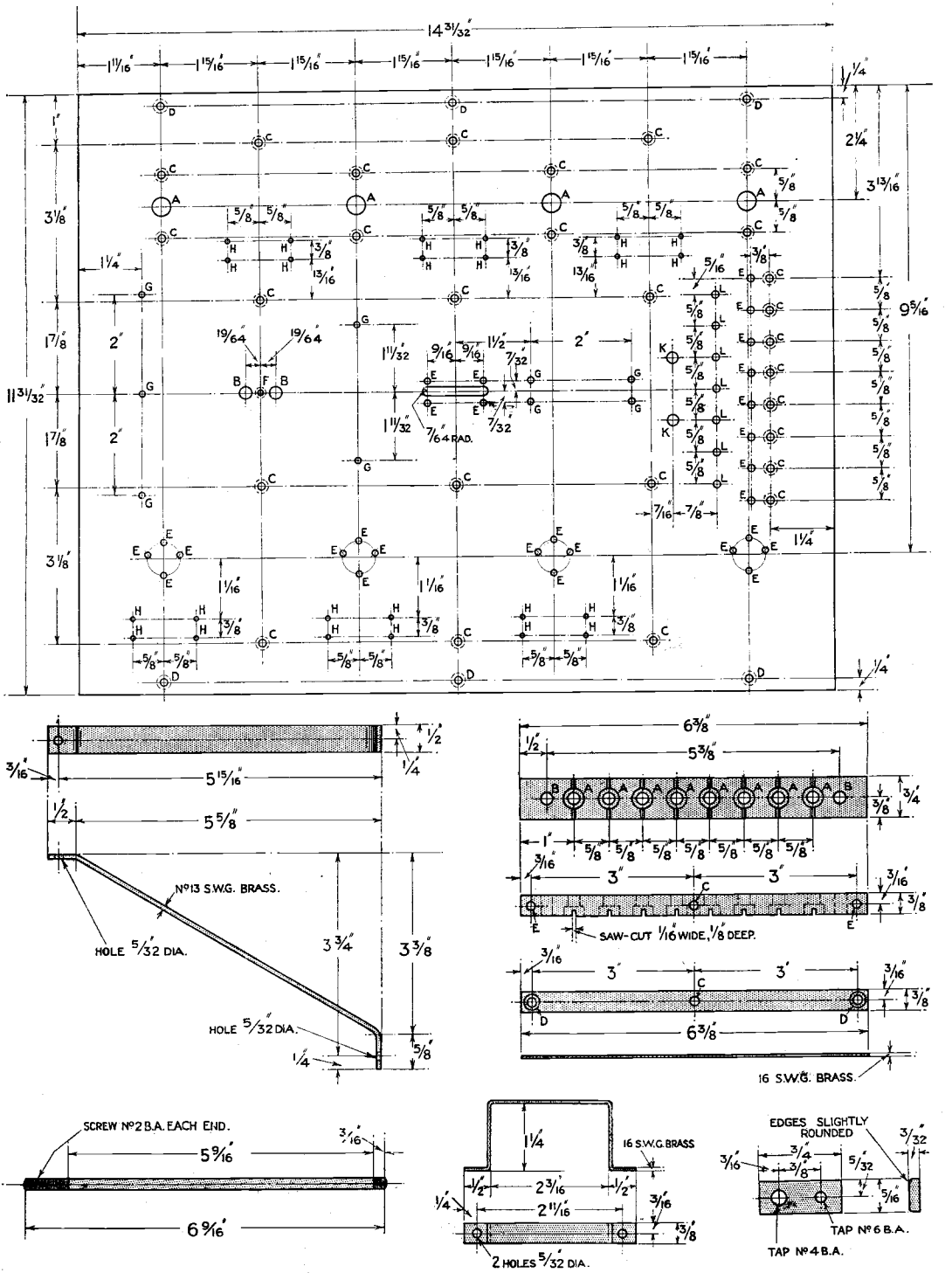
Detailed drawings* show the positions and sizes of all holes to be drilled, and the two panels should be completely prepared and rubbed down before assembly is commenced, though all components should be placed temporarily in position to ensure that all holes have been correctly located and to avoid the necessity of having to make readjustments with some of the apparatus secured to the panel.

The front panel should prove quite easy to build as it carries only a few components. A screw head of each condenser, and also a screw and nut specially attached in the case of the reaction coupling, will indicate the setting of the dials without the use of engraved lines. The positions for the engraving of the five words must be clearly marked in pencil on the face of the rubbed-down panel, and passed to an engraver with instructions as to size of letters, which on such a large panel may be $\frac{1}{8}$ in. The final rubbing down may be carried out with medium or coarse carborundum cloth, and a good finish may be obtained by rubbing




*Front and rear views of back panel which carries the amplifying apparatus.*

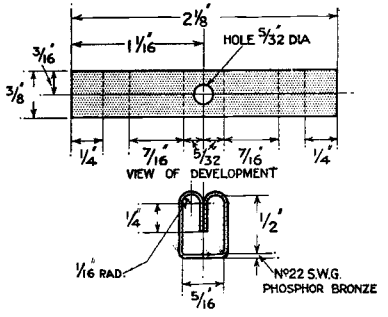
* See page 132, October 31st, 1923, for scale drawing of front panel.




*Dimensional drawings of back panel and various fitments.* (See p. 210)

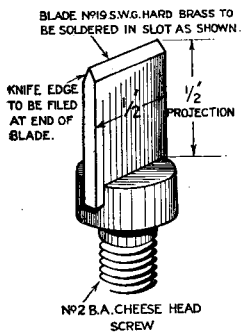
in straight lines to produce faint parallel vertical scratches.

The strip of contacts is not really difficult to make up. Small pieces of brass strip are soldered into the slots of 2BA cheese-headed screws, using "killed salts "(scrap zinc dissolved in hydrochloric acid) as a



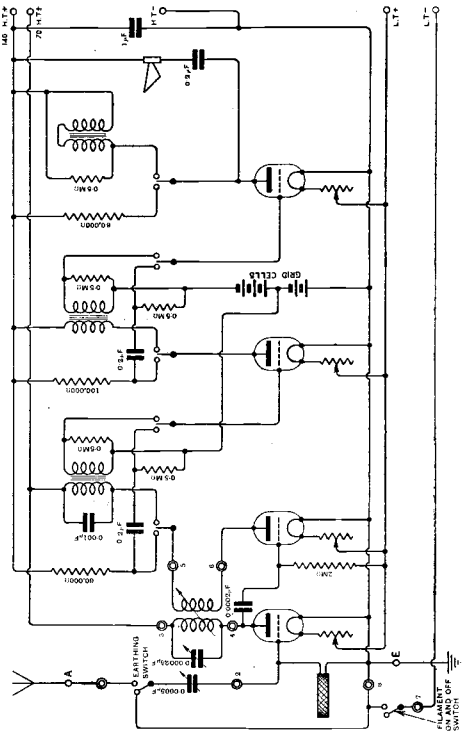

*Details for making the spring contacts.*

flux. These are then held in recessed holes in an ebonite strip in which cross saw-cuts have been made to allow the contact pieces to enter and to prevent them from turning. These saw-cuts must not be taken any deeper than is necessary or the ebonite will be weakened and in any case a piece of brass must be attached along one edge of the ebonite to prevent it bending. The strip of contacts must be held quite rigidly in position by the rods and bracket, and if it is found to possess play, an additional bracket should be fitted to one of the ends, for trouble will be experienced when bringing the two panels to register when fitting them together if the contacts are not perfectly stable. Another way of overcoming the difficulty, should it arise, is to attach a pair of tapering wooden guides to the base of the cabinet so that the strip is brought to a correct position when the panel is inserted.

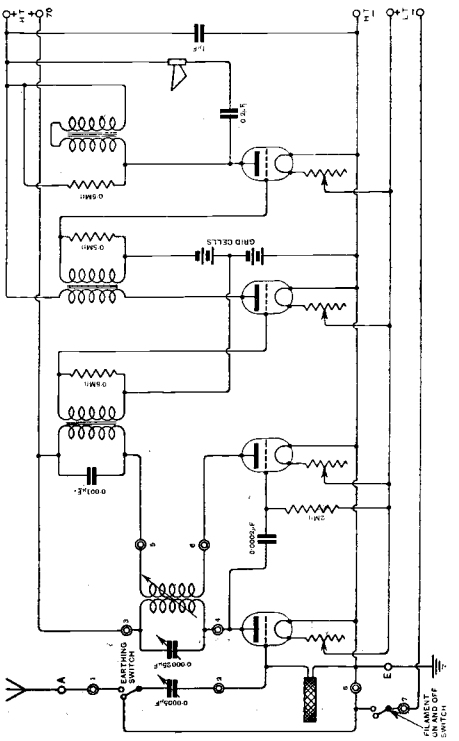



*Construction of a connector.*

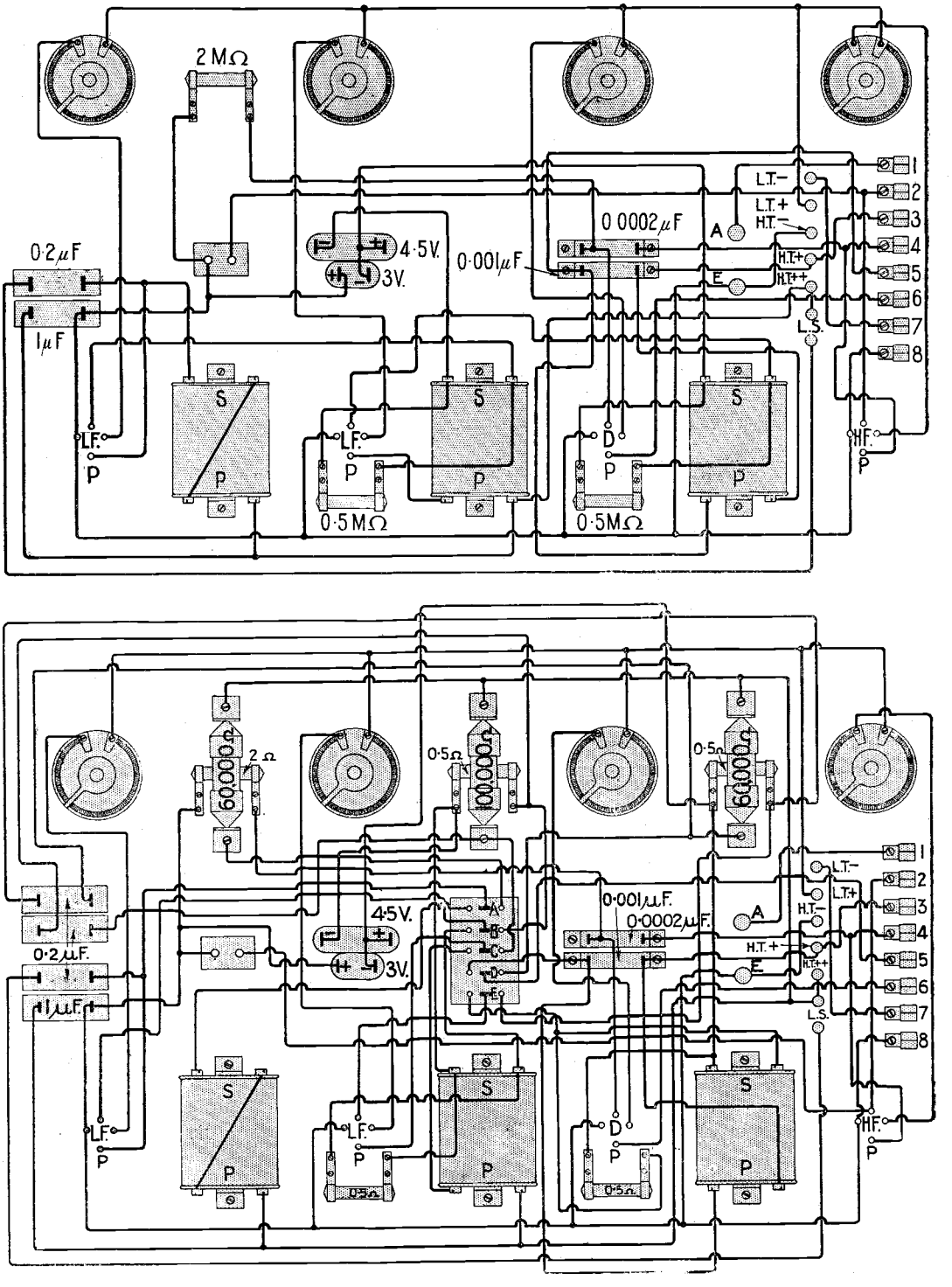
In wiring up the front panel it is necessary to avoid any of the leads projecting higher than the instruments, for they may foul leads on the back panel when assembled.



*Circuit in which L.F. amplification can be obtained either with resistances or transformers.*



*Simple transformer-coupled set.*

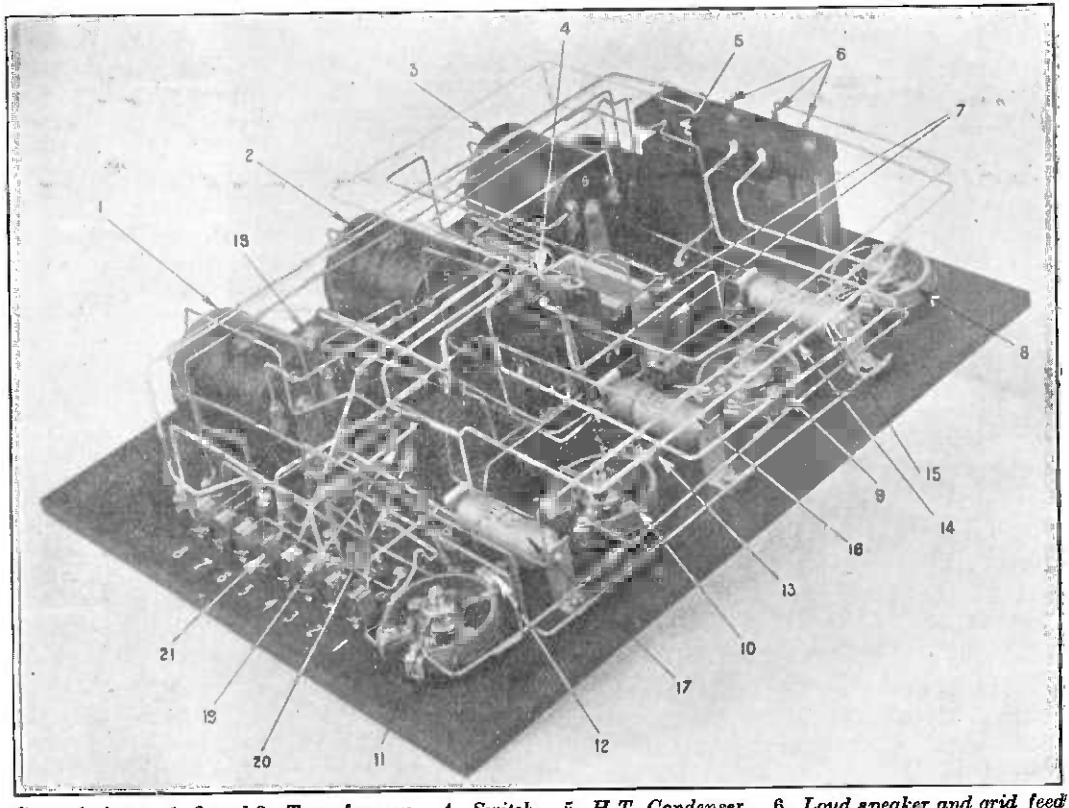



*Two practical wiring diagrams. The resistance L.F. amplifying apparatus is omitted in the upper figure.*

No. 16 S.W.G. tinned copper only should be used as the leads are somewhat long, and they must be strong enough to remain in position. The wire must be straightened by stretching and soldered where necessary with soft tinman's solder. It is as well to place a piece of wet cloth along the contact blades to prevent them from becoming detached when soldering to the stems of the screws. In wiring up the outside coil of the reaction coupling the writer removed the pair of terminals and inserted short screws, not for the purpose of making connection, but in order to support the connections for wiring up. To these connections the ends of the stationary winding can be soldered. A terminal which is provided on one of the aluminium supports must on no account be earth connected, and it is as well to throw off the short wire which connects the pair of supports together. While dealing with the variometer it might be mentioned that a piece of No. 16 S.W.G. wire should be hammered round the square part of the spindle and soldered to prevent the dial from scraping on the face of the 5/16 in. panel.

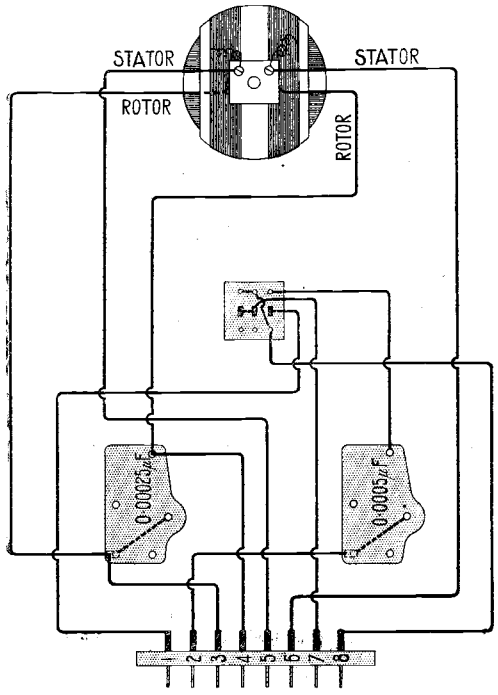
The building of the back panel should not present difficulties though the wiring up, if provision is made for transformer or resistance coupling, is distinctly complicated. The inexperienced constructor is advised to drill all the holes shown in the drawing and to assemble only the apparatus required for transformer coupling. This gives quite simple wiring, and he can add the resistance amplifier when desired.

The eight clips can be made from good springy bronze, and may take some time, though not difficult to construct, and there are many types of clip connectors on the market which might be adapted. When




*General view*: 1, 2 *and* 3. *Transformers.* 4. *Switch.* 5. *H.T. Condenser.* 6. *Loud speaker and grid feed condensers.* 7. *Grid cells.* 8, 9, 10 *and* 11. *Filament resistances.* 12 *and* 13. *Grid leaks of L.F. valves.* 14. *Grid leak of detector valve.* 15, 16 *and* 17. *Anode resistances.* 18. *Transformer secondary shunt resistance.* 19. *Transformer primary condenser.* 20. *Grid condenser.* 21. *Connector clips.*

wiring up one must guard against running wires by routes that will prevent the removal of resistances and grid cells, and also care must be taken to see that they do not foul leads or apparatus on the front panel, which can be tested by clipping the two panels together.




*Practical wiring of front panel.*

The following are the drilling sizes of the holes which bear letters in the working drawings. **Back panel:** **A.** Drill $\frac{3}{8}$" dia. **B.** Drill $\frac{1}{4}$" dia. **C.** Drill $\frac{5}{32}$" dia. and countersink on top side for No. 4 B.A. screws. **D.** Drill $\frac{5}{32}$" dia. and countersink on top side for No. 6 wood screws. **E.** Drill $\frac{1}{8}$" dia. **F.** Drill $\frac{3}{32}$" dia. and countersink on top side for No. 8 B.A. screws. **K.** Drill $\frac{7}{32}$" dia. **L.** Drill $\frac{5}{32}$" dia.

**Tapped holes:** **G.** Tap No. 5 B.A. × $\frac{3}{16}$" deep. **H.** Tap No. 7 B.A. × $\frac{3}{16}$" deep.

**Contact strip:** **A.** Drill $\frac{7}{32}$" dia. and counterbore $\frac{11}{32}$" dia. × $\frac{5}{32}$" deep. **B.** Drill $\frac{7}{32}$" dia. **C.** Drill $\frac{5}{32}$" dia. **D.** Drill $\frac{5}{32}$" dia. and countersink for No. 4 B.A. screws. **E.** Tap 4 B.A. × $\frac{3}{8}$" deep.

In the drawings given on page 206 the top figure shows the setting out of the holes for securing all of the components for both the transformer and resistance method of low frequency amplification, as viewed from the side to which the apparatus is to be attached. The bracket and connector mounting strip are also shown, together with the spacing rod for holding the connector strip, a bracket for fixing the grid cells in position, and a small terminal piece for holding down the spring clips.

Preliminary tests can be made by standing the two panels together, and when everything is in order they can be transferred to the cabinet and secured to substantial vertical filets, mounting the front panel first so that it is possible to more easily observe that the contacts are correctly engaging.

Sockets may be mounted underneath the cabinet so that they can be plugged into along the back and connection made by means of short flexible leads passing through holes in the base.

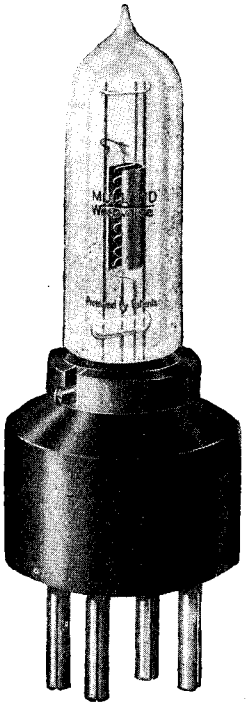
It is intended that the operation of the receiver should be simple, though one must appreciate that the settings will be extremely critical when receiving from distant stations. The "O" on the variometer dial is a position where the rotor and stator are at maximum inductive coupling, and in view of the high degree of capacity coupling present with this type of instrument, tests should be made by reversing the connections to the stator to find the arrangement which gives smooth reaction effects. In an instrument fitted with both resistances and transformers for amplifying it will be found that much tighter reaction-coupling is necessary when the resistances are in circuit owing to the reduced plate current, and, of course, the setting of the reaction coupling will need to be altered as changes are made with the condensers in order that oscillation may be maintained, if required, and howling avoided.

There may be many who, although not desirous of making a receiver exactly to the details given, owing to considerations of cost or requirement, may, in the reading of this article, have gleaned some ideas concerning certain points in design or circuit arrangement.

# NEW TYPES OF VALVES.

A GREAT drawback attendant upon the use of valves in wireless receiving apparatus is the necessity for having accumulators to heat the filaments.

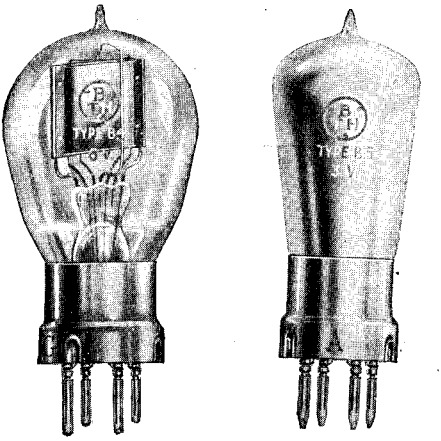
For a given temperature various substances when used for filament construction emit electrons to different degrees. Tungsten, for instance, will emit about 0·3 amperes per square centimetre at a temperature of about 2,200 degrees centigrade. This rate of emission is far exceeded by thorium, from which, at a lower temperature, the emission is many thousandfold that of tungsten. In the construction of many of the new types of dull emitter valve thorium treated tungsten is used for filament construction. In the B.T.H. new type "B.5" valve a special process applied to the tungsten filament enables a layer of thorium to be deposited on the surface and its great emitting properties utilised. The result is a valve requiring but 1/15th of the wattage to heat its filament which is needed by what is generally known as the "R" type valve, the latter requiring about 2·6 watts. The "B.5" valve takes 0·18 watts or 0·06 amperes at 3 volts. This at once makes it a practical scheme to dispense with accumulators with their inherent charging difficulties. Their place can be taken by dry batteries of reasonable size and cost, which can supply the current needed for two or three valves for several weeks of intermittent use.



*The "Wecovalve" with adaptor.*

When used as a detector, an anode voltage of 20/40 is advisable, and when connected in the amplifier circuit the plate voltage should be between 40 and 80.

Another new receiving valve is the "B.4" with a filament consuming 0·25 amperes at 6 volts, which is designed to have low anode resistance and high amplification factor, and although working as a detector, it is particularly suitable for use as a power amplifier for loud speaker work, and needs an anode voltage of 100. It is advisable to use this valve with a grid biasing voltage of minus 4 or 5, which ensures operation at the correct point of the characteristic curve. Both of these valves are fitted with the standard 4-pin caps.



*Types "B.4" and "B.5" dull-emitter valves manufactured by British Thomson-Houston Co. Ltd.*

Another new valve of interest is the "Wecovalve." In spite of the small dimensions of its electrodes, the valves are well constructed and quite robust. Designed to work with a filament current of 0·25 amperes, the voltage required was found to vary over a number of valves tested from about 0·8 to 1 volt. The operating characteristic of this valve is somewhat similar to that of the "V.24," with the exception of course that the saturation current at normal filament wattage is much less in the case of the "Wecovalve." Operating in a two-valve amplifier (one H.F. and detector), and using an anode potential of 40 volts, quite satisfactory results were obtained.

# LOOSE COUPLERS—III.

By W. JAMES.

(*Continued from page* 180 *of previous issue*).

**Loose Couplers** (*continued*).

(*G*). A particularly neat loose coupler is illustrated in Fig. 15. The lower coil has a bank winding which is tapped. Connection is made with the plug and sockets to be seen on the right-hand side of the illustration. The secondary coil is pivoted, and the coupling is varied by swinging this coil outwards. The knob is provided for this purpose. It will be noticed the coil has a stud switch fitted so that the inductance of the coil in circuit is easily changed.

Another coupler is illustrated in Fig. 16. The large outer coil is tapped and connections made with a plug and sockets. This coil may be swung on a knuckle joint, giving movement outwards and/or sideways. The inside coil is fitted with clamping pieces, and it is not tapped. Different coils may be connected or removed in a few moments.

(*H*) A variable inductance, which is especially useful in a transmitter, is given in Fig. 17. It consists of a cylindrical coil C, from which tappings are taken to the sockets secured to the ebonite strip D. On the top of the coil is fixed a flat coil, such as a pancake or spiral, marked A, and a similar coil, B, is provided and is pivoted so that the coupling between coils A and B is easily variable. It should be arranged that the inductance variation possible with the variometer (coils A and B) exceeds that between the tappings. Then we have a continuously variable inductance. Coils A and B are connected in series, and with the main coil C.

A simple construction is illustrated in Fig. 18. The outer coil consists of a winding of heavy gauge copper wire in grooves turned in the ebonite former. The winding is tapped, and connections are made to the stud switch. A smaller coil is mounted on the spindle which is shown in the figure, and the coupling is varied by sliding the coil in or out. The outer coil could be joined in the aerial circuit and the inner coil in the grid circuit of the transmitter.

(*I*) When it is possible to provide the same value of capacity in two tuned circuits, the tuning is made easier by using an arrangement such as that of Fig. 19. Here the variometers F and H are fixed to the bracket E. A gear-wheel is fastened to both

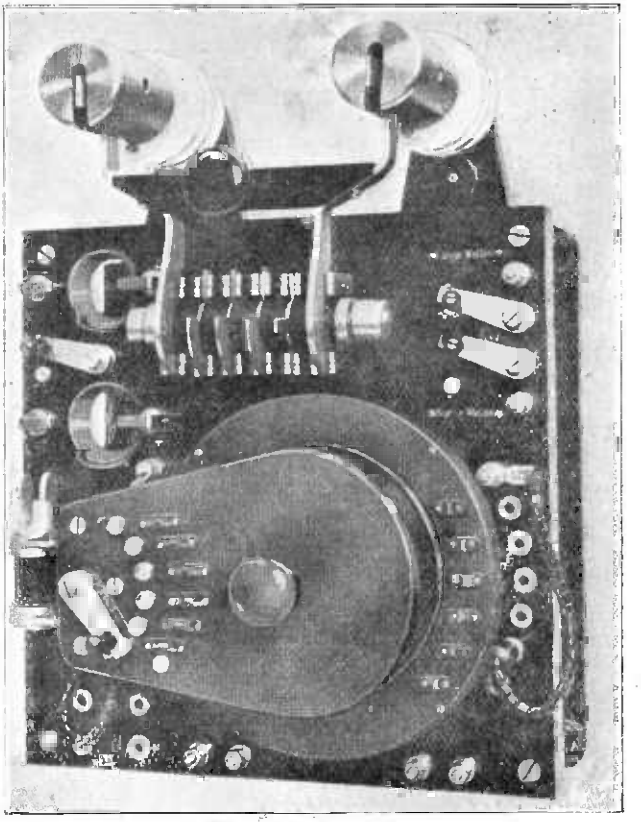


*Fig.* 15. *A coupler.*

variometer spindles A, C. The centre gear-wheel B is mounted in mesh with both the larger wheels, and is attached to the knob D. When the knob is turned, the rotors G and J are both turned together. Consequently the inductance of each variometer remains equal. This arrangement is particularly useful for tuning two valve plate circuits simultaneously. The metal plate K prevents interaction between the coils.

(*J*) When a fairly loose variable coupling is required, it has been found convenient to use coupling coils built as shown in Fig. 20. In the simplest arrangements, two coils

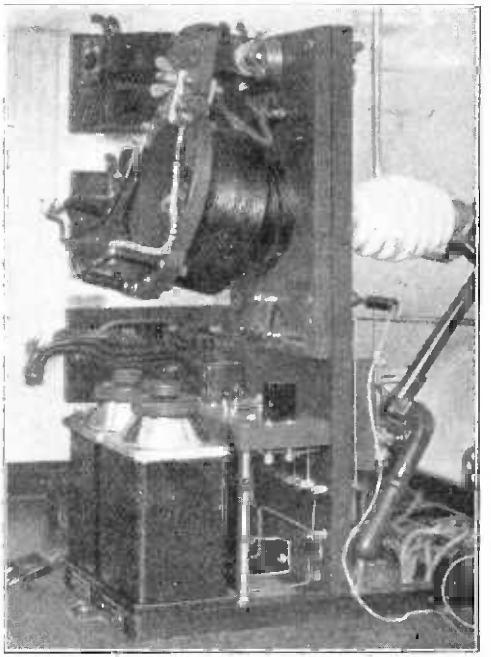


*Fig.* 16. *Another sort of coupler.*

such as the one illustrated are constructed, and one of these is fixed, while the other is mounted in order that it may be turned. A slot is cut in a piece of ebonite tube or rod, one end of the wire is fixed, and then it is wound in the direction of the arrows, resulting in a double D, or a figure 8 winding. The coupling between two such coils is greatest when both windings run in the same direction As one of them is turned, the coupling is reduced, because the voltage generated in one portion of the winding opposes that generated in the other. It is much easier to construct a variable coupling of this description than to arrange one coil to slide within another, but it should be remembered that the coupling will be fairly loose. Of course the whole of the inductance

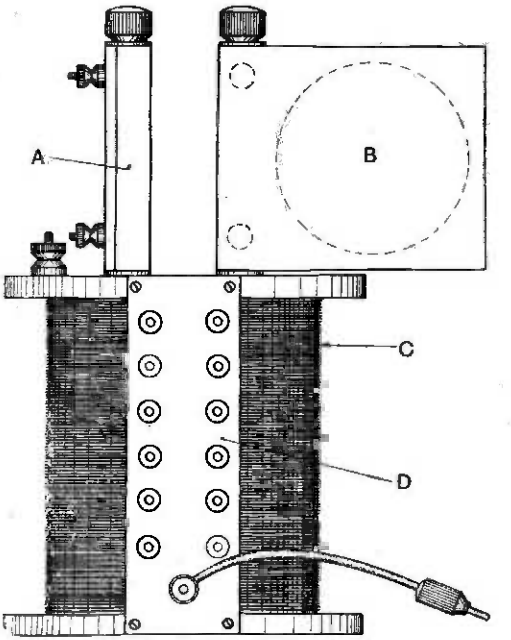



*Fig.* 17. *This sort of tapped coil, with variometer, is often used in small transmitters.*

required in the circuits is not provided by the coupling coils. Separate coils, which may be fixed to provide a permanent loose coupling between them, or fixed so that they are not coupled, are provided. These may be tapped if desired. The capacity coupling between the coupled windings with this construction is very small indeed.

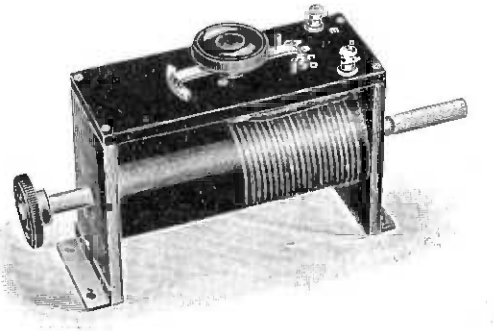


*Fig.* 18. *A coupling unit, suitable for low-power short-wavelength transmitters. (H. W. Sullivan, Ltd.,)*

(*K*) Those who prefer inductances of the basket type may find it convenient to construct their couplers or transformers in this way. A simple arrangement, providing a fixed coupling, is shown in Fig. 21. The two coils are marked P and S. This sort of construction is convenient for coupling valves arranged to operate as high-frequency amplifiers, when it is called a high-frequency transformer. The capacity between the windings is small.

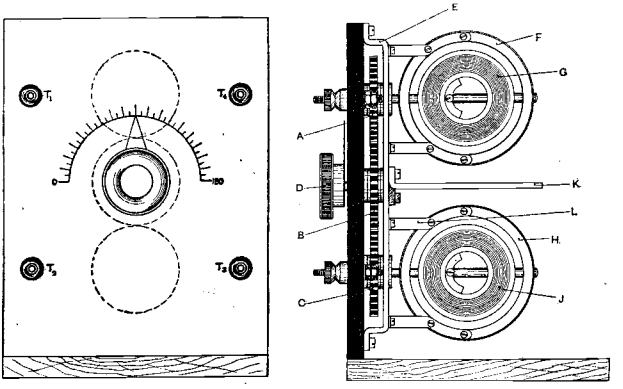



*Fig.* 19. *Two variometers, operated through gearing by a single knob.*

A number of these basket windings may be placed side by side on a rod, as in Fig. 22.

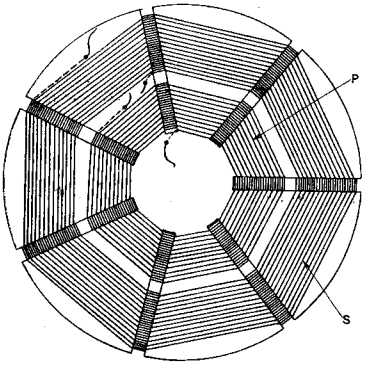



*Fig.* 21. *A useful high-frequency transformer.*

To easily tune the windings, using only a small capacity variable condenser, tappings are taken from the coils. It is generally better to connect the switch to leave the unused portions of the windings open.

The high-frequency resistance, and the capacity coupling are increased if the basket coils are placed too close together; a spacing of $\frac{1}{4}$ inch is satisfactory.

The connections with the circuit should be made for a maximum energy transfer, and this will be so when the capacity and magnetic couplings assist.

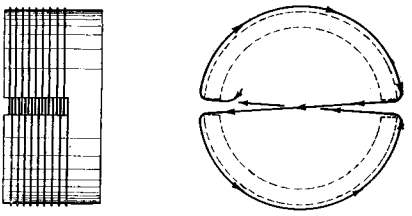


*Fig.* 20. *A* **D** *or figure* **8** *coupling coil.*

The fact that losses are caused through poor construction should be borne in mind and the components designed to keep the effective resistance and stray coupling as small as possible. It is a good plan to place the coupling unit in a box lined with copper foil when it is feared that other apparatus,

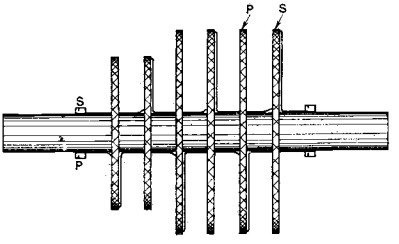
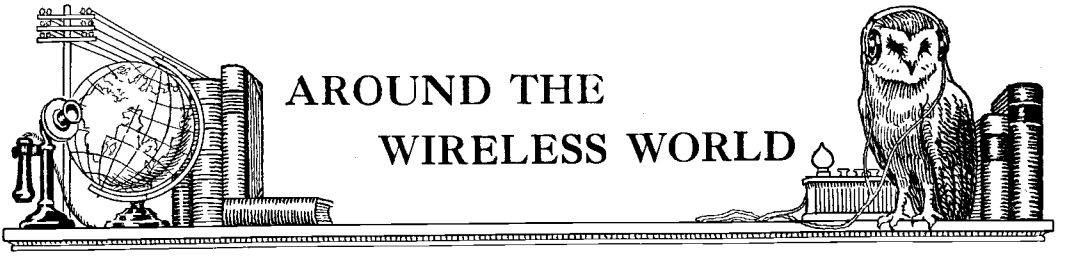



*Fig.* 22. *When a number of basket coils are employed in a transformer, they should be spaced to reduce self-capacity.*

or electrical disturbances may produce undesirable effects. The metal lining may be earthed, or connected with a point of fixed potential. The metal itself should not be too close to the coils, preferably not less than two or three inches.




### The Sheffield Relay Station.

The official opening of the new relay station at Sheffield has been arranged for Friday, November 16th.

### Norwegian Music from Aberdeen.

As a number of listeners-in in Scandinavia have reported reception of Aberdeen broadcasting, a special programme of Norwegian music is to be broadcast from the Northern Station on November 27th.

### South African Wireless Company.

The Wireless Company of South Africa, with a capital of £560,000,has been registered at Capetown. The Chairman is Sir Drummond Chaplin, and included on the Board are Colonel Childs (Vice-Chairman and joint Managing Director), Sir Jeremiah Wilson, the ex-Postmaster-General, and Mr. Harold Penrose, joint Managing Director.

### A "CQ."

An interesting message was intercepted recently by a correspondent at the Hague, Holland, who was surprised to hear the following :—

"CQ de OFD When you hear our signals ok pse write our calls to the Editor of *The Wireless World and Radio Review*. Tks beforehand GN de OFD ONY et OMX de OFD GN."

Our correspondent was using a two-valve set.

### Wireless Unity in France.

A French Wireless Union has been formed at a general meeting of experts, professionals and amateurs. The object of the new body is to protect the interests of all wireless users, to provide resources for research work and to maintain France's present position in the field of radio.

### A New Sussex Radio Society.

A Society is now being formed in the Bognor district, and those in the neighbourhood who are interested are requested to communicate with Major Page, Bognor and District Radio Society, "Frognal," Middleton, near Bognor, Sussex.

### The All-British Wireless Exhibition.

The All-British Wireless Exhibition was opened on Thursday, November 8th, at the White City, by His Majesty's Postmaster-General, Sir Laming Worthington-Evans. The illustration on the next page shows Sir Laming before the microphone in the demonstration hall.

After the Exhibition had been declared open, the Postmaster-General, together with a number of other guests, was entertained to a luncheon by the promoters of the Exhibition, the National Association of Radio Manufacturers, whose chairman, Mr. Burney, acted as host. Mr. Burney, in proposing a toast to Sir Laming Worthington-Evans, spoke of the satisfaction which had been felt by all concerned at the able manner in which he had handled the very difficult problems relating to broadcasting which confronted him on his appointment to the office of Postmaster-General.

Mr. Burney said that, speaking for those manufacturers whom he represented, they had not received all the consideration, perhaps, which they had looked for, but nevertheless as a compromise it could not be regarded as other than a satisfactory solution to a very difficult situation.

Sir Laming Worthington-Evans, replying, said that he hoped to see the manufacture of wireless instruments and components become a great and successful All-British industry. With reference to criticisms that had been made concerning the Broadcasting Committee, he emphasised the difficulties of the problem they had been called on to solve, and though the results might not satisfy all parties, he thought the conclusions would ultimately be adopted. It was difficult for a Postmaster-General to deal with the protection of manufactures, but if the next General Election was a success, he or his successor would be relieved of that great burden.

The British Broadcasting Company was doing a good public service without making an undue profit—he had seen to that part of it. (Laughter.) With regard to the new constructional licence, he was very gratified at the quick response of the public. He had been faced with two alternatives : the first was to appoint sleuth hounds to hunt down the "pirates" ; the second was to say, in effect, "Your present licence does not apply to your case, but we believe that you are honest." This appeal had met with a great response, for at the end of September there were 180,000 license holders, but during October 298,000 permits were taken out, and the total to-day was 492,000. He would not be content until this number was doubled or quadrupled, for every cottage, no matter how humble, should possess a receiving set. He urged manufacturers to go forward, and, by means of reduced prices and greater sales, extend British manufacture and employment in the interest of the welfare of the nation.

Mr. Reith replied on behalf of the British Broadcasting Company, and spoke of the determination of the Company to go ahead and surmount, or, if they could not surmount, circumvent every obstacle in their path.

## The B.B.C.'s New Licence.

The terms of the agreement between the Postmaster-General and the British Broadcasting Company signed on October 1st, states that :—

"The Company's licence of January 18th last is extended until the end of 1926, and the Company is debarred from receiving 'money or any valuable consideration from any person in respect of the transmission of messages by means of the licensed apparatus,' except with the written consent of the Postmaster-General. The Company, however, may receive a consideration for broadcasting names of publishers and prices of matter which is broadcast, or for broadcasting commercial information approved by the Postmaster-General; and may broadcast without payment concerts, theatrical entertainments or other broadcast matter given in public."

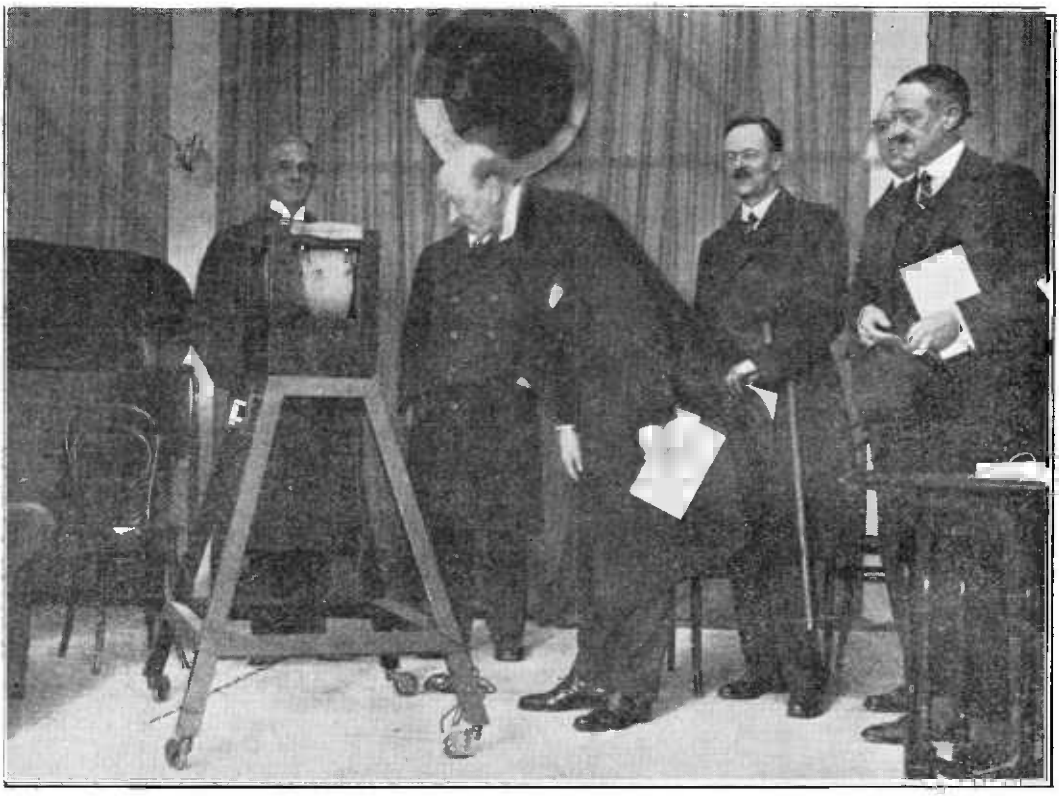
The Company may work any of the stations at any time subject to discontinuance at certain times during which the working of Government wireless or any other licensed undertaking might be interfered with.

Dealers in wireless apparatus exclusively of British manufacture are entitled to become members of the Company. The deposit of £50 paid by existing members is to be returned. The sums to be payable by members to the Company are as follows :—

| | s. | d. |
|---|---|---|
| Crystal set | 1 | 0 |
| Microphonic amplifier without using valves | 5 | 0 |
| Crystal set and one valve | 11 | 0 |
| Crystal set and two valves | 18 | 6 |
| One valve set | 10 | 0 |
| Two valve set | 17 | 6 |
| Set adapted for more than two valves, a further sum for each additional valve holder of | 5 | 0 |
| Low frequency valve amplifier (per valve holder) | 5 | 0 |

No sum is payable on telephone earpieces, loud speakers, and valves.

The agreement also sets out the prices of licences to listeners-in and the financial arrangements made between the Postmaster-General and the Company. No other licence for broadcasting is to be issued before January 1st, 1925, providing that meanwhile the Company supplies a satisfactory broadcasting service and erects additional stations where reasonably required.



[Photo Press.

*At the All-British Wireless Exhibition, Shepherd's Bush. The Postmaster-General, Sir Laming Worthington-Evans is here seen examining the latest type of broadcasting microphone.*

## FORTHCOMING EVENTS.

**WEDNESDAY, NOVEMBER 14th.**

**Tottenham Wireless Society.** At 8 p.m. At the Institute, 10, Bruce Grove, Tottenham, N.17. Special Demonstration of Gambrell Inductances by Messrs. Eustace Watkins, Ltd.

**Clapham Park Wireless and Scientific Society.** At 8 p.m. At 67, Balham High Road. Lecture: "Rejector Circuits." By Mr. Percy W. Harris.

**East Ham and District Radio Society.** At 7.30 p.m. At the Church Army, Social Centre. Lecture: "Low Frequency Amplifying."

**Streatham Radio Society.** Lecture, "Polarised Light." By Dr. J. J. Fox, O.B.E., F.I.C.

**Sockpor: Wireless Society.** At 7.30 p.m. Lecture: "The Development of the Exchange Telephone System." Mr. A. Roberts.

**Edinburgh and District Radio Society.** Lecture: "Theoretical Principles of Radio Transmission." By Mr. M. G. Scroggie, B.Sc.

**Manchester Radio Scientific Society.** At 7 p.m. At 16, Todd Street. Lecture: "Capacity Effects in Radio Telegraphic Circuits." By Mr. Halliwell.

**THURSDAY, NOVEMBER 15th.**

**Hackney and District Radio Society.** Lecture: "The Internal Economy of a Wireless Society." By Mr. Geo. Sutton, A.M.I.E.E.

**Luton Wireless Society.** At 8 p.m. At the Luton Road Boys' School. Exhibit and Demonstration by Mr. W. J. How.

**Ilford and District Radio Society.** Lecture: "Reception of Long-Distance Telephony." By Miss Denton.

**The Derby Wireless Club.** At 7.30 p.m. Lecture: "Elementary Wireless." By Mr. F. J. Allen.

**Manchester Wireless Society.** At 7.30 p.m. At Houldsworth Hall. Lecture: "Amplifiers." By Mr. J. Hollingworth, M.A., B.Sc. (Eng.).

**Radio Association of South Norwood and District.** At the Stanley Hall, South Norwood Hill. Discussion: "Reaction." Opened by Mr. E. A. Saunders.

**Stoke-on-Trent Wireless and Experimental Society.** Lecture by Mr. J. V. Brittain, B.Sc.

**FRIDAY, NOVEMBER 16th.**

**Institution of Electrical Engineers** (London Students' Section). At 7 p.m. At the Institution of Electrical Engineers. Lecture: "The De Forest Talking Film." By Mr. C. F. Elwell, M.I.E.E., M.I.R.E.

**The Wembley Wireless Society.** At 8 p.m. At Park Lane School Lecture: "Distortion." By Mr. L. V. Goodson, B.Sc.

**Sheffield and District Wireless Society.** At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Lecture: "Amplifiers." By Mr. J. Hollingworth, M.A.

**Leeds Radio Society.** At 7.30 p.m. At the Woodhouse Lane United Methodist Church Schools. Lecture: "A Three-Valve Receiver." By Mr. R. E. Timms (Hon. Treasurer).

**Norwich and District Radio Society.** At 8 p.m. Lecture: "X-Rays." By Mr. I. S. Spain.

**Radio Society of Highgate.** At 7.45 p.m. At the 1919 Club, South Grove. Sale of Apparatus.

**SATURDAY, NOVEMBER 17th.**

**T.O.T. Radio Association.** At 7 p.m. At L.G.O.C., Camberwell Garage.

**TUESDAY, NOVEMBER 20th.**

**Plymouth Wireless and Scientific Society.** At 8 p.m. At the Y.M.C.A., Old Town Street. Lecture: "Power Amplifiers and Loud Speakers." By Mr. Heal.

# Calls Heard.

Windsor.
**2 AH, 2 GG, 2 HF, 2 ID, 2 KF, 2 KT, 2 SH, 2 SR, 2 SZ, 2 TS, 2 WA, 2 WJ, 2 YH, 5 BV, 5 CS, 5 GA, 5 IC, 5 LF, 5 PO, 5 VD, 6 BV, 6 DK, 6 HD, 6 NI, 6 QZ, 8 BM.** (Single v.). (S. T. Nottley).

Lee, S.E.12.
**2 AN, 2 AQ, 2 BZ, 2 FQ, 2 FU, 2 HS, 2 JX, 2 KT, 2 KZ, 2 LW, 2 LT, 2 NQ, 2 PX, 2 VW, 2 VP, 2 OH, 2 ON, 2 OD, 2 QQ, 2 QU, 2 SF, 2 UV, 2 XI, 2 XR, 2 KK, 2 KF, 2 YH, 5 AC, 5 DT, 2 FP, 2 NM, 5 HY.** (P. W. Marriage).

Leeds.
**2 MC, 2 OK, 2 UZ, 5 AW, 5 OW, 5 PR, 5 SZ, 5 DP, 5 JA, 5 UR**(?), **6 MK, 6 MD, 6 DP, 8 AB.** (D—1 L.F.) (R. Lawson.)

Sedbergh, Yorks.
**2 AO, 2 FN, 2 GG, 2 JF, 2 JO, 2 LV, 2 NM, 2 OD, 2 PP**(?), **2 QN, 2 SZ, 2 VF, 2 WA, 2 XD, 2 ZK, 2 ZU, 5 DC, 5 LC, 6 NI, 8 BM.** (1 H.F. and D.) (J. W. Shepherd).

Kirkcaldy, N.B.
**2 DF, 2 FL, 2 FN, 2 HF, 2 JF, 2 JP, 2 LZ, 2 NK, 2 OM, 2 PP, SZ, 5 BV, 5 DN, 7 ZM, 8 AQ, 8 BM, 8 CS, 0 DV, 0 XP.** (1 H.F. & D.) (A. Shields).

Nottingham.
**2 AO, 2 FM, 2 FN, 2 GV, 2 GZ, 2 HM, 2 KA, 2 LW, 2 OD, 2 SA, 2 SZ, 2 WA, 2 WZ, 2 KZ, 2 ZU, 5 CX, 5 HM, 5 KO, 5 LO, 5 LH, 5 MU, 5 TW, 8 BQ, 8 CD.** (Single valve, D.E., Flewelling Circuit). C. A. Carpenter, **5 HZ.**).

Upper Bangor, N.W.
**2 II**(?) (or **2 YI**), **2 KF, 2 KS, 2 UF, 2 VF, 2 ZK, 5 AY, 5 BF, 5 CL, 5 CR, 5 DC, 5 KF, 5 LB, 5 NX**(?) (or **5 NF**), **5 OT, 5 OW, 5 UU, 5 XY, 6 DD** (?), **6 KK, 6 NI, 6 OK**(?). (J. C. Hughes-Roberts).

Mr. H. Collin, of Billericay, Essex, states that during the last three years, without intermission, very considerable interference has been taking place in his neighbourhood covering a wavelength band of from 200 to 230 metres. He hopes that this note will assist him and his wireless neighbours to locate the source of interference.

# Broadcasting.

**REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS:**

**GREAT BRITAIN.**

**LONDON 2 LO,** 363 metres; **MANCHESTER 2 ZY,** 370 metres; **BIRMINGHAM 5 IT,** 423 metres; **CARDIFF 5 WA,** 353 metres; **NEWCASTLE 2 NO,** 400 metres; **GLASGOW 5 SC,** 415 metres; **ABERDEEN 2 BD,** 497 metres; **BOURNEMOUTH 6 BM,** 485 metres. Regular daily programmes. Weekdays, 11.30 to 12.30 p.m. (**2 LO** only), 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 to 5 p.m., 8.30 to 10.30 p.m.

**FRANCE.**

**PARIS (Eiffel Tower), FL,** 2,600 metres. Daily, 6.40 to 7 a.m. Weather Forecasts; 10.5 a.m. (Thursday and Friday), 11.15 to 11.30 a.m., Time Signal and Weather Forecast; 12.0 noon, Live-stock prices; 3.40 p.m. (Saturday excepted); Financial report. 5.30 p.m. (Saturday excepted) Bourse Closing Prices; 6.10 p.m., Concert or Address; 7 p.m., Weather Forecast: 7.20 p.m. (Sunday), Concert and Address; 10.10 p.m., General Weather Forecast.

**PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), SFR,** 1,780 metres. Daily, 12.30 p.m., Cotton, Oil and Café Prices, News, Concert; 1.45 p.m., First Bourse Report; 4.30 p.m., Bourse Closing Prices; 4.45 p.m., Concert; 5.45 p.m., News and Racing Results; 8.30 to 9.30 p.m., News; 9.10 p.m., Concert; 10 p.m. to 10.45 p.m., Radio Dance Music.

**ECOLE SUPERIEURE des Postes et Télégraphes,** 450 metres 3.30 to 4 p.m. (Wednesday and Friday), 7.45 p.m. to 10 p.m. (Tuesday and Thursday), Tests (Music, etc.); 2.30 p.m. to 7.30 p.m. (Saturday), Tests (Music etc.).

**LYONS, YN,** 3,100 metres. Daily, 9.45 a.m. to 10.15 a.m., Gramophone Records.

**BELGIUM.**

**BRUSSELS, BAV,** 1,100 metres. 1 p.m. to 5.30 p.m., Meteorological Forecast; 9 p.m. (Tuesday), Concert.

**HOLLAND.**

**THE HAGUE, PCGG.** Temporarily suspended.

**THE HAGUE (Heussen Laboratory), PCUU,** 1,070 metres. 9.40 to 10.40 a.m. (Sunday), Concert; 9.40 to 10.40 p.m., Concert; 7.45 to 10 p.m. (Thursday), Concert.

**THE HAGUE (Velthuisen), PCKK,** 1,070 metres. 8.40 to 9.40p.m. (Friday), Concert.

**IJMUIDEN (Middelraad), PCMM,** 1,050 metres. Saturday, 8.40 to 9.40 p.m., Concert.

**AMSTERDAM, PA 5,** 1,100 metres (Irregular). 10 to 11 a.m., Concert; 5 to 6.30 p.m., Concert; 8.10 to 9.10 p.m., Concert.

**DENMARK.**

**LYNGBY, OXE,** 2,400 metres. 7.30 p.m. to 8.45 p.m., Concert (Sunday excepted).

**GERMANY.**

**BERLIN (Koenigswusterhausen), LP,** 4,000 metres. (Sunday), 10 to 11 a.m., Music and Lecture; 2,700 metres 11 a.m. to 12 noon, Music and Lecture. Daily, 4,000 metres, 6 to 7 a.m., Music and Speech; 11.30 a.m. to 12.30 p.m., Music and Speech; 4 to 4.30 p.m., News.

**EBERSWALDE,** 2,930 metres. Daily, 12 to 1 p.m., Address and Concert; 7 to 8 p.m., Address and Concert; (Thursday and Saturday), 5.30 to 6.30 p.m., Concert.

**CZECHO-SLOVAKIA.**

**PRAGUE, PRG,** 1,800 metres. 7 a.m., 11 a.m. and 3 p.m. Meteorological Bulletin and News; 4,500 metres, 9 a.m., 2 p.m., and 9 p.m., Concert.

**KBEL (near Prague),** 1,000 metres. Daily, 6.20 p.m., Concert Meteorological Report and News.

**SWITZERLAND.**

**GENEVA, HB 1 (Radio Club de Genève).** Temporarily suspended.
**LAUSANNE, HB 2,** 1,100 metres. Tuesday, Thursday, Saturday, p.m., Concert; Monday, Wednesday, Friday and Saturday p.m., Concert.

**SPAIN.**

**MADRID,** 1,650, 2,200 metres (Irregular). 12 to 1 p.m., Tests
**MADRID, PTT,** 400 to 700 metres. 4 to 5 p.m., Tests.

# Radio Society of Great Britain.

## THE NEW CONSTITUTION OF THE RADIO SOCIETY OF GREAT BRITAIN.

The reorganisation of the Radio Society of Great Britain has been proceeding during the past few months and a scheme has been evolved which will, it is thought, be appropriate to the national character of the Society and give solidarity to the amateur movement.

The old Wireless Society of London, when it resumed work after the war, found wireless transformed by the improvements in radiotelephony and other applications of the three-electrode thermionic valve. The increased interest in wireless science caused an influx of members, of whom many were resident far from London, and the title of the Society became a misnomer. As a consequence the Society was re-named last year the Radio Society of Great Britain. The new name is only one indication of its national scope for as a fact there are now more than 200 Societies affiliated to it, and the Prince of Wales has honoured the Society by becoming its Patron.

Since the change of name took place a first draft of new Memorandum and Articles of Association has been drawn up. The new constitution takes cognisance of the facts that—

(1) The Radio Society of Great Britain as it stands has a membership extending all over the country.

(2) The Affiliated Societies ought to have a more direct voice than at present in national matters affecting them.

(3) The Affiliated Societies must have complete autonomy.

Draft copies of the new constitution will shortly be submitted to the Society in General Meeting and to the Affiliated Societies.

Meanwhile a summary of the scheme proposed may be of interest. It provides that the affairs of the Radio Society will be managed by a Council of about twenty, meeting in London, and the relations between the Affiliated Societies and the Radio Society will be managed by a General Committee of about forty members meeting in various centres in turn. The Council will be elected partly by the members of the Radio Society (metropolitan and provincial) and partly by the General Committee. The General Committee itself will be elected mainly by the Affiliated Societies but will comprise two or three members nominated by the Radio Society. The subscription rates will remain approximately as at present, namely a guinea per annum from each member and from each Affiliated Society. The Radio Society will be financially responsible for the administrative expenses of both bodies.

All nation-wide matters will be referred to the General Committee and action will be taken by the Council upon the advice of the General Committee. In order to ensure singleness of purpose the Council will conduct all negotiations with the Government or with other bodies on matters when the national unity must be preserved and emphasised.

These are times of great stress for the amateur movement. A large public is growing up which tends to be unsympathetic to the experimenter. If, therefore, any clash of the interests of the listener-in and the experimenter should unfortunately occur, the case for the experimenter ought to be presented with a single voice. It is hoped that all experimenters will rally to the new constitution of the Radio Society of Great Britain.

(*Signed*) W. H. ECCLES.

## TRANSMITTERS AND RELAY SECTION.

### Calibration Waves.

The work of the Transmitters and Relay Section of the Radio Society has proved very interesting to more than one hundred members of the Section. The reports show that both transmitting and receiving apparatus is being rapidly brought into condition and that skill is being developed in picking up distant transmitters in spite of had QRN and QRM. The gist of these reports is being circulated privately to each of the transmitters concerned. But it is evident that some of the greatest difficulties arise from uncertainty of wavelength, and therefore a number of members of the section have asked for help in this matter. Two ways of helping have been considered and these will be tried in turn. The first method to be tested will consist in transmitting calibration signals from the London station of the Radio Society on various wavelengths. The start will be made at midnight on Wednesday next, November 14th. The Radio Society station will transmit from 2400 G.M.T. to 0005, on approximately 180 metres, from 0010 to 0015 on approximately 200 metres, and from 0020 to 0025 on approximately 220 metres. These calibration signals will be followed in about ten minutes by a message indicating the precise wavelength actually transmitted. Members of the Section will receive special circulars of instruction and other information about these signals, which will be repeated on future occasions and for other wavelengths as may be required.

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### "Radio Malabar."

An interesting description of the high power wireless station of Bandoeng, Java, appeared in a recent issue of the *Times*. This station, known generally as "Radio Malabar," is situated in a ravine of the Malabar Mountain, and uses two steep mountain-sides as aerial supports. The actual height of the aerials is some 2,000 ft. above the station and 6,600 ft. above sea level. No tower could reach this altitude, and hence the Malabar station has an immense advantage.

The Poulsen arc installation transmits with a power of 2,400 kilowatts, which is probably higher than that employed by any other station in the world.

## DESCRIPTION OF EXHIBITS

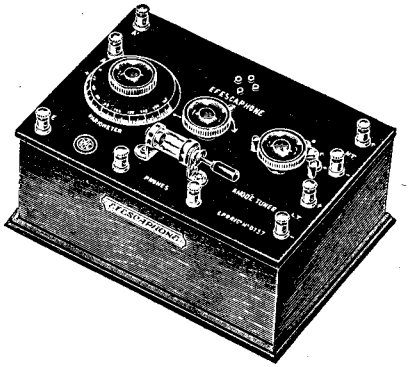
# ALL-BRITISH WIRELESS EXHIBITION

**November 8th-21st, 1923.**

(*Continued from p. 193 of previous issue.*)

**Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, E.C.1. Stand No. 79.**

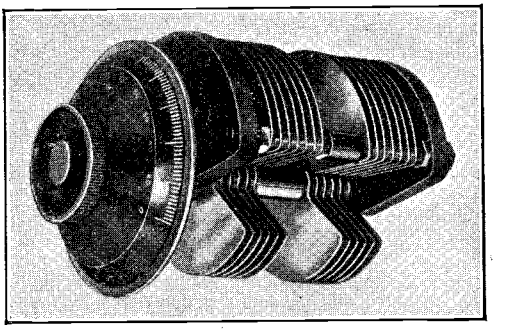
This Company manufacture the Efescaphone receiving equipments. They have a crystal set which is introduced to meet the demand for a simple receiving set, well made, and offered at a reasonable price. A crystal and valve set is also shown which makes use of a reflex circuit arranged to provide high and low frequency amplification with crystal detection, and it is claimed that it will operate a loud speaker within a distance of 10 to 15 miles from a broadcasting station. One, two, and three-valve sets of particularly neat appearance can also be inspected, built either as enclosed cabinets or housed in box work with or without lid, or for attaching to the wall. A particularly neat power amplifier designed to be portable, and with a key for throwing one or two valves in circuit, is of interest, the valves being enclosed beneath the panel. A feature associated with all the Efescaphone receiving sets is the exceptionally neat layout and compactness, and the departure, in the design of the cabinet work, from conventional lines.




*The Efescaphone crystal and valve set, making use of dual amplification.*

**Messrs. Fallons, The Condenser People, 230a, Hermitage Road, N.4. Stand No. 11.**

As specialists in the manufacture of dielectric variable condensers, Messrs. Fallons offer reliable instruments at moderate prices. Their condensers are probably well known to most builders of receiving sets, and, of recent introduction, is the "Duanode" Condenser which consists essentially of two condensers assembled on a common spindle with the object of effecting the tuning of two circuits simultaneously



*The Duanode variable condenser by the Fallon Condenser Co.*

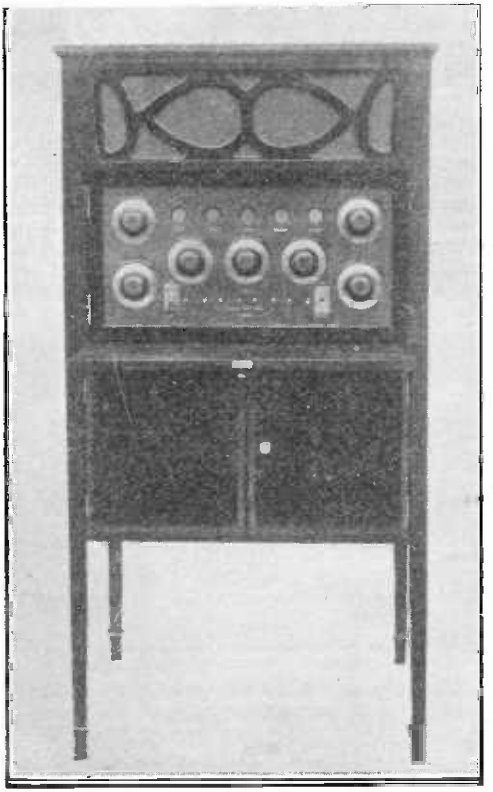
**Messrs. Harwell, Ltd., 28, John Street, Theobald's Road, W.C.1. Stand No. 44.**

This firm specialises in the manufacture of wireless component parts, and the materials generally used by manufacturers of wireless apparatus. Their products include mica, micanite sheets, mouldings, tubes and washers, bakelised paper, boards and tubes, varnished paper, ebonite and fibre sheets, rods and tubes. As agents for the Belleroid electric insulating materials, and also for the Precision Screw Co., Ltd., they can offer the manufacturer of wireless apparatus excellent service by way of producing small machine parts and moulded insulating materials.

**Messrs. General Radio Co., Ltd., Twyford Abbey Works, Acton Lane, N.W.10. Stand No. 74.**

Among the components to be seen at this stand, undoubtedly the most interesting is the "G.R.C." Type 71 Variometer, which has been carefully designed to eliminate losses. Variometer tuning is certainly the most efficient method, and is still very popular for reception of broadcasting. The contacts between the rotating spindles and

the stationary winding of the terminals is particularly well carried out by means of tight wire loops. These variometers, which are of particularly fine construction, are used in the building of "G.R.C." Receivers, and mention might be made of the Type 16 two-valve set which is particularly beautiful in appearance, and although it embodies high frequency amplification, it is easy to manipulate.



*G.R.C. Cabinet Set by the General Radio Co., Ltd.*

**Messrs. The Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15. Stand No. 32.**

Hart Cells for use in high and low tension batteries are well known, and the manufacturers have a reputation for producing accumulator batteries of the highest grade. A wide range of small accumulator cells assembled into batteries of various voltages for supplying plate current in receiving sets are of special interest. These cells are designed for severe work, such as may be occasioned when employed on ships' wireless installations, and are constructed in a durable way to withstand the rough handling they may receive during transit for recharging. The small cells in sealed glass boxes are also extremely useful in low power valve transmitting apparatus. A number of portable

*Two-valve receiver by Messrs. W. J. Henderson.*

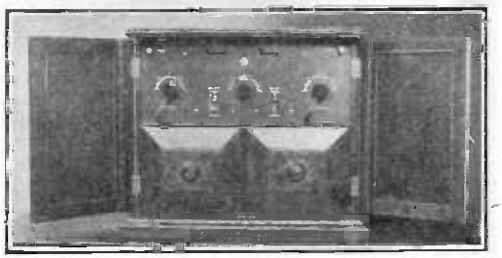
batteries in celluloid and glass boxes, and suitable crating, can be inspected, while a number of special types designed essentially for motor car purposes, are easily portable.

**Messrs. W. J. Henderson & Co., 351, Fulham Road, South Kensington, S.W.10. Stand No. 2.**

Attention should be directed in particular to the two-valve receiver and two-volt amplifier exhibited at this stand. The former is designed to give maximum efficiency over a wide band of wavelengths with extreme simplicity of control, and can be relied upon for reception from continental telephony stations, as well as those of the Broadcasting Company. The two-stage power amplifier is fitted with a key for varying the degree of amplification, and it can be operated from a crystal receiver where the distance from the transmitting station does not exceed 10 miles.

**Messrs. Hart Collins, Ltd., 38a, Bessborough Street, Westminster, S.W.1. Stand No. 24.**

Considerable attention has been devoted to the design of a really useful four-valve receiver, which is self-contained, and enclosed in a well-finished cabinet. Simplicity of operation has been foremost in the development of the design without loss of efficiency. The problem of accommodating the accumulator battery within the cabinet of the set presents difficulties, particularly with regard to corrosion arising from the acid fumes from the battery. This has been overcome by enclosing the



*Cabinet receiver by Messrs. Hart Collins, Ltd.*

battery in a well-sealed compartment, which is treated with an anti-sulphuric compound. The arrangement of the panel is such that it is easily adapted for fitting to almost any cabinet container, and this the manufacturers are prepared to carry out when required.

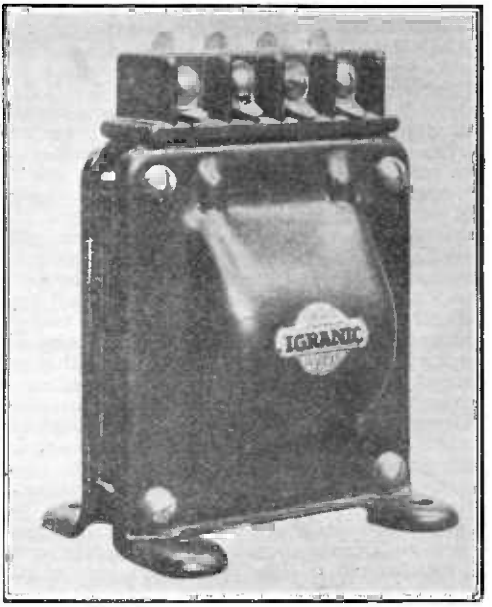
**Messrs. J. E. Hough, Ltd., Edison Bell Works, Glengall Road, S.E.15. Stand No. 36.**

Prominent among the exhibits is the model "B" Crystal Set, an extremely substantial article of good workmanship. The tuning is effected with the use of the Edison Bell variometer, while the crystal detector is a twin arrangement. By the use of twin crystals one is not tempted continually to reset the detector in the hope of obtaining improvement, for so long as one crystal gives better results than the other, then the inferior one needs resetting. A socket is provided in order that inductance coils may be plugged in to extend the tuning range of the receiver. A special amplifier is built for use in conjunction with this crystal set for operating a loud speaker. A wide range of components and mouldings are also exhibited, and should make a special appeal to manufacturers of wireless apparatus.


*Ingenious plug connectors of Messrs. J. E. Hough, Ltd.*

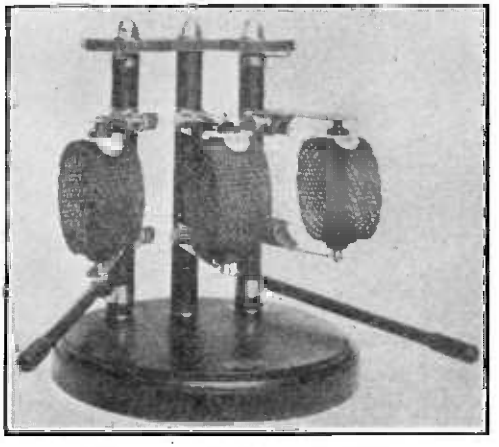
**Messrs. Igranic Electric Co., Ltd., Bedford. Stand No. 43.**

This company is responsible for the introduction of filament resistances and potentiometers of particularly clever design, which, if required, are fitted with vernier adjustments which may prove very useful for controlling the filament current of a high frequency valve or for obtaining the critical current adjustment often needed with valves of the soft variety. When it is desired to replace the ordinary "R" type of valve with one of the dull emitter type, additional resistance may be easily attached to one of the brackets of the rheostat. This is a particularly convenient arrangement, and the method of attachment extremely simple, whilst a variable clip on the additional resistance gives the approximate setting, and final adjustment is made on the variable resistance itself. Many other useful accessories manufactured by this company might be mentioned. The low frequency intervalve transformer, the special gimbal mounting for inductance coils, an extension handle for critically adjusting vernier condensers, and the new "S.R." type variometer. The introduction of an instrument arranged to provide filament heating current




*The Igranic intervalve transformer.*

from A.C. mains is a distinct advance, and will be at once appreciated by all those who have alternating current supply available and experience difficulty with accumulator charging. The step-down transformation includes certain circuit arrangements that effectively suppress A.C. noises. The device, which is known as the Igranic A.C. Valve Light Set, will probably prove of very considerable interest.

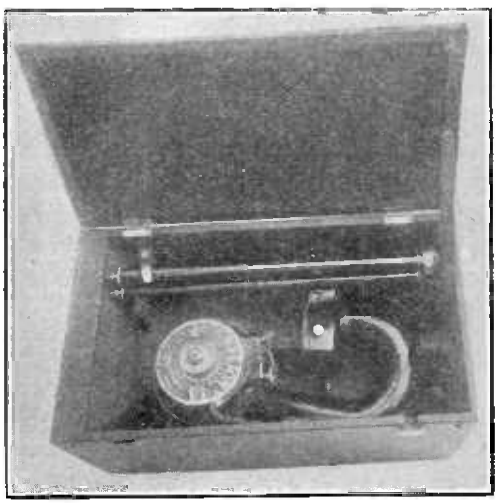


*The Igranic Gimbal 3-coil holder.*

**Alfred Graham & Co., St. Andrews Works, Crofton Park, S.E.4. Stand No. 113.**

The display of Amplion loud speakers is particularly comprehensive, covering as it does the entire

field of loud speaking application. The "Amplion Junior" is a very popular model, while the types A.R.1, 3, 5 and 7, are of unique design. These instruments are arranged for alternative wall or table use. The 1924 design of the "Music Master" includes new features of a distinctive character. Apart from the improved electrical movement, an acoustic conduit merits attention. The tone arm is now of stamped metal, and the trumpet is constructed of oak or mahogany. Between the metal conduit and the wood horn a substantial rubber bush is interposed which it is claimed has the effect of damping out undue resonance. Another model almost as popular as the "Amplion Junior" is the "Dragon," types A.R. 17 and 19, with oak or mahogany trumpet, and we learn that this loud speaker is meeting with favour in Canada, the United States, and abroad generally where the "Amplion" is asserting its supremacy. Adapted specially for lecture rooms and concert halls, styles A.R. 29, 31, 45 and 47, are exhibited. These instruments are of the straight horn pattern which, from a purely acoustic standpoint, must be preferred to the bent design of horn. The improvements embodied in the 1924 manufactures include a modified electro-magnetic system such as the mass of the magnets, the section of the laminated pole pieces and coil winding have been slightly modified. The diaphragm, instead of being rigidly clamped as hitherto, is simply retained in place without the imposition of stress or strain other than that due to the magnetic pole, so that the diaphragm is rendered less periodic than is ordinarily the case.



*Amplion portable loud speaker by Messrs. Alfred Graham & Co.*

A new portable model which, when closed, measures only $13 \times 7\frac{1}{2} \times 7$ ins., is of special interest. It is arranged to be easily collapsible, and is fitted with a tripod stand. The display of Amplion loud speakers is particularly comprehensive.covering as it does the entire field of loud speaker application.

**Messrs. Metropolitan Vickers Electrical Co., Ltd., Trafford Park, Manchester. Stand No. 98.**

The Cosmos receivers include models to suit all requirements. They are designed on the unit principle. For instance, the two-valve set type V.S.1 consists of a two-valve tuner unit united with

*Cabinet Receiver by Messrs. Metropolitan Vickers Electrical Co., Ltd.*

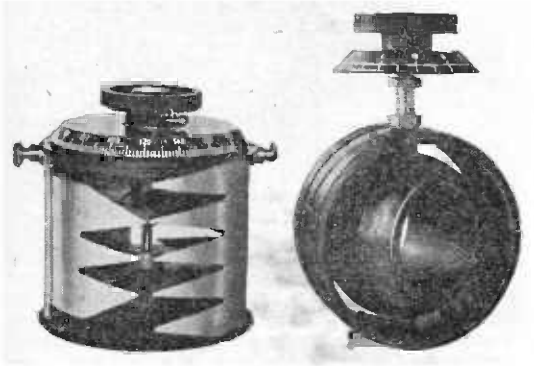
the necessary batteries and telephones. The addition of a two-valve power amplifier unit converts this into the four-valve set, type V.S.2. The units may be used by themselves or assembled in an outer case, or, if desired, in a cabinet enclosing a loud speaker. It is thus seen that one may start with the least expensive valve set which can be added to as desired.

Cosmos sets employ dual amplification circuits, and an increase in amplification range is claimed, with a reduction in cost and expense of upkeep, and the reaction is made use of in a manner which complies with Post Office requirements. In the design of the note magnifier, the utmost attention has been given to producing the clearest possible reproduction of speech and music as rendered from the loud speaker.

A Cosmos Radiophone six-valve set, type V.4, is now available. It is fitted with self-contained frame aerial, and also terminals for connecting up to outside aerial and earth lead. The set is intended particularly for use in flats or buildings where an outsido aerial cannot be conveniently erected, and consequently makes use of three high frequency amplifying valves. A carborundum crystal is

used for detection, and is followed by not less than three low frequency amplifying valves. The high frequency circuits are tuned simultaneously by the movement of a single knob, while the crystal detector is of a particularly stable variety and does not need critical adjustment. The low frequency amplifying circuits have been specially designed to give the clearest and purest reproduction. Break-jacks are made use of in order to alter the number of magnifying valves in circuit.

A range of units, Cosmos Radio Bricks, has been introduced for the purpose of catering for the experimenter, for by setting up a combination of the various units he can build a receiver embodying any desired circuit principle. A book of diagrams of suggested circuits is available with these units to serve as a guide to the beginner who is unacquainted with the more standard circuits.



*Maxone variable condenser with specially shaped plates and variometer by Messrs. J. Macdonald & Co.*

**Messrs. The Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, Balham, S.W.12. Stand No. 90.**

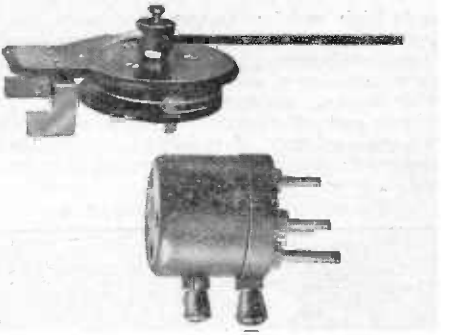
The complete range of Mullard Radio Valves may be seen, including Ora, R, L.F.Ora, P.A., small and large transmitting types, and also the special high power Mullard silica valve. At the present time considerable interest is taken in the new Mullard "Wecovalve" which is a dull emitter of very small dimensions. Mullard resistances grid leaks, condensers, and headphones can be inspected.

**J. Macdonald & Co., 2, High Street, Camden Town, N.W.1. Stand No. 28.**

Of special interest probably is the Maxone special valve holder in which the connection to the grid leak is broken and terminals are inserted on the side for inserting a grid bias, which should prove quite useful provided the cells used for the purpose are adequately insulated.

Another item is the Maxone coil tuner, which is a clever device and is built for clipping on to the side of an inductance in order to provide critical adjustment. The Maxone vernier variable condenser has specially shaped plates to provide fine adjustment as it advances from zero.

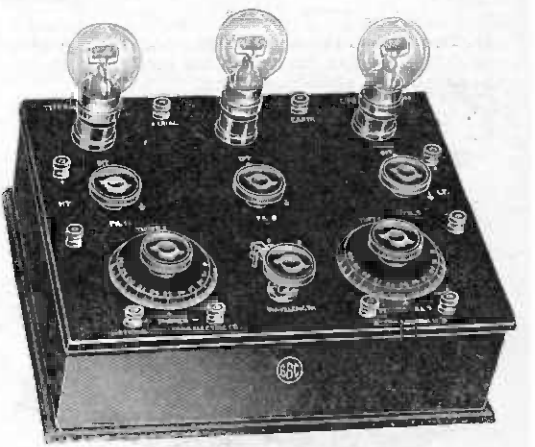
The manufactures of this Company include complete cabinet sets, and the "Clarabut" model is a particularly attractive receiver.



*Maxone coil tuner and valve holder in which terminals are provided for fitting grid cells.*

**The National Wireless and Electric Co., Church Road, Acton, W.3. Stand 30.**

As a complete range of apparatus and accessories, the exhibits of this firm are interesting, and prices competitive. The "Gnat" Super Crystal set is claimed to have a receiving range of over 40 miles, and makes use of the "National Super" crystal combination. Two more useful components are a note magnifier and high frequency amplifier for adding to the crystal set. One, two, and three-valve sets of good design are offered, whilst complete sets of parts for assembly are available, together with a good variety of well-designed components for the home constructor.



*Three-valve receiver by the National Wireless and Electric Co.*

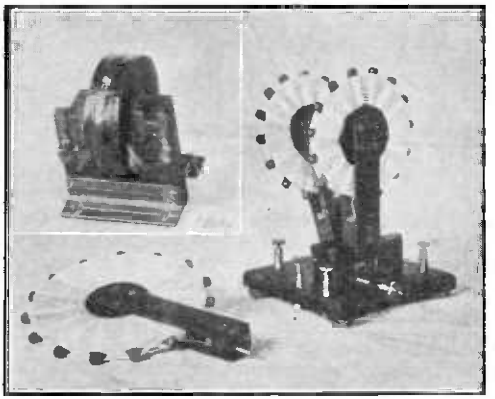
**Messrs. W. G. Pye & Co., Granta Works, Montague Road, Cambridge. Stand No. 92.**

A feature of the exhibits is a special type of tuning coil which is designed to have a minimum of self capacity. These coils are of very robust construction, and are fitted with the usual two-pin connector.

Messrs. Pye manufacture an anti-capacity switch designed for ordinary mounting and suitable for

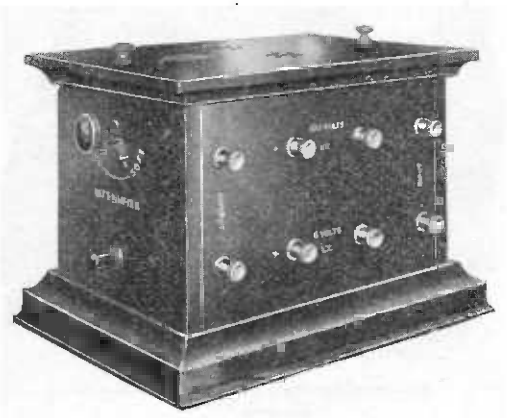
use in high and low frequency circuits and of a construction providing good rubbing contacts.

Complete receiving sets for two, three and four valves, covering a wavelength range from 300 to 3,400 metres, mounted in cabinets of various designs, and (if required) with a self-contained loud speaker, may be inspected, together with a number of unit valve panels which can be used



*Inductances and intervalve transformers by Messrs. W. G. Pye & Co.*

for putting together experimental multi valve receivers, and a two-valve power amplifier at moderate cost. The low frequency transformers have been designed to give uniform amplification and two types are available, the first for use after the detector valve, and the other for inter-coupling the stages of a power amplifier.



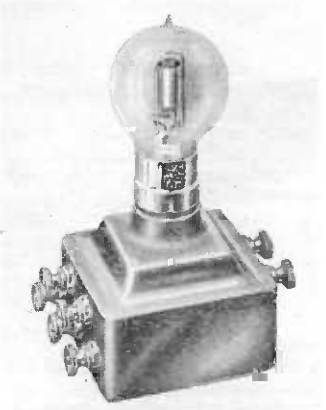
*2-valve amplifier in cabinet by The British Thomson-Houston, Co., Ltd.*

**British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2. Stand No. 99.**

The B.T.H. Company have now added to their variety of receiving apparatus a loud speaker. It is a well-built instrument, and is provided with an easily adjusted air-gap. Type C1 is encased in polished aluminium and is provided with an enamelled horn, whilst another type, C2, has a

*B.T.H. 2-valve receiver showing receptacle for head telephones.*

swan-neck horn and can be fitted either with a wooden or a metal flare. Other types of loud speakers, C3 and D, are intended for greater output, the latter being specially designed for high power work, whilst an elaborate arrangement of powerful permanent magnets obviates the necessity for employing polarising current. A particularly fine



*Single valve amplifier unit, also by the British Thomson-Houston Co., Ltd.*

B.T.H. receiving set is the V.R.2, which is a two-valve set fitted into a cabinet of pleasing design. It makes use of reaction and is provided with a number of simple adjustments which should render it sensitive and at the same time easy of manipulation. Another interesting instrument is the Valve-Crystal Receiver, which is intended to produce maximum signal strength with a minimum consumption of filament current.

# DISTORTION IN RADIO TELEPHONY*

By H. A. THOMAS, M.Sc.

INTRODUCTORY.

THE problem of eliminating distortion from both transmitting and receiving apparatus is one which interests all classes of wireless experimenters. All those who possess wireless equipment of almost any kind are naturally interested in this vital problem—the elimination of distortion—and yet, in spite of the numerous and diverse efforts that have and are constantly being made to rid radio practice from its greatest evil, I think I may say with confidence that no very radical step has been taken.

After twelve months of broadcasting, we may well ask as to its future, and we shall find that the unbiassed opinion of that section of the public who consider the new venture as a means of entertainment, is that it is not good enough to maintain a really important place in the household's amusement programme.

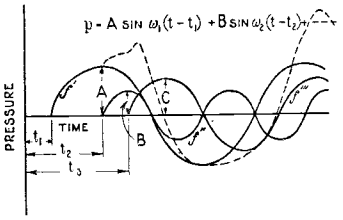



*Fig.* 1.

How commonly do we hear the phrase "It is nearly as good as a gramophone." Could a greater slight ever be uttered to a wireless enthusiast, for we all well know that the gramophone is a concoction of the devil, yet I hesitate to think that the wireless receiver is also to be attributed to his personality.

We have only to look at the present reproduction of orchestral items to realise the limitations of the type of transmission. It is well known to all of us that solo work is transmitted with a freedom from distortion that is apparent when it is compared with concerted music, which never has been claimed to be good. All types of percussion instruments are poorly transmitted, and also four-part vocal writing is extremely difficult to follow. The brass loses its blatancy, its whole function as a section of the orchestra, and the wood wind its characteristic flute tone. The range of audible intensities is narrowed, and it is this fact that renders the transmission of an organ solo, with its great range of intensity, so difficult.

In general we may state that the tendency is to level out both characteristic quality and also amplitude.

Realising these difficulties, on whose elimination the future of wireless telephony transmission, to my mind, rests, I feel that a general survey of the various links in the chain would be of interest, and I wish to state at the outset that the views which I put forward are merely the result of a general consideration.

Firstly, then, let me say that the problem is essentially an acoustic one. We have to reproduce at the receiver changes in air pressure identical in phase, frequency, and *relative* amplitude with those at the transmitter, although the absolute amplitudes may not be the same.

The links in the chain must therefore obey precise laws, and it is the failure of their behaviour to do so which produces all the trouble.

Any pressure wave form that may be obtained can be resolved into a series of sinusoidal waves of different frequencies, and different amplitudes and possessing various phase relationships with respect to any given arbitrary starting point.

In Fig. 1 the pressure wave indicated by the dotted line has been resolved into its components of frequencies $f'$, $f''$ and $f'''$, respectively, and of maximum amplitudes $A$, $B$ and $C$, the starting point of each wave from the arbitrary zero being given in time values as $t_1$, $t_2$ and $t_3$ respectively. Thus the pressure at any time interval "$t$" from the arbitrary starting point will be given by the equation $p = A \sin\omega_1(t - t_1) + B \sin \omega_2(t - t_2)$ where $\omega_1 = 2\pi f'$, $\omega_2 = 2\pi f''$, and so on.

We must preserve the time ratios $t_1$, $t_2$, $t_3$, etc., the amplitude co-efficient ratios $\frac{A}{B}, \frac{B}{C}$, etc., and the perfection of the sinusoidal form of the wave.

At the higher audible frequencies, this becomes a very serious problem.

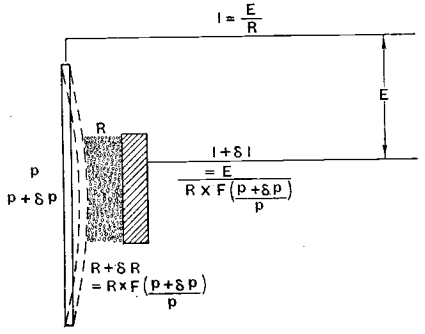



*Fig.* 2.

THE MICROPHONE.

The first link in our chain is the conversion of the air pressure changes into electrical changes of some type, and this is performed by means of a microphone, of which there are many types, the most usual being that well-known atrocity, the carbon microphone, with its almost unlimited series of defects.

* A paper read before the Radio Society of Great Britain on October 24th, at the Institution of Electrical Engineers.

Here we change our pressure variations into resistance variations, and we will consider the salient difficulties that are met with this type of instrument. In Fig. 2, if the pressure be changed from $p$ to $p+\delta p$, the resistance of the granules will change from the normal $R$ to $R+\delta R$, and equals $R \times F\frac{(p+\delta p)}{p}$, where $F$ is a function which is not linear. The current change is thus $\frac{E}{R \times F\left(\frac{p+\delta p}{p}\right)}$ which is not a linear function of the pressure change.

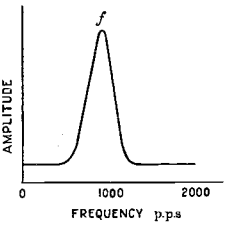



*Fig.* 3.

Now, we have a diaphragm which of course possesses inertia, and this mechanical inertia cannot be expressed very simply, for since every part of the diaphragm is moving at a different velocity, it is apparent that we must take each elemental mass and obtain the sum of these small inertias. The total inertia will thus be $\int \frac{1}{2}mv^2$, where "$m$" is the mass of each element and "$v$" is its velocity, and the value of the integral will depend upon the shape of the vibrating membrane when under stress, which is not always a spherical surface. Due to this inertia, there will be a time lag, which will vary with frequency, between the applied pressure and the response.

Like all mechanical systems, too, the diaphragm possesses a natural period of vibration, and the frequency at which this occurs is termed the resonant frequency. In Fig. 3, the amplitude is plotted against the frequency, and it is seen

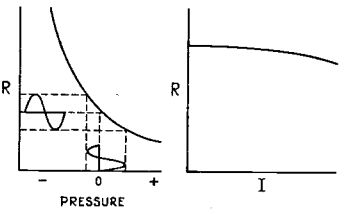



*Fig.* 4. *Fig.* 5.

that the resonant frequency lies at about the value of 900 cycles per second. If any component of the audio wave lies at or near this frequency a far greater motion will be obtained than if the frequency were removed from this resonant point.

Thirdly, we have the damping due to the natural inertia of the diaphragm, and its elastic properties, and also to the damping introduced by the carbon granules exerting a pressure on the diaphragm.

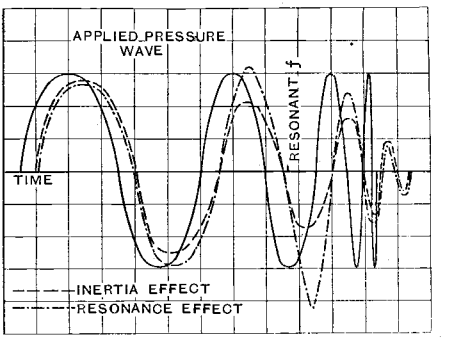



*Fig.* 6.

The curve giving the relationships between applied pressure and resistance is not a linear one, and is shown in Fig. 4.

The change of resistance produced by a given pressure in one direction is not the same as the change produced by the same pressure in the opposite direction.

Thus a sinusoidal resistance change is produced by a pressure change as shown, which is not sinusoidal.

Fifthly, the actual resistance of the granules is dependent on the current through them as shown in Fig. 5, owing to the fact that the contact

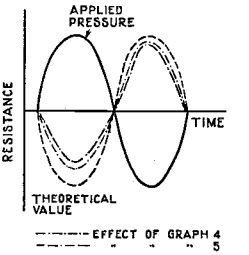



*Fig.* 7.

area increases more rapidly than the pressure applied to the granules.

I have taken a wave form of constant amplitude but varying frequency, and sketched the effect of these different distortions. Fig. 6 and 7 illustrate this point. The net result is to flatten out the peaks unsymmetrically, and to produce a bigger displacement near the resonance point, as shown in Fig. 8.

Fortunately, there are other and better microphones, which the radio engineer can turn to in his dilemma, and I will deal with these later.

The greatest advantage of the carbon microphone is undoubtedly its remarkable sensitivity, but its small power capacity, owing to the limiting condition of the current, due to arcs, is a serious disadvantage. 0·1 amp. is a safe maximum for current, and the usual resistance is 50-100 ohms, so that the power capacity is only about 1 watt. Special low resistance transmitters have been constructed as high as 5 watts.

### The Input Transformer

Having now converted our pressure wave into a change of resistance, and thus a change of current ,

we have to apply this change by means of a transformer to the grid of a valve, where the pressure change is here converted into a voltage change applied to the grid of the modulator. In Figs. 9

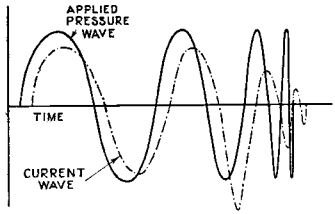



*Fig.* 8.

and 10, considering the primary circuit, the impedance offered to the current is principally the $\omega LI$ and the $\frac{I}{\omega C}$ reactance, the $RI$ vector being, except for the lower frequencies, small. Thus the current is a function of the frequency, and the $RI$ vector is dependent on skin effect, although this is small for audio frequencies.

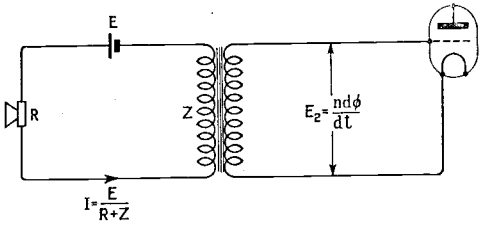



*Fig.* 9.

$Z$ and $\varphi$ will thus vary for different applied frequencies in the primary, the highest of which will be damped out. Since our primary current is dependent upon frequency, the carbon microphone will present a varying impedance, which will thus further modify the current in the primary circuit.

The secondary volts on no load will be given by

$$e = n \frac{d\varphi}{dt} = n \frac{di}{dt} \frac{d\varphi}{di}$$

Now $\frac{d\varphi}{di}$ is not linear as shown in Fig. 11

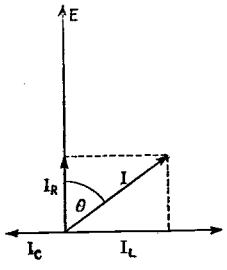



*Fig.* 10.

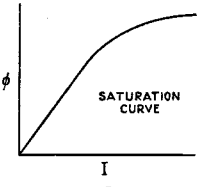



*Fig.* 11.

owing to the B-H curve. If we have no losses, $E_{sec} = KfI_p = KF = \frac{K^1 f}{\omega L} = \frac{K^1}{2\pi L}$ which is independent of frequency. However the losses are twofold, the hysteresis loss, given by the well-known Steinmitz formula of :—

Energy loss per cycle $= nB^{1.6}$ where "$n$" $=$ 0·015 for magnet steel and the eddy loss $= nB^2t^2f^2$ where "$t$" = thickness of laminations.

In Fig. 12, the various values of E.M.F., current and flux are drawn out, together with the resultant secondary volts, and it will be seen that a reduction of amplitude is obtained with the higher frequencies as well as a greater diminution on the positive half of the applied wave. Capacity coupling

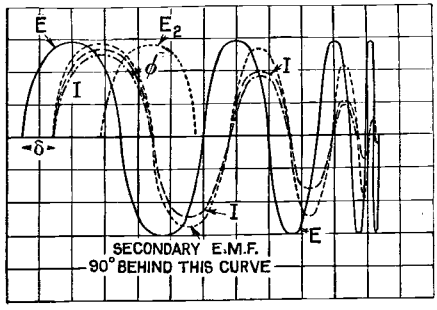



*Fig.* 12.

between the two windings has been neglected in arriving at these curves.

THE VALVE.

Having now arrived at a potential change upon the grid of a valve, we have the distortion produced by the non-linearity of the $v_g - i_a$ and $v_g - i_g$ characteristics, Fig. 13, and in order to eliminate the shunting effect of the valve on the transformer

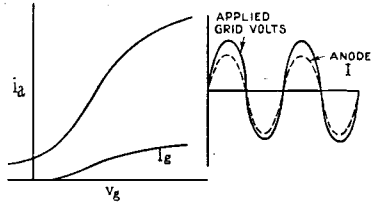



*Fig.* 13.

secondary, we have to keep our grid negative, thus giving usually a more curved characteristic for the plate current. If we make the grid slightly positive in order to maintain a linear $v_g - i_a$ characteristic, our transformer secondary will then become loaded.

The current changes in the oscillatory circuit are only a linear function of the voltage changes on the grid so long as limits due to saturation are not introduced.

If the grid be adjusted to give an anode current of half the saturation value, it is possible, by having a large grid change and a low anode voltage, to only very slightly increase the current in the oscillating circuit by a large change in the grid voltage.

In order to obtain proportional changes, it appears that we need an oscillating circuit of high resistance supplied by a valve with a high anode potential. This precaution will also prevent the evils of over modulation and the consequent

cutting off of wave peaks. It is possible to get very big distortion effects by bad adjustment of the transmitting valve.

In the antenna, we have the same case as in our receiving aerial, and we will leave this till we deal with the receiving end of our chain.

THE ETHER.

The ether is our next medium of propagation, and here we find that the distortion of the high frequency modulated energy is a minimum. Only one factor can produce any distortion, and that will be apparent from an examination of the transmission formula.

$$I_r = \frac{KI_s h_s h_r}{R\lambda x} \times coeff.$$

where $I_r$ = The received current.
$I_s$ = The sending current.
$h_r$ = The effective height of the receiving antenna.
$h_s$ = The effective height of the sending antenna.
$R$ = The resistance of the receiving antenna.

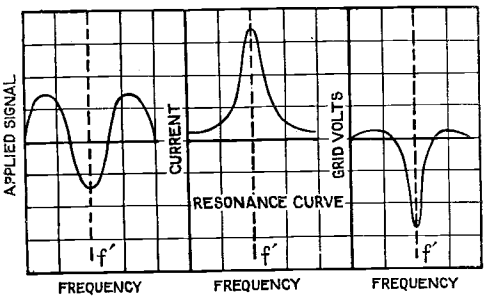



*Fig.* 14.

$\lambda$ = Wavelength.
$x$ = The transmitting distance.
and $K$ is a constant.

The co-efficient in the formula is given by Austin as $e^{\frac{-\cdot 0015}{\sqrt{\lambda}}x}$.

Now although the current in the receiving circuit is a function of the frequency, the E.M.F. applied to the grid of the valve is given by $\omega LI$, and thus there will be no quenching of the higher frequencies. However, since the attenuation constant is a function of frequency, and the modulation at the transmitter produces a change in the carrier wave frequency, we shall get a slight distortion on either side of the fundamental wavelength. However, we can neglect this factor for most purposes.

THE RECEIVING ANTENNA.

In the receiving antenna, we have to consider this variation in the transmitted frequency: $f = \sin\omega t \sin\omega' t$, where $\omega$ is the radio carrier wave frequency $\times 2\pi$ and $\omega'$ is the radio frequency $\times 2\pi$.

Now, if we consider the resonance curve of the receiving tuned circuit, or in fact of any of the oscillatory circuits in the amplifier, we shall find that the current in the resonant circuit is a very unfaithful reproduction of the E.M.F. inducing it. In Fig. 14, the first curve on the left represents a wave of varying frequency on either side of the true carrier wave frequency "$f$." The second curve is the usual one showing current plotted against frequency in the resonant circuit, and the third curve gives the grid volts applied by such a circuit, when the original wave induces the current. This point indicates that the resonant circuit

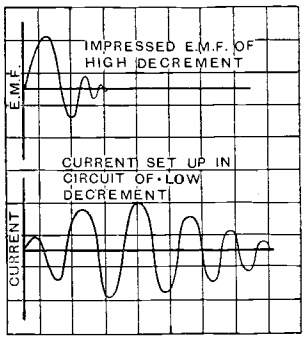



*Fig.* 15.

should be of high resistance, with consequent flat tuning.

Again, if the decrement is low, a damped impressed E.M.F. will produce a current as shown in Fig. 15, leading to very serious distortion. This is, of course, due to the property of a low resistance resonant circuit to maintain any oscillations once started in it. This is the real reason why reaction produces such serious distortion effects, as the effective resistance is very low.

Thirdly, we have the effect of time lag. If we consider a wave of square modulation, as shown in Fig. 16, applied to a resonant circuit in which $\frac{L}{R}$ is large, the current response will be of a form as shown, and is exponential in form, being the same as the building up of current in an inductive circuit when a source of E.M.F. is suddenly applied to it.

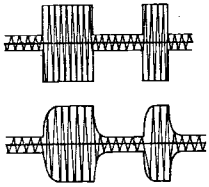


*Fig.* 16.

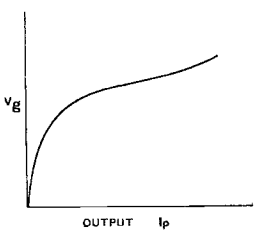



*Fig.* 17.

In general, it appears that distortionless reception as regards the resonant circuits requires primarily a highly damped circuit, and therefore it seems impossible to obtain selectivity and good

reproduction at one and the same time. The perfectly selective circuit cannot receive telephony at all, and the hoped-for prospect of substituting wireless for land line telephony with carefully tuned receiving circuits capable of discriminating between stations only a few metres apart in wave-length seems to be doomed to remain unfulfilled for at least a considerable period.

THE AMPLIFIER.

We now have to pass our modulated high frequency E.M.F. to an amplifier of some type, and it will be interesting to see the behaviour of such instruments.

The input-output curve of a typical amplifier is somewhat as shown in Fig 17, and clearly shows that small applied E.M.F.'s have a far smaller effect than the larger ones. An amplifier is very insensitive to small potential changes.

The distortion in high frequency transformers is of the same type as the resonant circuit distortion previously discussed, and the effects of saturation, inter-electrode capacity, and grid currents produces a series of effects, the product of which it is difficult to prophecy.

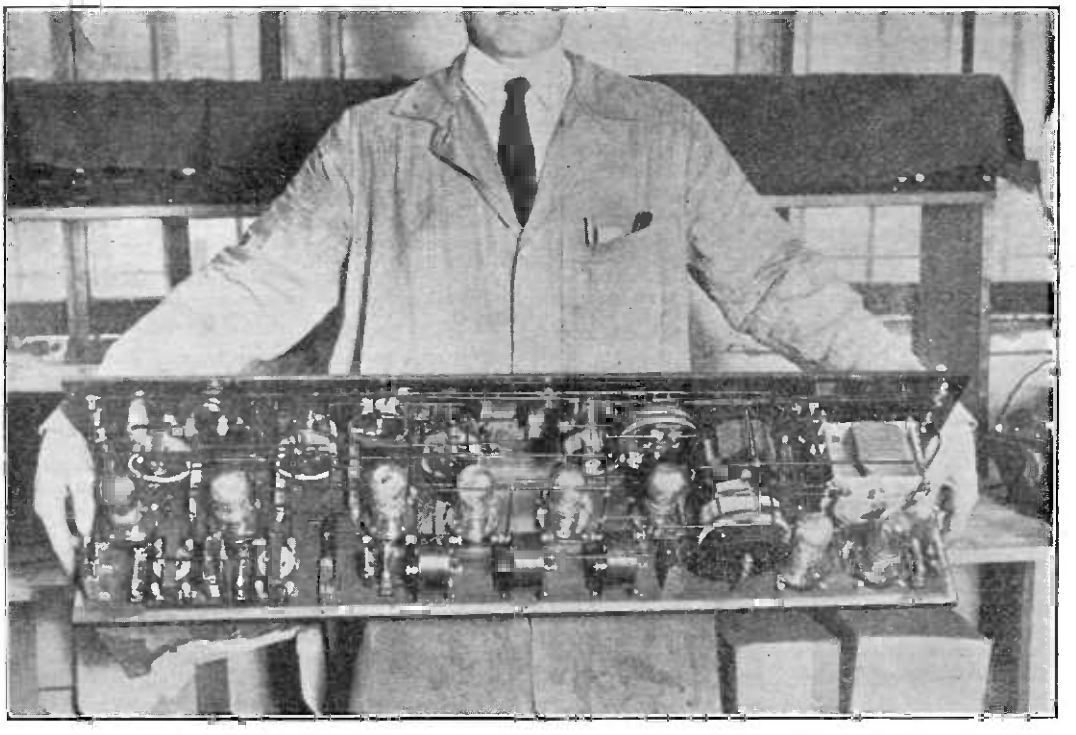
The greatest distortion maker is undoubtedly oscillation, or rather low resistances in the oscillatory portions of the receiving circuits produced by partial self-oscillation of certain sections of the amplifier and tuning coils. In order to stop this oscillation, the usual methods adopted are to use back reaction or to give positive potentials to the grids of the valves, but these methods reduce amplification, and we have yet to discover a stable amplifier giving a voltage amplification ratio near to the theoretical value indicated by the valve characteristics.

In our transformer we have the usual iron losses, and the resonance of both windings. The self-capacity often forms a lower impedance path than the inductance, and often a transformer operates virtually as a capacity; in fact many high frequency transformers operate as capacity couplings between one valve and the next.

A common source of serious distortion is the large applied voltage to the last valve of the amplifier, which runs the characteristic point well off the linear part of the $v_g - i_a$ curve snipping off the peaks of the applied wave. It is rarely realised what large voltages are applied to a loud speaker output valve, and it would be well if valves capable of handling such outputs were used more generally.

*(To be continued.)*

## An Eight-Valve Receiver.



*The photograph shows the interior of a well-built eight-valve super-heterodyne receiver. The first valve is the detector, the next the oscillator, then follow three H.F. stages, detector, and two note magnifiers.*

# NEW BOOKS.

## The Home Constructor's Wireless Guide.* By W. JAMES.

This is a new publication which will be very welcome to all readers of this journal. The author, Mr. W. James, is well known to readers by his contributions under the heading of "Wireless Theory," and numerous other articles.

The author examines each portion of the complete wireless receiving installation, first of all explaining the function and then the practical design. The scope is best shown by the contents :—

**Aerials and Earths.**—The Construction of Outdoor Aerials, Frame Aerials, and Earths. **Tuners.**—Construction and Dimensions of Tapped Coils, Plug-in Coils, Basket Coils, Loose Couplers, and Variometers.—Construction and Dimensions of Variable Condensers and Fixed Condensers.—How to Find the Inductance of Coils.—Hints on Better Tuning. **Crystal Receivers.**—Methods of Connecting and Constructing Crystal Receivers. Faults in Crystal Receivers. **Valves.**—How a Valve Works. The Two-Electrode Valve as Rectifier. Method of Connecting. The Three-Electrode Valve as Rectifier. Methods of Connection. Data on the Most Used Valves.—Reaction and How it is Obtained. The Single Valve Reaction Receiver. **How the Valve Amplifies.**—The Valve as an Amplifier. Resistance Coupling. Transformer Coupling. Tuned Anode Coupling. The Valve as a Low Frequency Amplifier. Resistance Coupling. Transformer Coupling. Choke Coupling. **How to Assemble a Receiver.**—A Two-Valve Receiver and Tuner. A Two-Valve Note Magnifier. A Three-Valve Receiver. A Unit System Receiver. Circuits of Various Receivers and Particulars of the Apparatus Used. Faults in Valve Receivers. **Six Sensitive Single-Valve Receivers.**—Dry Cells. Accumulators. Care of and Charging from Direct Current Mains. Charging from Alternating Current Mains.

The average wireless amateur generally acquires a fair practical knowledge of the nature and operation of wireless apparatus, without paying much attention to the underlying principles. It is believed that it is only by a proper understanding of the function of each component that one is able to properly arrange a receiver so that the best possible use is made of each component employed. Those who read this book will be in a much better position to properly appreciate the articles which appear in the technical press.

The book contains over 220 pages, with 100 figures and photographs, printed upon excellent paper with a good binding, and is sold at the modest price of 3s. 6d.

## Wireless Telephony: A Simplified Explanation.* By R. D. BANGAY.

Mr. R. D. Bangay is very well known as the author of "The Elementary Principles of Wireless Telegraphy," and "The Oscillation Valve," and it may be said, perhaps, that more people have read Mr. Bangay's books than any other.

The object of the present book is to assist those with receiving apparatus who have neither the taste nor the time for technical study, but who wish to acquire sufficient general knowledge of the whole subject to give them an intelligent interest in the apparatus they use. The author has endeavoured to cover as wide a field as possible, with the object of making clear the fundamental principles involved.

The first few chapters deal with Sound Radiation in the Air, Characteristics of Sound, Electricity, Telephony, The Aether, and Wave Radiation as a Carrier of Varying Power. The following chapters deal with The Valve, The Wireless Telephone Transmitter, Wireless Telephone Reception, The Oscillation Valve as a Relay, The Use of the Oscillation Valve in Receivers, Typical Wireless Telephone Receivers, Reaction and Re-radiation, Tuning-in, Frame Aerials and Directional Reception.

The book is very well illustrated, and has 130 pages, clearly printed and well-bound. The price is 2s. 6d.

## Time and Weather by Wireless.* By W. G. W. MITCHELL, B.Sc., A.R.A.S. F.R.Met.S.

Mr. W. G. W. Mitchell will be remembered for his articles dealing with the subject, which have appeared recently in *The Wireless World and Radio Review*. The scope of the book is perhaps best shown by the chapter headings, as follows :—

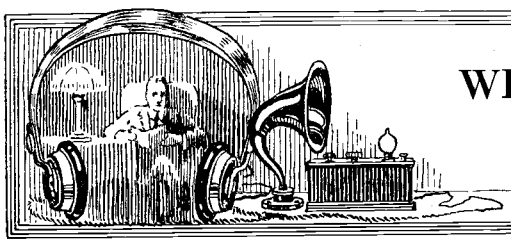
Time and Navigation, The Codes Used in Time Signals, Greenwich Time to Quarter Second, The American Signals, Stations Throughout the World, Sidereal Time, How to Make Use of the Scientific Time Signals, How Time Signals are Sent from the Eiffel Tower, Wireless and Meteorology, Weather Forecasts, The Factors Which Decide Our Weather, Pilot Balloon Reports for Airmen, The Organisation of a Meteorological Service, Meteorological Wireless Codes, How to Prepare a Synoptic Chart, Wireless and Weather Reports for the Northern Hemisphere, The Local Weather Forecaster, Week-End Forecasts, Time Table of Principal European Transmissions.

The book will be widely read by those who are interested in Time and Weather by wireless. It contains 120 pages and 60 figures. The price is 3s. 6d.

## The Wireless Atlas of the World.*

A very complete and convenient Pocket Atlas has recently been published by the Wireless Press, Ltd., in which every known land station is clearly marked. A figure against the name of each station denotes whether the nature of service is Public General, Direction Finding, Official, Military, Public Restricted, Private or for Aviation. The Atlas comprises seventy-six maps clearly printed in two colours, with insets of the Districts around Washington, New York and other busy wireless centres, and including key maps of Europe, Asia, Africa and North and South America. No pains have been spared to make the information complete and reliable. The fact that Messrs. G. W. Bacon & Co., Ltd., the well-known map printers have undertaken the drawing and printing is, in itself, a proof of the excellence of the work, and the very modest price of 1s. 6d. should ensure its being in the possession of every wireless enthusiast, whether amateur or professional.

*The Wireless Press, Ltd., 12 & 13, Henrietta Street, London, W.C.2.



# WITH THE SOCIETIES

Particulars of Membership of any Society can be obtained on application to the Secretary.
Societies marked with an asterisk are affiliated to the Radio Society of Great Britain.

**Paddington Wireless and Scientific Society.***

The second annual general meeting of the above was held on Thursday, October 18th. After a vote of thanks had been passed to the retiring officers and committee, the following were elected for the ensuing year :—

President, A. G. Cooke, M.A., A.M.I.E.E. ; Vice-President, Dr. J. H. Vincent, D.Sc., M.A. ; Committee, Messrs. A. Hoban, M. Hoban, A. Bursill, A.M.I.E.E., V. W. Venables, L. Taylor, and L. Bland Flagg.

At the invitation of the Society, Mr. J. H. Reeve, M.A., the Western District representative on the committee of the R.S.G.B., gave us a most interesting talk on the relations existing between that body and the affiliated societies, and outlined the policy of the main body for the future.

Hon. Sec., L. Bland Flagg 61, Burlington Road, Bayswater, London, W.2.

**The Dewsbury and District Wireless Society.***

On Thursday, October 18th, the members of the Society held their second "beginners' night." Mr. Dransfield gave an interesting talk on "Sound Waves in Wireless Telephony," this being illustrated by lantern slides.

Hon. Sec., Fred Gomersall, 1, Ashworth Terrace, Dewsbury.

**Finsbury Technical College Wireless Society.***

At a meeting of the Society held on Saturday, October 20th, Mr. G. Parr, demonstrator in the Electrical Department of the College, gave a lecture on "The Principles of Wireless Transmission." The problems of spark transmission were described and explained by the use of simple but very effective demonstrations.

Mr. Parr proposes to give another lecture at an early date on "Telephony and Continuous Wave Transmission."

Hon. Sec., F. W. Dawe, Finsbury Technical College.

**Wolverhampton and District Wireless Society.***

The fortnightly meeting of the Society held on Wednesday, October 24th, took the form of a lecture on "Oscillating Currents," and was given by Mr. A. H. Watkins, A.I.A.E.

The lecturer made a special point of treating the subject from the standpoint of the beginner, and dealt mainly with induction and capacity.

High and low frequency transformers, their construction and functions, were also matters dealt with by Mr. Watkins.

Hon. Sec., J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

**Lewisham and Catford Radio Society.***

On Thursday, October 18th, Mr. R. J. Stanley lectured before the above Society, the subject being "The Reinartz Tuner."

The lecturer described the theory of the tuner and gave the members many diagrams on the blackboard showing the original tuner and many modifications of it, including added H.F.

Keenness is being shown in the Morse class which is now held at 7.30 every Thursday. The Society are very lucky in having expert instructors in Morse.

On Thursday, October 25th, Mr. Pace lectured on "Wireless Worries."

The lecturer spoke on the subject of "Light," in referring to electrons, and explained the theory of radio.

Hon. Sec., F. A. L. Roberts, 43, Adelaide Road, S.E.4.

**Radio Association.**
**(South Norwood and District Branch.)**

Before a well-attended meeting held on Thursday, October 18th, Mr. S. W. Butters (5 VU) delivered a lecture on "Earths."

Mr. Butters explained various forms of earth systems, emphasising the fact that amateur stations need be more efficient in this respect than high power stations.

Hon. Sec., C. H. P. Nutter, F.R.A. (5 DB), Radio Corner, 243a, Selhurst Road, Norwood Junction, S.E.25.

**Liverpool Wireless Society.**

A meeting of members and friends of the Liverpool Wireless Society was held at the Liverpool Royal Institution, Colquitt Street, on October 18th, 1923, at which Mr. J. Wade, of the Marconi-Osram Valve Co., Ltd., gave a lecture on "The Manufacture of Thermionic Valves."

Examples of all types of valves in various stages of manufacture permitted the audience to follow the points of the lecturer throughout.

Hon. Sec., G. H. Miller, 138, Belmont Road, Liverpool.

**Liverpool Co-Operative Radio Association.**

On Friday, October 19th, Mr. S. Frith, President, delivered an instructive lecture on "Aerials" to a well-attended meeting at Unity House, Byrom Street.

He described the various types, including "L" and "T" aerials, and commented on the necessity of efficient insulation to prevent current leakage. He also explained Marconi's Directional Aerial, and the common "T" form used on ships, which

owing to its two-way direction, was slightly less efficient than the "L," especially when the latter was erected as a uni-directional type.

Meetings every Friday, at Unity House, Byrom Street, at 7.45 p.m.

Hon. Sec., Jas. Kearns, 162, Walton Road, Liverpool.

### Southend and District Radio Society.

A successful meeting of the above Society was held at the Hon. Secretary's address on Friday, October 19th, Mr. W. McGeorge in the chair.

Reflex circuits were discussed, and members gave accounts of their experiences and results of their experiments with them.

Hon. Sec., Mr. E. Haws, 101, Southchurch Avenue, Southend-on-Sea.

### Radio Association of Ireland.

There was a large attendance at a general meeting of the Association, held at the Technical Institute, Kevin Street, Dublin, on October 16th.

The Chairman, Professor W. J. Lyons, referred to the large number trained in wireless at the Municipal Technical Institute, and spoke of the slump in shipping which had given no outlet for expert operators. With these men originated the idea of an Association which should embrace all wireless interests, especially in view of the development of broadcasting.

It was announced that the Secretary of the G.P.O. approved the Association and welcomed its co-operation in securing the observance of the regulations by licence holders.

The Executive Committee has been entrusted with the preparation of a programme.

Hon. Sec., H. Hodgens, Radio Dept., Municipal Technical Institute, Kevin Street, Dublin.

### South Dorset Radio Club.

Captain P. P. Eckersley delivered an instructive and amusing lecture before the Club on October 13th, there being an audience of 350.

Captain Eckersley indicated that he would deal with the technical side of broadcasting; the organisation of programmes, which had aroused a good deal of opposition, did not come within his purview. He admitted that Weymouth had been unfortunately situated in regard to broadcasting up to the present. Dealing first with the elementary principles of wireless telephony, he spoke of the necessity of a medium for the transmission of electric or sound waves. His voice vibrations were transmitted through the medium of air. If the audience were in a vacuum they would not hear him. They would all be dead, but that, of course, would be a minor detail. (Laughter.)

The problem now was to enable the ordinary man to own a set which would allow him to hear any broadcasting by merely turning a variometer. After discussing the question of fading, the lecturer spoke of the opening of Bournemouth during the following week and said that good programmes were to be expected.

At the conclusion of the lecture, Capt. Eckersley answered many questions.

Hon. Sec., E. B. Cartwright, 18, Newberry Terrace, Rodwell, Weymouth.

### The South London League of Radio Societies.

The opening meeting of the South London League of Radio Societies was held at the Chess Room, Greyhound Hotel, Sydenham, on October 20th. The Chair was taken at 6.30 p.m., by Geo. Sutton, Esq., A.M.I.E.E. Rules were framed and adopted, headquarters decided on, the objects of the League defined, and the following officers elected for the ensuing year. To be Chairman, Geo. Sutton, A.M.I.E.E. (Wireless and Experimental Association); to be Hon. Gen. Sec., G. J. Price (Honor Oak Park Radio Society); to be Hon. Treasurer and Assistant Hon. Sec., Harrie King (Dulwich and District Wireless and Experimental Association).

Any South London Wireless Society desirous of joining the League may send two delegates to any League meeting at headquarters, the date and time of which will be duly notified in the Wireless Press.

Full particulars may be obtained from Hon. Gen. Sec., G. J. Price, 22, Honor Oak Park, S.E. 23.

The next meeting of the League will take place on Saturday, November 24th, at 6.30 p.m., at headquarters, the Chess Room, Greyhound Hotel, Sydenham. (Nr. L.B.S.C. Ry. Stn.).

### Bromley Radio and Experimental Society.

The annual general meeting of the above Society was held on October 23rd, when Mr. J. J. Brandon gave an interesting lecture on aerials and the installations of various commercial wireless stations. The lecture was illustrated by a number of slides kindly lent by Marconi's Wireless Telegraph Company, Ltd.

Hon. Sec., L. R. Stephens, 73, Mason's Hill, Bromley, Kent.

### C. S. C. A. Radio Society.

The Civil Service Clerical Association Radio Society is now in existence and meetings will be held at headquarters, 38a, St. George's Road, Victoria, S.W., on the first and third Wednesday in each month, at 6 p.m. The subscription has been fixed at 5s. per annum, with an entrance fee of 5s.

The first meeting of the Society was held on October 19th, when Mr. T. Procter gave an interesting talk and demonstration on "An Elementary Crystal Set," using a home-made set which proved exceptionally efficient. Mr. A. W. V. Scoble also demonstrated the Flewelling Circuit on an improvised indoor aerial. A discussion with questions followed, and the meeting concluded with a talk on "Morse" by Mr. Procter.

Hon. Sec., J. A. Nash, 149 Neasden Lane, N.W.10.

### The Newcastle Y.M.C.A. Radio Club.

At a meeting held in the Y.M.C.A. on October 25th, it was decided to form a club under the above title. There was an enthusiastic, if small attendance, and a start was very soon made by electing an Hon. Sec. and Committee of three.

It is proposed chiefly to carry out experimental work, and to this end the Club will meet every Thursday, when lectures, demonstrations of new circuits, morse practice, etc., will be held.

The Club propose to acquire immediately sufficient component parts to experiment with receivers of various types, up to three valves. It is particularly desired to try novel circuits as they appear in the radio press.

Hon. Sec. (*pro tem.*), J. Campbell Wood, 17, Queen's Road, Jesmond.

# Questions & Answers
## Solutions of Readers' Difficulties

*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—*(1) *Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor,* **The Wireless World and Radio Review,** 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *All questions will be answered through the post. Those of general interest will also be published.* (4) *Every question, except those under* (5) *below, should be accompanied by a postal order for* **1s.,** *or* **3s. 6d.** *for a maximum of four questions, and also the coupon taken from the advertisement pages of the current issue.* (5) *For the benefit of those readers who would rather not pay the charges, a free Questions and Answers Coupon will be placed in the advertisement pages of the first issue of every month. This coupon should accompany the question submitted, together with a stamped addressed envelope. The free coupon is valid for the current week only.* (6) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.*

(7) *Four questions is the maximum which may be sent in at one time.*

**"A.A.S." (S.E.4)** *referring to the article on a "One Valve Dual and Crystal Receiver" described in the issue of August 22nd, asks* (1) *If dull-emitter valves may be employed in this circuit with success.* (2) *For particulars of a set of aerial tuning transformers for use in this set to tune from* 150 *to* 3,000 *metres.* (3) *If the condenser D across the primary winding of the L.F. transformer may be omitted if a certain make of transformer is used.*

(1) Yes. (2) Suitable values are given in the following table, No. 22 S.W.G. D.C.C. being used for the primary, and No. 40 S.W.G. S.S.C. for the secondary winding.

| Wavelength metres. | Primary. | Secondary. |
|---|---|---|
| 150–450 | 25 | 50 |
| 450–1,000 | 60 | 150 |
| 1,000–2,000 | 150 | 350 |
| 2,000–3,000 | 250 | 600 |

(3) A condenser is already shunted across the primary of this make of transformer, and the condenser D may therefore be omitted.

**"D.C.W." (Kingston)** *submits specimens of tin foil and waxed paper, and asks* (1) *How much must be used to make condensers of* 0·006 *and* 0·00025 *μF respectively.* (2) *The sizes of coils marked D.L.*1,500 *and D.L.*1,250 *in the Armstrong Super-regenerative circuit described in the issue of August 15th.*

(1) The 0·006 μF condenser should consist of five plates with an overlap of 4 sq. ins., and the 0·00025 μF condenser should be made with three plates, the overlap in this case being 0·5 sq. ins. (2) The coils referred to are No. 1,500 and No. 1,250 Igranic duolateral coils.

**"D.G." (W.1)** *submits a diagram of his two-valve receiver, which consists of one H.F. transformer coupled valve and one rectifier. On touching the grid connections to the last valve there is a marked increase in signal strength, and he asks the reason for this.*

We notice from the diagram that you are not employing a grid condenser and leak for the rectifying valve, and we recommend that you fit one in accordance with diagrams given in this journal from time to time. The effect of touching the grid connections has been to give the grid a suitable normal potential, and this same result is achieved by the use of a grid condenser and leak.

**"A.P." (Sunderland)** *asks for the gauges of samples of wire submitted.*

The gauges are as follows:—"A," 24 S.W.G.; "B," 22 S.W.G.; "C," 20 S.W.G.

**"R.A.J." (Torquay)** *asks for a diagram of a crystal and L.F. receiver capable of receiving* **2 LO** *on a loud speaker, the distance from the station being* 12 *miles.*

The diagram is given in Fig. 1.

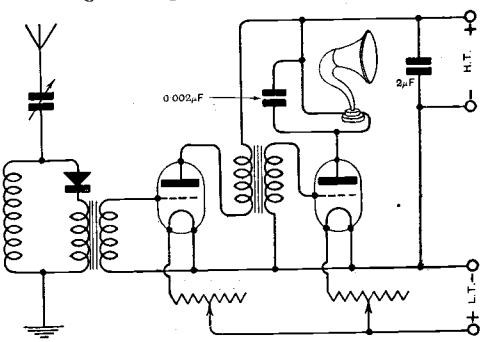



*Fig.* 1. **"R.A.J." (Torquay).** *A crystal receiver with two note magnifiers.*

**"L.J.B." (S.E.27)** *sends a sketch of an iron core and former, and asks for particulars of turns and gauge of wire to wind it as a choke coil having an inductance of 8 H. and carrying a current of 500 mA.*

We suggest that you wind the former with 6,500 turns of No. 28 D.S.C. wire.

**"E.B." (Leeds)** *has a Mark III* short wave tuner and three-coil holder, and asks for a diagram of a four-valve set (one H.F., rectifier, two L.F.) incorporating these components.*

We recommend that you use the coil-holder for the tuned anode and reaction coils, leaving one holder disconnected. The diagram is given in Fig. 2.

**"A.W." (Felixstowe)** *asks* (1) *How to connect up an ex-Army "Valve to 'phone" transformer.* (2) *The number of turns and weight of wire used for the windings.*

(1) The terminals marked 'phones should of course be connected to the low resistance telephones, and the remaining pair of terminals should be connected in the plate circuit of the last valve. (2) We believe that about 4,000 turns were used for the primary, and about 1,000 turns for the secondary in this type of transformer. We have no information concerning the weight of wire used.

**"J.W.G." (Leeds)** *asks how to construct magnet coils for a pair of headphones.*

The formers should be made of some insulating material such as sheet fibre or thin shellaced cardboard. They should be mounted on a temporary holder, and might be conveniently rotated by a hand-drill, held in the vice. No. 47 S.S.C. enamelled is the best wire to use for high resistance windings.

**"A.E.S." (Sidcup)** *asks what would be the most suitable resistance for the telephones to be used in the "One Valve Dual and Crystal Receiver," described in the issue of August 22nd.*

The telephones may have a resistance of either 2,000 or 4,000 ohms.

**"S.B.R." (S.E.15)** *proposes to use the "High Frequency Ammeter," described in the issue of April 1st, 1922, to measure minute direct currents, and asks for information.*

No advantage is to be gained by the use of this instrument for measuring small direct currents. A suspended moving coil galvanometer will be found to be much more sensitive and simpler in operation.

**"P.H.F." (Queen's Park, W.10)** *has assembled the two-valve receiver described on page 460 of the issue of July 7th, and asks* (1) *If the wiring diagram given is correct, as his H.T. battery has run down.* (2) *For particulars of basket coils for the above set, to be wound on slotted formers.* (3) *If all the British broadcasting stations could be received on this set.* (4) *If connecting the A.T.C. in parallel with the A.T.I. and connecting the positive side of the L.T. battery to earth would increase signal strength.*

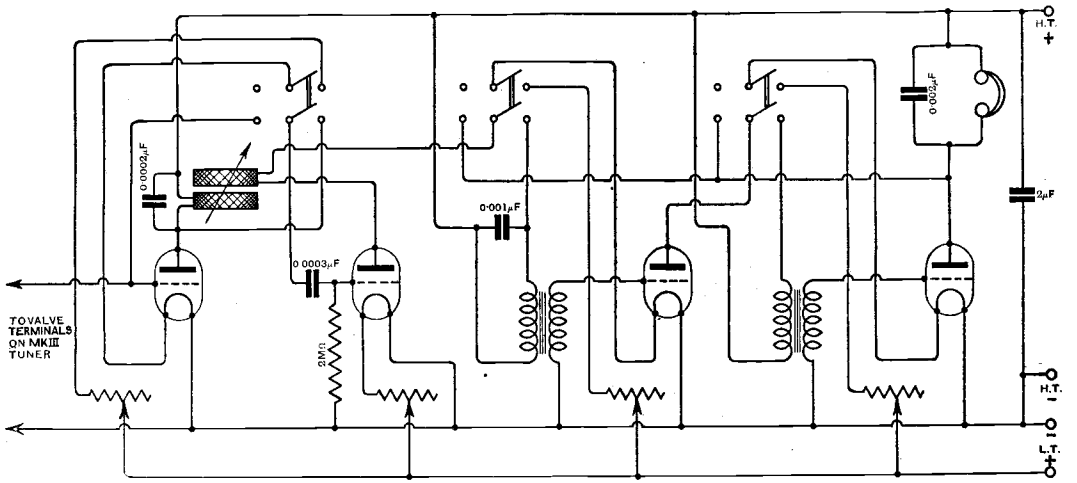



*Fig. 2.* **"E.B." (Leeds).** *The first valve operates as a high-frequency amplifier, the second as rectifier, and the last two as note magnifiers. The switches are connected so that the number of valves in circuit may be easily varied.*

(1) The wiring diagram given in the article is correct. We would recommend you to check the wiring of your receiver, bearing in mind that wires should be joined only at points marked by a black dot in the diagram. (2) Wind the formers with No. 22 D.C.C. wire and make the internal diameter 1½". The A.T.I. should be wound with 60 turns, the anode coil with 75, and the reaction coil with 75 turns. (3) The range of the set will depend upon the efficiency of the aerial and the skill with which adjustments are made. You should be able to hear stations as far north as Birmingham and Manchester, and under the best conditions, Newcastle and Glasgow. (4) The effect would be to decrease signal strength, but there would be less likelihood of energising the aerial with this arrangement.

# THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 223. (No. 8. Vol. XIII.) NOVEMBER 21st, 1923. WEEKLY




## CONTENTS



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# THE SUPERSONIC HETERODYNE RECEIVER.

By W. S. BARRELL.

In a previous article the author dealt with the principle underlying the action of the Armstrong supersonic heterodyne circuit. The simple construction of the rectifying and oscillator units is now described.

IT is now proposed to describe the apparatus required, which, for convenience, may be divided into the following four units :—(1) Rectifier unit ; (2) Heterodyne ; (3) Coupling unit ; (4) Amplifier.

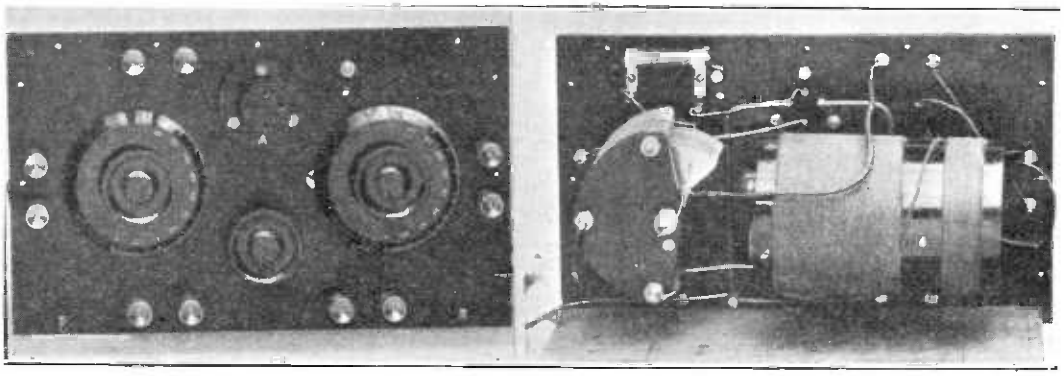


*Fig. 1. Front and rear view of the rectifier unit.*

## The Rectifier Unit.

The components for this unit are mounted on ¼ in. ebonite, measuring 10 ins. by 6 ins. Fig. 1 shows the front and rear view of the panel, and Fig. 4 is a scale drawing showing the layout of the components. The circuit is given in Fig. 2. The closed circuit inductance $L_1$ consists of 70 turns of No. 22 D.C.C. wire wound on a 3-in. diameter former. A ball coupling $L_2$ wound with 40 turns of No. 22 D.C.C. wire is capable of rotation inside $L_1$, and provides the means for varying the coupling between the aerial and closed circuits. A variable condenser, $C_1$ of 0·0003 mfds. maximum capacity is connected across $L_1$ and provides a range of wavelengths from 150 to 480 metres. The adjustable

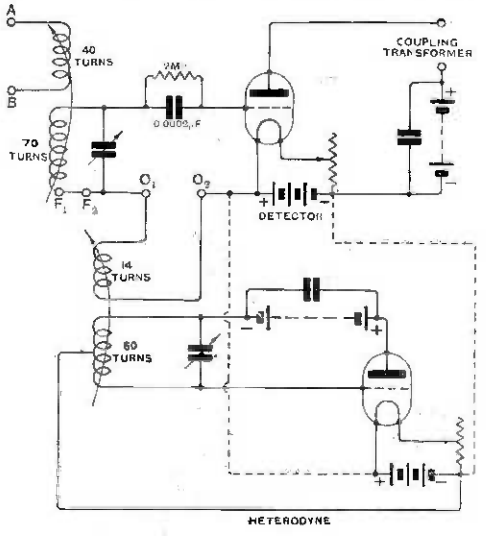



*Fig. 2. Circuit connections of the oscillator and detector units.*

filament resistance should be of the order of 10 ohms, and the grid condenser and leak 0·00025 mfds and 2 ohms respectively. "D.E.R." type valves were found quite satisfactory and need but 2 volts or less across the filament and 40 to 50 volts plate potential. The grid return lead, which is broken and taken to two terminals $O_1$ $O_2$, is connected to the positive side of the low tension battery. This provides the grid with the slight positive potential which is

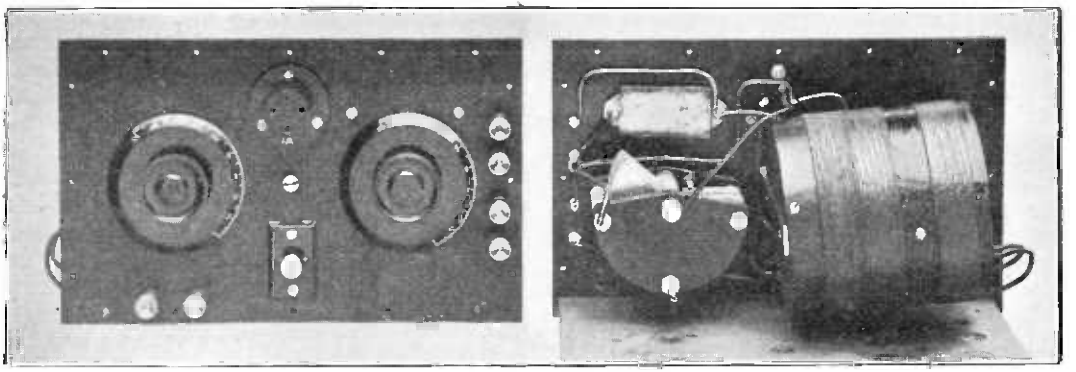


*Fig. 3. The oscillator.*

generally desirable for most efficient operation when using the grid condenser and leak method of rectification.

All connections may be very satisfactorily made by using fairly stout bare wire, say No. 20, covering with systoflex if so desired. Square section wire gives a very pleasing appearance.

It will be noticed that the grid circuit is also broken and brought to two terminals at $F_1$ $F_2$. Normally, and when working on an aerial, these two terminals should be bridged. If, however, it is desired to receive on a frame aerial, the bridging wire is removed and leads from the frame inserted. Under these conditions the coupling coil $L_2$ is of course inoperative.

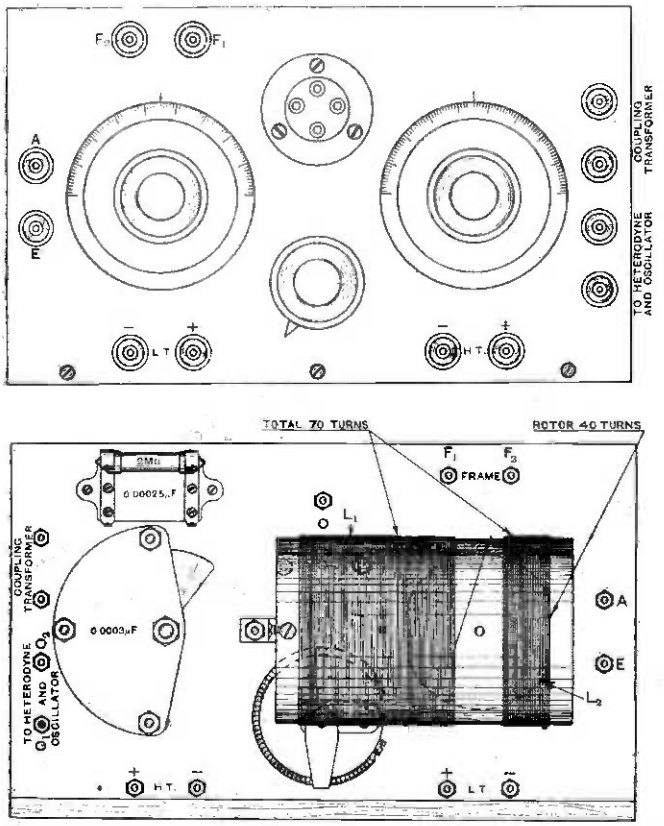



*Fig. 4. Constructional details of the detector unit.*

## Local Heterodyne.

The front and rear view and wiring diagram for this unit are shown in Figs. 3 and 5 respectively, and the panel measures the same as the rectifier unit, namely 10 ins. by 6 ins. The inductance $L_B$ is made up of 60 turns of No. 22 D.C.C. wire wound on a 4-in. former, and is shunted by a 0·0003 mfd. condenser. Special note should be taken of how this piece of apparatus is wired. One end of the inductance $L_B$ is taken to anode, *via* the anode battery, which is shunted by a 0·01 mfd. fixed condenser. The other end of the coil is taken to the grid, the lead to the filament being tapped on to the inductance 20 turns from the "grid" end. Quite a small anode voltage can be used, 12 volts being ample. The

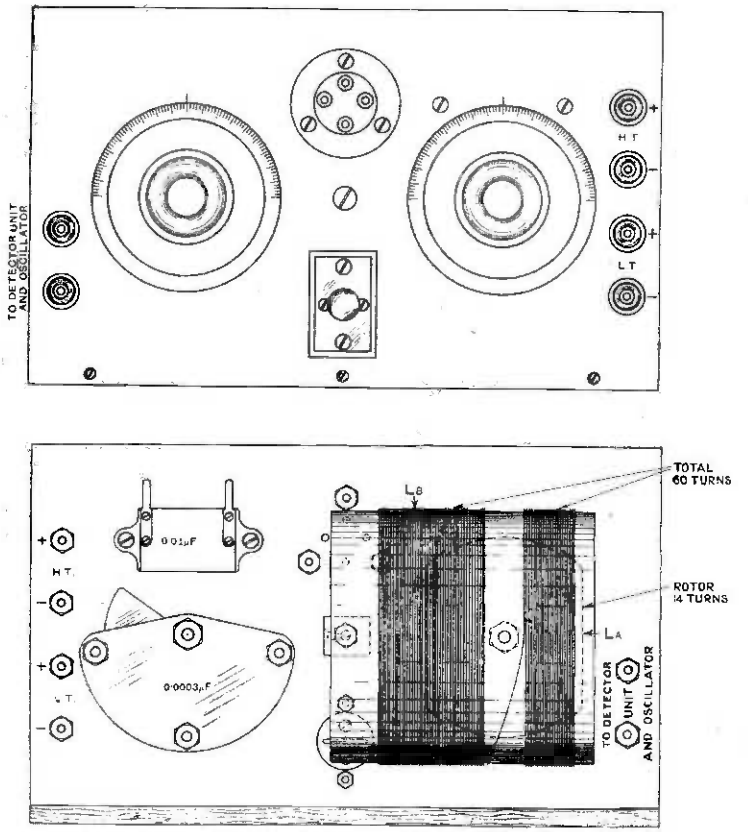



*Fig. 5. The local heterodyne.*

rotatable ball coupling coil $L_A$ has but 14 turns of No. 22 D.C.C., and its purpose is to lead the local oscillations to the detector unit. It is connected by twisted flex to the terminals $O_1$ $O_2$ on the rectifier panel, and is thus in series with the grid return lead.

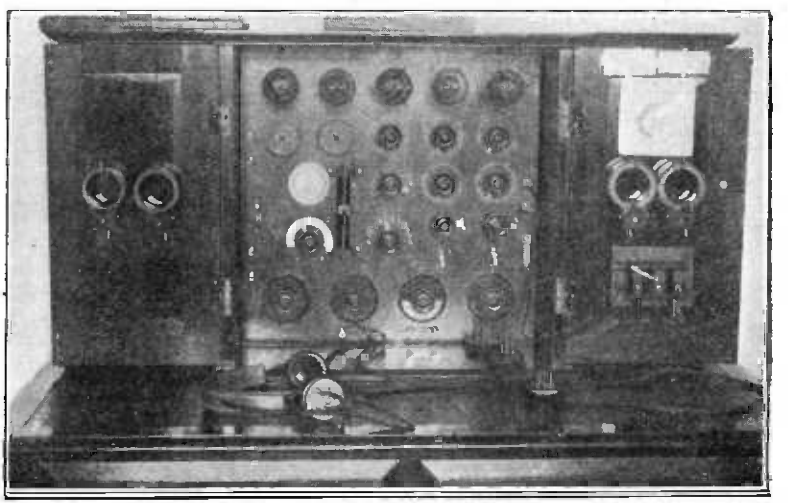
By connecting up the two units and inserting telephone receivers in the plate circuit of the detector at the point where it is intended to connect the coupling transformer, signals can be received and the tuning range ascertained.

*(The method of building the amplifier and coupling units will be described in the next issue.)*

## A FIVE-VALVE CABINET RECEIVER.

The photograph on the right shows the receiving apparatus of Mr. E. J. Bailey of Gerrard's Cross. The set, which consists of 2 H.F., detector and 2 L.F. valves, combines neatness with efficiency and is enclosed in a very compact cabinet.

The switching arrangements enable the use of any combination of valves, various methods of H.F. amplification and the switching of the reaction to either the A.T.I. or H.F. tuning inductances. The panel can be dismounted from the cabinet by the removal of only two screws.



*The five-valve receiver of Mr. E. J. Bailey of Gerrard's Cross.*

# THE OPERATION OF THE ARMSTRONG SUPER.

By D. F. STEDMAN. B.A.Sc. (Canadian).

NO satisfying theory has yet been published explaining the results obtained with the Armstrong Super-Regenerative circuits, either in their simple or complicated arrangements. On the basis of voltage measurements on a form of this circuit the author suggests the following as a satisfactory explanation of at least most of its peculiarities.

The circuit used is given in Fig. 1 (*The Wireless World and Radio Review*, April 28th, 1923), being about as simple as is possible,

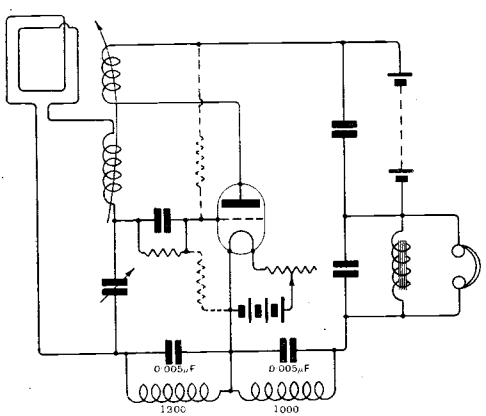



*Fig.* 1.

but nevertheless very satisfactory, and, quite contrary to the rather widespread idea, excessively stable. This stability seems to be the result of the grid condenser; rectification by a potentiometer promptly makes it very critical, causing the valve to oscillate on one frequency only (either H.F. or Armstrong) and howl very easily. As originally given, the grid leak was in the conventional position across the grid condenser, or virtually to the top of the Armstrong inductance. It seems somewhat better if put to L.T.— and sometimes shows an improvement if put to H.T.+, but the variation is not very great.

With this circuit it is entirely immaterial whether any aerial is used or not at short distances, and with a frame 18 in. square, Birmingham is quite pleasant at London, and Manchester weak, but just readable.

The voltage measurements being the basis of this discussion will be gone into in some detail. They were made with a low capacity quadrant electrometer, arranged for measuring both average D.C. potential and root mean square (R.M.S.) values by means of a change-over switch giving the two circuits shown in Fig. 2, and calibrated by means of batteries. With this instrument all voltages can be measured with equal accuracy, including the highest radio frequencies and steady potentials. The figures obtained are given in the table.

Although it is not generally realised that such considerable potentials are obtained with a valve oscillating under only 120 volts H.T., it actually is the case, the total swing of the Armstrong oscillation being nearly equal to the H.T. voltage applied. It will also be seen that grid current during the short time the grid is positive is sufficient to maintain it at from 20 to 40 volts negative, in fact only becoming just sufficiently positive to provide enough grid current to do this.

Any theory of the operation of this circuit must also conform to certain other requirements:—

1. Provide enormous amplification.
2. No distortion except for low whistle frequencies. This circuit is usually credited with much distortion, but a few

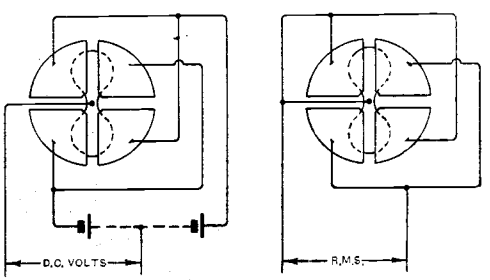
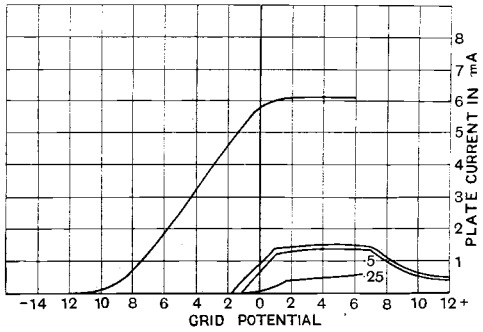



*Fig.* 2.

moments "fiddling" will eliminate it almost completely.

3. Good signals before any considerable amount of H.F. oscillation occurs, *i.e.*, before the "thud." These signals are here characterised as the "Infra Armstrong" region, while after the "thud" is here called the "Armstrong Region."




*Typical valve characteristic curves.*

4. The circuit is not on the point of oscillating, as is frequently stated. Reaction has been increased far beyond the ordinary oscillation point, usually into the howl, and any H.F. impulse given half a chance builds up very rapidly. In the Armstrong region the valve actually is oscillating before any signals are received at all.

5. Peculiarities as to heterodyne. In the Infra Armstrong region naturally no heterodyne is obtained, but after increasing reaction till a thud is produced, with reasonably strong signals still no heterodyne is obtained, although measurement shows 6 volts H.F. oscillation, but on changing to a weak signal heterodyne is at once produced. Also all heterodyne produced is of a very distinct character, instead of the usual single "chirp," a series of "bumps" are obtained on both sides of the wave.

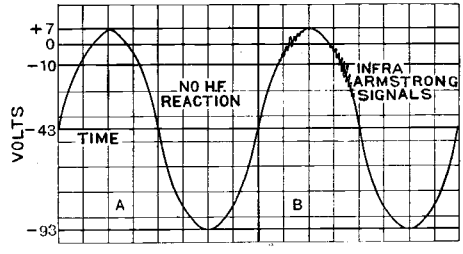
6. Extreme stability, as already mentioned using a grid leak and condenser is somewhat equivalent to a self-adjusting potentiometer, the grid automatically adjusting its own potential.

7. It is not in any way essential for the circuit to show overlap in H.F. oscillation, *i.e.*, for oscillation once started to continue even after loosening the reaction considerably. Sometimes one goes in and out of the Armstrong region with a barely perceptible movement of the reaction coil, without in any way affecting the stability, ease of operation, or the signal strength. The writer has found that, in any case, the Infra Armstrong signals are as strong as the Armstrong, even on distant stations. This would hardly be the case if oscillation hysteresis was the determining factor.

**Operation of the Circuit.**

In considering the operation of this type of circuit it is very usual to attempt to find the effect of an Armstrong oscillation on a valve already functioning, possibly as a detector. The writer proposes to go the opposite way, and to determine the effect of adding H.F. reaction to a valve oscillating very strongly on an Armstrong frequency. The relations in a simple oscillating circuit are very well defined and make a much better starting point.

In Fig. 3A is given a diagram of grid potential against time for one complete Armstrong oscillation, a sine wave of the proportions shown by voltage measurement (Table). It is actually slightly distorted at the positive peak by grid current, but not to any great extent. Now the useful part of the valve characteristic is between 0 and −10 volts (see valve characteristic given) and unless H.F. oscillations carry the grid on to this part of the characteristic, H.F. reaction is lost for the time being. It will be seen that the grid passes through this part twice in each Armstrong cycle, passing through




*Figs. 3A and 3B.*

it in about 1/100,000 of a second. It will also be seen that there is plate current only about a quarter of the time, agreeing with the drop in plate current actually obtained.

The voltage relations when no H.F. reaction is used are thus perfectly well defined, and it only remains to see the result of H.F. reaction. On increasing reaction

three distinct effects are noticed (excluding the howl finally produced) :—

1. Signals without heterodyne or apparent H.F. oscillation. Previously defined as the Infra Armstrong region.

2. A thud indicating H.F. oscillation, by measurement 6 volts, but still no heterodyne if tuned to a strong signal. Or,

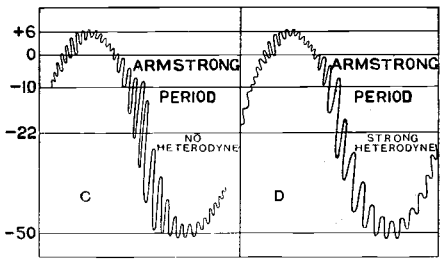
3. If tuned to a rather weak signal another faint thud, accompanied by strong heterodyne.

Two and 3 taken together are the Armstrong region, 2 being usually associated with strong signals, although 3 can also be obtained if the filament is a trifle cool. With weak signals when there is no appreciable wave to build up, more reaction has to be used to obtain oscillation, and one goes directly from 1 to 3. The distinguishing feature of region 3 is evidently that more reaction has to be used to obtain oscillation, which is then of a slightly different character to that obtained with a stronger signal and less reaction.

Now, with the circuit in operation and oscillating strongly on the Armstrong frequency consider that H.F. reaction has been increased to the point of signals in the Infra region (before the thud), although one gets a slight H.F. oscillation here (or signals would not be heard),the energy dissipated is so small that it does not decrease the size of the Armstrong oscillation appreciably. This state of affairs is represented in Fig. 3B. As soon as plate current commences, at —10 volts, any small wave received builds up rapidly, but the grid, after 1/100,000 of a second, becomes so positive that the very small H.F. oscillations fail to carry it below the top bend of the plate current characteristic, and reactive effects are lost. This wave then dies out completely (it may be noted that grid current provides considerable damping), and another small H.F. wave is built up as the grid drops from 0 to —10 volts, this again being completely damped before the next cycle commences.

As reaction is increased these oscillations will evidently become greater and take a longer time to damp out, and finally the first set of oscillations are not entirely gone by the time H.F. reaction again commences. Even if only a milli-volt or so is left it will be many times greater than the received waves, and upbuild during this second period will be very rapid. As a decided amount of energy is now dissipated in these H.F. oscillations the amplitude of the Armstrong oscillation necessarily decreases, permitting an even greater H.F. oscillation to build up. This does not go on indefinitely, however, as the circuit is still perfectly stable. If tuned to a rather strong signal, when no heterodyne is produced, the final condition is represented in diagram 3C. The oscillations induced in the first period nearly, but not entirely, die out before the second is reached, then, together with any received waves, build up to a considerable magnitude and again die out before the next cycle commences.

Now if the received signal is weak it will require more reaction before the first series of oscillations run into the second, and




*Figs. 3C and 3D.*

immediately it does so, the above process will go further. That is, after the circuit is again stable, the Armstrong oscillation will be slightly smaller, and the H.F. slightly greater, causing the second series to run slightly into the next cycle, as shown in Fig. 3D, and hence producing strong heterodyne.

On looking at diagram 3C, it will be seen that signals come almost entirely from the first upbuild in each cycle, the small residue from them being many times larger than the received waves during the second upbuild period, and also that each cycle starts independently of any cycles gone before. It would thus be expected that tuning would be very flat indeed, and this actually is the case, 20 metres each way being quite ordinary. As long as the grid circuit remains in phase with the received waves for 1/100,000 of a second, tuning makes very little difference. Conditions are somewhat different in diagram 3D. Here, although

the signal strength comes from the two very short upbuild periods in each Armstrong cycle, strong heterodyne compels one to tune sharply, and another peculiarity is at once apparent. The wave is, as it were, in the middle of a series of " bumps," that is, heterodyne alternately increasing and decreasing for quite a long way each side of the signal. It is evident how these are produced. On detuning slightly a heterodyne note is produced, increasing in pitch until it is the same as the Armstrong, when it is indistinguishable from it, and disappears. In fact, as it approaches this frequency, it re-heterodynes with the Armstrong whistle and produces another note of diminishing pitch, becoming zero when the heterodyne is equal to the Armstrong in frequency. Electrically, after one Armstrong cycle the received wave is then just one H.F. cycle out of phase with any residues left in the circuit, or in other words, in phase again, and signals are quite strong, but as there are two upbuild periods in each Armstrong cycle the quality of speech suffers somewhat. This process then repeats itself till the received wave is two H.F. cycles out of phase and so on, reminding one of interference fringes in optics, but owing to the two upbuild periods speech is lost after the second heterodyne. This tendency towards " bumps " is shown even in the Infra Armstrong period by a slight hissing effect where heterodyne would be a maximum, but it is, of course, little trouble to tune sharply and avoid it entirely.

With reference to rectification, it is evident that the valve will be rectifying by grid current, and on both the upper and lower bends of the plate current characteristic, the latter working in opposition to the two former. Rectification is consequently very inefficient. It is also evident that there is a great deal of H.F. in the grid circuit that does not affect the plate current in any way.

Although such good results are obtainable, the limitations of the single valve Armstrong Super-Regenerative circuits are thus rather considerable :—

(*a*) A definite limit seems to be set to signal strength, and no useful system has yet been suggested for the addition of note magnifier valves.

(*b*) The valve is rectifying extremely inefficiently, and the use of a crystal limits one to about the same signal strength as before.

(*c*) The whistle must be rather too distinctly audible if good signals are to be obtained on 400 metres or thereabouts.

(*d*) The characteristic re-heterodyning effect brings in a great deal of heterodyne noises, and causes a powerful wave to give strong heterodyne possibly 40 metres each way.

[Photo : Topical.

## THE INVISIBLE BAND.

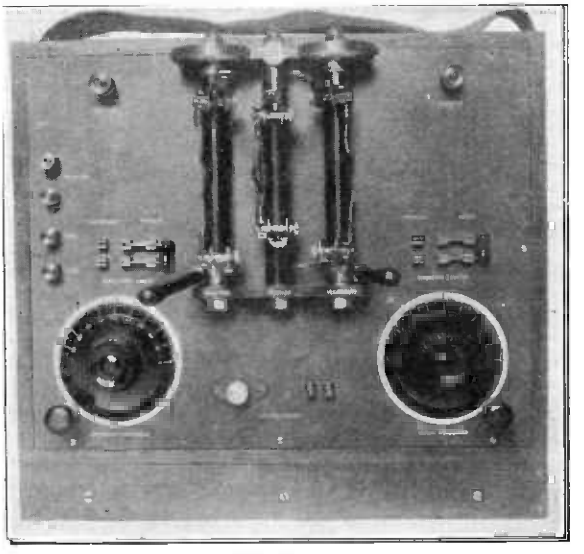
Much wonder was aroused during the progress of the Lord Mayor's Show by the spectacle shown in the picture. Music was supplied by the Band of H.M. Irish Guards broadcasting from **2LO**.

# A GIMBAL COIL TUNER.

By H. E. ADSHEAD, B.A.

The use of a self-contained tuner unit apart from the amplifying and detecting apparatus is recommended. The unit does not permit of reacting on to the tuned anode inductance, but this does not greatly matter, for when a tuned high frequency amplifier is in circuit the aerial can be energised irrespective of method of reaction coupling employed. The design given is attractive and the provision of terminals and switch for connecting a crystal detector is unique.

NOW that the gimbal-mounted coils manufactured by the Igranic Company are coming into favour, perhaps a description of a complete tuner I have made for these will prove of interest. The accompanying photograph will show the arrangement of the instrument, which has been engraved to add to its appearance. I can inform those who have not experimented in this line that it costs about ½d. per letter to have this done.



*The tuner.*

The panel cannot conveniently be any smaller than the drawing shows. This one has been made to fit into one of the teak ex-Government 200-volt battery boxes sold by Leslie Dixon. It is usually suggested that the ebonite be brought to size by filing, but I prefer to plane it down as though made of wood. Granted that the reader can plane square, then a flat edge with sharp corners results, and with more likelihood of success than by draw-filing, which requires a good deal of practice. Unless the 0·0015 condenser is very compact the 4½ in. depth of case will not be enough. By sawing up the surplus lid into three 1-in. strips, glueing these round the edges, and using the spare piece to replace the hinged side, the case can be suitably enlarged.

The Igranic Gimbolder tuner comes mounted on a circular base. This is removed and two new pieces of ebonite provided, wider than the makers employ, namely 1⅛ in., to allow the long arms to swing round without fouling the panel.

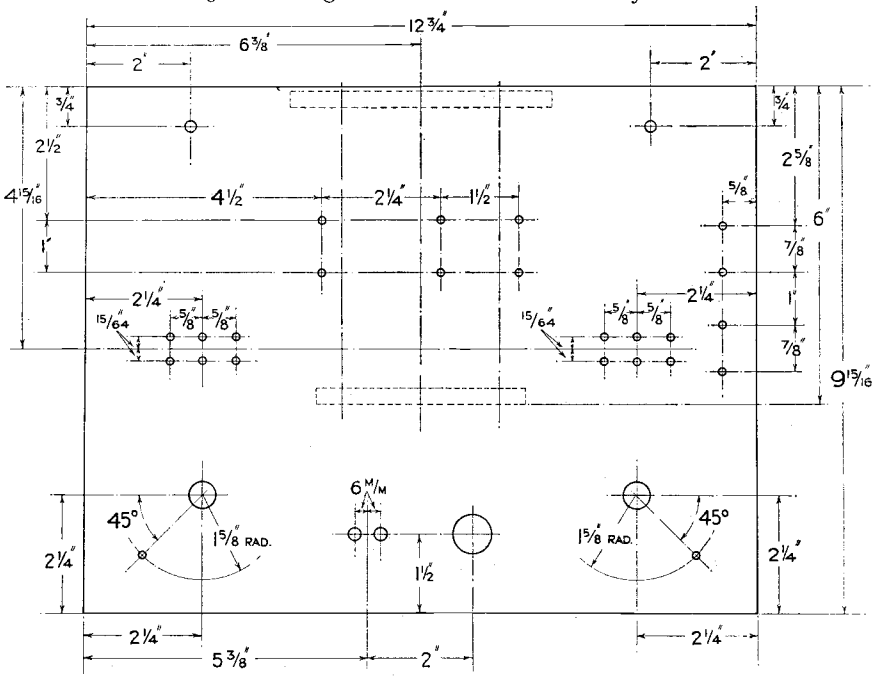
The top piece is made 4⅞ in. long as before, but 4⅛ in. is enough for the bottom one to clear the condenser dials. ⅜ in. can further be sawn off the vertical pillars, as they are longer than any coil the arms would accommodate. There are several points which may be modified, in this Gimbolder. For instance, whichever coil the reader elects to use as reaction, the carrying arms should be insulated with ebonite covers at the ends, or there will be fireworks when they come into contact with their neighbours! The arms are pressed with a curve, but this is a mistake, as the holes for the coil contacts are no longer circular. They should be hammered flat for about ¾ in. back.

I have also some remarks to make concerning the small changeover switches. I find these suffer from three faults—the side arms are often not of equal length (important, or it will not lie straight), the end contacts are tight or loose, and the nuts are badly threaded. It is therefore advisable to turn over the dealer's stock and pick out the good ones. A large accumulation of rejects might cause the manufacturers to improve their tool department!

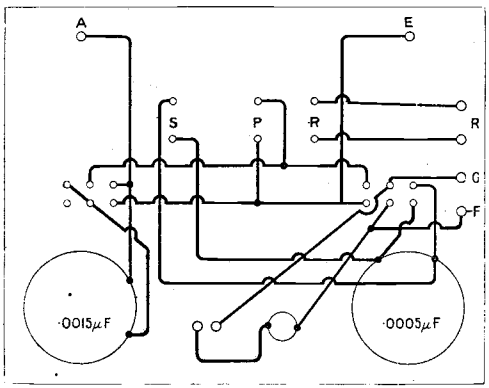
Provision is made for crystal reception by connecting up a detector and telephones. The wires are spaced out different distances from the panel so as to keep them well apart.

The white xylonite discs have a rather smart effect and a $\frac{1}{8}$-in. margin will be found to be heavy enough. The material can be obtained at Hobbies, in Bishopsgate Street, London, if otherwise difficult to find. Unfortunately, the engravers annoyingly reversed the aerial and earth on the panel, but the drawing shows all the aerial arrangements correctly placed on one side. Not long ago I described a slow motion drive for condenser dials.* They are seen here in operation.

"Trials of a Country Experimenter, No. 1." The white plug in the telephone jack is an original refinement. It is to keep earwigs out of the only entrance to the interior!

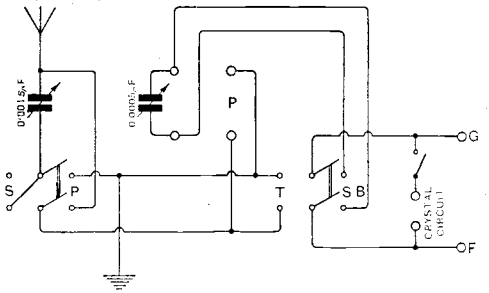



*Dimensional drawing of panel.*




*Practical wiring diagram.*

On one occasion I found ten inside a blind-ended jack, and before I adopted Brown telephones I have had them get behind the ebonite caps, where the scratching puzzled me greatly until I tracked it down.




*Circuit of tuner.*

The polished circular base can be turned into a stand for a set of No. 20 to 50 drills. If the B.A. taps are also let in on the radii which pass through their respective tapping-size drills they are conveniently to hand.

* *Wireless World and Radio Review*, p. 663, August 15th, 1923.

# LOOSE COUPLERS—IV.

By W. JAMES.

(*Concluded from page 214 of previous issue.*)

(*L*) There are, roughly, two sorts of couplings used for transferring energy from the output circuit of one valve to the input circuit of the next.

In one sort the two windings are wound close together, resulting in very tight magnetic coupling, and considerable capacity

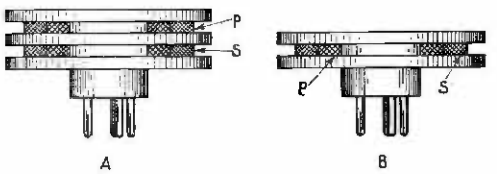



*Fig. 23. Two well-known types of plug-in high-frequency transformers.*

coupling as well. The ends of the coupling unit are then so connected that the maximum energy (or the voltage) is transferred by the magnetic and the capacity couplings to the secondary.

A transformer of this type is shown in Fig. 23. In Fig. 23A, the primary and secondary windings, P and S, are accommodated in slots turned in a piece of circular ebonite. The ends of the windings are soldered to pins, which in the type shown in the figure take the form of valve legs, in order that the unit may be plugged into a valve holder. A number of these units with different windings may be made up, and in this way, the best coupling for signals of different frequencies may be chosen. If the windings are wound in opposite directions, it is usual to connect the two inside ends to the points of fixed potential (in valve circuits to positive plate battery and negative filament battery), and the outside ends to the plate and grid of the valves to be coupled. If the beginnings of the primary and the secondary are labelled I P and I S, respectively, and the ends O P and O S, then the two inside ends are O P and I S, and are connected with plate battery and filament battery respectively.

The natural frequency of the coupling depends on the inductance and capacity of the windings and the circuit to which they are connected, and the distance between the windings. When fine wire or resistance wire is used, the coupling may be practically aperiodic, and respond to a small band of frequencies equally well. When the coils are wound with larger wire, it is necessary to use a variable condenser for tuning purposes. If the condenser is joined across one winding, the effect of tuning is to tune both windings equally well, because of the close coupling which exists between them.

Instead of placing the two windings in different slots, they are sometimes both

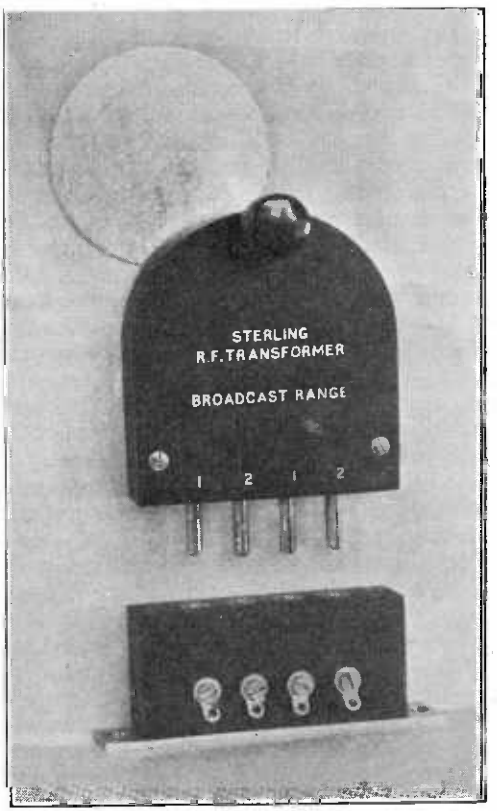



*Fig. 24. A plug-in transformer with mounting. The inductance of the coils, and therefore their natural frequency, is varied by changing the position of the metal plate.* (The Sterling Telephone Co.

wound in the same slot (Fig. 23B). Coupling is tighter than before, but there is the danger that the insulation between the windings P and S may break down, and care should be taken to carefully insulate them. A piece or two of paper placed over the primary winding will in general suffice.

Instead of tuning couplings of this type with a variable condenser, the inductance

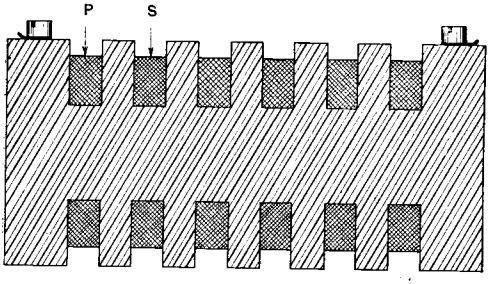



*Fig.* 25. *A common form of long range high-frequency transformer.*

of the windings may be varied by fixing a metal plate which can be easily moved with respect to the coils. A transformer of this sort is illustrated in Fig. 24. One winding has its ends soldered to the left-hand pins 1 and 2, and the other winding is connected to the right-hand pins 1 and 2. The circular metal plate is pivoted so that its position may be altered by turning the knob at the top of the transformer. The greater the area of the windings covered by the plate, the lower is their inductance. The self-capacity of the windings remains fixed, therefore the natural frequency of the transformers is increased. The lower portion of the figure shows the mounting unit, which may be fixed to a panel. To tune the different bands of frequencies, different transformer units with appropriate windings are used.

It is sometimes more convenient to use a single coupling unit, and to take tappings from the windings at definite inductance values so that a wide frequency range may be tuned using only a small variable condenser. The windings may be accommodated in slots, after the style of that shown in Fig. 25. As one would expect, the capacity coupling is considerable, and provided a sufficient number of tappings are taken, the transformer will tune to a wide band of frequencies quite well. There are, of course, considerable losses in the unused end of the coils, which has the effect of providing poor coupling (small amplification in valve circuits) when only a little of the windings is connected in circuit. Sometimes the primary winding only is tapped, and in other types, both windings are tapped. It is not usual to provide dead-end switches, but the switch blades are generally made sufficiently wide to make contact with two contact studs simultaneously. This, in effect, places a short-circuited section between the used and unused portions of the windings and helps to reduce the losses. The unused end is generally short-circuited around itself, the end of the winding being connected to the circuit along with the switch arm.

Transformers of this sort may be built to tune over a frequency range of 1,000,000 to 10,000 (300 to 30,000 metres), but naturally they will not tune sharply to any definite frequency, so that if there are interfering signals present with the required signal, each will be dealt with to practically the

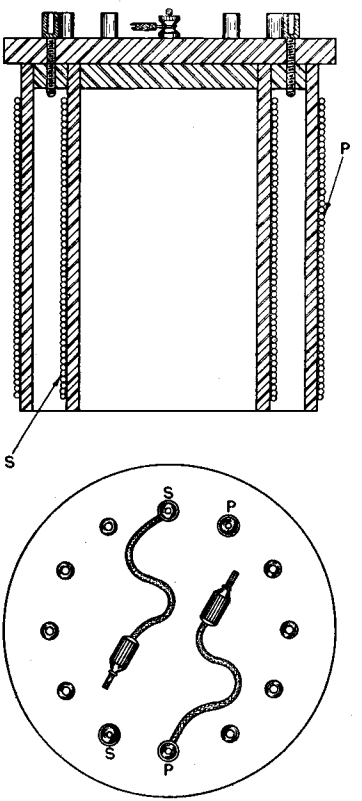



*Fig.* 26. *A tapped transformer with the windings wound on tubes of different diameters.*

same extent, whereas when a sharply tuned coupling is used, only the signal whose frequency corresponds with that of the coupling is transferred to the secondary winding.

To compensate for the losses which are the cause of flat tuning, energy with a frequency

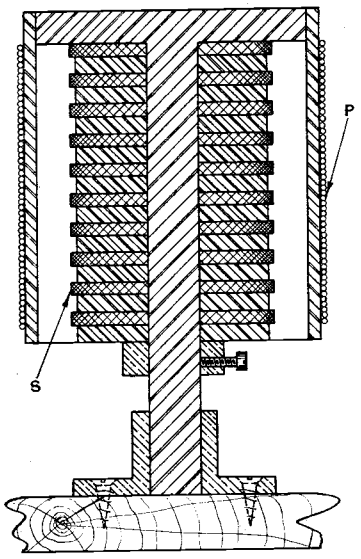



*Fig. 27. A transformer with one winding in the form of a cylindrical coil, and the other consisting of a number of basket coils.*

the same as that of the signal may be introduced into the coupling. The usual method is to use a reaction coupling. Then the losses for that particular frequency are reduced, while so far as the interfering signals are concerned, the losses are still present.

(*M*) When good selectivity is required, as well as good transformer action, it is usual to space the windings apart. The capacity coupling may then be quite small, but it is essential to properly tune each winding by using a variable condenser across each.

One form is shown in Fig. 26. The two windings, P and S, are wound on thin tubes of prepared paper or ebonite which differ in diameter. The bigger the space between them, the easier is it to sharply tune the windings. In the construction shown in Fig. 26, the windings are wound on cylinders secured to a top plate which carries the connection terminals and the tapping sockets. The sockets are connected with suitable points of the windings, so that with a tuning condenser having a given capacity range, a band of wavelengths may be properly tuned.

The capacity between the windings is still sufficient to appreciably affect the transformer action, because they cannot be spaced very far apart for fear of reducing the coupling to such an extent that insufficient energy is transferred.

The arrangement of coils in Fig. 27 is then to be preferred. Here the primary winding marked P is wound on the outside of a tube, and the secondary winding consists of a number of basket coils S. The basket coils are spaced apart to keep down the total secondary winding capacity. Tappings may be brought out as before.

With transformers of this description it is possible to satisfactorily employ more turns of wire in the secondary than the primary. To tune both windings to the same frequency, the secondary tuning condenser will necessarily be smaller than that used to tune the primary, consequently the voltage developed across the ends of the secondary may be several times that across the primary. This is, in general, very desirable.

(*N*) Instead of providing tappings and variable condensers for tuning purposes,

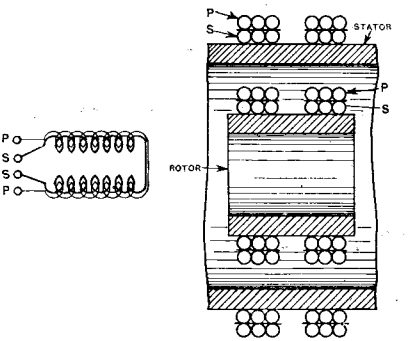



*Fig. 28. A vario-transformer, consisting of a variometer with two sets of windings.*

we may construct the transformer coupling so that the inductance of the windings is easily variable over a fairly wide range. One form is shown in Fig. 28. The transformer consists, essentially, of a variometer which has two distinct sets of windings. Referring to the figure, the stator is wound with two windings forming the primary and secondary, P and S. One winding is

wound above the other, and they are separated with a sheet of insulating material such as empire cloth. The rotor also has two

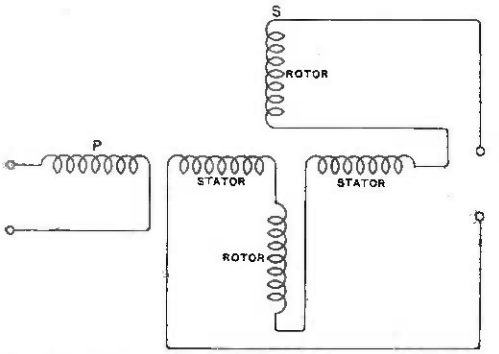


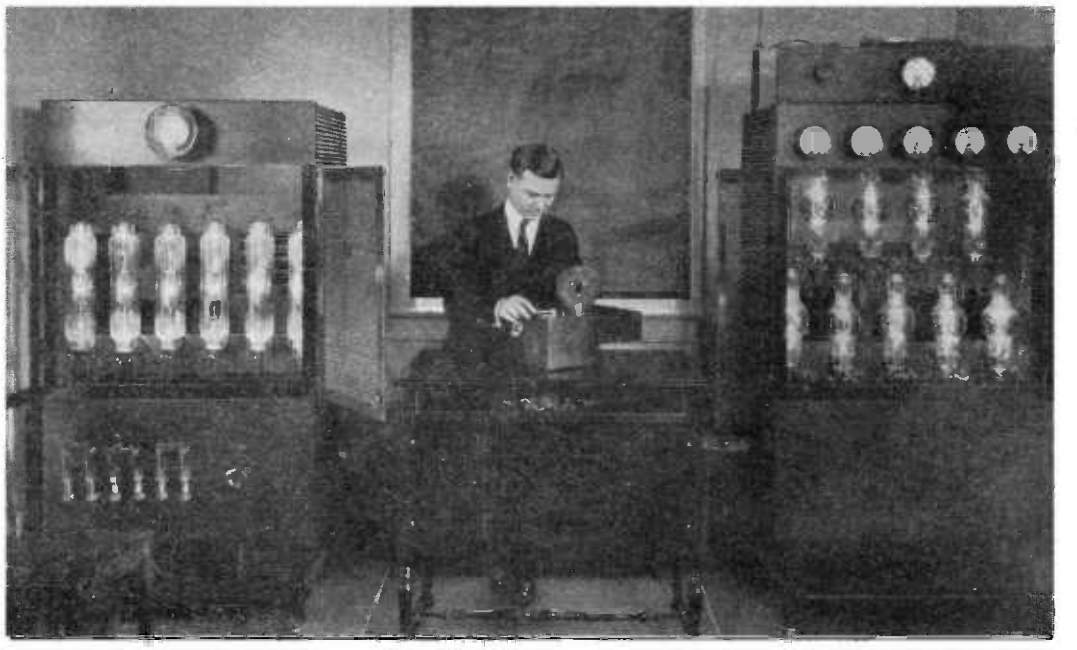

*Fig. 29. Connections of another sort of vario-transformer.*

windings P and S. Both sets of primary windings are connected in series, and the same with the secondaries. When the rotor lies parallel with the stator, the inductance of both windings is a maximum. As the rotor is turned the inductance falls. The capacity may be added in the form of fixed condensers, or the inherent capacity may be sufficient to give the *vario-transformer* the required frequency range. The coupling is of course practically fixed by the position of the windings, but the self-capacity varies as the position of the rotor is changed.

To provide a looser coupling, with sharper tuning, the primary may consist of a winding wound over a portion of the stator only, as represented in Fig. 29. With this sort of transformer coupling, very good results may be obtained, the capacity coupling being small, and the tuning of the secondary circuit quite sharp. As a consequence, the selectivity of an arrangement such as this is good.

To increase the tuning range of couplings such as those of Figs. 28 or 29, switches may be connected with fixed condensers, so that they may be joined across the windings conveniently, as required.

## TRANSMITTING EQUIPMENT AT WJZ.



*A corner of the transmitting room of station* **WJZ**. *The power panel is shown at the left. The six rectifier valves supply the* 2,200 *volts of direct current for the modulator and oscillator valves of the transmitter panel to the right.* **Five** 250*-watt modulator, and* 4 *oscillator valves of same rating are used in the transmitting circuit. The operator is shown checking the wavelength, which is* 360 *metres.*

# MINOR REFINEMENTS IN H.F. CIRCUITS

By F. H. HAYNES.

IN putting forward a few simple suggestions it is hardly necessary to give constructional data, for the experimenter can see at once how they may be applied to the instrument he is using or constructing.

It is well known that providing precautions are taken to ensure that the windings of the high frequency intervalve transformer possess a minimum of self-capacity, that it is possible to use a secondary winding having many more turns than the primary and thus to obtain a reasonable step-up of potential. In transformer construction, however, it is not an easy matter to obtain windings of low capacity unless primary and secondary are loosely coupled, with the disadvantage that the circuit becomes very selective. The use of basket coils in short wave H.F. transformer construction with 50 per cent. more turns on the secondary is probably the best method for providing for a step-up of potential.

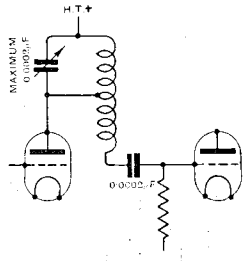



*Fig. 1. Simple method for obtaining a potential step-up in a H.F. circuit.*

When making use of the tuned anode arrangement a much higher degree of amplification can be obtained if an additional inductance is connected in the lead to the grid condenser, and is coupled to the tuned anode coil. In the case of a single layer anode coil it is only necessary to wind on between 50 and 100 per cent. more turns, or when using duolateral coils of the plug-in type, to mount an additional coil near the tuned anode inductance (Fig. 1).

Reference has already been made to a method of high frequency amplification* in which a small value fixed condenser is connected in the tuned anode circuit and the plate current fed through a high frequency choke of low self-capacity. This method makes use of a larger inductance coil for anode tuning than would normally be em-

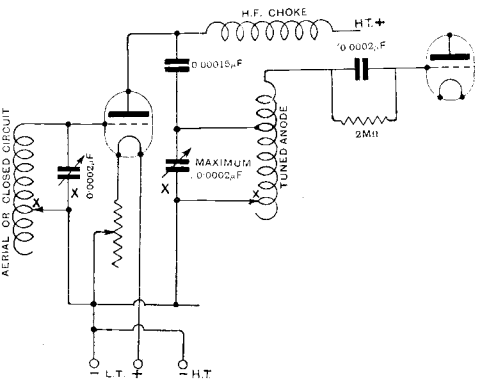



*Fig. 2. An interesting H.F. amplifying arrangement. By reason of the small condenser in the plate lead it is possible to secure a higher potenial across the anode coil than is normally possible. The H.F. feed choke must be well designed and of low self capacity to avoid excessive leakage.*

ployed in the more ordinary circuit, with a consequent increase in the potential applied to the detector or next H.F. valve. This system offers an advantage, inasmuch as, should simultaneous tuning of an aerial or closed circuit and the anode circuit be considered practical, it will not be necessary to insulate the spindles of the two condensers which are operated together, or to divide the switches that may be employed to tap out the inductances, for it will be noticed that all the points marked "x" in an accompanying circuit (Fig. 2) are of similar potential. One possible drawback to this method is that the tuning of the high frequency circuit is particularly sharp. Extra turns included in the grid circuit will provide the necessary step-up of potential.

No reference is made here to the neutrodyne arrangement which is almost essential when more than one stage of high frequency amplification is employed, and the points for connecting the additional condensers in the circuits can easily be identified or created by the use of an additional inductance.

* *Wireless World and Radio Review*, Sept. 19, 1923, page 819.

# A SHORT WAVELENGTH RECEIVER WITH TWO STAGES OF H.F. AMPLIFICATION.

## I. General Principles.

By W. JAMES.

THE output energy from a detector valve varies roughly according to the square of the signal voltage applied to the grid circuit. In the case of a simple detector valve set, consisting of a tuner with a detector valve, the voltage applied to the grid as the result of a transmission from a distant station will depend upon the constants of the aerial and tuning circuits, as well as the adjustment of the detector valve.

For a given receiving aerial, the voltage developed across the ends of the aerial tuning inductance is greatest when the aerial circuit is sharply tuned, and when its losses are a minimum. Sharp tuning may be obtained by using well-designed tuning units, and it is generally better to employ a small value of capacity with a correspondingly large value of inductance. If a secondary circuit is used, the coupling with the aerial should be variable, and care taken to ensure that the losses due to the effective resistance of this circuit are as little as possible.

Even with very careful design, however, the amplitude of the signal voltages generated across the input circuit of the detector valve is less than it might be, on account of the losses, which are due to a number of things. To compensate for these losses, energy may be introduced into the aerial and secondary circuits. The energy is taken from the detector valve output circuit, and it is introduced generally by magnetic coupling (although there are several other methods of coupling), care being taken that the induced currents have the correct phase. In this way the energy which is already in the tuning circuits will be increased, and therefore the voltage applied to the detector is increased, resulting in stronger signals. The result of transferring energy from the plate to the grid circuit is, in effect, to partly neutralise the losses. By increasing the coupling so that more energy is transferred, a condition may be reached where the effective resistance of the tuning circuits is zero. If this state is obtained, and a voltage is applied to the circuit, a current will flow which will have a magnitude determined by the maximum output of the valve. The valve is generating oscillations, and the frequency is determined by the circuit constants. The reaction coupling should therefore be critically adjustable, because then a given signal will produce a maximum amount of energy (or voltage) in the plate circuit.

The arrangement is very sensitive, but there are serious disadvantages attending the use of reaction to such an extent that a slight change in the signal strength or in the circuit adjustments causes the generation of oscillations, and it is better to amplify the signal before it is applied to the detector.

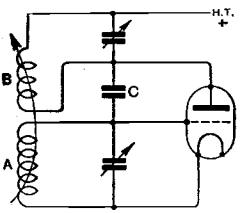



*Fig.* 1.

To secure reasonable amplification the circuits associated with the valve amplifier are tuned. When the valve is used as a voltage amplifier the voltage amplification will be a reasonable percentage of the amplification factor of the valve, when the effective resistance of the circuit joined to the plate is two or three times the internal resistance of the valve. The internal resistance of the valves ordinarily used for reception is fairly high, perhaps in the neighbourhood of 30,000 ohms, hence for reasonable amplification the output (plate) circuit should be

sharply tuned. To this end a small value of tuning capacity is used to tune the inductance coil, and care is taken to keep the losses of the circuit small. The effective resistance of the tuned parallel circuit to a signal will then be high, resulting in good amplification.

If the coil in the output circuit B is coupled with the tuning circuit A, Fig. 1, reaction effects may be obtained. However, when sharply tuned circuits are used it is generally found that with the slightest magnetic coupling, oscillations are generated, and it is usual to place the coils A and B so that they have zero coupling. Even when this precaution is taken it is hard to operate an

Let us suppose the value of the capacity is fixed. The current which will pass through it is determined by the voltage difference between the grid and plate, and the frequency of the voltage. The reactance of the capacity $\left(\frac{1}{2\pi fc} \text{ ohms}\right)$ falls as the frequency is increased, and, from Ohm's Law, the current is directly proportional to the voltage.

At short wavelengths the effect of this coupling capacity in feeding back energy acts to modify the operation of the amplifier, the amplification obtained being due to

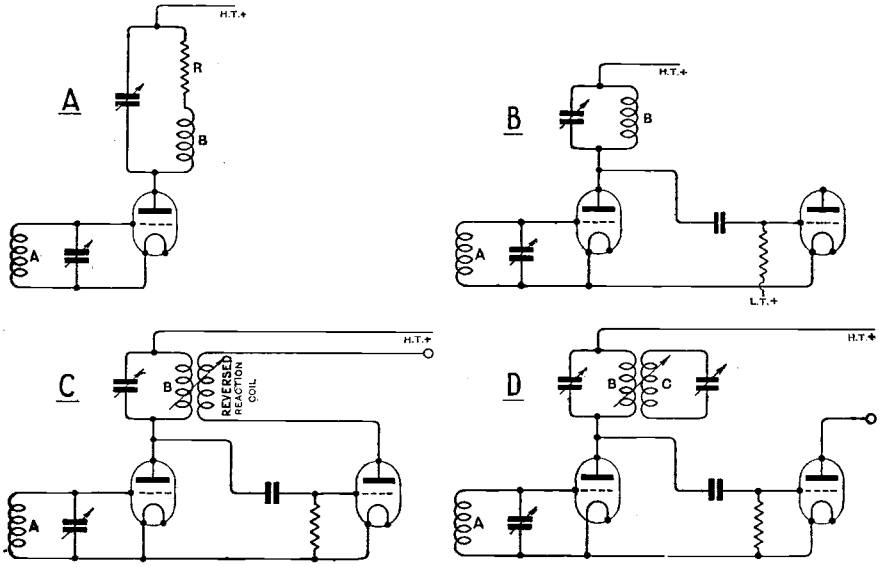



*Fig. 2. Four methods for reducing the tendency of sharply tuned circuits connected with valves generating oscillations.*

amplifier of this sort with sharply tuned circuits because of the difficulty of making adjustments without setting up oscillations.

The difficulty is caused by the capacity coupling which exists between the grid and plate circuits. No matter how carefully the circuit wiring is arranged, there is always present the capacity between the elements of the valve itself. The capacity is represented by the condenser C, Fig. 1. A little consideration will show that the effect of the capacity coupling between the plate and grid circuits is that energy is passed from the plate to the grid circuit, and further that the energy assists that already in the grid circuit.

regeneration as well as the capability of a valve to amplify. Further, the magnitude of the energy fed back is increased as the voltage amplification is greater. Consequently, when dealing with short-wavelength signals, it is generally necessary to arrange the circuits so that the amplification is far less than it would be if the coupling capacity was eliminated, in order to prevent the generation of oscillations.

One method is to increase the damping of the plate circuit by increasing its losses. This reduces the amplification. A usual method is to wind the plate coil with relatively fine wire, or to connect a resistance in

series with it as at R, Fig. 2A. The same result may be obtained by connecting the grid circuit to which the plate circuit is coupled, so that current flows in it as in Fig. 2B.

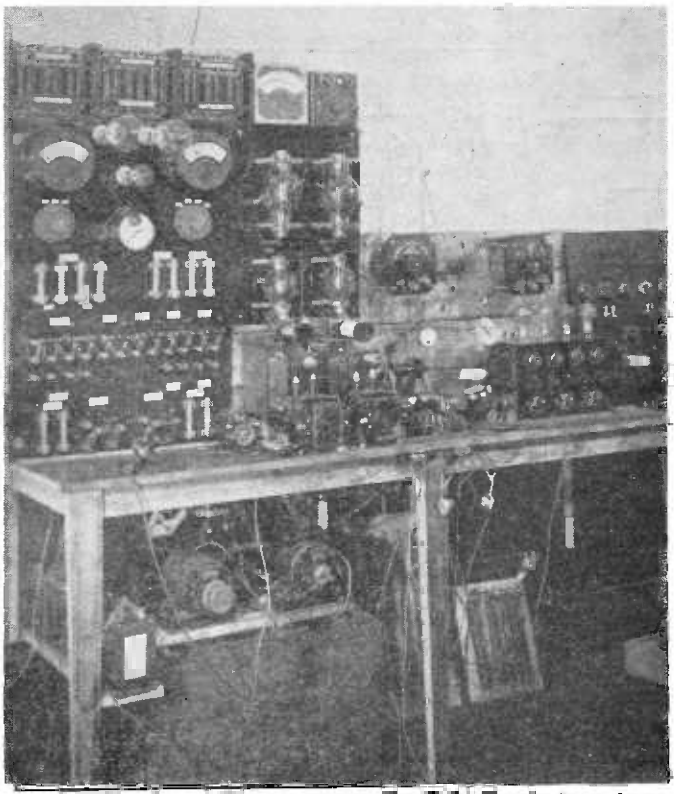
Perhaps a better way is to introduce into the plate circuit a voltage which acts to oppose the voltage already there, for example, by coupling a coil in the reverse direction to that used when reaction effects are desired as in Fig. 2C. As the coupling is increased, the amplitude of the voltages in the plate circuit B is reduced. Alternatively, a second circuit could be coupled to the plate circuit as in Fig. 2D when energy is absorbed by the coupled circuit according to the setting of the condenser. Here the coupled circuit is represented by C.

In all these methods of producing stability, the amplification is reduced. It should be clear that if the capacity coupling could be balanced out in some way, the result would be better amplification and sharper tuning. Sharp tuning is particularly desirable, otherwise trouble is experienced through interference.

It is believed there are at present two solutions to the problem of obtaining high amplification of short wavelength signals. One method due to Armstrong consists in changing the frequency of the signal, and then amplifying it.* The second method, due to Prof. Hazeltine, consists of arranging the circuits so that the capacity is balanced.†

A receiver which employs high frequency transformer coupling, with neutralisation of the unwanted capacity is called the Neutrodyne receiver by its inventor. Transformer couplings are preferred because it is easier to arrange for complete neutralisation. The principle may, of course, be applied to "tuned anode" couplings as explained in an article called "Short Wavelength High Frequency Amplification," Vol. XII., September 19th, pages 819-821.

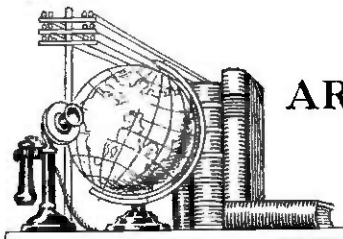
* The super-heterodyne receiver.
† See Vol. XII, April 24th, pages 67 to 71.



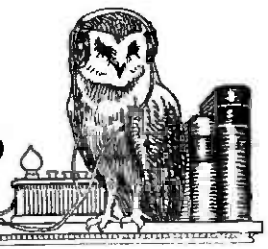
*The experimental transmitting station (2 DY) of Mr. F. H. Haynes at Regent Square, London, W.C.1. The two small generators supply A.C. at 700 cycles for stepping up to H.T., and also for the filament heating of the rectifying, oscillating and modulating valves.*

## AN INTERESTING EXPERIMENTAL TRANSMITTING STATION.

The accompanying photograph shows the equipment of the experimental transmitter of Mr. F. H. Haynes at Regent Square, London, W.C.1. **(2 DY)**. The two motor generators deliver A.C. at 700 cycles for stepping up for H.T. and for filament heating. Most of the components can readily be identified. A high-tension condenser near the change-over switch is used in conjunction with a resistance as an artificial aerial so that the aerial circuit is not energised except when actual transmission tests are to be carried out. By means of switches it is possible rapidly to change over from telephony to C.W., interrupted C.W., or tonic train.



# AROUND THE WIRELESS WORLD



### An Exceptional Relay Test.

A remarkable radio experiment is reported in *The New York Evening Post.* Under the direction of Dr. E. F. W. Alexanderson, Chief Engineer of the Radio Corporation, a wireless signal was recently transmitted direct from Radio Central, on Long Island, to Poland. At Warsaw the signal was made to actuate the transmitter, and thus send itself back to New York, the entire operation occupying the merest fraction of a second. At New York the "tick" again transmitted itself, this time to Warsaw, and the cycle of operations was continued 40 times before the "ticks" had died down to inaudibility.

### Radio for South African Farmers.

The feasibility of organising a wireless broadcasting service for farmers was recently discussed at the Annual Congress of the South African Agricultural Union, when the desirability of having the latest market information, etc., broadcast, was emphasised.

### Christiania Broadcasting.

The transmissions from Christiania, reception of which has been reported on several occasions in these columns, have been suspended for an indefinite period. This information reaches us from a Birmingham correspondent, who has been in communication recently with the Chief Engineer of the Christiania station.

### The Wireless Club Amalgamation.

At a joint meeting of members, it has been decided to amalgamate the Worthing Y.M.C.A. Radio Club and the Worthing Radio Association, forming the Worthing Radio Club.

### "Tons of Money."

That he had a wireless set installed at his house was submitted as proof of a debtor's means at the Clerkenwell Court recently.

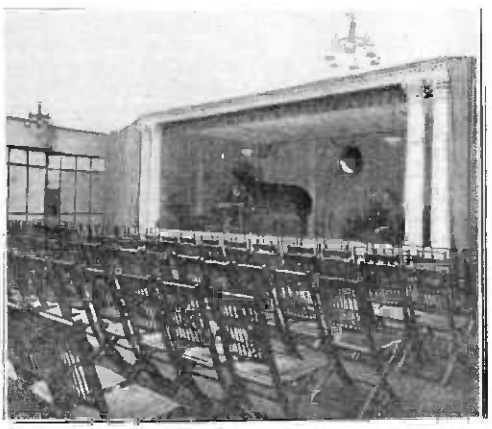
### New Societies for Golder's Green and Kennington.

It has been suggested by several residents in the Golder's Green and Hendon area that there is room for a Wireless Society in the district. All interested in such a scheme are requested to communicate with Mr. W. J. T. Crewe. "The Dawn," 111, Prince's Park Avenue, Golder's Green, N.W.11. (Phone, Hampstead 3792.)

The formation of a Wireless Society for Kennington is also being considered, and prospective members should write for particulars to the offices of this Journal, 12 and 13, Henrietta Street, Strand, W.C.2.

### Broadcasting a Wireless Journal.

An interesting legal point with regard to broadcasting arose recently in France, where a proposal was made and all arrangements prepared for broadcasting a complete wireless journal under the title of *Journal sans Fil.* Those who waited at the appointed hour for the first number of this spoken newspaper, however, were disappointed, for at the last moment the French Minister of Posts and Telegraphs raised an objection to publication, stating that, under the present regulations governing wireless, all transmitting stations had to be officially authorised.



*A realistic reproduction of the studio at* 2LO *in the demonstration hall at the All-British Wireless Exhibition.*

### Seeing by Wireless.

At the Royal Society of Arts on Wednesday, November 14th, M. Edouard Belin gave a lecture and demonstration dealing with the process of transmitting and reproducing writing, drawing and photographs without wires. Mr. Alan A. Campbell Swinton presided.

In the course of his interesting remarks, M. Belin spoke of what had been and would soon be achieved. Real half-tone photos had been transmitted successfully, and the lecturer expressed the belief that television would soon mean actual vision at a distance.

### D.F. Apparatus for Cunarders.

As testifying to the value of wireless direction-finding apparatus on board ship, it is interesting to learn that the Marconi International Marine

Communication Co., Ltd., have been instructed to fit direction-finding apparatus on all passenger ships of the Cunard fleet.

### Anniversary of the British Broadcasting Company.

November 14th, 1923, marked the first anniversary of the British Broadcasting Company, and to celebrate the occasion speeches were broadcast from **2LO** by Senatore G. Marconi, and by Mr. J. C. W. Reith, Managing Director of the Company.

Senatore Marconi's remarks dealt simply and briefly with the rapid development of broadcasting in this country since its inception but a year ago, and he proceeded to emphasise the potential value of the new method of communication for binding together the peoples of the British Empire.

Referring to his latest experiments with wireless telephony, Senatore Marconi mentioned that these had entirely revolutionised current ideas, both of the power and of the wavelengths required for effective signalling. Working with only 1 kilowatt, and on a wavelength of 100 metres, he had been able to maintain effective communication over a distance of 2,250 miles between Poldhu, in Cornwall, and his yacht "Elettra."

Mr. Reith said that on November 14th, 1922, the British Broadcasting Company was represented by a staff of three in temporary possession of one small room. Developments since then had been such that within a year, 15,000 hours of programmes had been transmitted from the various stations and a large organisation created. Broadcasting was now an established institution. By its aid he believed the Company could bring into homes, hitherto for a variety of reasons inaccessible, all that is best and most worth while in every department of human achievement, knowledge and endeavour.

### Radio Developments in Greece.

It is reported from Greece that a national wireless service has been agreed upon, to be installed by the Marconi Company. The agreement will be ratified by the National Assembly.

Negotiations are also pending for the installation, by a Franco-Greek Company, of a wireless telephone system between the principal towns of Greece and the Eiffel Tower,

### The "Catseye" Crystal Detector.

It is regretted that an error occurred in the advertisement of the above product, appearing in our issue of October 31st. The price of the crystal detector is 1s. 6d., and not as stated.

### The "Radiolog."

We have been advised by the publishers, Messrs. Pallett Brothers of 29, Silver Street, Leicester, that it has been found necessary to increase the price of their "Radiolog" (referred to recently in these columns) to 2s. 6d. net.

### Resolutions of International Committee.

At the recent meeting of the Wireless Telegraphy Committee of the International Shipping Conference, two resolutions were passed as follows:—"(1) It is desirable that the maritime States should take steps to convene an international conference for the consideration of wireless problems, and, pending the proposed conference, all maritime States are urged not to apply to foreign vessels regulations more onerous than those in the Convention of 1914. (2) In the meantime the Governments of the maritime States should be invited to give the closest study to the problem of perfecting the automatic device within the next six months."

The automatic device referred to under Resolution 2 is an automatic alarm system which will call up efficiently in cases of emergency even in the absence of an operator.

### A Burglary.

Messrs. Radio Instruments, Ltd., of 12, Hyde Street, New Oxford Street, W.C.1, inform us that, owing to a burglary on their premises on the night of November 15th, their mail was seriously tampered with. Readers who may have communicated with the firm on that date are advised to get in touch with the Company at once.

### Misuse of a Call Sign?

Messrs. Frank Hough (Southport), Ltd., of 60, Sussex Road, Southport, have informed us that they have recently received many reports of crystal reception in London of their transmitting station **5 AW.** As this station has not recently been in operation, they are forced to the conclusion that their call sign is being illegitimately used by someone in the London area. Unless this ceases they will be obliged to take steps to locate the offender and report him to the authorities.

### A Useful Connector Clip.

Those undertaking the construction of the cabinet receiver given in recent issues will be interested to learn that a suitable connector clip can be obtained from Messrs. A. G. Wright & Co., Ltd., 302a, Kentish Town Road, N.W.5. This clip is exceedingly useful in the building of instruments when it is necessary to carry a connection from a panel to its box container and avoid the use of flexible leads.

# Correspondence.

### Automatic Reception of Wireless Signals.

*To the Editor of* THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—In your issue of October 24th there is an article by Mr. E. R. Batten on the Automatic Reception of Wireless Signals. I would ask you to be so good as to compare this article with a paper read by the writer before the Radio Society and reported in your issue of October 29th, 1921. You will see that the methods described by your contributor are in the main identical with those worked out by the writer for use in connection with his own Relay, and that whole paragraphs have been quoted verbatim from this paper (in one case in the first person without any acknowledgement being made as to their source.

In view of the prevalence of this practice at the present time I would ask you to publish this letter in the hope that it may act as a deterrent to other prospective plagiarists.

I should be glad if you would be so good as to forward a copy of this letter to your contributor

in time for him to make reply in the same issue as that in which this letter will be published, should he desire to do so.

R. E. H. CARPENTER.

*November 6th*, 1923.

*To the Editor of* THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—In answer to Mr. Carpenter's letter, it was quite an oversight on my part in omitting to mention the source of information.

However, it may be of interest to note, that, part of the information referred to may also be found in a pamphlet issued by Messrs. Creed & Co., Ltd.

E. R. BATTEN.

*November 11th*, 1923.

## FORTHCOMING EVENTS.

**WEDNESDAY, NOVEMBER 21st.**

**Radio Society of Great Britain** (Informal Meeting.). At 6 p.m. At the Institution of Electrical Engineers. Lecture: "Aerial Construction and Design." By Mr. G. P. Mair.

**The Institution of Electrical Engineers** (Wireless Section). At 6 p.m. (tea at 5.30). In the Lecture Theatre. Lecture: "Periodic Trigger Reception." By Dr. E. V. Appleton, M.A., and Mr. F. S. Thompson, B.A. Also "A Dynamic Model of a Valve and Oscillating Circuit." By Mr. R. C. Clinker, M.I.E.E.

**East Ham and District Radio Society,** At 7.30 p.m. At the Church Army Social Centre, Barking Road, E. Informal meeting.

**B.T.H. Recreation Club. Rugby.** At 7.30 p.m. At the Caldecott Girls' School, Church Street. Discussion.

**Stockport Wireless Society.** At 7.30 p.m. Lecture: "Inter-Valve Coupling." By Sergt. Bunter.

**Edinburgh and District Radio Society.** At 117, George Street. Lecture: "The Armstrong Receiver." By Mr. J. G. W. Thompson.

**Manchester Radio Scientific Society.** At 7 p.m. At 16, Todd Street. Lecture: "Wireless Circuits." By Mr. L. J. Wood.

**Hackney and District Radio Society.** At 6 p.m. Demonstration at the Clapton Palais de Danse, Lower Clapton Road, E.5. In the chair, Sir Arthur Lever, Bart., M.P., J.P. Speakers: Mr. Arthur Burrows and Capt. P. P. Eckersley.

**THURSDAY, NOVEMBER 22nd.**

**Liverpool Wireless Society.** At Liverpool Royal Institution. Demonstration of High Speed Recording. By Mr. H. H. Harrison (of A.T.M. Co., Ltd.).

**Ilford and District Radio Society.** Informal Meeting.

**Luton Wireless Society.** At 8 p.m. At Hitchin Road Boys' School. Experimental Demonstration by Mr. E. Porter.

**Hackney and District Radio Society.** Demonstration and Lecture on the Society's Seven-Valve Set by Mr. Walker.

**Cardiff and South Wales Wireless Society.** At 7.30 p.m. At the Institution of Engineers, Park Place. Lecture: "Early Experiments by the British P.O. Signalling Without Wires." By Capt. C. Crompton, O.B.E., R.E., M.I.E.E.

**St. Pancras Radio Society** Lecture: "The Design of an Efficient High Frequency and Detector Panel." By Major Page, B.Sc.

**FRIDAY, NOVEMBER 23rd.**

**The Wembley Wireless Society.** At 8 p.m. At Park Lane School. Lecture: "Wireless with the Juniors." By Mr. B. P. Rossi.

**Honor Oak Park Radio Society.** Lecture by Dr. Higson.

**The Working Men's College Wireless Club, London, N.W.** Grand Bazaar in aid of College Appeal Fund (and following day).

**Sheffield and District Wireless Society.** At 7.30 p.m. At the Dept. of Applied Science, St. George's Square, Elementary class. Conducted by Mr. J. G. Jackson, M.Sc.

**Leeds Radio Society.** At 7.30 p.m. At Woodhouse Lane U.M. Church Schools. Continuation of Discussion, "The Propagation of Aether Waves." Led by Mr. W. G. Marshall.

**Norwich and District Radio Society.** At 8 p.m. Lecture: "Telephones." By Mr. Gates.

**Radio Society of Highgate.** Dance.

**SATURDAY, NOVEMBER 24th.**

**South London League of Radio Societies.** At 6.30 p.m. At the Chess Room, Greyhound Hotel, Sydenham.

**Mount Pleasant Radio Research Society.** At 8 p.m. Lecture: "Crystals." By Capt. A. Hinderlich, M.A.

**MONDAY, NOVEMBER 26th.**

**Barking and District Radio Society.** At 8.15 p.m. At Congregational Church. Lecture: "The Thermionic Valve." By Mr. R. C. Jones.

**TUESDAY, NOVEMBER 27th.**

**West London Wireless and Experimental Association.** Sale and Exchange Night.

# Broadcasting.

**REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS**

**GREAT BRITAIN.**

**LONDON 2 LO,** 363 metres; **MANCHESTER 2 ZY,** 370 metres; **BIRMINGHAM 5 IT,** 423 metres; **CARDIFF 5 WA,** 353 metres; **NEWCASTLE 2 NO,** 400 metres; **GLASGOW 5 SC,** 415 metres; **ABERDEEN 2 BD,** 497 metres; **BOURNEMOUTH 6 BM,** 485 metres. Regular daily programmes. Weekdays, 11.30 to 12.30 p.m. (**2 LO** only), 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 to 5 p.m., 8.30 to 10.30 p.m.

**FRANCE.**

**PARIS (Eiffel Tower), FL,** 2,600 metres. Daily, 6.40 to 7 a.m. Weather Forecasts; 10.5 a.m. (Thursday and Friday), 11.15 to 11.30 a.m., Time Signal and Weather Forecast; 12.0 noon, Live-stock prices; 3.40 p.m. (Saturday excepted); Financial report. 5.30 p.m. (Saturday excepted) Bourse Closing Prices; 6.10 p.m., Concert or Address; 7 p.m., Weather Forecast; 7.20 p.m. (Sunday), Concert and Address; 10.10 p.m., General Weather Forecast.

**PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), SFR,** 1,780 metres. Daily, 12.30 p.m., Cotton, Oil and Café Prices, News, Concert; 1.45 p.m., First Bourse Report; 4.30 p.m., Bourse Closing Prices; 4.45 p.m., Concert; 5.45 p.m., News and Racing Results; 8.30 to 9.30 p.m., News; 9.10 p.m. Concert; 10 p.m. to 10.45 p.m., Radio Dance Music.

**ECOLE SUPERIEURE des Postes et Telegraphes,** 450 metres. 3.30 to 4 p.m. (Wednesday and Friday), 7.45 p.m. to 10 p.m. (Tuesday and Thursday), Tests (Music, etc.); 2.30 p.m. to 7.30 p.m. (Saturday), Tests (Music, etc.).

**LYONS, YN,** 3,100 metres. Daily, 9.45 a.m. to 10.15 a.m. Gramophone Records.

**BELGIUM.**

**BRUSSELS, BAV,** 1,100 metres. 1 p.m. to 5.30 p.m., Meteorological Forecast; 9 p.m. (Tuesday), Concert.

**HOLLAND.**

**THE HAGUE, PCGG.** Temporarily suspended.

**THE HAGUE (Heussen Laboratory), PCUU,** 1,070 metres. 9.40 to 10.40 a.m. (Sunday), Concert; 9.40 to 10.40 p.m., Concert; 7.45 to 10 p.m. (Thursday), Concert.

**THE HAGUE (Velthuisen), PCKK,** 1,070 metres. 8.40 to 9.40 p.m. (Friday), Concert.

**IJMUIDEN (Middelraad), PCMM,** 1,050 metres. Saturday, 8.40 to 9.40 p.m., Concert.

**AMSTERDAM, PA 5,** 1,100 metres (Irregular). 10 to 11 a.m., Concert; 5 to 6.30 p.m., Concert; 8.10 to 9.10 p.m., Concert.

**DENMARK.**

**LYNGBY, OXE,** 2,400 metres. 7.30 p.m. to 8.45 p.m., Concert (Sunday excepted).

**GERMANY.**

**BERLIN (Koenigswusterhausen), L.P.,** 4,000 metres. (Sunday), 10 to 11 a.m., Music and Lecture; 2,700 metres 11 a.m. to 12 noon, Music and Lecture. Daily, 4,000 metres, 6 to 7 a.m., Music and Speech; 11.30 a.m. to 12.30 p.m., Music and Speech; 4 to 4.30 p.m., News.

**EBERSWALDE,** 2,930 metres. Daily, 12 to 1 p.m., Address and Concert; 7 to 8 p.m., Address and Concert; (Thursday and Saturday), 5.30 to 6.30 p.m., Concert.

**CZECHO-SLOVAKIA.**

**PRAGUE, PRG,** 1,800 metres. 7 a.m., 11 a.m. and 3 p.m., Meteorological Bulletin and News; 4,500 metres, 9 a.m., 2 p.m., and 9 p.m., Concert.

**KBEL (near Prague),** 1,000 metres. Daily, 6.20 p.m., Concert; Meteorological Report and News.

**SWITZERLAND.**

**GENEVA, HB 1 (Radio Club de Genève).** Temporarily suspended.

**LAUSANNE, HB 2,** 1,100 metres. Tuesday, Thursday, Saturday, 4 p.m., Concert; Monday, Wednesday, Friday and Saturday, 7 p.m., Concert.

**SPAIN.**

**MADRID,** 1,650, 2,200 metres (Irregular). 12 to 1 p.m., Tests.

**MADRID, PTT,** 400 to 700 metres. 4 to 5 p.m., Tests.

# Radio Society of Great Britain.

## TRANSMITTER AND RELAY SECTION.

During the tests of the week before last a number of transmitters who had not previously been on the programmes obtained an opportunity of taking part. Not all the reports from receivers are yet in, and it is therefore impossible to give a complete account of the results. But the reports already to hand show that there were some very successful performances. For example **2 IN** (Blackpool) was received by **5 JX** and **2 TF** (Edinburgh) by **2 DR** (Shipley), **5 SZ** (Baildon), **5 DN** (Sheffield), **2 VC** (Nottingham), **2 LG** (Birmingham), **5 QV** (Clacton), **5 SI** (Shrewsbury) among others. Another station highly reported on is **5 PS** (Farnborough), who has figured prominently in previous tests. **2 DR** (Shipley) was picked up by **5 JX** (Edinburgh), **6 HR** (New Southgate), and others. **5 JX** (Edinburgh) was read by **2 DR** (Shipley), **5 SI** (Shrewsbury), etc. **5 KO** (Bristol) was heard by **2 TF** (Edinburgh) and **2 VC** (Nottingham).

Each of the transmitters who were working will be given the gist of the reports when they come in. Up to the present in these later tests the best record for reception is that of **2 DR** (Shipley), who has received **5 DN** (Sheffield), **2 IN** (Blackpool), **5 SZ** (Baildon), **5 US** (York), **2 MG** (Glasgow), **5 JX** (Edinburgh), **2 TF** (Edinburgh). Another good reception record was that of **2 TF** (Edinburgh).

From all directions it is reported that much jamming is caused unnecessarily by experimenters. Sometimes two persons only a mile or two apart will monopolise the air for long periods by emitting disproportionately strong radiation. It would help greatly if such transmitters would be sporting enough to reduce their power and to minimise the amount of time they occupy, especially while tests are on. But a great deal can be done to reduce jamming in other ways. Every owner of receiving apparatus ought to endeavour to use highly selective circuits and weak coupling to the aerial. At the same time every transmitter ought to adjust his apparatus accurately to a definite wavelength, and keep it there. To assist in both these improvements in apparatus the Radio Society's calibration signals have been sent out during the past week, and each member of the section has had a sheet of instructions showing the best way of utilising the signals, if his call sign had appeared on any of the Society's transmitting programmes. But this is not the only method of alleviating the trouble; another method is for every transmitter to submit to a reasonable amount of discipline for the good of all, including himself.

The first election of the T. and R. Section is drawing near. The elected members of the Committee will be three in number, and two of them must be members of the Radio Society, while the third need not be. All of them must be members of the T. and R. Section. The method of election is as follows :—

Before November 29th next each member of the T. and R. Section ought to receive a postcard stamped and addressed for return. On this postcard each member is requested to write the names of three members of the Section in order of preference. The votes given on the returned postcards will be counted by a method giving full weight to the preferences expressed, and the President will then make enquiries as to whether the persons getting the most votes are able and willing to serve. In this way three members will be chosen for the Committee.

Up to the present the Section has been worked by a Committee consisting of Mr. Child, a Vice-Chairman of the Society, Mr. Coursey, who is the organiser of the transatlantic tests, and the President.

## THE TRANSATLANTIC BROADCAST TESTS.

The arrangements for the Broadcast Transatlantic Tests promoted by *The Wireless World and Radio Review* and by *Radio Broadcast* in America are now complete.

The simultaneous transmission from all the British stations will commence, as announced in our last issue, at 3 a.m. on November 26th. At 3 a.m. on November 27th America will transmit for half an hour for test purposes from a number of stations on wavelengths between 300 and 500 metres, and an address will be made by Mr. Henry Ford. American transmissions will also take place commencing at the same hour on November 29th, thus alternating with the British transmissions already announced. On December 2nd, provided that the tests have met with success, an attempt will be made at two-way communication, when England will transmit at 3 to 3.5 a.m., 3.10 to 3.15 a.m., and so on every five minutes until communication is established. America will transmit at 3.5 to 3.10, 3.15 to 3.20 etc.

Reports on reception should be forwarded to *The Wireless World and Radio Review*, 12/13, Henrietta Street, London, W.C.2., and to *Radio Broadcast*, at Doubleday, Page & Co., 120, West Thirty-Second Street, New York, U.S.A.

# DISTORTION IN RADIO TELEPHONY.

By H. A. THOMAS, M.Sc.

(*Continued from page 229 of previous issue.*)

THE TELEPHONE.

The last link in our chain is the telephone receiver, a piece of apparatus nearly as defective as the carbon microphone. It is usually considered that if there is no saturation, *i.e.*, if the displacement of the diaphragm is a linear function of the current through the exciting coils, there is no distortion.

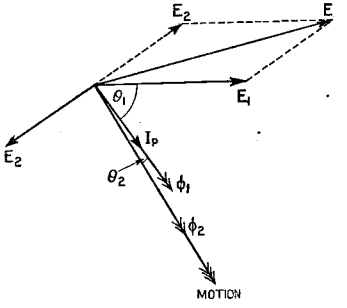



*Fig.* 18.

However, if we examine the vector diagram of a telephone receiver, we shall see that we have four factors to consider, namely :—

(1) The static resistance.
(2) The static reactance.
(3) The motional resistance.
(4) The motional reactance.

In Fig. 18, if the E.M.F. applied to the terminals of the receiver be represented by $E_1$, the current due to the normal impedance of the winding will be $I_P$ making a phase angle difference of $\theta_1$. Now, in phase with this current vector, we have the flux change $\varphi_1$ which will produce a motion of the diaphragm lagging a little behind the operating flux. This lagging angle $\theta_2$ is dependent on the effective mass of the diaphragm, its constants of elasticity, and the frequency. This motion will now produce in phase with it a flux $\varphi_2$ due to the variations of the air gap and consequently the reluctance of the magnetic circuit. The changing flux $\varphi_2$ will induce an E.M.F. $E_2$ in the original winding, and thus the E.M.F. required to maintain the current $I_P$ when the diaphragm is in motion will be the vectorial addition of the components $E_1$ and $E_2$, namely $E$.

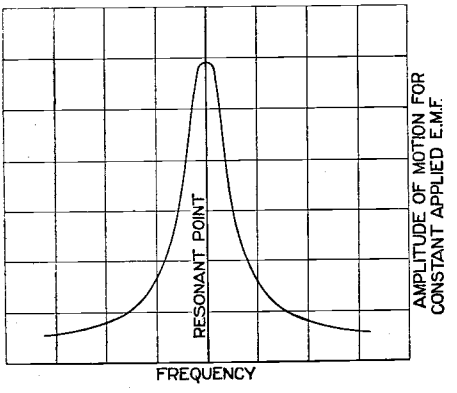



*Fig.* 19.

It is apparent therefore that the effective motional impedance of the receiver will vary with frequency. We must not forget also the natural period of vibration both of the mechanical and electrical systems, and the decrement and inertia of the diaphragm. Fig. 19 gives the type of resonance curve obtained from the mechanical system, and Fig. 20 gives the sort of motion obtained by an applied wave of constant amplitude, as the frequency passes through the resonance point.

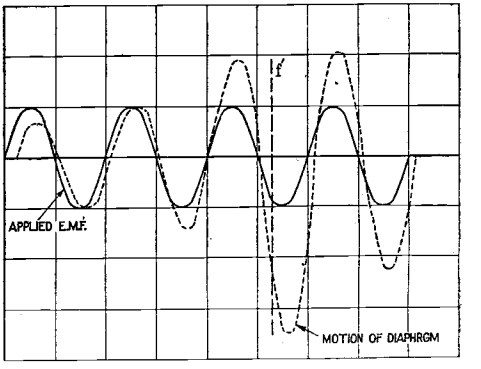



*Fig.* 20.

The static and motional resistances and reactances of a typical receiver are well shown by the following curves given in Fig. 21.

In general, it appears remarkable that a metal diaphragm is capable of following the current changes as well as it does. The motion is exceedingly small, being of the order of 1/20,000 cm., for a sound of strength R8 at 256 f.

LOUD SPEAKERS.

In the case of loud speakers, the horn plays a prominent part in the quality of the reproduction and it will be well to ask ourselves what its function is. We have a motion of the diaphragm giving pressure impulses to a small area of the surrounding medium, and by means of the horn, we convert these impulses into smaller pressure changes acting over a greater area. Now, a horn must produce some type of distortion, but sometimes this distortion effect is considered an advantage.

However, the real function is to preserve the initial least distorted pressure changes at the diaphragm, and for this purpose the horn should add nothing to the tone by virtue of its own resonance and elastic properties. Many loud speakers suffer materially from sustained vibration of certain frequencies, giving a jarring effect.

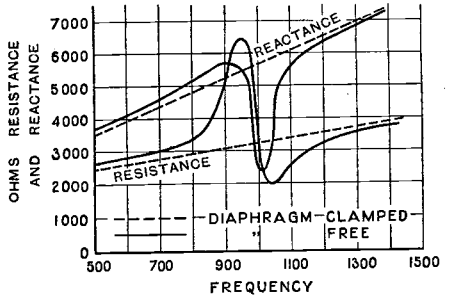



*Fig.* 21.

The ideal horn should therefore be made of a vibrationless material, and castings in iron have so far proved to give the best results. Anything of the nature of thin metal should be avoided, as invariably there is resonance frequency, often in the audible range.

Having given a rough sketch of the factors which produce the evil, I will mention a few of the possible means of improvement.

With reference to microphones, there are several types which are more or less successful, which do not depend upon the variable resistance offered by a mass of carbon granules.

There is the Jet Microphone, in which the resistance of an electrolyte sprayed from an electrode on to the moving diaphragm which acts as the other electrode, is utilised to convert the pressure impulses into corresponding electrical ones. However, the clumsiness of the instrument is apparent, and there is great difficulty in preserving a constant cross sectional area of the liquid. Fig. 22 illustrates the method. The power that can be handled may be as high as 400 watts.

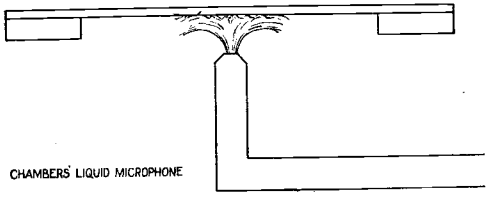



*Fig.* 22.

The capacity transmitter is another form, illustrated in Fig. 23. Here, the motion of the diaphragm produces changes in capacity, and these changes may be utilised in two ways. The usual method is to apply a high frequency potential, and the current is a linear function of the capacity, which is very nearly proportional to the displacement of the moving plate.

I have succeeded in getting this type of transmitter to work very well by merely connecting it to a 4-volt cell, and telephone in series. In this case a potential "$v$" is applied across the plate, and the change in electrical charge on the condenser is "$vc$," where "$c$" is the capacity. Now, since $v\frac{dc}{dt} = \frac{dq}{dt} = i$, a current will be produced which is a function of the rate of change of the capacity, and since this is also sinusoidal if the impressed pressure is sinusoidal, a satisfactory transformation is obtained.

However, the difficulty with all capacity transmitters is that a large amplification is usually required.

I have tried a capacity transmitter without a diaphragm with considerable success. In this case a condenser with a very small air space and a large number of plates was enclosed in a box with a trumpet at one end, as shown in Fig. 23. The variations of pressure produce variations in the specific inductive capacity of the air dielectric, and over the small range utilised, this change is linear. The capacity is thus varied. From a theoretical point of view, this transmitter appears to be ideal, as we have no moving mechanical system. Practically we have the difficulty of

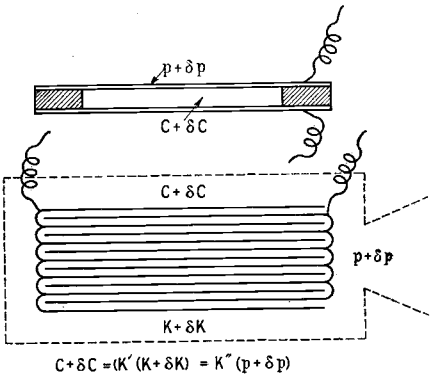



*Fig.* 23.

insensitivity and consequent necessity of amplification, but I feel, in spite of this, that the system has much to commend it.

It is obvious that there is much scope for improvement in valve design. Characteristics with longer straight portions are urgently required, as also are low impedance valves for large outputs. Self-capacity between various parts of the valve should be reduced, especially for the lower wavelengths.

Transformers are always open to much discussion and self-capacity in this case must be reduced materially.

In reception, we *must* get away from the shocking habit of low resistance resonant circuits produced by such devices as negative grids, reaction coils, and so on. Bigger aerials, and less valves are wanted. The wireless experimenter is too fond of freak performances on the top of resonance curves, and when his aerial resistance is just and only just on the right side of zero. Also, let us realise that the audio voltage changes on the grid

of the last valve of a note magnifier may be very large, and higher anode volts with consequent increase in the length of the linear portion of the characteristic is very desirable.

I shall conclude by giving a few more suggestions relative to audio frequency amplification.

The problem of high frequency amplification being more difficult in theory and practice than that of audio, has had bestowed upon it a comparatively large amount of experimental and theoretical investigation, and almost every type of circuit has been tested and compared. Thus we have the transformer-coupled amplifier, the tuned transformer, the impedance capacity, resistance capacity form of coupling, and so on.

However, since audio frequency amplification is apparently so simple a matter, and is not dependent on tuning or any like critical conditions it is the favourite method of amplification adopted by experimenters, and of course, the desired output for the successful operation of large audio apparatus such as loud speakers is obtained.

It is owing to the fact that valves may so easily be hooked together by iron core transformers in cascade, and also that the average wireless enthusiast is rarely a musician, that little, if any, research in the improvement of articulation has been attempted bv the experimenter.

It is therefore with a view to arousing interest in these finer points of improvement that I feel that the results of a few simple experiments may be of interest, and hope that others will try to improve upon the results given.

In the first place, therefore, let it be understood that the iron core transformer is a "dark horse." It is not nearly such a simple piece of apparatus as we all feel it is.

In view of recent experiments upon standard intervalve transformers, we are forced to very seriously modify our conceptions of the action of such pieces of apparatus. To begin with, it has long been known that the amplification obtained by a transformer is not a mere function of the ratio of the turns on the secondary and primary only; in fact if the number of secondary turns be doubled, the voltage step-up effect is not magnified in the same ratio. The value of the effective step-up effect "$K$" is dependent on frequency, and also the impedance of the circuits. Since the impedance varies with the frequency, it is clear that the amplitude of the impressed volts on the grid for a given constant amplitude of applied current in the previous anode circuit will vary with frequency, and thus it is impossible from this consideration to obtain a true distortionless amplification. The effective resistance of the primary also increases with frequency, still further modifying the secondary applied volts, and thus it is seen that no transformer can approach the conditions necessary for true amplification, for surely, our definition of a transformer implies that "$K$" is a constant, neglecting iron losses.

A considerable part of the energy transfer takes place electrostatically, the secondary winding virtually acting as the plate of a condenser.

By virtue of these and similar considerations, it seems clear that a large part of the transfer of energy from the anode circuit of a valve to the grid of the next takes place by virtue of the capacity reaction between the windings of the transformer, and one is driven to the paradoxical statement that the one thing that a transformer cannot do is to transform.

Thus it is seen that the possibilities of distortion in an iron core transformer are very real, and in fact, it appears marvellous that such excellent results have been obtained with a piece of apparatus so full of defects. It is certainly true to say that most of the crackling sounds of audio amplifiers and practically all the distortion is produced by the transformer. We are, of course, neglecting the distortion at the transmitting end.

There are two other well-known methods of coupling two audio valves, the impedance capacity, and the resistance capacity. The three different methods are shown in Fig. 24.

(*a*) Represents the usual transformer method of coupling, (*b*) the iron core impedance capacity, and (*c*) the resistance capacity.

The impedance capacity operates by virtue of the drop across the impedance "x," which is passed on to the grid of the next valve by means of

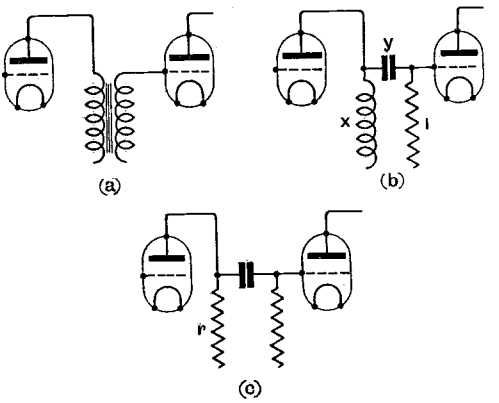



*Fig.* 24.

a low impedance condenser "$y$," which permits the grid to remain at an approximately zero potential. The leak "$l$" is inserted merely to maintain the grid mean potential constant, and in most cases is unnecessary, as sufficient leak is present in the valve and its connections.

In the resistance capacity case, a resistance is substituted for the impedance, and the drop across this resistance "$r$," produced by the varying anode current in the rectifier valve, is utilised to operate the next grid, as before.

In case (*b*), the impedance usually would be made with an iron core, so that a far greater inductance value would be obtained with a given number of turns. However, the iron distortion due to hysteresis and eddy current effects is still present, though less than in the transformer case, but the amplification is naturally less, since we virtvally have a transformer of 1 to 1 ratio instead of 5 to 1 as is supposed to be the case with the iron transformer.

If the impedance be large, and of the air core type, there is far less possibility of distortion, but the winding would then be very bulky, and probably as expensive to manufacture as the present transformer.

The resistance capacity method, on the other hand, has the great advantage that the resistance can produce no distortion and it is therefore the ideal method from the theoretical point of view. The old disadvantage claimed for it was that an excessive high tension voltage was necessary to compensate for the normal large drop across the resistance under steady conditions. We will consider this point later.

In order to compare amplification and articulation by the three methods simultaneously on the same piece of telephonic transmission, a circuit arrangement was built up as shown in Fig. 25 with a switching system, by means of which the method of amplification could be immediately changed.

It will be seen from the diagram that the three arms of the four-blade switch are engaged in changing connections, while the fourth inserts small detuning capacities into any part of the tuning circuit, so that the amplitude of the received signal in the telephones could be made the same in each case, this being the only way in which articulation could be compared. These condensers are abstracted, of course, to compare amplification.

The arrangement was tested out on various pieces of telephonic transmission, and it was found that the articulation in the iron impedance case was about the same as the ordinary transformer method, but the resistance capacity method of

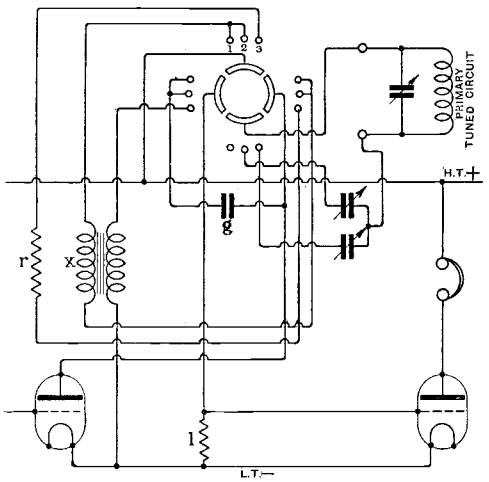



*Fig.* 25.

coupling gave distinctly better and cleaner articulation. A certain amount of "body" was lost, but this was completely outweighed by the improvement in clarity, especially when it is realised that most of the so-called "body" produced by the transformer is not so much a true replica of the actual tonal characteristics of the instruments, so much as a general overlapping of the various frequencies, not so apparent in solo work as in concerted instrumental and vocal works.

It is in such cases that the resistance amplifier effectively usurps the place of the transformer coupled amplifier, and there can be no doubt, as a result of the experiments performed with the apparatus described, that the usurper is more capable of handling the problem.

And now, as regards amplification, it was found, as would be expected, that the impedance capacity method was far poorer than the transformer, since it is virtually a 1 to 1 ratio, but strange

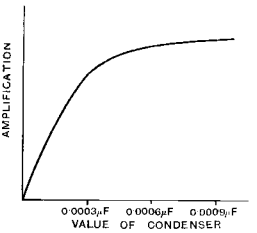


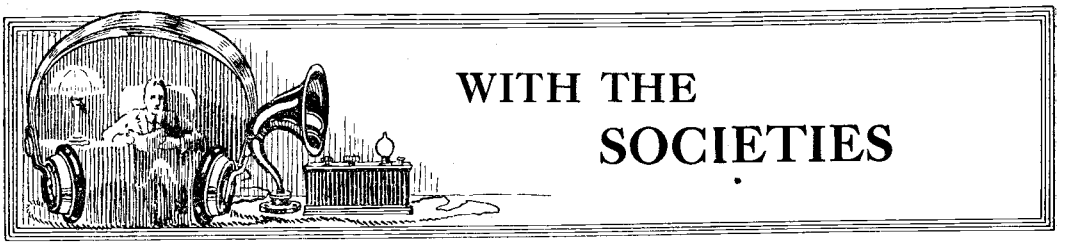

*Fig.* 26.

though it may appear to many, the resistance capacity gave results quite as good as the transformer. The high tension voltage was only 60, and with a resistance of 100,000 ohms, and no increase in this voltage, it was found that no real change in amplitude could be detected. If the battery voltage be put up to such a value that the anode voltage was the same in both cases, the resistance capacity method gave a greater amplification. The amplification curve plotted against the value of the capacity used is shown in Fig. 26, from which it will be seen that little is gained by increasing the value of this condenser above 0·0003 mfd. This is an exceedingly small condenser, yet it was found to be quite sufficient to pass the audio frequency energy.

The obvious conclusion is that the resistance capacity high frequency amplifier may act as well as an audio frequency magnifier, and thus, in the case of a five or six-valve set, if two valves be connected as high frequency amplifiers, the third as rectifier, and the others as low frequency resistance capacity magnifiers, it is difficult to differentiate between the actions of these valves for the connections are identical in each case, and we simply assume that the detector is working at a different point on its characteristic to the amplifying valves. In practice, however, no special precautions are taken to ensure this being the case, and so we are driven to the conclusion that each valve is acting partially as an amplifier, detector and magnifier. The connections of such an amplifier are extremely simple, and the overall cost is far less, since resistances are comparatively cheap compared to transformers.

It is thus hoped that the results of these tests will resurrect the resistance capacity amplifier, since the faults claimed for it seem to be unreal, and its advantages seem to amply justify its adoption to the needs of the discriminating experimenter.

*(The Discussion on this paper will be included in a subsequent issue.)*



# WITH THE SOCIETIES

Particulars of Membership of any Society can be obtained on application to the Secretary. Societies marked with an asterisk are affiliated to the Radio Society of Great Britain.

### THE BRISTOL AND DISTRICT RADIO SOCIETY.*

A most interesting lecture on "High Frequency Amplifiers and Short Wavelengths" was given at the Physics Lecture Theatre, Bristol University, on Thursday, October 25th, by Mr. Leonard Lott, F.S.M.C., F.I.O., of Burnham-on-Sea. The lecturer dealt very thoroughly with the different methods in use, giving members the result of his experiences.

Hon. Sec., A. S. Harvey, 6, Woodleaze, Sea Mills, Bristol.

### BOROUGH OF TYNEMOUTH Y.M.C.A. RADIO AND SCIENTIFIC SOCIETY.*

The first meeting for the winter session took place on October 25th, when the President, Mr. J. Ed. Burnett, F.R.Met. Soc., gave his Presidential address, in which he dealt with the subject of "Direction Finding."

In concluding, he emphasised the benefits derived by amateurs in joining a wireless society, with the result that at the close of the meeting, a good number of new members were enrolled.

Hon. Sec., L. L. Sims, c/o Y.M.C.A., Bedford Street, North Shields.

### HONOR OAK PARK RADIO SOCIETY.

The feature of the evening meeting on October 26th was a lecture by Mr. W. J. Rickets, A.M.I.E.E., on "Audio Frequency Amplification and Loud Speakers."

After speaking at length on the general causes of distortion and methods of elimination, illustrating his remarks by means of characteristic curves, the lecturer dealt with Audio Frequency and Resistance-Coupled Amplification.

At the conclusion of the programme, Mr. W. J. Rickets presented to the Society, on behalf of Mr. A. Graham (President), the splendid gift of an A.R.27 type "Amplion" Loud Speaker.

Hon. Sec., G. J. Price, 22, Honor Oak Park, S.E.23.

### THE STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.*

On Thursday, October 18th, Mr. F. J. Goodson, B.Sc. (Hon. Secretary) read a paper on "Simple Circuits for Beginners."

The lecture was primarily intended for holders of the new Constructor's licence, being in the form of practical notes on the construction of wireless receiving apparatus. The lecturer explained very lucidly the methods of connecting up simple valve and crystal circuits, and dealt with both high and low frequency amplification

It was announced by the Secretary that a class for beginners and students would be held on alternate Thursdays.

Hon. Sec., F. J. Goodson, B.Sc., G.I.Mech.E., Tontine Square, Hanley.

### ILFORD AND DISTRICT RADIO SOCIETY.*

On October 18th, Mr. A. E. Gregory gave a most instructive lecture on "H.F. Amplification," describing the various methods by which this could be done. Mr. Gregory, who is thoroughly at home with this subject, covered an enormous amount of ground in the comparatively short time available.

Hon. Sec., L. Vizard, 12, Seymour Gardens, Ilford.

### TOTTENHAM WIRELESS SOCIETY.*

On October 24th, experiments were made with various combinations of high and low frequency amplification, and a number of circuits of normal design were tested out. The results were admirable, and the best results (economically), were obtained from a single valve and crystal reflex circuit.

The set made by Mr. Vickery was chosen by the Society to represent them at the forthcoming exhibition. This valve and crystal reflex set would have disgraced no manufacturer either for construction or efficiency, and in addition, it includes several special gadgets.

Mr. Grimshaw gave the results of his preliminary investigation of reflex circuits. This week the Society is losing one of its most valued members, Mr. Ellis, who is taking a post in the Argentine. Besides lecturing frequently, Mr. Ellis has nearly always been able to help with difficulties in wireless theory or practice. The Society's congratulations on his advancement are mingled with regrets at his departure.

Hon. Sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

### STREATHAM RADIO SOCIETY.

An excellent paper was read before the Society on October 24th, by Mr. A. Neilson, on the subject of "Rectification." The lecturer described in full all the known methods, including electro-thermionic, electrolytic, synchronisation by convertors and synchronous commutators. Mention was also made of mercury vapour and other forms of rectifiers, including the charging of condensers by rotary distribution.

Hon. Sec., S. C. Newton, A.M.I.E.E., "Compton," Pendennis Road, S.W.16.

### MANCHESTER WIRELESS SOCIETY.*

A lecture was given on October 24th, on the "Construction of the Cossor Valve," and proved very interesting to the large number of members present, the lecturer being Mr. Y. W. P. Evans, A.M.I.R.E. The lecture was illustrated by means of lantern slides loaned by the Cossor Valve Co.

Following the lecture, a discussion took place on the merits of various valves and the members gave their several experiences.

Hon. Sec., Y. W. P. Evans, 2, Parkside Road, Princess Road, Manchester.

### HACKNEY AND DISTRICT RADIO SOCIETY.*

On Thursday, October 18th, Mr. Geo. W. Walton, of the General Radio Co., lectured on "Television," or the "Transmission of Views instantaneously by Electrical Means." Mr. Walton compared the two principal transmitting methods, the Photo-Electric device, which is a metal emitting electrons under a beam of light, and the chemical device which at present uses the Selenium Cell. The latter unfortunately is not constant or capable of responding to the speed required, but promises most success if these drawbacks can be obviated. The lecturer pointed out that when "Television" became a commercial success, transmission would most probably take place on a wavelength of only one foot, and that it was to be hoped that experimenters would consequently continue their efforts to overcome the difficulty of transmission on short wave. Mr. Walton ventured to predict that five years hence, Television would hold the same place as Broadcasting at the present moment. This would be the greatest revolution the world had ever known.

At our meeting on Thursday, October 5th last, a series of Waistcoat Pocket Lectures were given by members. Our Secretary, Mr. Phillips, demonstrated a new variable condenser of his own invention, which is entirely unlike the usual type. This condenser will shortly appear on the market, and the Society wishes Mr. Philips every success. Mr. E. Cunningham next told how not to start in wireless, and provided many laughs when describing how he erected a 50 ft. aerial and searched under the drawing-room floor for an earth. Mr. Van Colle concluded with many useful constructional tips.

Hon. Sec., C. C. Phillips, 57, Highfield Avenue, Golder's Green, N.W.11.

### SALISBURY AND DISTRICT RADIO SOCIETY.*

The winter session was opened on Thursday, October 25th, with a public demonstration. Unfortunately, the weather and a mass political meeting adversely affected the attendance.

The President, Mr. J. E. Alcock, very aptly described the object and aims of the Society, remarking that now that Bournemouth was functioning, the home constructor who had not the means to make and maintain the more elaborate valve sets formerly necessary, had everything to gain by joining the Society.

The Hon. Sec., said the Society was indebted to Messrs. A. E. Tribe & Co. for

the loan of the set that was in use; Messrs. Clayton Bros., for accumulators, etc., Messrs. The Western Electric Co. for loud speakers.

New members are needed and will be made welcome.

S. W. Johnson, 19, Fisherton Street Salisbury.

### THE PRESTWICH AND DISTRICT RADIO SOCIETY.*

On Thursday, October 25th, a demonstration was given by Mr. Bamford of the Northern Radio Co., of their new dual amplification set. The lecturer described the construction and components employed and illustrated the circuit used by blackboard illustrations, showing its evolution from a simple crystal circuit.

Hon. Sec., H. A. Wood, Spring Bank, Church Lane, Prestwich.

### THE RADIO SOCIETY OF HIGHGATE.*

At the meeting held on October 26th, the Hon. Secretary announced that on and after November 30th, the headquarters of the Society would be moved to Edco Hall, 270, Archway Road, Highgate. Members please note. A lecture was then given by Mr. E. A. Saunders on "Some Considerations of Ether, Electrons and Material Phenomena." Mr. Saunders outlined the atomic theory, and showed how, although this theory would explain much, it did not explain the phenomena of magnetism and electricity. Mr. Saunders concluded his very interesting and instructive lecture with a few remarks on the subject of Television, a question on which he is at present carrying out research.

At a recent meeting of the Society, it was announced that Mr. J. F. Stanley, B.Sc., A.C.G.I., had been elected to the Committee of the Radio Society of Great Britain, as the temporary representative of the Eastern Metropolitan Societies.

Hon. Sec., J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

### THE HOUNSLOW AND DISTRICT WIRELESS SOCIETY.*

The Society has had a very full programme during the past month. On the 4th, Mr. Hinderlich gave a lecture on "Crystals." On the 11th, the Society's second Dutch auction was held; the Vice-President, Mr. D. V. L. Fellows, of magneto fame, very kindly consented to be "Dutch Auctioneer" for the night. On the 18th, the Society gave a demonstration at Isleworth, in aid of St. John's Parish Hall, most of the B.B.C. Stations and Paris (**FL**) being received. On the 25th, Mr. Reeves, Metropolitan member for the Western Section of the Radio Society of Great Britain, spoke of the aims of the Western Metropolitan Association of Affiliated Societies. On November 1st, Mr. G. G. Blake of Richmond, Surrey, gave a very interesting lecture on the "Development of Radio Telegraphy and Telephony." with lantern slides, and a demonstration of the R.A.F. Valve Model, showing the action of a valve.

Any person in the district who is interested in wireless, will have particulars of membership sent them on application to the Hon. Sec., at headquarters, The Council House, Hounslow.

### THE WIRELESS AND EXPERIMENTAL ASSOCIATION OF PECKHAM.*

On Saturday, November 3rd, members of the Society had the pleasure of listening-in to their President, Mr. William Le Queux, speaking from **2 LO**. Mr. Le Queux spoke on "Other Things That I Know," and began with reminiscences of broadcasting from his own station **2 AZ** at Guildford. The little stories which he then broadcast, reminded one more of the novelist than of the wireless experimenter. and made one understand how Mr. Le Queux is able to enthrall his readers.

Hon. Sec., Geo. Sutton, 18, Melford Road, Dulwich, S.E.22.

### THE LEEDS RADIO SOCIETY.*

On October 26th, Mr. W. G. Marshall delivered a lecture upon "The Propagation of Ether Waves." Mr. Marshall had been specially requested to repeat this paper from last session, and the Society had been looking forward to its repetition with great enthusiasm. The lecturer described the function of the electromagnetic medium, and paid especial attention to the theories as put forward by Maxwell. Many modes of producing ether waves were examined, and the nature of these waves was compared with those due to the Hertz Oscillator. The discussion which followed proved most valuable, it being decided to continue the discussion in the near future.

An instructional meeting was held on November 2nd, the Honorary Secretary giving an elementary talk upon "The Radiotelephone and How it Works." There was, as usual at these instructional meetings, a very large attendance of beginners and others.

Applications for membership are invited, and should be addressed to the Hon. Sec., D. E. Pettigrew, 37, Mexborough Road, Leeds.

### THE CIRENCESTER RADIO SOCIETY.*

Before a large and appreciative audience Mr. C. Hart Collins lectured on "Th Elements of Wireless Telephony" on Saturday, October 27th.

Mr. Hart Collins spoke of his preference for the term "radio" in place of "wireless," and proceeded with a detailed explanation of the phenomena that occurred in the transmission and reception of speech by radio.

In an interesting speech at the conclusion of the lecture, the Chairman, Prof. M. J. R. Dunstan, O.B.E., M.A., dealt with the peculiarities of sound and the methods of reproducing it electrically.

A feature of the meeting was the presentation of a 14-day clock to the retiring Hon. Sec., the Rev. B. R. Keir Moilliet, whose new duties necessitated his removal from the district.

Hon. Sec., A. J. Carter, X-Ray Dept., Memorial Hospital, Cirencester.

### NORWICH AND DISTRICT RADIO SOCIETY.*

Mr. Meadows White, on November 2nd, delivered an interesting and instructive lecture on "Adding a H.F. Valve to a Short Wave Tuner," and a vigorous discussion followed. Among the lecturer's handsome display of apparatus was a very efficient potentiometer which attracted considerable attention.

Hon. Sec., J. G. Hayward, 42, Surrey Street, Norwich.

### LIVERPOOL CO-OPERATIVE RADIO ASSOCIATION.

A crystal and four-valve receiving set, with loud speaker, is being erected, separate detector, audio and high frequency units being employed. Mr. S. Frith, at a recent meeting, gave a detailed explanation of these, and said provision was being made by means of switches to experiment with various circuits.

An interesting programme has been arranged for the winter session, including Talks on Tuning, Condensers, Valves and Transformers, and an exhibition of members' apparatus.

The subject discussed at the last meeting of the Association was "Tuning In," on which Mr. S. Frith gave a clear and instructive lecture.

Hon. Sec., Jas. Kearns, 162, Walton Road, Liverpool.

### FYLDE WIRELESS ASSOCIATION.

This Society, together with the Ansdell Radio Society, the Fleetwood and District Amateur Wireless Society, and the Lytham St. Annes' Wireless Society, recently formed the Fylde Radio Association, which now has a strength of 300 members. Through the aid of the local press, excellent publicity has been obtained and it is hoped that the membership will continue to grow.

Hon. Gen. Sec., C. Sheffield Doeg, "The Poplars," 6, Seventh Avenue, South Shore, Blackpool.

### CLAPHAM PARK WIRELESS AND SCIENTIFIC SOCIETY.

The winter session of the Society has just commenced, and an interesting programme has been prepared. It is also hoped to organise an exhibition of member's apparatus, including a competition for home-constructed parts. The attendance at recent meetings has not been as good as might have been expected, and it is hoped that a greater interest will be aroused in the Society during this session. Meetings are held every Wednesday at 67, Balham High Road, at 8 o'clock, and prospective members are invited to attend them, or communicate with the Hon. Secretary, H. C. Exell, 41, Cautley Avenue, Clapham Common, S.W.4

### MOUNT PLEASANT RADIO RESEARCH SOCIETY.

On Sunday, November 4th, the Society visited the Croydon Aerodrome, where most of the time was spent in the various wireless buildings, a courteous operator explaining and demonstrating the apparatus in use.

The system of direction finding and the aerial used caused much comment, and the evening concluded with a tour of inspection round the hangars, where the guide readily explained the types of machines.

Applications for membership should be made to the Hon. Sec., Geo. H. Vine, 23, Melville Road, Walthamstow.

### EVESHAM AND DISTRICT RADIO SOCIETY.

This newly-formed Society is now holding regular meetings, and it is hoped to augment the membership very considerably. Applications for membership will be warmly welcomed and should be addressed to the Hon. Sec., F. E. Mason, F.I.O., M.P.S., 50, Port Street, Evesham.

### DULWICH AND DISTRICT WIRELESS AND EXPERIMENTAL ASSOCIATION.

An excellent lecture was delivered by Mr. F. B. Bartlett on October 10th, his subject being "Capacity." Much had been expected from the lecturer, and his audience was not disappointed, much useful information being imparted. New and commodious headquarters have now been acquired by the Association, and enquiries as to membership will be warmly welcomed by the Hon. Sec., Mr. L. Pilbeam, 499, Lordship Lane, East Dulwich, S.E.22.

### BRIGHTON AND HOVE RADIO SOCIETY.

At the first meeting of the new session held on November 1st, the President, Captain Hoghton, F.P.S.L., F.R.S.L., A.M.I.R.E., gave a very interesting lecture on "C.W. Transmitters," including wireless telephony.

Hon. Sec., D. F. Underwood, 68, Southdown Avenue, Brighton.

## DESCRIPTION OF EXHIBITS

# ALL-BRITISH WIRELESS EXHIBITION

**November 8th-21st, 1923.**

(*Continued from p. 224 of previous issue.*)

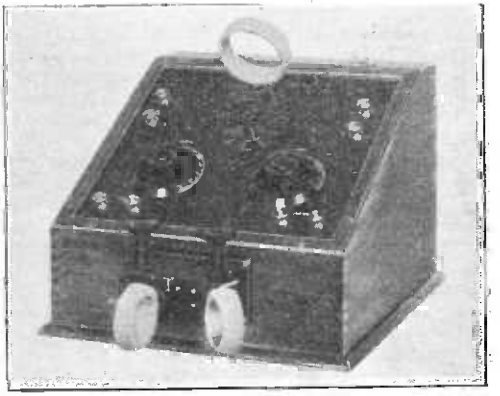
**British Ebonite Company, Ltd., Nightingale Road, Hanwell, W.7. Stand No. 59.**

As suppliers of high-grade ebonite sheet and tube this Company is well known among manufacturers of wireless apparatus, and now they are devoting their attention to the production of finished panels with matt or polished surface in both black and grained ebonite. Their exhibits include a large number of useful mouldings and ebonite fitments useful to the trade.

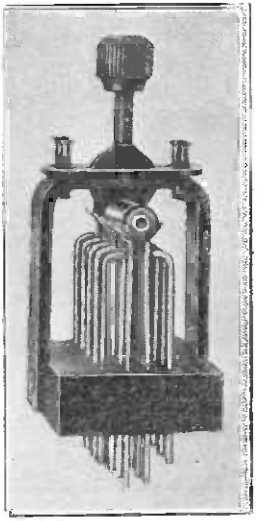
**Burndept, Ltd., Aldine House, Bedford Street, Strand, W.C.2. Stands No. 112 and 75.**

The Ethophone instruments are designed to give high efficiency combined with simplicity of control, in order to bring their operation within the ability of the non-technical listener-in. The class comprises the Ethophone "Junior" and Ethophone "No. 1" Crystal Receivers, the Ethophone "Popular," which is a highly efficient two-valve long distance receiver, and the "Popular" speech amplifior, which is a companion of the last-named instrument, and is intended to give a high degree of amplification. The Ethophone "IV" is a three-valve receiver capable of long distance reception and of operating a loud speaker without the addition of other apparatus, whilst a special amplifier for use with this instrument provides sufficient power to operate up to twelve ordinary loud speakers, while the quality of speech and music produced by this means is not impaired. The Ethophone "V" is a combination of the last two instruments, and is a four-valve set. The Ethophone "Selector" is an instrument which may


*The Burndept two-valve Ethophone, "Popular"*



*The constructor's two-valve receiver assembled. (Burndept*



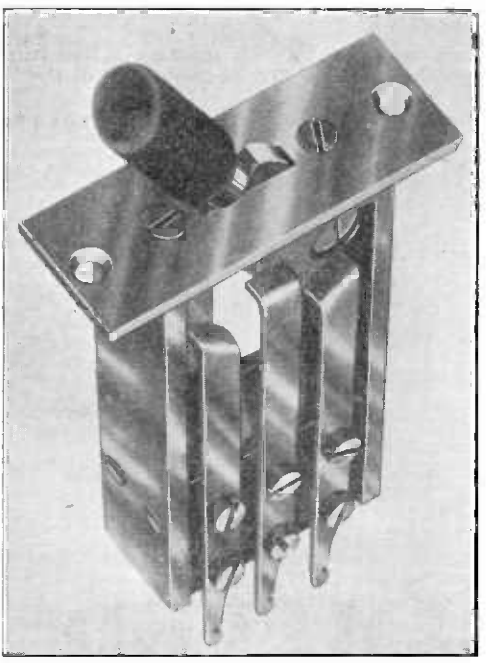
*Burndept key switch for use in H.F. or L.F. circuits.*

be used with either the Ethophone "IV" or "V" when trouble is anticipated or experienced through interference by ships and unwanted land stations, etc.

Home construction apparatus for use by those who possess the constructors' licence is exhibited and includes the components right up to the last nut or screw required for building a variety of highly efficient sets. The Burndept accessories and components should meet the needs of the discriminating experimenter because they are carefully designed and can be relied upon to function efficiently in any apparatus in which they may be incorporated.

### Climax Patents, Ltd., 182, Church Street, Kensington, S.E. Stand No. 25.

As a receiver of unique and original design, the "Climax" Monovalve is arranged to be as portable as a gramophone, low in cost, and the manufacturers claim that all broadcasting stations can be received on a folding frame aerial. Probably its strongest point will be that it is intended for use without an outside aerial, which to many users of wireless apparatus is the real bugbear, and to many who live in flats is an insurmountable obstacle. The operation of the set is simple, and as it is already provided with a frame aerial it is quite simple to tabulate the various adjustments before despatch. At the same time it is easily portable, and for those who wish to use a loud speaker, provision is made for the addition of a stage of low frequency amplification.



*The new Dubilier key switch, designed to possess a minimum of capacity between its contacts and specially suitable for use in H.F. circuits.*

### The Dubilier Condenser Co. (1921), Ltd., Ducon Works, Goldhawk Road, Shepherd's Bush, W.12. Stand No. 106.

The products of the Dubilier Condenser Company to be seen at their stand serve to emphasise the importance of the condenser in all its phases of radio work. Condensers for general use for receiving sets of the fixed type (Nos. 600, 600a, and 577), are all well constructed and fitted with carefully selected mica, and losses by careful research have been reduced to a minimum to ensure the most efficient operation under all conditions.

The "Vanicon" air dielectric variable condenser is built in three patterns, suitable respectively for panel mounting, general experimental work or for laboratory use, the difference between them being the type of container. Specially built condensers with electrostatic screening, which on occasion is a very desirable feature, are also shown, together with many standard laboratory instruments, grid leaks, and anode resistances. The latter are capable of passing currents up to the value of two milliamperes and can be relied upon to be accurate, which is such an essential point in regard to such apparatus. The "Minigap" key switch is a new product designed to have a minimum of capacity. Various other condensers suitable for use in high voltage H.F. circuits are also exhibited.

### Darimont Electric Batteries, Ltd., 536, Salisbury House, E.C.2. Stand No. 71.

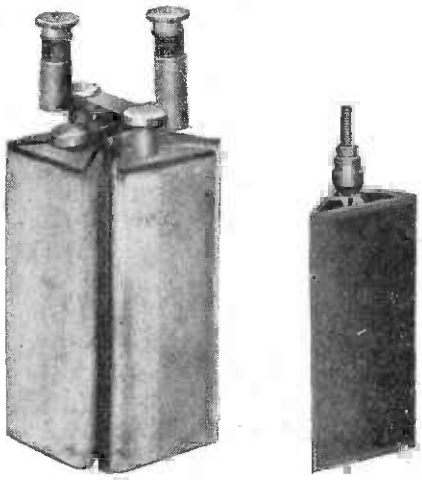
The unique construction and the marked advantageous properties of the new battery put out by this company were described in a recent issue.* One should make a point of inspecting this cell. It is one of the few primary batteries available that can be relied upon for use with multi-valve sets in which valves of the dull-emitter type are fitted.

### Edison-Swan Electric Company, Ltd., 123-5, Queen Victoria Street, E.C.4. Stand No. 87.

The principal item of interest is probably the "Toovee" set, which is a two-valve set employing an improved method of dual amplification, and making full use of the reaction. It is claimed that it will bring in any of the B.B.C. stations, whilst signals of loud speaker strength can be obtained at distances up to approximately thirty to forty miles from a broadcasting station. Another set is the four-valve "Radiophone" for long range work, in which many refinements have been introduced, such as a unique selector switch for two three, or four valves. Among the accessories the L.F. transformer attracts notice. It is of the closed iron core type, and has a ratio of 1 to 3·5. It is fitted with a 0·001 mfd. condenser across its primary winding. As manufacturers of valves their exhibit would not be complete without the "A.R.," "R," and "A.R.D.E." types, together with a comprehensive range of other valves of Ediswan manufacture both transmitting and receiving. A splendid range of Ediswan accumulators and H.T. batteries is also shown.

* A New Type of Primary Battery, page 183, November 7th issue.

**Fullers United Electric Works, Ltd., Woodland Works, Chadwell Heath. Stand No. 27.**



*Compressed plates of Fuller block secondary cell.*

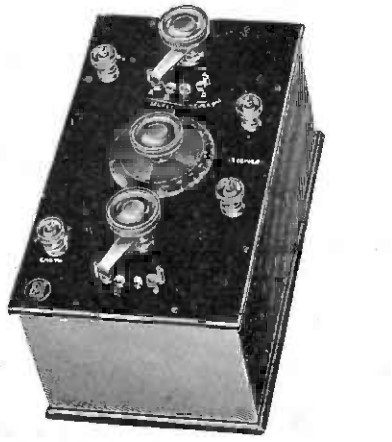
**Marconi Scientific Instrument Co., Ltd. Stand No. 57.**

An instrument of special interest at this stand s the self-contained set with loop-aerial arranged in its lid and with special compartments for telephones and batteries, and measuring only 20 ins. by 14 ins. by 6½ ins. It employs six valves of the "V.24" type as high frequency amplifiers, a detector and two note magnifiers, and is operated with only four controls. Other instruments of special interest are the heterodyne wavemeter and one, two, three and five valve cabinet sets, including a cabinet set de luxe in various styles.

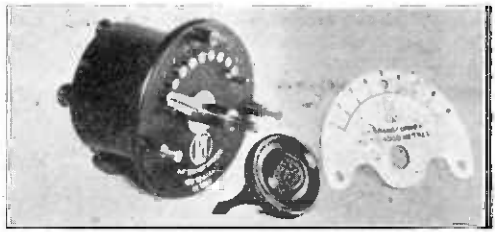
**Radio Instruments, Ltd. Stand No. 105.**

The standard valve sets of this Company warrant attention, and the range of types includes one, two, three, four, five and seven valve sets. The outstanding feature of all these receivers is the wide tuning range, and in all sets from two valves upwards, provision is made to operate over a band of wavelengths of from 300 to 4,000 metres, suitable for bringing in Continental as well as British telephony. As specialists in the design of efficient component parts, their H.F. transformers and anode reactance units are of special interest. A new instrument is the "R.I." Eliminator for minimising interference. A new feature in component construction is a system by which each part is mounted on a small ebonite base which can be attached to the face of the panel with one or two screws, for which a special tin plate is provided, showing the setting out. Thus nothing is seen on the front of the instrument, with the exception of the handle and dial indicating the tuning adjustment.

The "Lyrian" cabinet sets are particularly well designed and are complete with frame aerial, so that they can be used where it is not possible to erect an elevated aerial, and at the same time are portable.



*The "R.I." interference eliminator.*



*The anode reactance unit made by Messrs. Radio Instruments, Ltd.*

**The Rawlplug Company, Ltd. Stand No. 14.**

The Rawlplug, with its thousand-and-one uses finds an application in wireless instrument making. It is at once obvious that the most convenient method for attaching wireless instruments to the wall is to use the Rawlplug, whilst for switchboard work such as securing meters to slate and marble panels, there is no better method than to drill a clearance hole and make use of a Rawlplug.

The new recess headed screw of this Company is of special interest.

**Radio Supplies, Ltd. Stand No. 38.**

This firm has been established for many years and specially caters for the needs of the experimenter. A wide range of parts is offered, and special components have recently been introduced to meet the needs of those who have constructors' licences.

**Rogers, Foster & Howell. Stand No. 96.**

A large and varied display of wireless instruments can be inspected at this stand and particular prominence is given to a four-valve set which is designed to be specially suitable for receiving British and Continental broadcasting and arrangements to provide great selectivity.

The "Standard" R.F.H sets, so well known to readers, are also displayed, and these instruments have been slightly modified this season, inasmuch as the valves are mounted underneath the panel so that it is now possible to close the lid without first removing them.

D

Other instruments known as the "Minor" class are highly efficient sets, but tune only to the wavelengths of the British Broadcasting stations, and in recommending this type of receiver, one must not overlook the additional complications and difficulties encountered when designing receiving sets to operate over such a wide band of wavelengths that they are capable of receiving the Continental telephony.

The needs of the home constructor are also met by a number of attractive sets of parts complete to the last screw, and with blue print which, when the instrument is complete, can be attached to the interior of the lid for immediate reference. The ebonite panels are drilled, engraved and rubbed down, and it is quite a simple job to build an instrument of good finish.

**Radiax, Ltd. Stand No. 8.**

Among the items of interest will be found complete sets of parts for the home constructor, including in particular, a one-valve model, making use of a reflex circuit.

A new loud speaker of moderate price has also been introduced, and a new type of grid leak of the carbon pellet type.

*Two-valve receiver by Messrs Radiax, Ltd.*

**Radio Communication Co., Ltd. Stand No. 111.**

Apart from the many multi-valve receivers of first class design and construction which can be seen at this stand, is a new unit system known as the "Polar" block, by which a complete receiving set can be constructed in a short space of time, embodying any type or make of apparatus without undue mechanical process. The specialised "Polar" accessories include their well-known condenser, the "Cam Vernier" coil holder, which is particularly ingenious; the fuse and fuse-holder; the Dynaphone (which is a telephone receiver of unique design), and the "Polar" battery tester.

**Sterling Telephone and Electric Co., Ltd. Stand No. 108.**

From the designs adopted in the Sterling apparatus, it is evident that very considerable thought has been given to the electrical principles underlying the design of wireless apparatus. Not only are the circuit arrangements distinctly clever and highly efficient, but the component parts which are

*The Sterling four-valve receiver de luxe.*

employed in building up the complete receiving sets bear evidence that their construction has been evolved only after considerable research work. Their products include the crystal receiver, two-valve and four-valve cabinet sets, and a complete range of units, all of which are built to be thoroughly durable, easy to manipulate and embodying the soundest electrical principles. This Company has earned the thanks of every user of wireless apparatus who appreciate refinements in design by the introduction of a new type of variable condenser which has specially shaped plates providing critical adjustment near the zero position and, if desired, a concentric knob gives vernier adjustment, which is almost indispensable when tuning the

*Crystal receiver by the Sterling Telephone and Electric Co., Ltd.*

circuits of an H.F. amplifier. There is little doubt that this condenser will find a place in every tuning instrument that the experimenter may build. There are other Sterling components useful to the experimenter and of equally clever design.

# Questions & Answers
## Solutions of Readers' Difficulties

*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—*(1) *Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor,* **The Wireless World and Radio Review,** 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *All questions will be answered through the post. Those of general interest will also be published.* (4) *Every question, except those under* (5) *below, should be accompanied by a postal order for* **1s.**, *or* **3s. 6d.** *for a maximum of four questions, and also the coupon taken from the advertisement pages of the current issue.* (5) *For the benefit of those readers who would rather not pay the charges, a free Questions and Answers Coupon will be placed in the advertisement pages of the first issue of every month. This coupon should accompany the question submitted, together with a stamped addressed envelope. The free coupon is valid for the current week only.* (6) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.* (7) *Four questions is the maximum which may be sent in at one time.*

**"EXPERIMENTER" (Nr. Birkenhead)** *asks* (1) *For dimensions of a coupled tuner for* 150 *to* 350 *metres using an A.T.C. of* 0·001 $\mu F$ *and C.C.C. of* 0·0005 $\mu F$. (2) *How to determine the tuning range of coils with capacity in series.* (3) *The most stable crystal detector which will operate without applied potential.* (4) *The natural wavelength of his aerial (sketched).*

(1) For the A.T.I. wind 50 turns of No. 20 D.C.C. on a $2\frac{1}{2}$" diameter former, and for the secondary 50 turns of No. 20 or No. 22 D.C.C. on a 3" diameter former. The A.T.C. should be used in series with the A.T.I. (2) When a series aerial condenser is used, the capacity of the aerial is in series with that of the condenser. In the wavelength formula put $C = \frac{C_1 \times C_2}{C_1 + C_2}$. When $C_1$ = capacity of aerial, $C_2$ = capacity of condenser. The result is only approximate. (3) Detectors in which contact is made between two crystals are in general quite stable. We think you will find zincite and copper pyrites satisfactory from this point of view. (4) Approximately 120 metres.

**"E.K.S." (Malton)** *has constructed the L.F. power amplifier unit described in "The Wireless World and Radio Review" of May 26th,* 1923. *Instead of obtaining an increase in strength, signals are weaker, and he asks the reason for this.*

Assuming that the wiring is correct, and all transformers, grid cells, etc., are in good condition, the most likely cause of trouble is that the input from the four-valve set is overloading the particular valves in use. We suggest that you first experiment with other values of grid potential, and, if necessary use valves rated at a higher power.

**"E.B." (N.W.3)** *has a two-wire aerial* 20 *ft. long and* 8 *ft. above the roof. He gets* **2 LO,** *Croydon and the London amateurs well on two valves, one rectifier, one L.F., but cannot get Birmingham or Cardiff even after adding two H.F. valves. He submits a diagram of his receiver and asks for comment.*

The diagram is in the main correct. The primary of the intervalve transformer should, however, be shunted by a 0·001 mfd. condenser, while the grid condenser of the detector valve and the telephone condenser would give better results if altered to 0·0003 mfd. and 0·001 mfd. respectively. Probably your chief trouble lies in the aerial, the effective height of which is much less than 40 ft., although this is the height above ground level. It should be raised as far as possible from the surrounding roofs and chimneys.

**"A.M." (King's Lynn)** *sends a diagram of a two-valve and crystal receiver* (2-C-o) *and asks* (1) *If basket coils could be used for the A.T.I. and anode tuning coils.* (2) *Particulars of coils suitable for the reception of The Hague, Radiola and Eiffel Tower telephony.* (3) *If the circuit is suitable for all-round reception of telephony with a minimum number of valves.*

(1) Yes. (2) Using No. 24 D.C.C. wire, wind on a former with an inside diameter of 2", 350 turns for The Hague and 500 turns for the Radiola and Eiffel Tower. Two of each of the above will be required for the tuned anode coils. It is possible to give only approximate values for the A.T.I., the dimensions of which depend upon the aerial used. You might try for The Hague 175, and for the Paris transmissions, 250 turns on the same size of former, using for preference No. 26 or No. 28 D.C.C. wire. (3) Yes. The H.T. battery should be shunted by a 2 $\mu$F condenser.

**"C.P.D." (Weston)** *asks for particulars of a single-valve Armstrong super-regenerative receiver.*

We would refer you to articles on the subject in the issues of this journal of August 15th, April 28th, March 10th, etc.

**"W.H.T." (Huddersfield)** *has a three-valve set (one H.F., rectifier, one L.F.) which howls badly when the L.F. valve is switched on, and asks how the trouble may be remedied.*

Test the secondary of the L.F. transformer for continuity. If you do not find a break, try a different switching arrangement for the last valve; in the method which you are using at present, the telephones are shunted by the primary of the L.F. transformer when using the detector valve alone. You might also try the effect of applying a negative potential to the grid of the last valve and of shunting the H.T. battery with a 2 $\mu$F condenser; also the use of a different plate voltage for each of the three valves.

*rectifier), the tuning condensers for the H.F. valves to be operated by one spindle, with switch to cut out one stage of H.F.* (2) *In what positions the use of a vernier would be advantageous.* (3) *The wavelength range of a frame aerial 2 ft. square, wound with 15 turns and tuned with a 0·001 $\mu$F condenser.*

(1) The diagram is given in Fig. 1. (2) A vernier condenser in parallel with the 0·001 $\mu$F tuning condenser which you propose using would be a distinct advantage, while another might be connected across one side of the double tuning condenser in order to correct any lack of symmetry in the anode circuits. (3) The frame should receive between 250 and 1,000 metres, though the results will not be so good on the upper wavelengths.

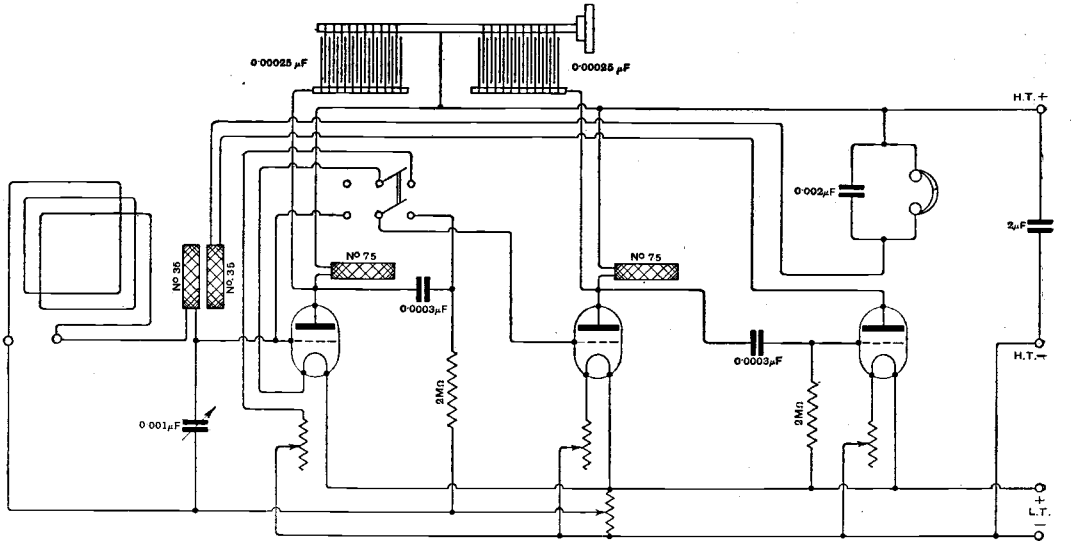



*Fig.* 1. **"NITON" (Boscombe).** *Three-valve receiver (two H.F. and det.,) with switch to cut out one stage of H.F., and employing a coupled variable condenser for tuning the H.F. circuits.*

**"A.C.M." (Birmingham)** *asks for our opinion on improvements in L.F. amplifiers advocated in a certain article.*

The article refers to American practice, and we do not think any advantage would be gained by carrying out the alterations with the valves and components available in this country. We would refer you to the article on "Hints for Better Reception" in the issue of September 5th.

**"E.S.E.C.L." (Orpington)** *can receive Paris telephony faintly on one valve, and asks whether it would be better to use another stage of L.F. amplification, as he has not been successful with "tuned anode" H.F. amplification.*

We would recommend you to persevere with the "tuned anode" circuit. In all probability the size of anode coil employed is not suitable. Try a basket coil of 400 turns, having a mean diameter of about 3½", tuned with a 0·0002 $\mu$F variable condenser.

**"NITON" (Boscombe)** *asks* (1) *For a diagram of a three-valve receiver (two H.F., one*

**"T.L.G." (Halifax)** *submits a diagram and asks* (1) *Whether the circuit is better than that given on page 462 of the issue of July 7th, 1923.* (2) *If basket coils could be used, and if so, what diameter.* (3) *Range of set with an efficient aerial.*

(1) We think the diagram given in this journal is probably the better of the two. (2) Basket coils could quite well be employed, and the diameter of course will depend on the number of turns used. Use a 13-peg former with 1" diameter centre and wind for the A.T.I. 35 turns of No. 20 D.C.C. copper wire, for the anode coil 60 turns, and for the reaction coil 25 turns. (3) You should receive, on telephones, all broadcasting stations within 150 to 200 miles.

**"A.V.L." (Birmingham)** *submits a diagram of a single-valve receiver, and asks how a three-coil tuner may be connected to it.*

We would refer you to Circuit No. 26 of the "Amateurs' Book of Wireless Circuits." The set should not be used on broadcast wavelengths if there is any likelihood of self-oscillation taking place.

# THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 224. (No. 9. Vol. XIII.) NOVEMBER 28th, 1923. WEEKLY




## CONTENTS



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# THE TRANSATLANTIC BROADCASTING.

BY THE EDITOR.

AT the time these lines appear in print the Transatlantic Broadcast Tests promoted by *The Wireless World and Radio Review*, in conjunction with *Radio Broadcast*, of America, will be in full swing.

Details of the transmissions have been published in previous issues, but some additional information is now available. We are advised by *Radio Broadcast* that five hundred American broadcast stations have made arrangements to broadcast announcements of the tests, and special steps are being taken to ensure freedom from interference whilst American listeners endeavour to hear the British Broadcasting Company's stations transmitting from England.

On November 29th, the second occasion on which America will transmit, the Broadcasting will be made from the station at Schenectady **WGY**, when the President of the Radio Corporation of America will speak.

The keenest interest is being shown in these tests in America, and this is enhanced no doubt by the fact that in America the opportunity has never before occurred for listening to British Broadcasting under the favourable conditions provided by the fact that darkness will prevail all the way across the Atlantic.

Special arrangements have been made, both here and in America, for the exchange of reports on reception with a minimum loss of time.

Below we publish details of the times of transmission by the British and American stations.

| Time G.M.T. | Date. | Remarks. | Wavelength. | Call Sign. |
|---|---|---|---|---|
| 0300 to 0345 | November 26th | England transmitting from all stations simultaneously. | | |
| 0345 to 0355 | ditto | London | 363 m. | **2 LO** |
| 0355 to 0405 | ditto | Bournemouth | 385 m. | **6 BM** |
| 0405 to 0415 | ditto | Cardiff | 353 m. | **5 WA** |
| 0415 to 0425 | ditto | Glasgow | 415 m. | **5 SC** |
| 0425 to 0435 | ditto | Birmingham | 423 m. | **5 IT** |
| 0435 to 0445 | ditto | Newcastle | 400 m. | **5 NO** |
| 0445 to 0455 | ditto | Manchester | 370 m. | **2 ZY** |
| 0505 to 0515 | ditto | Aberdeen | 495 m. | **2 BD** |
| | | America will cable as to which station is best received in the States. | | |
| 0300 to 0330 | November 27th | America will transmit an address by Mr. Henry Ford. We will cable to America results of reception in England. | | |
| 0300 to 0400 | November 28th | England will transmit to America. | | |
| 0300 to 0400 | November 29th | America will transmit a reply to addresses delivered on the morning of the 28th. The President of the Radio Corporation of America will speak from **WGY** Schenectady. | | |
| 0300 | December 2nd | Attempt at two-way communication. England to transmit 0300-0305, 0310-0315 and so on every alternate 5 minutes until communication established. America will conversely transmit 0305-0310, 0315-0320, etc. | | |

Reports on reception are invited by *The Wireless World and Radio Review*, 12-13, Henrietta Street, London, W.C.2, and by *Radio Broadcast*, at Doubleday, Page & Co., 120, West 32nd Street, New York, U.S.A.

# A THREE-VALVE RECEIVER.

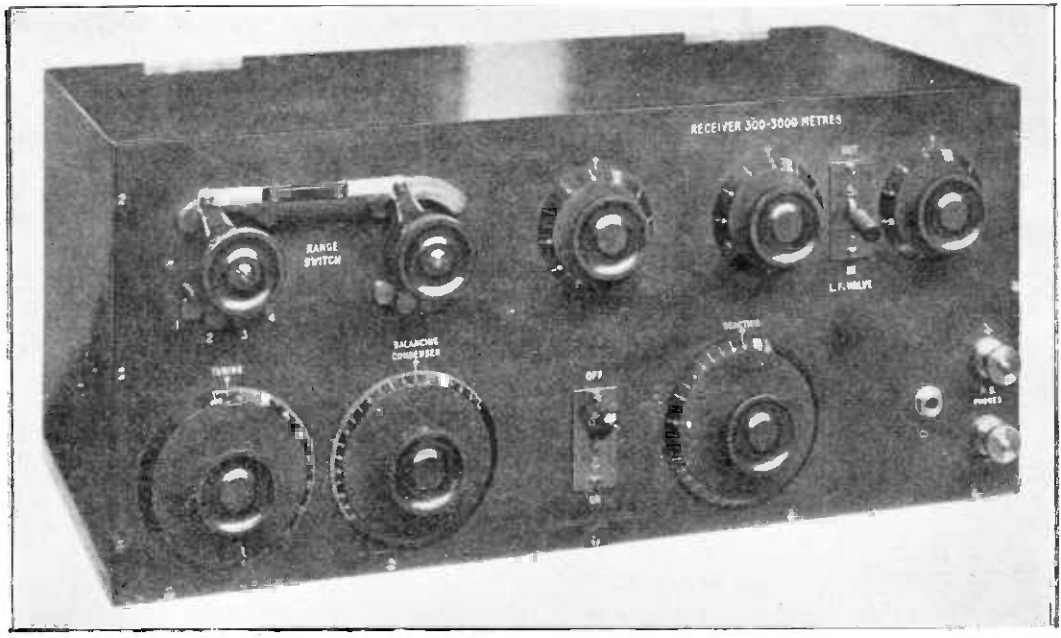
The following article describes the construction of a three-valve receiver embodying certain novel features. Tuned anode and aerial circuit are simultaneously controlled by one knob, and this with reaction tuning are the only critical adjustments to be made in operating the receiver.

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

FOR the reception of European broadcasting in particular there is now need for a receiving set which will tune to a range of wavelengths of approximately 300 to 3,100 metres. This range is therefore provided for in the set to be described.

The reception of transmissions by distant stations calls for a high frequency amplifying valve, and to minimise disturbance to other listeners when searching, the reaction effect should not be made directly on to the aerial circuit. For this reason the receiving set is arranged to have three valves, the first being an H.F. amplifier with "tuned-anode" coupling, the second a detector with reaction on to the tuned anode, and the third an L.F. amplifying valve. A switch is provided for cutting out the third valve in cases where the use of two valves proves sufficient.

In the ordinary course of events the use of a receiver of the above type entails the manipulation of three controls: (1) The aerial tuning circuit, (2) the tuned-anode, and (3) the reaction. In the set described below, however, by the use of a special compensating condenser, it has been found possible to reduce the effective controls to two, one knob providing the tuning operation and the second the reaction control. The compensating condenser provides a means of balancing out the effect of aerials of different capacities, and when once adjusted for best results on the particular aerial with which the set is to be used, little further attention is required. The single tuning knob provides simultaneous tuning for both the aerial circuit and the




*General view of front of receiving set.*

tuned anode circuit, so that in this way the operation of the set is much simplified.

The set has been designed to be of the vertical panel type with the valves mounted behind the panel, as such an arrangement gives a neater appearance and greater protection to the valves from accidental damage.

We will deal first with the various parts required, as these can with advantage all be prepared first before any attempt is made to assemble them on a panel. These are :—

- 2 Tuning coils, one for the aerial circuit and one for the tuned anode circuit.
- 1 Reaction coil (on ball former).
- 1 Double tuning condenser, the two parts being of equal capacity—the maximum capacity of each being about 0·001 $\mu$F. The maximum capacity of these condensers should preferably be rather over than under 0·001, say between 0·001 and 0·0011$\mu$F. Their minimum capacity at zero of the scale should not exceed about 40$\mu\mu$F.
- 1 Special " centre-zero " balancing condenser (range 0·0001 to 0·0005$\mu$F).
- 3 Valve-holders (" R " type).
- 3 Filament resistances.
- 1 D.P. four-way tuning range switch.
- 2 Key switches for L.F. valve and filament control.
- 1 L.F. intervalve transformer (Radio Instruments, Ltd.).
- 1 Telephone jack.
- 1 Fixed mica condenser, 0·0003$\mu$F (Dubilier).
- 1 Ditto 0·001$\mu$F (Dubilier).
- 1 Ditto 0·004$\mu$F (Dubilier).
- 1 Grid leak, 1·5 MΩ (Dubilier).
- 8 Terminals.

Most of these components can be bought ready made, but the tuning and reaction coils must be built up specially. These two tuning coils are wound with the same number of turns of the same size wire on formers of the same size. For these coils 4 ozs. of No. 28 S.W.G. double silk covered copper wire will be required. Care must be taken to ensure that wire of the correct size is obtained as otherwise the inductance of the coils will not be correct should the requisite number of turns occupy a different winding length on the former.

The materials required for these two coils and for the reaction coil are therefore as follows :—

- 4 ozs. No. 28 S.W.G. D.S.C. copper wire.
- 2 Ebonite tubes $3\frac{1}{4}$ ins. outside diameter by 3 ins. inside diameter by 6 ins. long.
- 1 Ball rotor (*for reaction coil*), $2\frac{5}{8}$ ins. diameter.
- 2 Brass spindles for ditto, $\frac{1}{4}$ in. diameter.
- 2 Phosphor-bronze connection strips and bobbins for same.

Holes for the rotor spindles in one of the formers and for the brackets to hold these

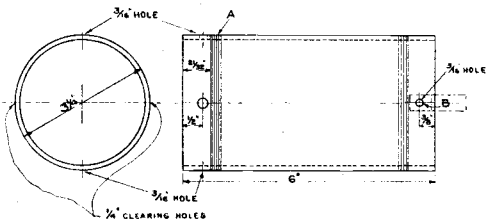



*Fig. 1. Arrangement of tuning coils.*

coils in position should be drilled before they are wound. These details are set out in Fig. 1, which also shows the position of the commencement of the winding in relation to these holes. The diagram in Fig. 1 gives the positions of the two holes for the spindles required in one of the tubes. In the other tube these two $\frac{1}{4}$ in. holes can be omitted. The first turn (A) of the winding should be put on as close up to the side of the spindle hole as possible, so as to obtain sufficient

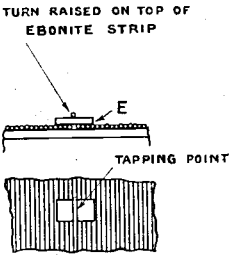



*Fig. 2. Method of making tappings.*

coupling between the rotor winding and the outside coil. Care must, however, be taken that the spindle does not actually rub against the wire, or the insulation would soon be removed and a short-circuit result. A clearance of say 1/32 in. should be allowed.

The winding of each of these coils should be commenced at the point A, and 20 turns wound on before the first tapping point is reached. The tapping should be made preferably in the manner sketched in Fig. 2, where E is a small strip of ebonite slipped under the turn to which the tapping is to be made. The actual tapping connection can be made by soldering a wire to the raised turn on top of the ebonite.

Total number of turns of wire on each coil = 206.

Turn numbers at which tappings are to be made, 20, 40 and 85, the turns being counted from the beginning of the coil in all cases.

Overall length of winding = about $3\frac{7}{8}$ ins.

The rotor for the reaction coil should have a diameter of $2\frac{5}{8}$ ins., and should preferably have the dimensions set out in Fig. 3. Two grooves $\frac{5}{8}$ ins. wide by 1/32 in. deep should be turned in the surface of the ball to provide a location for the windings. The ball is mounted on a spindle $\frac{1}{4}$ in. diameter, which is made in two parts in order to provide a ready means of connection to the two ends of the rotor winding, as sketched in Fig. 4, which is drawn as seen when looking at the rotor in the direction of the arrow in Fig. 3. In Fig. 4, $S_1$ and $S_2$ are the two parts of the spindle (brass rod $\frac{1}{4}$ in. diameter),

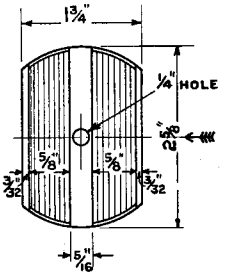



*Fig. 3. Reaction coil.*

which should be a tight fit in holes drilled with the rotor R. Two screws, XY, about 5BA size, cheese or round heads, should pass through holes in the body of the central part of the rotor and be tapped into the ends of the two parts of the spindle so as to make connection with them and also to secure them in position. The ends of the rotor winding can be clamped under these screws so as to make connection with the two parts of the spindle.

The rotor should be wound with a total of 70 turns of No. 28 double silk-covered copper wire, one half of the total number of turns being wound in each groove which is turned in the rotor face. Obviously the

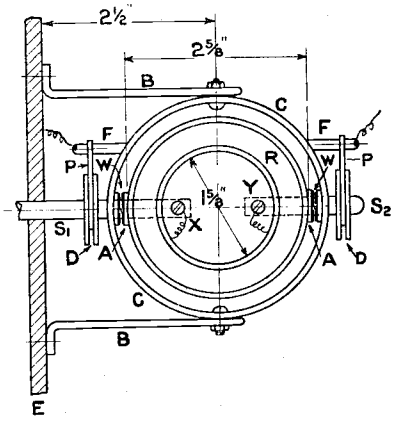



*Fig. 4. End view of tuning and reaction coils.*

two halves of the winding must be wound on separately, commencing in each case from the outer end as this has the smallest diameter. The directions of winding must be carefully noted to ensure that the two halves assist each other, when they are joined in series.

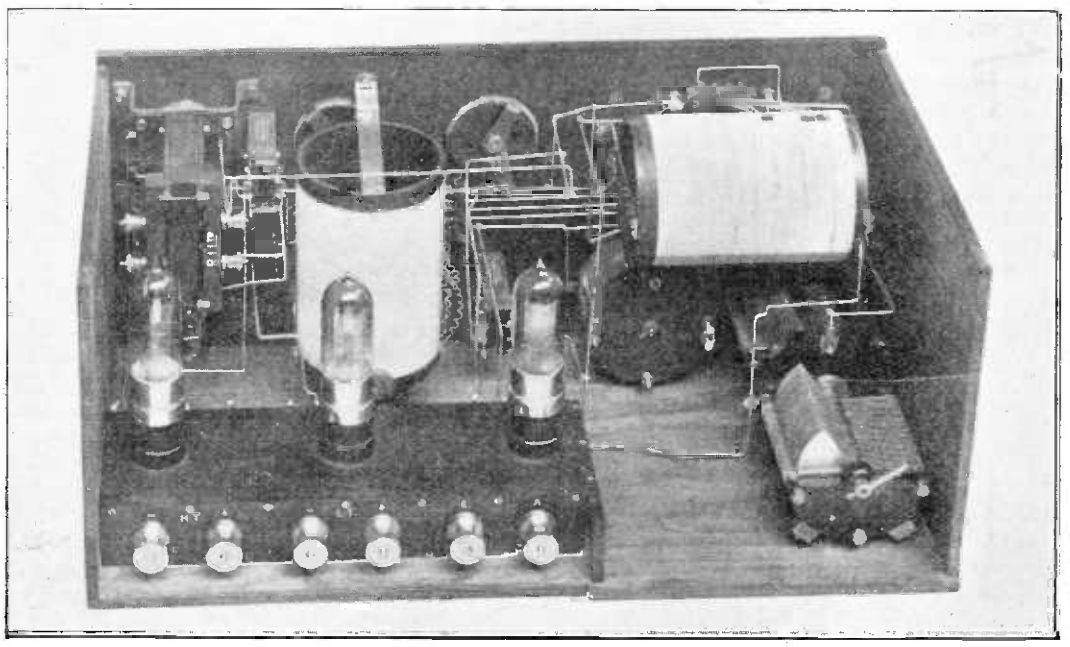
Two ebonite spacing pieces should next be prepared as indicated by AA in Fig. 4. These may be circular washers, $\frac{3}{4}$ in. diameter, with a $\frac{1}{4}$ in. hole in their centre to allow the spindle to pass through. They should be secured to the ebonite rotor ball on each side of the spindle by two small screws or pins, or by any convenient adhesive which will prevent their rotation when the rotor is turned round. These ebonite spacers thus serve to protect the insulation of the rotor winding from abrasion by the spring washers which should be fitted on to the spindle on each side of the rotor so as to maintain the rotor in a central position in the outer tube CC, as sketched in Fig. 4. This tube CC, on which the tuning coil is wound, is mounted on the ebonite panel E by means of the two brass brackets BB, which are bolted to the sides of the tube CC, and also to the ebonite panel E. To keep the rotor R approximately central in the tube C, the spring washers and ordinary brass washers

WW are threaded on the spindle between the ebonite spacers AA (described above) and the tube C. Connections to the two parts of the spindle $S_1$ $S_2$ are made by the flexible phosphor bronze strips PP, which are housed in the groove of the two small bobbins D D, which are mounted on the spindle outside the coil C. These bronze strips may conveniently be about 1/16 in. wide, and should be very thin so as to be flexible. Alternatively a spiral of flexible wire may be used instead of the bronze strips. The inner ends of the bronze strips or flexible wire should be soldered to the brass spindle, while the outer ends are soldered to the small brass studs FF, which are screwed into the ebonite tube CC carrying the tuning coil. The external connections to the reaction coil can thus be soldered to these studs also. The holes in the rotor ball with which the two halves of the spindle are fitted should preferably not meet in the centre, but a separate hole should be drilled from each side, leaving the solid material in the centre to insulate the two parts of the spindle from each other.

Two of the brackets used for holding the tuning coil C in position are shown at BB in Fig. 4. They may be bent up from brass strip $\frac{3}{8}$ in. wide by 3/32 in. thick. Their exact dimensions are not very important provided that the centre of the tube C is held about $2\frac{1}{2}$ ins. from the back of the ebonite panel as indicated in Fig. 4. Two such brackets will be required for the anode tuning coil.

The third point of support for this coil is provided by a small bracket secured to the coil tube by a screw through the hole marked B in Fig. 1. This bracket also can be bent up from brass strip $\frac{3}{8}$ in. wide by 3/32 in. thick, to the dimensions indicated in Fig. 5. By placing this bracket at right angles to the other two, as indicated here, greater rigidity is given to the coil. The position occupied by this bracket in relation to the coil former is shown by the dotted lines at the right-hand end of Fig. 1. For the aerial tuning coil two brackets like Fig. 5 only are required, one being mounted at each end of the coil.

The double tuning condenser required for this set next needs consideration. As has already been stated, this consists of two similar variable condensers, each of about



*View of interior of receiving set with back removed.*

0·001 $\mu$F maximum capacity. In order to reduce the tuning operations when using this set, these two condensers should be coupled together so that they can be controlled by a single knob. This was done by providing an insulating coupling between the two condenser spindles as sketched in Fig. 6. The vertical ebonite panel on which the whole set is assembled, is secured to the horizontal base of the instrument H of 5/16 in. wood. This base should be 9½ ins.

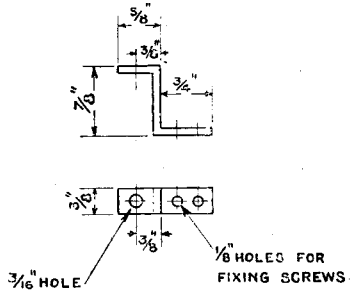



*Fig. 5. Bracket for tuning coil.*

long from front to back, and should be rigidly secured to the panel by screws and by the wooden ends of the set. The two condensers $C_1$ and $C_2$ are held in position on this base by small angle brackets $B_1$ $B_2$. The coupling between the two condenser spindles is very conveniently provided by the use of two standard 1½ in. ebonite condenser knobs, which can be secured together by two screws AB (Fig. 7) tapped through them. The knobs can be secured to the spindles by screws S S (Figs. 6 and 7) screwed hard on to the spindles. By loosening one of these screws it is possible to adjust the movable vanes of one condenser relative to the

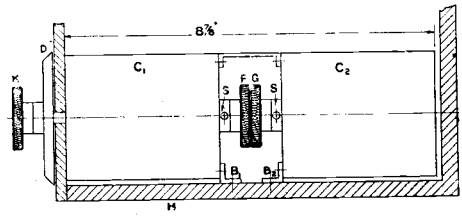



*Fig. 6. The double tuning condenser.*

other, so as to ensure that the two circuits tune together. The two condenser spindles are moved together by the common knob K and dial D.

The one remaining item of particular interest on the list given near the beginning of this description is the "centre-zero balancing condenser." The functions of this condenser can best be seen by an inspection of the schematic connection diagram of the set which is given in Fig. 8. This diagram gives only the essential features, omitting details of range, switches, etc. It will be noted that $C_1$ $C_2$ is the double variable tuning condenser which has just been described. The balancing condenser is $C_3$. It is connected across the anode circuit tuning condenser $C_2$ in the same way that the aerial is connected across the primary tuning condenser $C_1$. This balancing condenser

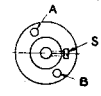



*Fig. 7. Coupling for double condenser.*

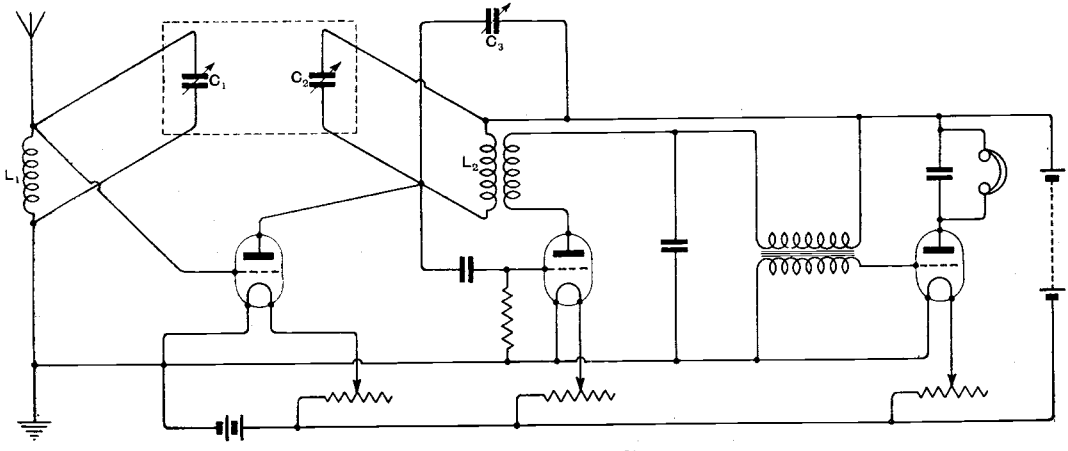



*Fig. 8. Schematic wiring diagram.*

thus serves to balance the effect of the aerial capacity so as to enable the two coils $L_1$ and $L_2$ to be tuned together by the double condenser $C_1$ $C_2$. This condenser thus enables the set to be used on aerials of different capacity, while it also provides a vernier tuning by balancing out the changes in the effective capacity of the aerial as the wavelength is changed. These changes in effective capacity are usually not large, but by balancing them out a closer tuning becomes possible. The functions of this condenser are thus threefold :—

(1) Balancing of aerial capacity when aerial is changed.
(2) Balancing the changes in the effective capacity of the aerial for different wavelengths, giving a vernier adjustment to the tuning.
(3) Balancing out any differences between the two tuning coils $L_1$ $L_2$ (Fig. 8) on the different tappings.

The tuning range required on this condenser does not exceed 0·0001 to 0·0005$\mu$F—a range sufficient to balance out the differences between any ordinary aerials. This range can be provided by means of a 0·0004 variable air condenser connected in parallel with a fixed condenser of 0·0001$\mu$F, but it is perhaps somewhat more convenient to employ a special condenser made up for the purpose, having the desired capacity range, and having its dial engraved with " zero " in the centre of the scale corresponding to a capacity of 0·0003 $\mu$F. This value is chosen as the " zero " as being the normal average capacity of the standard P.O. receiving aerial. Thus if the capacity of the aerial with which the set is to be used is less than the assumed value of 0·0003$\mu$F, the balancing condenser can be moved towards the lower end of its scale until resonance of the two tuning circuits is again obtained, and *vice versa*. Resonance is indicated by the sounds in the telephones due to atmospherics, " mush " and other noises which can always be heard in a receiving set joined up to an aerial.

*(To be concluded.)*

# VULCANISED FIBRE

**Vulcanised fibre of good quality has displaced ebonite almost completely in high-tension electrical fittings at the present day. For ordinary electrical fittings it does very well. It is a good insulator for high voltages, is much cheaper than ebonite, and is mechanically stronger. The use of fibre for wireless panels is generally condemned, however, because it is not so efficient as ebonite in the insulation of conductors carrying high frequency oscillations. The reason for this is that vulcanised fibre is hygroscopic, and all such substances carry surface films of moisture.**

By JAMES STRACHAN, F.Inst.P.

THERE are on the market several cheap compositions of compressed material passing under the name of fibre, most of which are not so good as the latter, either mechanically or electrically. They may be recognised by their lack of uniformity and by their brittle nature.

True vulcanised fibre is prepared from a high grade of brown paper made from manilla hemp or flax fibre. A number of sheets of the paper are treated with a parchmentising liquid, such as a solution of zinc chloride, and compressed in a hydraulic press. The hydrolysing agent is removed by solution in water, and the compressed material dried into a hard horny mass of cellulose. The best quality is absolutely uniform in grain, has a natural bright red terra-cotta colour, and is very tough and strong.

When a sheet of this fibre is heated on one side in front of a fire it shows a distinct tendency to warp uniformly, and when a weighed sample is incinerated, the completely burned ash should not weigh more than 2 or 3 per cent. Cheap substitutes do not

warp so distinctly on heating, and they often contain over 20 per cent. of ash or mineral matter.

As a matter of experiment I mounted a two-valve panel on this material and found it to function fairly well even in damp weather, but the reception was improved to a marked extent when the panel was left in a warm room or warmed in front of the fire before use.

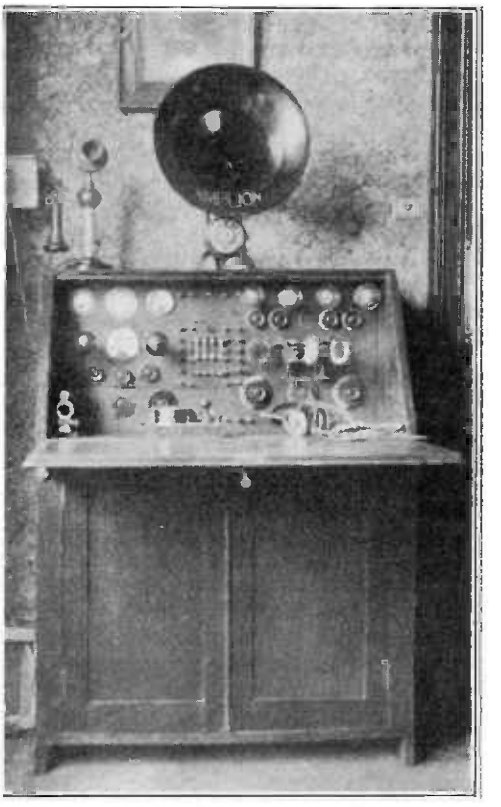
A sample of this vulcanised fibre was dried at 100° C., and found to contain 7½ per cent. of hygroscopic moisture. As the sample cooled, it rapidly absorbed this moisture from the atmosphere again, and when weighed every day over a period of several weeks was found to vary up and down with the variations in atmospheric humidity by about 1 per cent. A surface coating of shellac varnish did not reduce the hygroscopic action to any marked extent. It has been stated that vulcanised fibre does not absorb paraffin wax, but this is not the case. I find that when a sample is thoroughly dried at 100° C., and baked in melted paraffin wax at 105° C. for an hour, wiped dry and cooled, it absorbs a weight of paraffin wax almost equal to the weight of moisture lost in drying. Further, a sample treated in this way does not vary in weight when exposed to atmospheric conditions. In other words, it is no longer hygroscopic, and is quite an efficient insulator for wireless panels. A sample of this wax-impregnated fibre after prolonged soaking in water absorbed a small percentage of water, so that its use is not recommended for outside work such as aerial insulators, but for inside work fibre treated in this way by drying and baking in a wax bath is a cheap and efficient insulator.

In preparing a panel from fibre the surfaces should be cleaned and all holes drilled before drying and baking in wax. The baking process should be continued until bubbles of steam or air cease rising from the fibre through the melted wax.

It is evident that it cannot be claimed for this prepared fibre that it is as satisfactory an insulator as high-grade ebonite. It has, however, several advantages. It is quite satisfactory for panel work. It is cheap and is mechanically strong. It stands up to the heat of soldering operations. One knows exactly what it is, which you cannot say about ebonite unless you know for a certainty what you are buying.

It should be noted here that there is no advantage gained in winding a D.C.C. coil on an ebonite former over the same winding on poorer insulators such as paper or card, because the cotton covering is very hygroscopic, carrying in damp weather over 10 per cent. of moisture. Reception with such coils is often materially improved in damp weather by drying out the apparatus in a warm dry atmosphere. This applies to some extent even to the best of insulated wireless sets, because in damp weather surface films of moisture are present even on ebonite. Too often the wireless den of the amateur is relegated to an outhouse or some cold attic room next the slates. Wireless apparatus should be warm and dry to obtain maximum efficiency. Bear this in mind during the winter months.

## AMATEUR STATION 5IF.



*The compact and efficient transmitter and receiver of Mr. H. Featherstone, of Tunbridge Wells, Kent.*

# NOVEL IDEAS AND INVENTIONS.

Abstracted by

PHILIP R. COURSEY, B.Sc., F.INST.P., A.M.I.E.E.

## Wavelength Indicators for Receiving Sets.

In order to facilitate the tuning of a radio receiver to any given wavelength, it is desirable either to have a calibration curve or chart for the tuning scale, or to have the scale of the tuning means (condenser or variometer, etc.) graduated directly in terms of wavelengths. Either method is frequently difficult when the set is used with different aerials having different electrical constants.

One way of overcoming the difficulty when the range of aerial sizes with which the set is to be used is not too great, is to provide the tuning condenser, or other tuning means, with a scale which can be moved to a limited extent in either direction from its normal position.* Then by listening-in to some well-known transmission of which the wavelength is known, it is possible to set the scale of the tuning means to the correct position. Provided then that the displacement is not too great, the remainder of the scale will be practically correct for other wavelengths. This method can be used both when the scale is graduated directly in wavelengths, and when a uniformly divided scale is used in conjunction with a calibration curve or chart.

## A Novel Variable Condenser.

Most of the forms of variable condenser employing a solid dielectric are variations only on the air dielectric condensers having movable and fixed vanes or plates. A recently devised variation of this method makes use of two drums, one being covered with a metallic cylinder coated on the outside with the solid dielectric.† The capacity is varied by winding on to this drum, to a greater or less extent as required, a flexible metal band which forms the other electrode of the condenser. The part of this band which is not in use is stored on the second drum, the band being kept taut by a spring. Fig. 1 diagrammatically represents the arrangement, $D_1$ being the main drum on to which the metal band B is wound by rotating the spindle S. The part of the band that is not in use is stored on the drum $D_2$. Drum $D_1$ has a cylindrical layer of metal M on its outside, forming one electrode of the condenser, the dielectric coating this electrode being E. The spindle S is provided with some form of knob for rotatiug it, and a pointer and scale, a dial, or some similar indicating means.

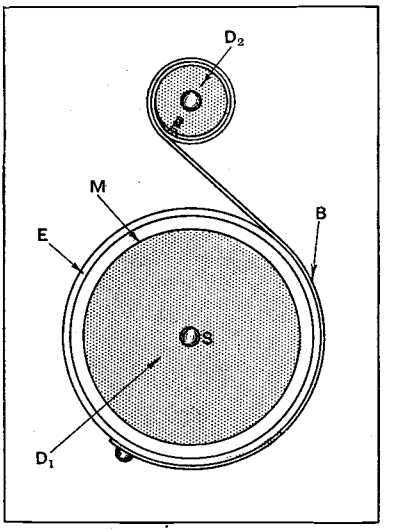



*Fig.* 1.

## Variable Condensers with Solid Dielectric.

The main difficulty experienced in building variable condensers of the vane type, having discs of a solid dielectric between the fixed and movable vanes, arises from the excessive friction which is set up if the spacing washers between the vanes are not all of exactly the proper thickness. This difficulty may be lessened by using spacing washers for one set of vanes only—for example, for the

* *British Patent* No. 199233, by H. Powell Rees.

† *British Patent* No. 199283, by Igranic Electric Company (communicated from the Cutler-Hammer Manufacturing Company, U.S.A.).

movable vanes—and allowing the other set to space themselves appropriately to the thickness of the solid dielectric discs.* Thus in Fig. 2, which shows a portion only of a variable condenser of this type, the parts are all mounted between an insulating top plate P, and another similar plate forming the lower end of the condenser.

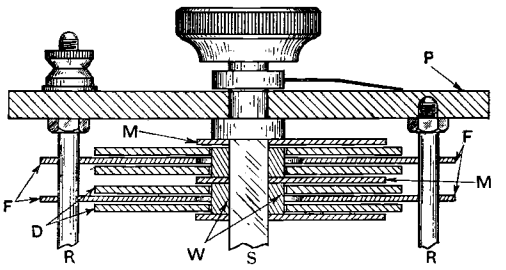



*Fig.* 2.

The spindle S, which is squared where it passes through the vanes, has fitted on to it the movable vanes, MM, spaced apart by the washers WW. Over these spacing washers are slipped the solid dielectric discs DD, which serve not only as dielectrics, but also to space apart the fixed (F) and movable (M) vanes so that they cannot touch each other.

The fixed vanes FF are prevented from rotation by being threaded over rods RR, but apart from this restraint they are free to adapt their position to suit the thickness, spacing, and irregularities of surface of the movable vanes. Separate connections are made to each fixed vane, as without such provision there would be only a very poor electrical contact between them and the rods R.

## Exhausting Vacuum Tubes.

In the production of the extremely high vacua necessary for modern thermionic valves—particularly for transmitting valves —it is usual to employ vacuum pumps of the mercury condensation type, known also as Langmuir pumps after the inventor of the first patterns. A disadvantage of these pumps is that mercury vapour is left in the vessel being exhausted unless a liquid air trap is inserted between the vessel and the pump. To avoid the disadvantage of having to maintain the liquid air trap, the material used in the condensation pump may be chosen so that it has a smaller vapour pressure. Lead, tin, zinc, bismuth, or cadmium are suitable materials from this point of view. When in use in these pumps the metal is melted, and boiled or volatilised so as to produce a vapour with which the gases from the vessel being exhausted can be trapped, thus exhausting the vessel. When lead is used the pump is maintained at a temperature of about 800° C.*

## Intervalve and Telephone Transformers.

Unless the transformers used in valve circuits are provided with closed iron cores it is not easy to screen them from reaction effects between the various stages. A simple way of effecting this screening without adding materially to the cost of manufacture,

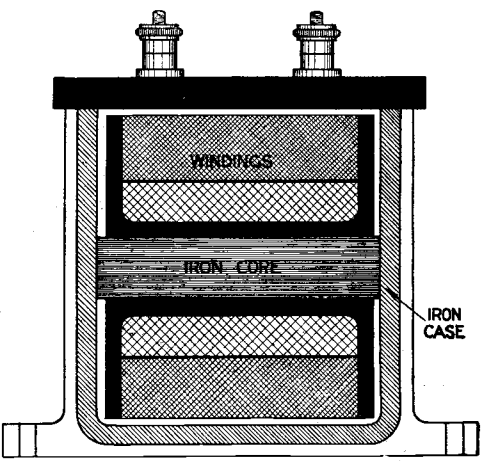



*Fig.* 3.

is to fit the open cored transformer into an iron box so that the magnetic circuit is closed through the case, as indicated in Fig. 3, which is a section through a transformer of this type.† The transformer winding is held in position in the box by a filling of wax compound.

* *British Patent* No. 199238, by A. C. Huskinson.

* *British Patent* No. 182090, by W. G. Housekeeper and Western Electric Company.

† *British Patent* No. 196453, by A. P. Welch.

# THE SUPERSONIC HETERODYNE RECEIVER.

The reader is referred to the issues of this journal of November 14th and 21st for a description of the principles of the Armstrong supersonic heterodyne circuit and constructional details of the detector and oscillator units.

By W. S. BARRELL.

## Amplifier Unit.

The amplifier as shown in Figs. 1, 3 and 4, has been constructed on the tuned anode principle, mainly on the score of economy and adaptability. By making use of coils other than those necessary for the 3,000 metre wave employed in connection with the supersonic circuit, the amplifier can be used by itself for any required wavelength, and provides three stages of high frequency amplification followed by a detector. The addition of a simple tuning circuit converts this piece of apparatus into a complete receiver.

For use with the supersonic circuit three Igranic coils No. L 1250 are used for the anode circuits. The other components required are four valve holders, four fixed condensers 0·0003 mfd., three grid resistances, 2 megohms each, one 10 ohm resistance, one 240 ohm potentiometer. The set is wired in the usual well-known manner, as shown in Fig. 2, and requires no further description. Bare copper wire bent to shape is very suitable for connecting up, and the usual precautions should be taken to prevent interaction between various parts of the circuit. Careful thought in laying out the wiring will be time well spent, as anyone who has had experience in building amplifiers will know.

Because of the low filament power required "D.E.R." type valves have been used throughout, although, of course, "R" valves could equally well be employed provided the filament and anode potentials are suitably increased.

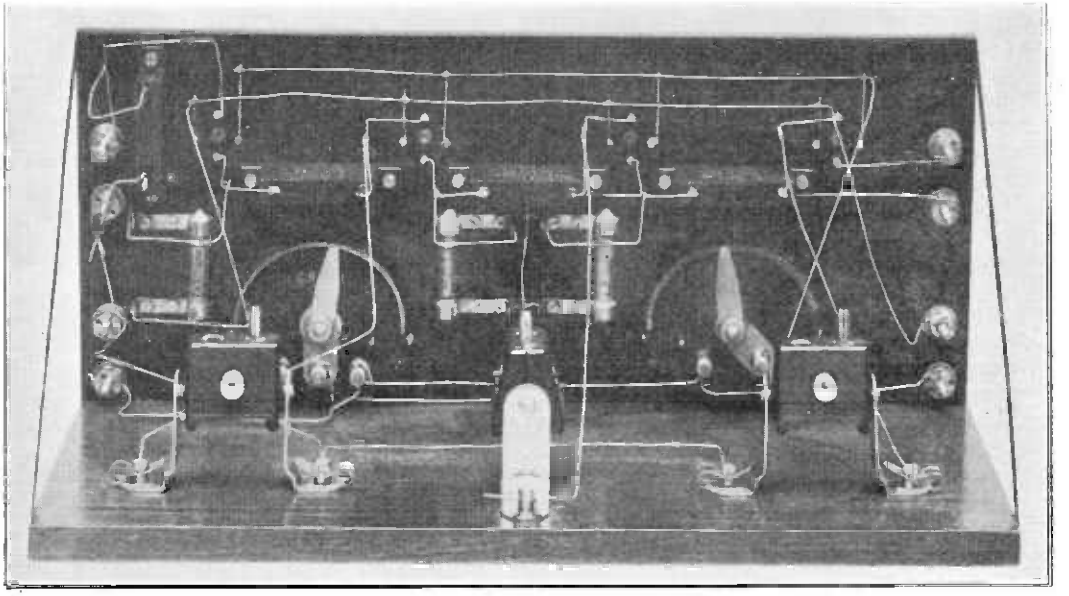


*Fig.* 1. *Four valve long wave amplifier with three high frequency circuits and detector.*

**Coupling Unit.**

This consists of two Igranic No. L 1250 coils mounted in such a way that the coupling between them is capable of adjustment. One coil is connected in series with the anode of the valve on the rectifier panel, and the second coil is connected directly to the input terminals of the amplifier. It is sometimes useful to connect a small condenser across the first coil, though in general this is not required.

The adjustment of the complete circuit in order to get the best results may at first be somewhat difficult, but after very little practice it will be found quite easy. The adjustment of the filament current on the amplifier is usually rather critical, but once found need not be touched. Preliminary

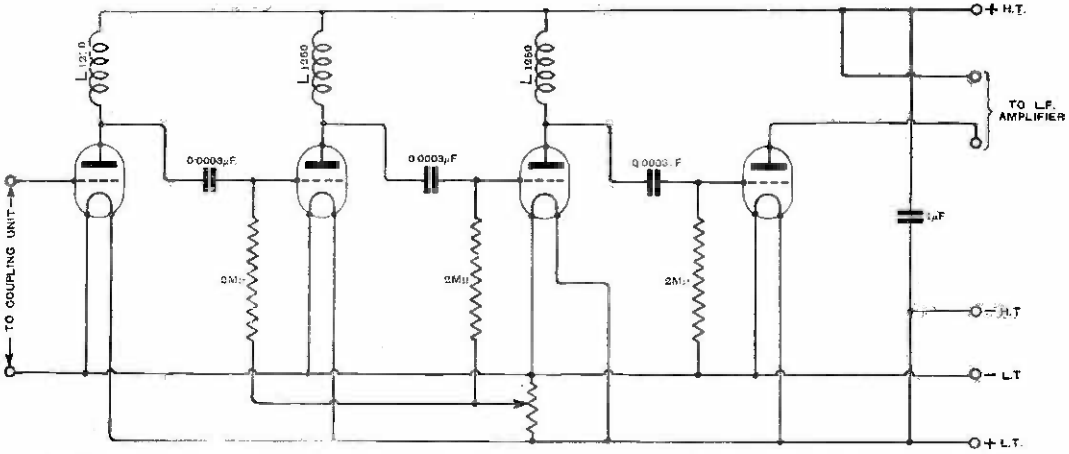



*Fig. 2. Circuit of H.F. amplifier for use after the frequency change is effected by the detector and oscillator.*

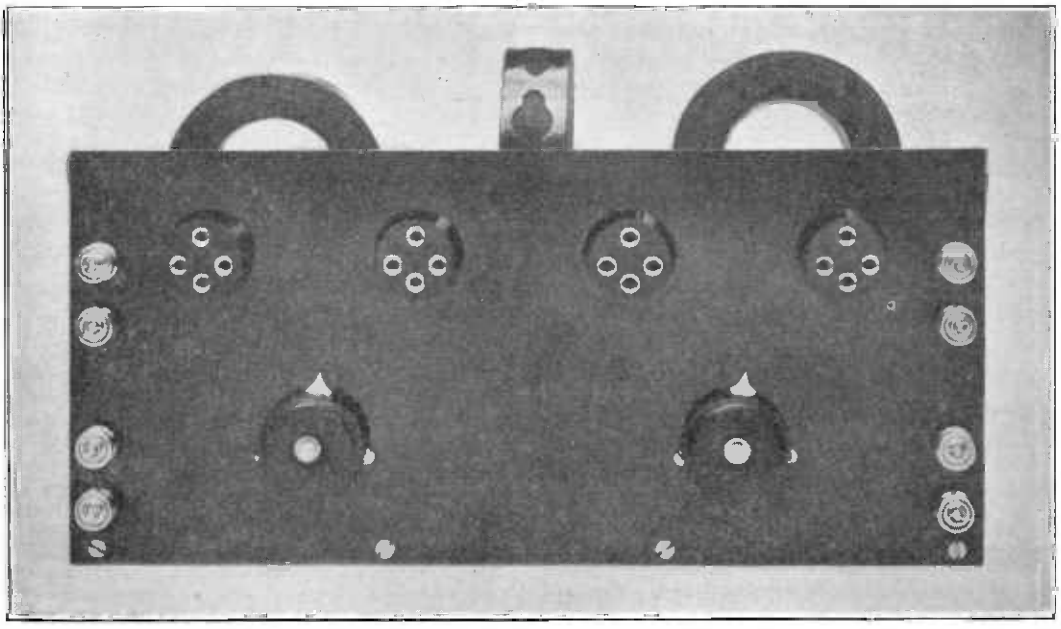


*Fig. 3. The H.F. amplifier panel. The terminals are for input from the coupling unit, output to telephones, and H.T. and L.T. batteries. The inductances are arranged so that they present a minimum of coupling to each other.*

trials with this circuit are best carried out with a buzzer, and it will always be noted that there are two distinct points on the heterodyne condenser which give maximum signal strength. The coupling between the detector unit and the amplifier should be as loose as possible, and this, combined with careful adjustment of the heterodyne coupling, makes the circuit extremely selective.

The set should be carefully calibrated over its whole range, thereby saving a great deal of time when a certain station is required.

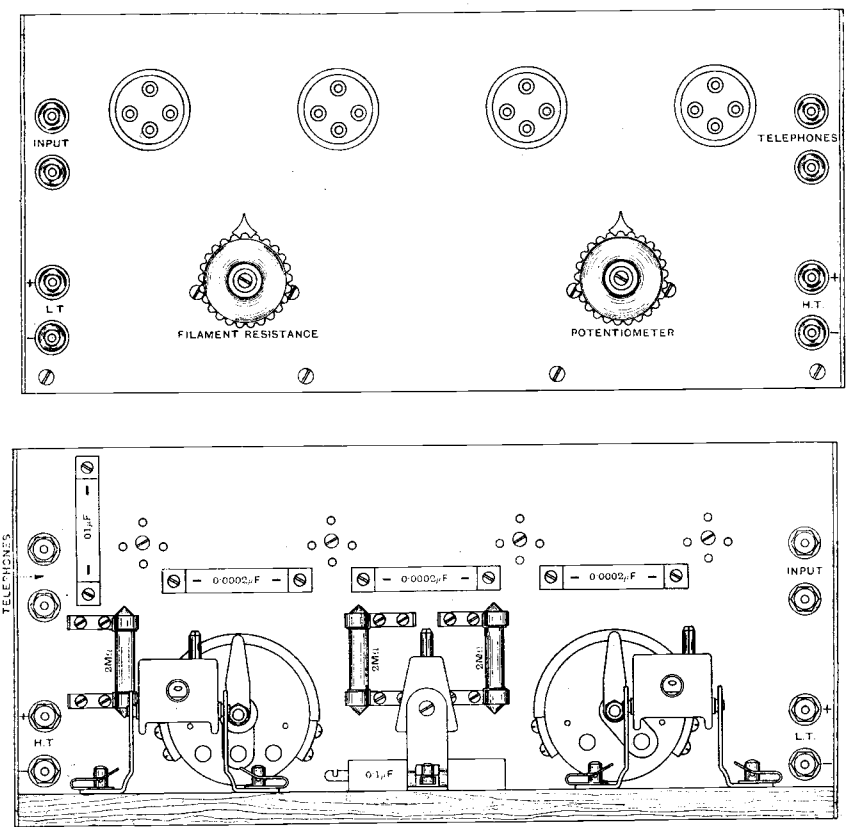



*Fig. 4. Drawings showing constructional details.*

## THE SHEFFIELD RELAY STATION.

The official opening of the Sheffield Relay Broadcasting Station, which took place in the Applied Science Department of the University on November 16th, was attended by an enthusiastic gathering. The proceedings of the evening were broadcast from the relay station. This was effected by a microphone in the University connected by land line to the station in Corporation Street. Among those present at the opening ceremony were Sir William Clegg, the Lord Mayor of Sheffield, the Master Cutler, the President of the Chamber of Commerce, Sir Frederick Sykes, and Mr. J. C. W. Reith, Managing Director of the B.B.C. Captain P. P. Eckersley, Chief Engineer of the B.B.C., said that it had been decided to use a wavelength of 300 metres, which would render it easier for valve set owners to tune in London direct if they so wished.

The opening speech was made by Sir William Clegg, who laid stress on the educative value of broadcasting, and also paid a high tribute to the pioneer wireless work in Sheffield of Mr. J. C. Reith and Mr. F. Lloyd, while Sir Frederick Sykes spoke of wireless as a factor in the promotion of world peace.

# PARLIAMENTARY DEBATES.

## SHOULD THEY BE BROADCAST?

In the following article our contributor discusses some points regarding the Broadcasting of Parliamentary speeches. His views should be of interest to those of our readers who have given consideration to the subject.

By A. JENKINS.

A SECTION of the daily press has been agitating recently for, and strongly advocating, the broadcasting of Parliamentary debates. A perusal of the arguments put forward force one to the opinion that the slogan is "Let the constituents know first-hand what their members are *saying*." This advocacy of an operation which was discussed over a year since by the B.B.C. with the Postmaster-General takes a very superficial and near-sighted view of the matter, and the attempt is here made to point out the other sides—more important and far reaching in their effects—of this question.

This question is one likely to be discussed far and wide in the near future, and interest in it will naturally be quickened, first in view of the keener attention given by the public in what their legislators are doing, and the more so because, with the country now being in the throes of a General Election, with its customary accompaniment of personal contact between candidates and their constituents, the advocates of the "Broadcast" proposal will lose no opportunity to endeavour to enlist the co-operation of the "seekers after honour" in gaining their object. Before digging beneath the surface of this subject, let it be perfectly understood that broadcasting can perform useful service in the political and parliamentary arena by announcing "events"—concrete items of news such as important votes, particularly interesting incidents, and, for example during a General Election, constituency results where practicable—which of course is making use of the facilities of broadcasting to a useful end with no disadvantages or difficulties.

The fallacy is enunciated by the importance placed on "listening-in" to a member's speeches, that legislation is effected by speeches, whereas, in the final course, legislation is effected by *votes*. A recently lamented member of the Upper House wrote, after having his early experience of Commons legislating, that "the best member is the member who can listen well, keep his tongue between his teeth, and vote accordingly." That remark was made by one on whose words the House used to hang, and whose debating powers were of a very high order. It is an undoubted fact that some of the finest parliamentary work as regards consistency, regularity of attendance both in the chamber and lobbies, is done by "silent" members. The encouragement given to the proposition to broadcast the debates would tend to develop the thesis among that great mass of constituents and the public to whom good work and valuable service of a member of parliament is reflected only by the number of words he utters, that the only or essential qualification of an M.P. is a good flow of words, irrespective of the mind behind the words having a knowledge of the subject under debate. That is a great danger; it is dangerous to let the view go unchallenged that governing a country is comprised in speech-making, interjections, and oral questions. To judge from some of the speeches delivered in the House, this conception of an M.P.'s duties is not confined to those outside its precincts. It has in fact been put forward, to my mind with a certain measure of justification, that the ideal method is for the measure under discussion to be dealt with by the principals, *i.e.*, the leaders of the parties, whose speeches portray the definite attitude agreed on by such parties, the main body of members having the advantage, and the constituents through them likewise having the advantage, of digesting the pros and cons of the subject, and then *voting*. One has only to peruse the

parliamentary reports appearing in the daily press, or Hansard, to realise the gross wastage of valuable time caused through speeches made " in the air " ; then when the records of voting are examined, one can realise the advantage to the country at large, and his own constituency in particular, of the consistent, silent member.

Another aspect is the effect that the knowledge of broadcasting would have on the members themselves. Would one envy the duty of the Speaker, in a nightly quandary as to who to call on when being bombarded by an eager crowd of members, anxious to " catch his eye " in order that they may impress their constituents with the fact that they are working hard ? After all, the member is the servant of his constituents, and the knowledge that the debates are being broadcast would stimulate and intensify his desire to " get going "—irrespective of whether it is essential, or whether he has any fresh point to touch upon which will usefully direct the debate towards the desired goal ; this effect would tend to demoralise the House, would make it rather a keen debating society, with the spectacle of all the members " speaking," not with the sole object of helping in the debate, but in order that their words should resound into their own constituency. The tendency ought to be to quicken up the debates—within reason—not to amplify them, and get on to the next subject, in order that the many problems (both internal and external) causing grave anxiety to the mass of the people, might be brought into the purview of sound legislation.

The arguments that the public should know what is happening and should not have to rely upon what some erroneously deem to be " doped " reports of the proceedings are, I think, answered by the fact that several of the leading papers, both in London and the provinces, specialise on their unbiassed reports of the essential points of parliamentary work.

One difficulty, and disadvantage, requires some combatting. And that is—even if one took for granted the thesis that the public wants to listen-in to full debates—some of the most important contributions are made towards midnight, or in the early hours of the morning, and I put it as a foregone result that the " listening-in " public would go to bed with a very garbled idea of what had really gone forward, and that they would miss what was often best, unless it is to be assumed that their eagerness would pin them down to their sets without thought for the outraged goddess of sleep.

I would also prophesy very confidently that *The Wireless World and Radio Review* and other technical journals would be inundated with inquiries as to the cause of mis-hearing, " jazzing " (apparent) and interruptions. I am certain anyone who has had the pleasure (and sometimes the pain !) of listening to a debate from the Gallery will agree with my suggestion that, given the usual (and in fact general) bad delivery most members acquire, the result in effect would be that the few really eloquent " broadcasting " members would impress the public, while the army of parliamentary " mumblers " would simply disgust them.

From the members' standpoint I believe, although certain sections and individuals would probably welcome this opportunity of enlarging the scope of their oratorical powers, the mass of saner M.P.s would be solid against this innovation, and it would, in short, greatly detract from the value and final issue of debates, and in that way greatly jeopardise the dignity of the House, and legislation.

Broadcasting has a sphere of great utility, as a medium for entertainment and enlightenment, and it would without the shadow of a doubt be a serious menace to its popular functioning if the endeavours to make it embrace the thorny field of parliamentary debates were successful.

The repercussions which would result from endeavouring to broadcast parliamentary debates would be so grave that I do not hesitate to say they would have a serious effect on the proper functioning of this fine medium for enjoying in the home circle the best features of the entertainment programmes, and deriving the knowledge to be gained from the edifying addresses from time to time brought within the scope of the " listener-in." It is not too much to affirm that the popularity of the broadcasting programmes, instead of being increased and creating a wider field—with all its attendant advantages to those experimentally and commercially interested—would be considerably prejudiced by the innovation against which it is the purpose of this article to sound a warning.

# THE "GECOPHONE" CONSTRUCTOR'S SET.

IF it were possible to take a plebiscite of listeners to determine what is the true attraction which wireless holds for its devotees, quite a large proportion of the answers would point to the joy of making a piece of apparatus which works. This pride of achievement may, in a few instances, be augmented by the pleasure of saving a few shillings compared with the price of a shop-made set, but we prefer to think that the home-built set is a species of revolt from the gramophone, and other "tinned amusements" which are the products of this very "ready-made" age. Be this as it may, there is to-day a vast market for wireless components and materials and, the home-made set having the official blessing of the Postmaster-General, the demand for such components is bound to increase. It has been a matter of wonder that the complete set of parts has not been marketed on a large scale until quite recently. The reason is probably that factory assembly and marketing under a well advertised brand have built up a reputation for the various manufacturers, and it has been feared that sets for home construction associated with these brands would suffer somewhat through the lack of skill of the amateur constructor and bring some measure of disrepute on the brand. The wireless exhibition, however, has brought into the light several sets of parts put up for home assembly, and their appearance is an indication of greater confidence in the skill of the amateur on the part of the manufacturer.

We have been privileged to examine the "Gecophone" Constructor's Set which the General Electric Company, Ltd., have recently introduced. This is a two-valve set, which, when made up, is identical with the "Model B" Gecophone receiver. The valves are respectively a detector, with tuned anode coupling, the circuit being quite a standard one. The aerial circuit is tuned by a variometer, and the anode circuit by a variable condenser (0.0002 mfd).

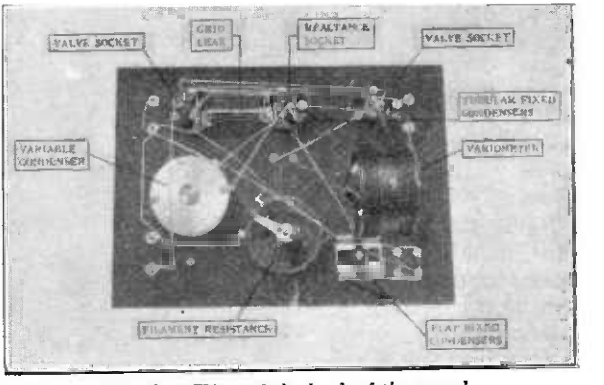



*Fig. 2. View of the back of the panel.*

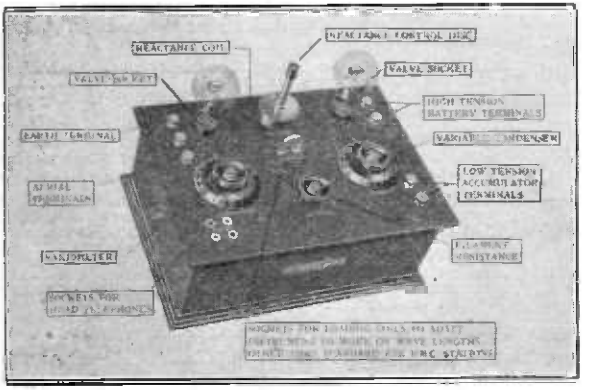



*Fig. 1. The lay out of the "Gecophone" Constructor's Set.*

The instrument is of the panel type to be mounted on a polished mahogany box, both box and panel, the latter ready drilled and engraved, being included in the outfit.

The photograph reproduced in Fig. 1 shows the lay out of the set, while Fig. 2 illustrates the deposition of the various components and the wiring. At the left-hand top corner are the earth and aerial connections, two terminals being provided for the aerial connection, one for use with long aerials and the other, which places a small fixed condenser in circuit, for use with aerials less than

60 ft. in length. Suitable terminals for high and low tension batteries are at the right-hand side of the set, and the left-hand bottom corner is provided with two sets of sockets to receive the telephone plugs.

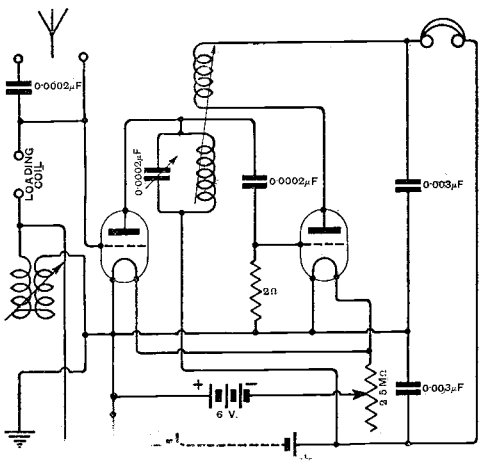



*Fig.* 3. *Circuit diagram of the set.*

Between the two valve sockets is a socket to accommodate the reactance coil. Reactance control is obtained by an aluminium disc which can be screwed close to or away from the coil, thus loosening or tightening the coupling between the reactance coil and anode coil. This form of control is a feature of all the "Gecophone" valve sets. Below the reactance coil is a pair of sockets, normally short-circuited by a U-shaped metal plug which can be replaced by loading coils when it is required to receive wavelengths other than those allocated for B.B.C. stations.

Turning now to the components themselves, these comprise variometer, variable condenser, filament resistance, two reactance coils, control disc, two valve holders, socket for reactance coil grid leak, four fixed condensers and the necessary sockets, terminals, screws, nuts and washers, together with a liberal supply of tinned copper connecting wire.

It will be noticed that the variometer and variable condenser are sent out completely assembled. We think this is a wise precaution for there are very few amateurs who have the necessary skill and patience to attain that "sweet" action which is characteristic of "Gecophone" components. When we remark that the clearance between the fixed and moving vanes of the "Gecophone" condenser is only 0.010 in., it will be realised that this is a perfection that the average home constructor could not achieve. The components are well made, and of a high order of excellence. We are informed that they are identical with those employed in every one of the Gecophone series. With each outfit is supplied a pamphlet containing very full and clear instructions, and also diagrams of connections. (Fig. 3).

Reviewing the set as a whole, this outfit at £7 2s. 6d. will enable the amateur to make up a piece of apparatus which he will be proud to exhibit as his own handiwork, and at the same time assure him the high efficiency which is to be expected from a factory-made set.

## Catalogues, Price Lists, etc., Received.

**The Sterling Telephone and Electric Co., Ltd.** (Telephone House, 210-212, Tottenham Court Road, London, W.1.) A catalogue of this well-known firm's radio unit system components. Publication No. 364, dealing with Sterling Radio Receiving Sets.

**The Waterloo Electric Co.** (129, Waterloo Road, S.E.1.). A Price List of Wireless Accessories and Apparatus marketed by this Company.

**Hobday, Bros., Ltd.** (21, 23, 25 and 27, Great Eastern Street, London, E.C.2). Radio Catalogue of Components and Accessories.

**A. J. Dew & Co.** (21-25, Endell Street, London, W.C.2.). A hundred-page Illustrated Catalogue of Apparatus and Components retailed by the firm.

**Alfred Graham & Co.** (St. Andrew's Works, Crofton Park, London, S.E.4.). Artistically arranged and illustrated panphlets dealing with the wide range of "Amplion" Loud Speakers produced by the Company.

**Pickford, Johnson & Co., Ltd.** (Crescent Works, Ecclesall Road, Sheffield). An illustrated catalogue covering the range of Wireless Receivers manufactured by the firm.

**Western Electric Company, Ltd.** (Connaught House, Aldwych, W.C.2). Two attractive pamphlets, dealing respectively with Western Electric Loud Speakers and the "Weconomy" Wireless Sets.

**A. H. Hunt, Ltd.** (Tunstall Road Croydon, Surrey). Leaflet No 142, containing particulars of Hellesen Low Tension Dry Batteries for Valve Filament Lighting. Leaflet 134, dealing with Hellesen High Tension Dry Batteries.

**The Chloride Electrical Storage Co., Ltd.** (Clifton Junction, nr. Manchester). A well-produced handbook, illustrating famous cars fitted with "Exide" Batteries.

**Burndept, Ltd.** (Aldine House, Bedford Street, Strand, W.C.2). A comprehensive catalogue (Publication No. 237), describing "Ethophones," and Burndept Standard Receiving Equipment, together with particulars of components and accessories.

**Chambers & Ellis** (Craven House, Kingsway, London, W.C.2). A descriptive leaflet containing illustrated particulars of Chellis Cabinet Wireless Sets.

**Scientific Supply Stores** (126, Newington Causeway, London, S.E.1). Catalogue of Wireless and Electrical Instruments, Apparatus and Tools (6th edition).

**Midland Radiotelephone Manufacturers, Ltd.** (Brettell Lane Works, Stourbridge). An illustrated catalogue of Mellowtone Wireless Specialities.

# AROUND THE WIRELESS WORLD

## Synchronisation of Time Signals.

Apropos of the note which appeared in our issue of July 21st last on the subject of the synchronisation of the time signals from Annapolis (NSS) and Lyons (YN), we have received an interesting communication concerning a similar phenomenon in regard to Nauen (POZ) and Pearl Harbour Honolulu (NPM).

Writing from Singapore, Mr. J. H. Maade states that POZ sends out time signals from 2357-2400 G.M.T. on a wavelength of 12,600 metres (alternator), while NPM gives time signals from 2356-2400 G.M.T. on a wavelength of 11,500 metres (arc). POZ can be tuned to its loudest while NPM is still readable, and both time signals may thus be checked simultaneously. Both stations can be easily read on one valve as detector anywhere in China or Japan.

## "Freak" Receptions.

Freaks are by no means the prerogative of the golfer or the angler; the wireless amateur may justly claim his share, and the approach of winter conditions undoubtedly increases the possibilities of such exceptional results.

Listening-in on a recent evening with a two-valve set at Eastbourne, Mr. A. Roach was impressed by the remarkable strength of several of the broadcasting stations. Accordingly he switched over to a simple crystal circuit and was surprised to hear London (usually very faint) at considerable strength. More astonishing still, Cardiff (5 WA) could be heard jamming, and on tuning in, this station was clearly received. Newcastle (5 NO) was next heard though fading was rather pronounced. A soprano voice was then heard jamming, and, on altering tuning, our correspondent was in time to hear the familiar words: "Glasgow calling!"

We shall be glad to receive further reports of "freaks."

## British Broadcasting Received in Norway.

Transmissions from five of the B.B.C. stations are being received regularly on a single-valve set in the Maalselv Valley in Norway, near Tromso, and Mr. F. Diesen, the owner of the set, has forwarded us some interesting details of his receptions. Most of his wireless equipment is home-made, partly from instructions given in *The Wireless World and Radio Review*. The single-valve set referred to embodies reaction in the secondary circuit, and, with an aerial of 40 ft. high and 240 ft. long, Newastle and Glasgow are heard loudly. London is fairly well received, though there is much fading.

Mr. Diesen does not confine himself to short wave reception, for, with a single-valve set adjusted to work on from 1,000 to 20,000 metres, he intercepts almost all the larger European stations, and also Beyrouth in Asia, Cairo and several of the American high power stations.

## "Hobbies for Boys."

The above publication, by J. Reindorp, has been reprinted by Messrs. Sampson Low, and now contains an additional illustrated chapter on wireless.

*This photograph, kindly forwarded to us by the Compagnie Francaise de Radiophonie, shows Madame Louise Faure Fauvier giving an address by wireless whilst on board a Goliath aeroplane. The aeroplane transmitter worked on 600 metres with 40 watts and the address was retransmitted by the company's 2 kW telephony station on a wavelength of 1,780 metres.*

## Interference in South Essex.

Regarding the note which appeared in our issue of November 14th, in which Mr. H. Collins, of Billericay, Essex, drew attention to the interference on short wavelengths in the district during the last three years, the Hon. Secretary of the Southend and District Radio Society states that this matter

has been discussed by his Society many times. One member has experienced trouble of the kind referred to when working on a wavelength as low as 70 metres. No indication of the source of interference has been discovered, and any correspondence which may serve to locate the offender will be welcome.

It has been suggested by members of the Southend Society that the trouble may be due to Government working at Shoebury and Sheerness, but there is no definite evidence to support this view.

### New Belgian Broadcasting Station.

On Saturday, November 24th, the Belgian Minister of Railways opened a new broadcasting station at Brussels. "Radio Electrique de Bruxelles," as the new station is called, transmits regular programmes commencing at 8.30 p.m. daily, on a wavelength of 410 metres. A correspondent in Switzerland, Mr. Hugh R. Macdonell, informs us that he has heard the new station very clearly on his three-valve set, but that fading was rather pronounced.

### A Famous Wireless Contralto.

Probably one of the most popular singers associated with broadcasting during the past two years has been Madame Lily Payling, the Australian contralto. Madame Payling will be remembered for her success at the inauguration of the *Daily Mail* wireless concerts from Holland in July of last year, and, more recently, for her broadcasting experiment at the Royal Albert Hall in April last. On that occasion her singing, broadcast from **2 LO,** was received on three loud speakers in the hall, and there accompanied on the pianoforte by Mr. L. Stanton Jefferies.

### Australian Broadcasting Regulations.

From a glance at the new broadcasting regulations for Australia it is at once evident that Government control of the service is their keynote. These regulations, which were instituted by the Australian Commonwealth on August 1st, are entirely different from those obtaining either in the United States or in Great Britain. The object of the Commonwealth has been to exercise an efficient control of all wireless communications without closing any avenues for the advancement of the science, and to allow for reasonable private and competitive enterprise.

A special examination must be passed by applisants for the experimental licences, and recipients of transmitting licences must be able to operate Morse at a speed of 12 words per minute.

The wavelengths available for broadcasting and experimenting are from 250 to 3,500 metres, and the Government authorities will stipulate what wavelength is to be allowed to any specified station.

The fees payable annually for licences, of which there are five, are as follows :—Broadcasting station, £15; broadcast receiving station, 10s.; dealer, 20s.; experimental (transmission and reception), 20s.; reception only, 10s.

To amateurs in this country, the conditions relating to broadcast receiving sets will appear rather severe. In addition to the 10s. licence fee payable to the Government, the broadcast listener will be required to pay an annual amount to the broadcasting licensee whose programmes he intends to receive. Every broadcast set must be approved and sealed by the authorities *and shall be so constructed as to respond to the wavelength shown on the Government stamped indication, not differing more than ten per cent. from that specified.* This implies that one broadcasting station only will come within the range of any particular set.

Greater variety than in this country will be available, however, in regard to the choice of broadcasting stations. Within reasonable limits any number of broadcasting stations may be erected and it will rest with each individual to choose which station he prefers to listen to before having his set sealed. In this way it is hoped keen competition will exist among broadcasters for the provision of the best programmes.

## Calls Heard.

Muswell Hill, N.10.
**2 AH, 2 AJ, 2 AQ, 2 BM, 2 BX, 2 BZ, 2 DA, 2 DC, 2DI(?), 2 FC, 2 FG, 2 FQ, 2 FU, 2 GG, 2 HC, 2 HB, 2 HT, 2 IF, 2 JS, 2 JX, 2 JZ, 2 KF, 2 KK, 2 KT, 2 KV, 2 KZ, 2 LI, 2 LO, 2 LT, 2 LW, 2 LZ, 2 MF, 2 MI, 2 MM, 2 MO, 2 MT, 2 MK, 2 NH, 2 NM, 2 OD, 2 OI, 2 OM, 2 ON, 2 OS, 2 OU, 2 PA, 2 PB, 2 PW, 2 PX, 2 PY, 2 PZ, 2 QQ, 2 QV, 2 QY, 2 SF, 2 SH, 2 SS, 2 SX, 2 SZ, 2 TA, 2 TI, 2 TQ, 2 TV, 2 UI, 2 UV, 2 VB, 2 VM, 2 VH, 2 VJ, 2 VK, 2 VW, 2 WC, 2 WD, 2 WJ, 2 WP, 2 WQ, 2 WR, 2 WT, 2 XI, 2 XR, 2 XL, 2 XX, 2 XZ, 2 YH, 2 YJ, 2 YR, 2 YL, 2 YY, 2 ZO, 2 ZQ, 2 ZY, 2 ZZ, 5 AC, 5 AQ, 5 AR, 5 AW, 5 BF, 5 BT, 5 BV, 5 BY, 5 CB, 5 CP, 5 CS, 5 DT, 5 DS, 5 IC, 5 IO, 5 IT, 5 IS, 5 HY, 5 KS, 5 LP, 5 LF, 5 NO, 5 OX, 5 PD, 5 PJ, 5 PZ, 5 SC, SR, 5 SU, 5 UO, 5 VD, 5 VR, 5 VM, 5 WA, 5 WR, 5 YX, 5 ZJ, 6 HD, 6 IM, 6 KI, 6 RS, FI, HB 2.**
(J. H. Forbes, **5 XD**).

Reading.
France: **8 AA, 8 AB, 8 AQ, 8 ARA, 8 AS, 8 AU, 8 AY, 8 BA, 8 BF, 8 BM, 8 BN, 8 BQ, 8 BV, 8 BW, 8 CD, 8 CF, 8 CM, 8 CS, 8 DA, 8 DK, 8 JA(?), 8 LA, 8 MZ (?), 8 XB(?), 8 ZZ.** Denmark: **7 JS, 7 ZM, 7 MJ(?).** Holland: **0 AA, 0 BQ, 0 BS, 0 DV, 0 GS, 0 IL, 0 MX, 0 NY, 0 RX, 0 VB, 0 XL, 0 XP, 0 XQ, 0 XW, 0 YS.** American: **1 DL, 3 MG, 4 RP, 5 EF, 5 EV**(Spk.), **5 EVF** (Spk.) **8 BQG, 9 RB(?).**
V. A. G. Brown (**6 JZ.**)

Tulse Hill, S.W.2.
**2 HF, 2 IN, 2 JF, 2 KW, 2 NA, 2 OD, 2 TB, 2 VF, 2 ZK, 5 CX, 5 KO, 5 NA, 5 QF, 8 AA, 8 AQ, 8 BM, 8 CS, 0 DV, 0 MX, 0 YS.**
(A. G. Wood, **5 RZ**).

West Norwood, S.E.
**2 AH, 2 BF, 2 BS, 2 CT, 2 FN, 2 IJ, 2 JF, 2 JT, 2 JW, 2 JX, 2 KB, 2 KM, 2 KN, 2 KV, 2 KW, 2 KZ, 2 LZ, 2 NA, 2 NM, 2 OD, 2 QD, 2 RB, 2 RS, 2 RW, 2 SF, 2 TV, 2 VU, 2 YR, 2 YW, 2 ZT, 2 ZO, 5 AD, 5 AR, 5 AQ, 5 CV, 5 CX, 5 KD, 5 KO, 5 FS, 5 FE, 5 IA, 5 IK, 5 IL, 5 KS, 5 LZ, 5 MA, 5 MC, 5 MI, 5 MY, 5 OC, 5 PZ, 5 RN, 5 RR, 5 TJ, 5 UC, 5 VP, 5 WR, 5 XN, 6 AH, 6 AY, 6 DD, 6 FE, 6 JX, 6 MZ, 6 NB, 6 NI, 6 OY, 6 TM, 6 TS, 6 ZI, 8 AQ, 8 AS, 8 AW, 8 BA, 8 BF, 8 BM, 8 BN, 8 BV, 8 CS, 8 CM, 8 OY, 0 DV.** (Single V.)
(L. F. Aldous).

Huddersfield.
**2 BC, 2 CK, 2 FQ, 2 KF, 2 KW, 2 KX, 2 NM, 2 NQ, 2 OD, 2 OM, 2 TR, 2 UF, 2 VF, 2 VN, 2 WA, 2 WK, 2 XP, 2 AJ, 5 BV, 5 CC, 5 CR, 5 CU, 5 CX, 5 IK, 5 JH, 5 JX, 5 KC, 5 KO, 5 MU, 5 NB, 5 OW, 5 PR, 5 SZ, 5 TC, 5 US, 5 WY, 5 XQ, 6 DR, 6 HS, 6 MK, 6 NI, 6 NR, 6 VP, 8 AE, 9 AY, 8 AQ, 8 BA, 8 BM, 8 CS, 8 CM, 8 CZ, 8 FF.** (Heard by **5 BG**).
(Joseph B. Kaye, **5 BG**).

London, N.8.
**2 FK, 2 HF, 2 JX, 2 KT, 2 NM, 2 OD, 2 OM, 2 ON, 2 OS, 2 PX, 2 PZ, 2 SZ, 2 TA, 2 VH, 2 WJ, 2 XI, 2 XR, 2 XZ, 5 AI, 5 CS, 5 IC, 5 IO, 5 JW, 5 LP, 5 OA, 5 PD, 5 PU, 5 PZ, 5 SU, 5 TR, 5 UL, 5 VD, 5 VR. 5 WR, 6 IM, 6 KI, 6 LJ, 6 NI, 6 QV, 6 TM, 8 BM.**
(o—v—1.)
(F. G. S. Wise).

West Norwood, S.E.27.
**2 HF, 2 JP, 2 VF, 5 GS, 5 TK, 5 MU, 6 GO, 6 KO, 6 VT, 0 NY, 0 XP, PCII, 8 CD, 8 DK.** (One-valve).
(L. F. Aldous).

Handsworth, Birmingham.
**2 AO, 2 DF, 2 DJ, 2 DU, 2 FH, 2 FN, 2 HA, 2 HF, 2 HV, 2 IJ, 2 IP, 2 JF, 2 JU, 2 KF, 2 KO, 2 KQ, 2 KR, 2 LG, 2 LX, 2 MD, 2 MO, 2 NA, 2 NM, 2 NO, 2 NP, 2 NV, 2 OD, 2 OG, 2 OM, 2 ON, 2 OX, 2 PD, 2 PP, 2 PV, 2 RD, 2 RG, 2 RQ, 2 SI, 2 SY, 2 SZ, 2 TA, 2 TM, 2 TN, 2 TO, 2 TV, 2 UW, 2 UX, 2 UY, 2 UZ, 2 VC, 2 VI, 2 VN, 2 VP, 2 WB, 2 WJ, 2 XC, 2 XF, 2 XQ, 2 YV, 2 YX, 2 ZO, 2 ZK, 5 BV, 5CI, 5 DG, 5 FC, 5 FH, 5 FI, 5 FV, 5HN, 5 KG, 5 KO,**

5 KY, 5 LJ, 5 LT, 5 MS, 5 NH, 5 NN, 5 NW, 5 OK, 5 PU, 5 RI, 5 SL, 5 TM, 5 TW, 5 UW, 5 VM, 5 VR, 5 VT, 5 XC, 5 YS, 6 AG, 6 BY, 6 HU, 6 MZ, 6 UC, 6 UR, 8AQ, 8 AS, 8 AW, 8 BN, 8 BQ, 8 BU, 8 BV, 8 CF, 8 CM, 8 CS, 8 CZ, 8 ZZ, 0AA, 0 DV 0 MX, 0 NY, 0 XP, PCII, PCTT, 3 UN. (Wilfred Bates).

Nr. Leicester.
2 CZ, 2 DU, 2 FJ, 2 FN, 2 FZ, 2 HF, 2 IL, 2 IQ, 2 KO, 2 LG, 2 LX, 2 MV, 2 NA, 2 NP, 2 NV, 2 OM, 2 OP. 2 OX, 2 PV, 2 TI, 2 TN, 2 UG, 2 UT, 2 UY, 2 WB, 2 WD, 2 WM, 2 WN, 2 WO, 2 XZ, 2 YV, 2 YX, 2 ZK, 2 ZU, 5 CK, 5 FU, 5 HF, 5 HN, 5 KY, 5 LP, 5 LT, 5 NX, 5 OP, 5 PU, 5 PX, 5 RI, 5 TR, 5 TW, 5 YI, 5 YS, 5 ZV. 6 IM, 6 MJ, 6 MQ, 6 NI. (1—v—1.) (F. H. Tyler).

Ilford, Essex.
2 FC, 2 FK, 2 FP, 2 FQ, 2 JX, 2 KF, 2 KG, 2 KT, 2 LT, 2 MF, 2 OM, 2 ON, 2 PT, 2 PW, 2 PX, 2 QQ, 2 XD, 2 XP, 2 XR, 2 XX, 5 AC, 5 AG, 5 DT, 5 HI, 5 HR, 5 IC, 5 JT, 5 JW, 5 LZ, 5 LP, 5 PU, 5 PZ, 5 QJ, 5 SU, 5 TR, 5 UC, 5 UL, 5 VR, 5 WR, 6 CD, 6 IM, 2 RE. (o—c—o). (C. E. Largen).

Croydon.
2 AN, 2 AQ, 2 DF, 2 FN, 2 FP, 2 FQ, 2 FU, 2 HS, 2 JS, 2 JX, 2 KC, 2 KF, 2 KT, 2 KZ, 2 MF, 2 MK, 2 NA, 2 NM, 2 OD, 2 OM, 2 ON, 2 PA, 2 PB, 2 PX, 2 RW, 2 SF, 2 SH, 2 SI, 2 SQ, 2 SX, 2 SZ, 2 TI, 2 TP, 2 TQ, 2 VJ, 2 VK, 2 VR, 2 VT, 2 WJ, 2 XI, 2 XR, 2 XZ, 2 YG, 2 YQ, 2 YR, 2 ZO, 5 AC, 5 BT, 5 BW, 5 BV, 5 CP, 5 DB, 5 DT, 5 FR, 5 HI, 5 ID, 5 KO, 5 NN, 5 OX, 5 PU, 5 PZ, 5 QJ, 5 RZ, 5 TR, 5 VP, 5 VU, 5 WR, 6 AL, 6 CW, 6 IM, 6 MZ, 6 NF, 6 RM, 8 AA, 8 AB, 8 BF, 8 BM, 8 BN, 8 BV, 8 CA, 8 CF, 8 CM, 8 CZ, 8 AW, 8 AQ, 8 MG, 8 ZZ, 0 MX, 0 XP, PCII. (o—v—1). R. R. Sawell.

London, N.8.
2 AJ, 2 AP, 2 AQ, 2 BT, 2 BZ, 2 CB, 2 CW, 2 DC, 2 DF, 2 DO, 2 DU, 2 DY, 2 FJ, 2 FQ, 2 FU, 2 GO, 2 ID, 2 IL, 2 JS, 2 JT, 2 JX, 2 KF, 2 KT, 2 KZ, 2 LM, 2 LP, 2 LT, 2 LZ, 2 MF, 2 MK, 2 NM, 2 OD, 2 OH, 2 OM, 2 ON, 2 OS, 2 PA, 2 PW, 2 PX, 2 PZ, 2 QQ. 2 RS, 2 SF, 2 SH, 2 SK, 2 SP, 2 SR, 2 SX, 2 SZ, 2 TA, 2 TK, 2 TX, 2 UL, 2 UV, 2 VB, 2 VJ, 2 VS, 2 VT, 2 VW, 2 WD, 2 WJ, 2 WP, 2 XB, 2 XD, 2 XI, 2 XL, 2 XP, 2 XR, 2 XZ, 2 ZO, 5 AC, 5 BW, 5 CB, 5 CF, 5 CP, 5 CQ, 5 DK, 5 DT, 5 HI, 5 HY, 5 IC, 5 IO, 5 IS, 5 JW, 5 LF, 5 LP, 5 LY, 5 LZ, 5 MA, 5 OB, 5 OU, 5 OX, 5 PB, 5 PD, 5 PU, 5 PZ, 5 QB, 5 SU, 5 TR, 5UO, 5 VD, 5 VJ, 5 VR, 5 XD, 5 YX, 5 ZJ. 6 IM, 6 KI, 6 OY, 6 QV, 6 RM, 6 TM, 6 VO, 6 VR. (o—v—o). (Eric C. Button.).

Belfast.
2 DF, 2 FL, 2 FN, 2 IN, 2 JF, 2 JP, 2 KF, 2 KS, 2 KW, 2 NA, 2 NM, 2 OD, 2 OL(?), 2 PP, 2 SZ, 2 UF, 2 VF, 2 WJ, 2 WK, 2 ZK, 2 ZU, 4 FT, 5 BF, 5 CR, 5 CX. 5 DT, 5 HG, 5 KC, 5 KO, 5 LT, 5 NX, 5 OP(?), 5 OT, 5 RI, 5 RQ, 5 SK, 5 UQ, 5 XY(?), 6 KK, 6 NI, 6 NL, 6 NQ, 6 RY, 6 TM, 8 AG, 8 AW, 8 AS, 8 BF, 8 BM, 8 BN 8 BW, 8 CM, 8 CN, 8 CS, 8 DO, 9 CHC, 0 DV, 0 YS. (2—v—1). (F. R. Neill).

Burley-in-Wharfedale, Yorks.
2 AA, 2 AL, 2 AW, 2 AY, 2 BM, 2 CV, 2 CT, 2 CW, 2 DF, 2 DM, 2 DN, 2 DJ, 2 DR, 2 DX 2 FN, 2 FP, 2 FQ, 2 GG, 2 GJ, 2 GM, 2 GN, 2 GU, 2 GZ, 2 HF, 2 HW, 2 HT, 2 IG, 2 IN, 2 IQ, 2 JF, 2 JO, 2 JP, 2 JX, 2 JZ, 2 KB, 2 KD, 2 KF, 2 KQ, 2 KS, 2 KT, 2 KW, 2 KX, 2 LA, 2 LB, 2 LG, 2 LZ, 2 MO, 2 NA, 2 NB, 2 NC, 2 NK, 2 NM, 2 NV, 2 NW, 2 OD, 2 OG, 2 OM, 2 ON, 2 PC, 2 PF, 2 PO, 2 PP, 2 PT, 2 PX, 2 PY, 2 QJ, 2 QK, 2 QQ, 2 RH, 2 RP, 2 RY, 2 SH, 2 SS, 2 ST, 2 SX, 2 SZ, 2 TA, 2 TB, 2 TC, 2 TR, 2 TV, 2 UY, 2 UZ, 2 VF, 2 VK, 2 VO, 2 VS, 2 WJ, 2 XR, 2 YF, 2 YR, 2 ZK, 2 ZU, 3 XB. 5 AJ, 5 AV, 5 BH, 5 BG, 5 CU, 5 CX, 5 CR, 5 DN, 5 DT, 5 FW, 5 GL, 5 GJ, 5 GT, 5 HQ, 5 IC, 5 ID, 5 KO, 5 KX, 5 LZ, 5 MU, 5 MT, 5 PR, 5 PT, 5 PZ, 5 RZ, 5 SZ, 5 NN, 5 XL, 5 XZ, 6 BR, 6 NI, 6 SS, 6 RY, 8 AB, 8 AG, 8 AQ, 8 AW, 8 BA, 8 BM, 8 BV, 8 CS, 8 XY, 8 RRX, 8 TA, 0 XB, 0 FN, PCII, OBM; (J. Croysdale).

Mablethorpe, Lincs.
2 AM, 2 AQ, 2 CK, 2 CW, 2 DD, 2 DF, 2 DS, 2 DU, 2 DX, 2 FL, 2 FN, 2 FR, 2 FQ, 2 FU, 2 GG, 2 GJ, 2 GM, 2 GO, 2 GV, 2 GZ, 2 HF, 2 IN, 2 IQ, 2 JF, 2 JP, 2 KF, 2 KO, 2 KP, 2 KW, 2 LZ, 2 MC, 2 MK, 2 MN, 2 NK, 2 NM, 2 NR, 2 OD, 2 ON, 2 OM, 2 OS, 2O Z, 2 PS, 2 QH, 2 QQ, 2 SC, 2 SV, 2 SY, 2 SZ, 2 TN, 2 TV, 2 UY, 2 VC, 2 VN, 2 VQ, 2 VS, 2 VW, 2 WA, 2 WD, 2 WR, 2 XI, 2 XY, 2 XZ, 2 ZG, 5 BG, 5 BJ, 5 BS, 5 BT, 5 BW, 5 CA, 5 CC, 5 CK, 5 CV, 5 CX, 5 D M, 5 DN, 5 DK, 5 DT, 5 DX, 5 FS, 5 FU, 5 GS, 5 GL, 5 GX, 5 HI, 5 HL, 5 HY, 5 IC, 5 IO, 5 KO, 5 LP, 5 LS, 5 NN, 5 OP, 5 OW, 5 OZ, 5 PS, 5 PU, 5 RI, 5 SU, 5 TJ, 5 VD, 5 VR, 5 XR, 5 ZV, 6 GQ, 6 NI, 6 RY, 6 SO, 6 ST, 7 ZM. 8 AG, 8 AP, 8 AQ, 8 BF, 8 BN, 8 BM, 8 CD, 8 CM, 8 CZ, 8 DA, 8 ZZ, 0 MX, 0 AA, 0 AW, 0BQ, 0 DE, 0 DV, 0 NY, 0 SA, 0 XO, 0 XP, 0 YS, 0 ZN, PCM, PCII. (V. Det., 1 L.F., occasionally 1 H.F.). (T. Malow).

Heaton Moor, Stockport.
2 AL, 2 AR, 2 AW, 2 AY, 2 AZ, 2 BC, 2 BZ, 2 CW, 2 CZ, 2 DF, 2 DJ, 2 DS, 2 DX, 2 FH, 2 FL, 2 FN, 2 FQ, 2 FU, 2 FZ, 2 GJ, 2 GU, 2 GV, 2 GW, 2 GZ, 2 HF, 2 HM, 2 HV, 2 HW, 2 IL, 2 IJ, 2 IN, 2 IQ, 2 JF, 2 JO, 2 JP, 2 JZ, 2 KD, 2 KF, 2 KG, 2 KH, 2 KO, 2 KQ, 2 KS, 2 KW, 2 KX, 2 LA, 2 LG, 2 LW, 2 LZ, 2 MG, 2 MT, 2 NA, 2 NB, 2 ND, 2 NM, 2 NV, 2 OD, 2 OH, 2 OM, 2 ON, 2 PC, 2 PO, 2 PP, 2 PT, 2 QH, 2 QJ, 2 QK, 2 QQ, 2 QV, 2 RB, 2 RD, 2 RM, 2 RN, 2 RP, 2 SF, 2 SO, 2 SP, 2 SR, 2 SZ, 2 TB, 2 TC, 2 TN, 2 TR, 2 TV; 2 TZ, 2 UB, 2 UF, 2 UX, 2 UY, 2 VF, 2 VO, 2WA, 2 WK, 2 WO, 2 WN, 2 YC, 2 YF, 2 ZG, 2 ZK, 2 ZS, 2 ZU, 5 AJ, 5 AY, 5 AZ, 5 BF, 5 BG, 5 BH, 5 BV, 5 CR, 5 CU, 5 CX, 5 DC, 5 DN, 5 EW, 5 FD, 5 HA, 5 HS, 5 ID, 5 IK, 5 JX, 5 KC, 5 KO, 5 LC, 5 LJ, 5 LZ, 5 ML, 5 MS, 5 MU, 5 NN, 5 OW, 5 QA, 5 RT, 5 SI, 5 SZ, 5 VK, 5 WC, 5 WY, 5 XJ, 5 XP, 5 XQ, 6 AJ, 6 GR, 6 HS, 6 IK, 6 JQ, 6 MU, 6 NI, 6 PL, 6 RY, 6 TM, 6 VF, 6 WC, 6 ZY, 7 JS, 8 AW, 8 AB, 8 AQ, 8 AS, 8 BA, 8 BM, 8 BN, 8 BV, 8 BW, 8 CC, 8 CH, 8 CS, 8 CM, 0 AA, 0 BQ, 0 DV, 0 FL, 0 MX, 0 NY, 0 XO, 0 YS. (One valve only). H. A. Woodyer (2 XW).

# Broadcasting.

**REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS:**

## GREAT BRITAIN.

**LONDON 2 LO,** 363 metres; **MANCHESTER 2 ZY,** 370 metres; **BIRMINGHAM 5 IT,** 423 metres; **CARDIFF 5 WA,** 353 metres; **NEWCASTLE 2 NO,** 400 metres; **GLASGOW 5 SC,** 415 metres; **ABERDEEN 2 BD,** 497 metres; **BOURNEMOUTH 6 BM,** 485 metres. Regular daily programmes. Weekdays, 11.30 to 12.30 p.m. (**2 LO** only), 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 to 5 p.m., 8.30 to 10.30 p.m.

## FRANCE.

**PARIS (Eiffel Tower), FL,** 2,600 metres. Daily, 6.40 to 7 a.m. Weather Forecasts; 10.5 a.m. (Thursday and Friday), 11.15 to 11.30 a.m., Time Signal and Weather Forecast; 12.0 noon, Live-stock prices; 3.40 p.m. (Saturday excepted); Financial report. 5.30 p.m. (Saturday excepted) Bourse Closing Prices; 6.10 p.m., Concert or Address; 7 p.m., Weather Forecast; 7.20 p.m. (Sunday), Concert and Address; 10.10 p.m., General Weather Forecast.

**PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), SFR,** 1,780 metres. Daily, 12.30 p.m., Cotton, Oil and Café Prices, News, Concert; 1.45 p.m., First Bourse Report; 4.30 p.m., Bourse Closing Prices; 4.45 p.m., Concert; 5.45 p.m., News and Racing Results; 8.30 to 9.30 p.m., News; 9.10 p.m., Concert; 10 p.m. to 10.45 p.m., Radio Dance Music.

**ECOLE SUPERIEURE des Postes et Telegraphes,** 450 metres 3.30 to 4 p.m. (Wednesday and Friday), 7.45 p.m. to 10 p.m. (Tuesday and Thursday), Tests (Music, etc.); 2.30 p.m. to 7.30 p.m. (Saturday), Tests (Music, etc.).

**LYONS, YN,** 3,100 metres. Daily, 9.45 a.m. to 10.15 a.m., Gramophone Records.

## BELGIUM.

**BRUSSELS, BAV,** 1,100 metres. 1 p.m. to 5.30 p.m., Meteorological Forecast; 9 p.m. (Tuesday), Concert.

**BRUSSELS (" Radio Electrique ")** 410 metres. Daily, 8.30 p.m. to 9.30 p.m., Concert.

## HOLLAND.

**THE HAGUE, PCGG.** Temporarily suspended.

**THE HAGUE (Heussen Laboratory), PCUU,** 1,070 metres. 9.40 to 10.40 a.m. (Sunday), Concert; 9.40 to 10.40 p.m., Concert; 7.45 to 10 p.m. (Thursday), Concert.

**THE HAGUE (Velthuisen), PCKK,** 1,070 metres. 8.40 to 9.40 p.m. (Friday), Concert.

**IJMUIDEN (Middelraad), PCMM,** 1,050 metres. Saturday, 8.40 to 9.40 p.m., Concert.

**AMSTERDAM, PA 5,** 1,100 metres (Irregular). 10 to 11 a.m., Concert; 5 to 6.30 p.m., Concert; 8.10 to 9.10 p.m., Concert.

## DENMARK.

**LYNGBY, OXE,** 2,400 metres. 7.30 p.m. to 8.45 p.m., Concert (Sunday excepted).

## GERMANY.

**BERLIN (Koenigswusterhausen), L.P.,** 4,000 metres. (Sunday), 10 to 11 a.m., Music and Lecture; 2,700 metres 11 a.m. to 12 noon Music and Lecture. Daily, 4,000 metres, 6 to 7 a.m., Music and Speech; 11.30 a.m. to 12.30 p.m., Music and Speech; 4 to 4.30 p.m., News.

**EBERSWALDE,** 2,930 metres. Daily, 12 to 1 p.m., Address and Concert; 7 to 8 p.m., Address and Concert; (Thursday and Saturday), 5.30 to 6.30 p.m., Concert.

## CZECHO-SLOVAKIA.

**PRAGUE, PRG,** 1,800 metres. 7 a.m., 11 a.m. and 3 p.m., Meteorological Bulletin and News; 4,500 metres, 9 a.m., 2 p.m. and 9 p.m., Concert.

**KBEL (near Prague),** 1,000 metres. Daily, 6.20 p.m., Concert, Meteorological Report and News.

## SWITZERLAND.

**GENEVA, HB 1 (Radio Club de Genève).** Temporarily suspended.

**LAUSANNE, HB 2,** 1,100 metres. Tuesday, Thursday, Saturday, 4 p.m., Concert; Monday, Wednesday, Friday and Saturday, 7 p.m., Concert.

## SPAIN.

**MADRID,** 1,650, 2,200 metres (Irregular). 12 to 1 p.m., Tests.
**MADRID, PTT,** 400 to 700 metres. 4 to 5 p.m., Tests.

# Radio Society of Great Britain.

An informal meeting of the Society was held at the Institution of Electrical Engineers on Wednesday, November 21st, when Mr. G. P. Mair read a paper on "Aerial Construction and Design." The Chair was occupied by Mr. L. F. Fogarty, A.M.I.E.E., F.R.S.A.

Mr. Mair's paper dealt with the arrangements of masts and the methods of staying and strutting. The various types of aerials to be recommended for different purposes were touched upon and attention was given to the use of counterpoises and to the various earthing systems.

During the discussion some controversy was aroused as to the relative merits of single and stranded wire. Several speakers were in favour of the use of 26 D.C.C. wire in preference to the usual 7/20 or 7/22 stranded pattern, it being maintained that the former variety was better protected against dirt, etc., and tended to keep the resistance low. On the other hand it was pointed out that no better results were experienced by the use of rubber-covered wire.

Materials for masts also formed a subject of discussion and certain speakers advocated the use of tubes of steel as thin as 18 gauge with a diameter of 1 to 1½ inches.

On the subject of lightning protectors the general opinion was in favour of the earthing switch in preference to the spark gap. Several speakers recommended the use of the counterpoise for reception as well as for transmission.

## TRANSMITTER AND RELAY SECTION.

### Franco-British Tests on about 200 metres Wavelength.

The following arrangements have been made in consultation with the President of the Joint French Committee.

The tests will take place between November 26th and December 9th, 1923; French amateurs will transmit on November 26th, 28th and 30th, and December 2nd, 4th, 6th and 8th; British amateurs will transmit on November 27th, 29th and December 1st, 3rd, 5th, 7th and 9th; all between the hours of 2300 and 2400.

French amateurs whose call signs begin with the letters **8 A** will transmit from 2300 to 2315; those whose sign begins with **8 B** from 2315 to 2330; those whose sign begins with **8 C** from 2330 2345; those whose sign begins with **8 D** or **8 E** from 2345 to 2400. The test transmitted will consist of the letters **R S G B** repeated three times, followed by the word "de," and by the call sign of the station calling, repeated three times; the whole being repeated throughout the fifteen minutes allotted.

British amateurs will transmit as follows:—The southern group from 2300 to 2315; the midland group from 2315 to 2330; the north of England group from 2330 to 2345; and the Scottish group from 2345 to 2400. The test should consist merely of series of V's with the occasional interpolation of the call sign of the station calling. Precise instructions will be posted to the members of the T. and R. Section.

British amateurs who succeed in picking up any of the French signals are requested to report immediately to the Hon. Secretary of the T. and R. Section, Finsbury Technical College, Leonard Street, London, E.C.2. Other British amateurs who are not taking part in these tests are requested to be so courteous as to refrain from unnecessary jamming.

The French and British organisations will in due course exchange reports regarding successful receptions in the two countries.

## FORTHCOMING EVENTS.

**WEDNESDAY, NOVEMBER 28th.**

**Radio Society of Great Britain.** At 6 p.m. (tea at 5.30 p.m.). At the Institution of Electrical Engineers. Lecture: "Leafield Imperial Wireless Station" (illustrated by lantern slides). By Mr. E. H. Shaughnessy, O.B.E., M.I.E.E., M.I.R.E.

**East Ham and District Radio Society.** At 8 p.m. At the Church Army Social Centre, Barking Road, E.C. Public Demonstration.

**Stockport Wireless Society.** At 7.30 p.m. Lecture: "Crystal Rectification and Valve Amplification." By Mr. H. A. Woodyer.

**Edinburgh and District Radio Society.** At 117, George Street. Lecture: "Distortion of Sound Waves in Radio Telephony Receivers." By Mr. H. W. Clark.

**Manchester Radio Scientific Society.** At 7 p.m. At 16, Todd Street. Lecture by Mr. Kemp

**Barnet and District Radio Society.** At 8 p.m. At Club Room, Bells Hill. Lecture and Demonstration by Mr. Miller (of Western Electric Co., Ltd.).

**Streatham Radio Society.** Informal meeting with paper on: "The Rectification of Alternating Currents." By Mr. W. K. Hill (**2 VT**).

**Clapham Park Wireless and Scientific Society.** At 8 p.m. At 67, Balham High Road. "Testing Night."

**THURSDAY, NOVEMBER 29th.**

**Plymouth Wireless and Scientific Society.** At 8 p.m. At the Y.M.C.A. Building, Old Town Street. Lecture: "Transformers." By Mr. Voss.

**Radio Association of S. Norwood and District.** At the Stanley Halls, S. Norwood Hill. Lecture: "Association Internal Economy." By Mr. Geo. Sutton, A.M.I.E.E.

**Luton Wireless Society.** At 8 p.m. At Hitchin Road Boys' School. Exhibit and Demonstration.

**Hackney and District Radio Society.** Demonstration of a five-valve set with 50 combinations. By Mr. Van Colle.

**Brighton and Hove Radio Society.** At 7.30 p.m. At the Brighton Technical College. Lecture: "Workshop Practice in Electrical Engineering." With cinematograph illustrations.

**FRIDAY, NOVEMBER 30th.**

**Birmingham Wireless Club.** Lecture (with lantern illustrations). "My Visit to **FL**." By Dr. J. R. Ratcliffe (Presi ent).

**Wembley Wireless Society.** At 8 p.m. At Park Lane School. Lecture: "The Electron." By Mr. W. A. Robinson.

**Sheffield and District Wireless Society.** At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Lecture: "The Design of Broadcast Receivers." By Mr. W. Forbes-Boyd.

**Leeds Radio Society.** At 7.30 p.m. At Woodhouse Lane U.M. Church Schools. Lecture: "Electric Oscillations and Electric Waves." By Mr. F. Bowman.

**Norwich and District Radio Society.** At 8 p.m. Lecture: "Low Frequency Magnification." By Mr. Rudd.

**Honor Oak Park Radio Society.** Lecture by Mr. Voigt.

**Radio Association of Brockley and District.** At 7.30 p.m. At Deptford Town Hall, New Cross Road, S.E.14. Lectures: "How Wireless Works," by Prof. P. M. Baker, B.Sc.; "The Audiometer," by Prof. A. M. Low, D.Sc.; "Demonstration of Wireless Controlled Train and Guns," by Major Raymond Phillips.

**TUESDAY, DECEMBER 4th.**

**Plymouth Wireless and Scientific Society.** At 8 p.m. At the Y.M.C.A. Building, Old Town Street. General Discussion and Questions.

**West London Wireless and Experimental Association.** Annual General Meeting.

## A Correction.

We have been asked by Mr. Horace W. Cotton, Hon. Secretary of the West London Wireless and Experimental Association, to draw attention to a mistake which occurred in printing his address in the Official Guide to the All-British Wireless Exhibition. Mr. Cotton's address is 19, Bushey Road, Hayes, Middlesex.

# DISTORTION IN RADIO TELEPHONY.

By H. A. THOMAS, M.Sc.

(*Continued from page* 260 *of previous issue.*)

## DISCUSSION.

**Mr. M. Child,** who opened the discussion, said:—The subject we have listened to to-night is of great interest to everybody, I feel sure. The problem of distortion and amplification for audio frequency work is certainly, as the lecturer pointed out, a very big one. As the author of one of the first papers to this Society on resistance coupled amplifiers, you can imagine that I am particularly interested in what our lecturer has told us in reference to the work which he has done on these amplifiers. There is one point I should like to mention—and the author's remarks certainly came as a surprise to me—namely, why is it that we can dispense with fairly large coupling condensers? That is, at the moment, difficult for me to understand. Naturally, I should assume, with audio frequency currents, that the size of the condensers between the resistance and the plates of the succeeding valves would have to be fairly large values. Personally, I would have thought the value would be about 0·01 microfarads, but I have not yet had the opportunity of testing one of these types of amplifiers on low frequency work.

It certainly seems astonishing to me that we get any speech through at all, after what the lecturer has told us to-night; with the inefficiency of the microphone and the inefficiency of the valve, and the losses in the aerial circuits, and so on, it seems extraordinary that we get anything at all, and I certainly think he has opened our eyes to a very much better outlook of the problems which are facing many of us in connection with broadcasting. I must say that I think that the problem of telephony at the present time seems an almost insuperable one to get over. I refer to the multiplication of stations. The author has shown us, and rightly, that the fairly high resistance aerial circuit is essential in order to get good speech reproduction, and if that is so it means that we are not going to multiply our stations very far. Short wavelengths will have to be more widely separated, and, of course, as things go on—the ether is already pretty crowded—other wavelengths will have to be found.

Perhaps one point on which we should like information is as to what the author thinks can be done in the way of short waves for actual commercial telephone work.

**Mr. C. F. Phillips.**

There is one point I should like to raise in regard to resistance coupled low frequency amplifiers, and it is a simple technical one. If we intend to go in for considerable amplification of speech—I mean perhaps amplification exceeding that of ordinary room strength—the resistance coupled amplifier is a little difficult to construct from the point of view of obtaining the necessary resistances capable of carrying the anode current. In order to obtain high power amplification, it is necessary to use low impedance valves and fairly high resistances. It is also necessary to bias the grids of such valves so that, in the static condition, the anode current drawn will be reasonably low, but one must, when speech comes along, have the resistances of such a nature that they will be capable of carrying, say, 20 or 25 milliamperes. It is not easy to obtain resistances of that nature and of a value of 100,000 ohms. I believe the failure of speech on ordinary transformer coupled amplifiers is largely due to the use of unsuitable valves, which have not the necessary thermionic properties to enable the curve to maintain its straightness as the grid becomes more positive (not, however, so positive as to start grid currents). A further source of difficulty is that few people seem to recognise the essential point of biasing the grids properly. You cannot make a good amplifier of any kind if you do not take characteristic curves, and when you have taken them you must set your grid bias correctly. You can go lower down the curve than half way, and then, when incoming speech makes the grids more positive than they were before, anode current can increase largely without the grids passing the zero potential point, and thus without any grid current being drawn.

Provided that grid current is prevented from starting, that the characteristic curve to the left of the zero grid potential line is long and straight, and that the impedance of the valve is low enough to cause this long straight portion of the curve to be obtainable without excessive anode voltage, I venture to say that it is possible to secure just as linear amplification of speech with good transformers as with the resistance coupled amplifier and at the same time to make use of considerable voltage step-up of the transformers.

**Mr. Philip R. Coursey.**

I think the paper has served to emphasise the enormous extent of the problem of radio-telephonic transmission. In fact, the theoretical aspect of the question which has been given to us gives one almost the impression that everything is bad, and one is almost tempted to ask "Is there anything in the wireless circuit at all which is good?" "Should we not scrap the lot and start again?" The practical results obtained in everyday working hardly lead to that suggestion, and put a brighter outlook on the subject.

If there is anything in the paper which I personally would rather have seen emphasised more it is the practical side of the problem; in other words, to what extent each of the various suggestions made by the author is of real practical value in normal working. For instance, it is all very well to talk about the disadvantages of selective circuits. They obviously must produce distortion if the resistance is very low, but in practice one must

use resonance circuits to some extent, and, after all, the resonance curve has *some* width. If we can confine our working wavelength band due to the speech to the effective width of the resonance curve, it does not matter how sharp the resonance curve is.

It is rather the practical application of the theoretical difficulties of the transmission of speech that the experimenters are concerned with, and which, if anything, want a little more emphasis. However, there is no harm in stressing all possible sources of distortion, as they may suggest fields for experiment where useful work can be done.

There is one point mentioned by the author as to the distortion introduced, for instance, in the horn of a loud speaker. If there is distortion in some part of the amplifier circuit, it may so happen that added distortion due to resonance, for instance, in the horn or some other part of the instrument, would give improved results by tending to flatten out the amplification over a band of frequencies. If there is one resonant point only in a whole system, naturally that frequency will be unduly emphasised, but if there are several resonant points, the net result may be much better than if there were only one resonant point, and therefore, having distortion may sometimes improve the quality of the reproduction.

There is one further point apropos of the resistance-capacity coupled amplifier which has been mentioned. I have not seen any figures of the actual amplification factor of the resistance-capacity coupled amplifier when used at low frequencies. Curves have been published of the amplification factor of resistance-capacity coupling between valves at high frequencies, and those curves all show a sloping line—*i.e.*, variation of amplification with frequency. If that is so at high frequencies, surely there may be some such effect at low ones which may give rise to distortion.

The question has been raised as to the difficulty of getting more signals or stations into a given wavelength band, especially in view of the undesirability of using very selective circuits if good articulation is wanted. A help to the solution of this difficulty, or at least a partial solution, may be found in the application of filters. Many complicated filters have been devised, both for high and low frequencies, and it seems possible that we might, at some point in the circuit, add some type of filter which will definitely define the limiting frequencies above and below the carrier wave frequency, so as to limit the reception by the receiver of other wavelengths.

I should like also to add my expression of thanks to the author for the exhaustive manner in which he has treated this most interesting subject.

**Mr. R. L. Smith-Rose.**

I am rather afraid that if I had never heard any broadcasting I should conclude from Mr. Thomas's paper that it was about the most hopeless business I could imagine, but I think that the discrepancy which arises from theoretical considerations rather than from actual experience is somewhat of a physiological character. Mr. Thomas has carefully considered each article of the apparatus employed in transmission and reception, and has given theoretical, or in some cases accurately measured curves, showing up the various defects possessed by every single component. But at the receiving end, where the loud speaker or loud-sounding receiver launches the reproduction of the original speech or music, we have at present no means of measuring the wave form. The only means we have of detecting it is the human ear, but I rather think a large amount of accommodation is taken up by the human ear, resulting in the impression that what the ear is really listening to is a true reproduction of the original. That, I think, will account for a good deal, and reception is, after all, fairly good, though it may not be as good as Mr. Thomas himself desires. There are one or two points in connection with his consideration of the various components which I should like to comment upon. First of all, in connection with the iron core coil generally, the author referred to the distortion which would be produced by the ordinary B and H curve, but I think that is rather misrepresenting the actual state of affairs. It is the differential permeability that should be considered in dealing with the distortion that might arise. A steady current flowing through the core might give a magnetisation to the core, and the speech which is impressed upon that is merely a variation in the permeability. The differential permeability, of course, does introduce some distortion, since it produces a loop with a definite hysteresis loss attached to it. The same remarks rather apply to intervalve transformers.

Concerning the sharpness of tuning of the receiving circuit, if one considers the wavelengths which are being used for broadcasting, I think the resonance conditions are not nearly so drastic as we might be led to assume. The wavelength of the London station corresponds to a frequency of about 840,000, whereas the impressed speech covers a range of 3,000 cycles per second. The amount of spread, therefore, of the original radio frequency wave due to the impressed speech is only three parts in 840 on either side, corresponding to about two thirds per cent. of the original wavelength. I suggest that few receiving circuits have a resonance which will allow them a selectivity of that order without the use of retroaction, and that two-thirds per cent. is not a great band for any one station to occupy.

The latter portion of the lecture dealt with the rather serious problem of low frequency amplification, and what are the best arrangements to use to avoid any possible distortion. The iron core transformer would appear theoretically to be very bad as compared with purely resistance capacity coupling, which is largely independent of the frequency. The iron core transformer, as many of those who have attempted to design theoretically such transformers know, does not lend itself easily to treatment in the ordinary way in which the transformer theory is applied. One has, therefore, to resort to actual measurements. As to the means available for measurement, I might mention that a method has been developed for actually measuring the voltage amplification of low frequency transformers at the National Physical Laboratory, and the apparatus is in use for the testing of commercial types of transformers.

The intervalve transformer does give distortion quite definitely in certain cases, for if one measures the actual amplification of a stage comprising one transformer with one valve, that amplification, in almost every case, varies with the frequency

over the audible ranges, so that if one is working over a band of frequency from one or two hundred to two or three thousand, the amplification at the higher frequencies may be 100 per cent. greater than it is at the lower frequencies. On the other hand, if the connections of the transformer with the valve are varied, one usually finds that the amplification alters at one frequency, due to various capacity effects acting in the transformer, and often it can be found that a transformer can be so connected that whatever transference of energy may take place by capacity, this can be set in such a manner relative to the inductive transfer of energy that there is no appreciable increase of amplification with the increase of frequency. This is a point on which I think many commercial people are making a mistake at the present time. They have laid down a hard and fast rule for connecting up inter-valve transformers, but the tests upon which the rule was based were probably made at a single frequency, and although those connections do definitely give an increased amplification at that frequency, they may also give a decreased amplification at another frequency. If it is connected up in a different manner, the amplification will be less, but this sacrifice can be afforded if one obtains the advantage of uniform amplification with varying frequency.

With the resistance capacity coupling it is found that the amplification does not vary with the frequency, as one would expect, because the capacities are very small. With the transformer coupling one can obtain very nearly, if not quite, the same absence of distortion, *i.e.*, the same absence of any increase of amplification with frequency, but, at the same time, one can take advantage of the step-up ratio of the transformer. In many cases, with a suitably designed transformer, used under proper conditions, the step-up ratio can be utilised to almost its full extent. I rather appreciate the difficulties of using a resistance capacity coupling, not only in respect of the value of the resistance and the current it is required to carry, but also the amount of energy that one requires in high tension batteries. When one requires to get a steady current of two or three milliamps in the valve, with the resistance of the order of 100,000 ohms, then the drop of 200 or 300 volts in the resistance is a very serious drawback in the resistance coupling over the transformer coupling. There is one point in regard to the last stage that I should like to give my views upon. One frequently hears the statement that it is absolutely necessary to use high power valves in the last stage to operate loud sounding receivers. My experience has been somewhat different. Actual measurement shows that with the small type of loud speaker, used in an ordinary room, an oscillating current through that loud speaker of the order of 1 milliampere is ample to produce the loudest sound anyone can possibly wish for. That 1 milliampere can be obtained from an ordinary "R" type of valve, and I put forward the idea that it is not always necessary to use power valves in the last stage of an amplifier for loud speaker purposes.

**Mr. Holbeach.**

I should like to express my surprise at the speaker's remarks on amplification with resistance capacity couplings and transformer couplings. I find that the difference in amplification is enormous with a transformer coupling compared with a resistance capacity coupling. As an example, a six-stage resistance capacity amplifier would not give any more amplification than, say, a three-stage amplifier that is commonly called a power amplifier, with suitable valves and suitable grid bias. Regarding Mr. Phillips' remarks on power amplification, and with regard to getting sufficient current in the power valve, it can be done, but naturally, one has to have a pretty high potential in the last stage. I have tried it myself, and have had a number of milliamperes on the last stage quite satisfactorily. I have had to use 1,000 volts on the last stage, with suitable valves, and with a suitable grid potential, the latter being about 150 volts.

**A Member.**

With regard to improving the quality in a transformer coupled low frequency amplifier, I find the action of a high resistance, of the order of 60,000 to 100,000 ohms, across the secondary of a transformer appreciably improves the quality from a loud speaker, but, at the same time, it decreases the amount of amplification very considerably. I do feel, however, that the increase in quality obtained more than compensates for the loss in amplification. There is another point with regard to the quality in loud speakers. When one is using power valves, like the ES.2, with about 300 volts on the anode, one is passing a good deal of current, and it is putting rather a strain on the high resistance loud speaker. Under such conditions it may improve the quality to arrange a combination of choke coil and condenser to separate the steady anode current from the pulsating speech current.

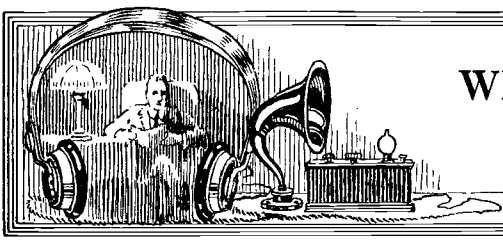
There is much food for thought in the lecture for those engaged in giving trade demonstrations. I do not think I am far wrong in saying that almost as big a depression has been caused in the sale of wireless sets through bad loud speaker demonstrations than through any other difficulty with regard to the licensing regulations.

Even the big wireless companies are not without reproach. I remember recently a representative of one of the big pioneer companies giving a demonstration with a loud speaker, using eleven valves. There was a horrible noise, and I am convinced that anyone who went to the demonstration and had thought of buying a set, was convinced when he came away that he would not.

*(To be concluded.)*

# An American Wireless Award.

Each year the Institution of Radio Engineers presents a sum of $500 to the radio worker whose inventions or contributions to the science are of the most outstanding and practical nature. This year the prize has been awarded to Harold H. Beverage, an engineer of the Radio Corporation of America, for his invention of the "Wave Antenna."



# WITH THE SOCIETIES

Particulars of Membership of any Society can be obtained on application to the Secretary. Societies marked with an asterisk are affiliated to the Radio Society of Great Britain.

### TOTTENHAM WIRELESS SOCIETY.*

A Junior Section of the Society is in course of formation, and those under 18 interested, should get in touch with Mr. E. S. Usher, 12, Alston Road, Edmonton, N.18. Members are asked to note that lectures now commence at 8 o'clock. Those interested, in this and adjoining districts, are cordially invited to become members; all are assured of a hearty welcome.

Hon. Sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

### WEST LONDON WIRELESS AND EXPERIMENTAL ASSOCIATION.*

The committee has decided to support the newly-formed Western Group Association the provisional title of which is "The Western Metropolitan Association of Affiliated Societies."

On October 23rd Mr. William Casson commenced his paper, constructed upon Professor J. A. Fleming's new work—"Electrons, Electric Waves and Wireless Telephony." The lecturer dealt briefly with each chapter, and at the close of the meeting many members decided to obtain a copy of the book for their own benefit.

Mr. Casson concluded his paper on October 30th, and the manner in which the details were put before the meeting made another most interesting evening.

Headquarters: The Acton and Chiswick Polytechnic, Bath Road, Chiswick.

Hon. Sec., Horace W. Cotton, 19, Bushey Road, Hayes, Middlesex.

### BOROUGH OF TYNEMOUTH Y.M.C.A. RADIO AND SCIENTIFIC SOCIETY.*

At the Society's meeting on November 8th, Mr. Harold Taylor, the editor of the local newspaper, gave a lecture entitled "The Romance of the World's News."

After a most interesting talk in which the speaker outlined the wonderful system involved in the collection and dissemination of news for the press, a lengthy discussion took place upon the value of "Wireless" for this purpose.

Hon. Sec., L. L. Sims, Radio Society, Y.M.C.A., Bedford Street, North Shields.

### CARDIFF AND SOUTH WALES WIRELESS SOCIETY.*

A very interesting evening was spent on Thursday, November 8th, when Mr. L. W. Murkham lectured on the Armstrong circuit, and, using his own portable Armstrong set, assisted by a single note magnifier, obtained extraordinarily good loud speaker results.

Local experimenters will be sorry to hear that owing to ill-health Mr. A. R. Roberts has been compelled to give up his active interest in the welfare of the Society. It is hoped that he will soon be well again.

The apparatus store-room has recently been considerably enlarged to accommodate a fresh stock of experimental apparatus.

Meetings are held every Thursday from 7.30 to 9.30 p.m. at The Institute of Engineers, Park Place, and the Hon. Secretary will be pleased to supply information regarding the Society.

Hon. Sec., P. O'Sullivan, 37, Colum Road, Cardiff.

### WEMBLEY WIRELESS SOCIETY.*

On Friday, November 9th, Mr. W. R. Mickelwright, Hon. Secretary, opened the meeting with a paper on "Comparative Results in Reception." This provoked an interesting discussion, which was followed by demonstrations by Mr. W. A. Robinson, with a four-valve set, and Mr. Mickelwright with two valves and a crystal.

Hon. Sec., 10, Westbury Avenue, Wembley.

### WOLVERHAMPTON AND DISTRICT WIRELESS SOCIETY.*

On Wednesday, November 7th, a lecture entitled "Telephony from its Early Stages," was given by Mr. Arnold A. Devey.

The lecturer treated the subject lucidly from a historical and practical point of view, and took his audience back to the very early experiments, leading up step by step to the most modern methods in use at the present time.

Various systems employed in connection with telephonic communication were outlined in considerable detail and supported by blackboard diagrams, many intricate circuits being drawn to illustrate the points of the lecture.

Transmission and reception, both in landline and wireless, were fully dealt with, and the lecture proved of considerable technical value to the experimenter.

Hon. Sec., J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

### FULHAM AND PUTNEY RADIO SOCIETY.*

On October 26th, Mr. G. G. Blake, A.M.I.E.E., A.Inst.P., delivered a very instructive and interesting lecture on "The Birth and Development of Radio Telegraphy and Telephony." The lecturer explained the relativity of the electron to the more commonly known objects, and proceeded to show the gradual improvement and growth of radiotelegraphy to its universal and efficient use of to-day. Some very interesting slides were shown, which dealt with the circuits and instruments used by the many early experimenters.

Hon. Sec., H. Finlay, 169, New King's Road, Fulham, S.W.6.

### SOUTHAMPTON AND DISTRICT RADIO SOCIETY.*

A general discussion on radio matters was held on November 1st. Several members sought the elucidation of their difficulties, and much helpful advice was given.

Mr. Bateman exhibited a neatly constructed home-made loud speaker, with which excellent results are obtainable.

On Thursday evening, November 8th, Mr. Bateman lectured on valves. He dealt with his subject very exhaustively, touching upon all phases of the valve, from construction to final operation, afterwards describing several interesting and useful circuits.

Hon. Sec., P. Sawyer, 55, Waterloo Road, Southampton.

### ILFORD AND DISTRICT RADIO SOCIETY.*

On November 1st Mr. Cooper lectured on "Patents." Although not directly connected with radio, Mr. Cooper's remarks proved of great interest. As experimenters we all hoped that some day we shall be able to make practical use of the hints and advice which the lecturer gave us with regard to taking out patents.

Hon. Sec., L. Vizard, 12, Seymour Gardens, Ilford.

### KENSINGTON RADIO SOCIETY.*

At the November meeting, held at 2, Penywern Road, S.W., on Thursday, November 1st, the Club exhibit for the All-British Wireless Exhibition was on view.

In the absence of the lecturer, who was to have given a demonstration of the Flewelling circuit, Mr. M. Child gave a most interesting and instructive demonstration of capacity measurements.

Particulars of the Society will be supplied on application to the Hon. Sec., J. Murchie, 33, Elmbank Gardens, Barnes, S.W.

### WALTHAMSTOW AMATEUR RADIO SOCIETY.*

The members of the Society spent a very pleasant evening on Thursday, November 1st, when Mr. Dowding, Mr. Rogers and "Ariel" of the Technical staff of "Popular Wireless" came down to Walthamstow to describe and demonstrate the P. W. Dual Combination Set.

Touching briefly each phase of dual amplification from its first discovery, Mr. Dowding very ably described all the intricacies of this subject in such a manner that even the rawest recruit to the ranks of wireless amateurs could not fail to understand.

Hon. Sec., H. J. Sarson, 29, Maynard Road, Walthamstow, E.17.

### HORNSEY AND DISTRICT WIRELESS SOCIETY.*

On November 12th Mr. G. Mulch gave a very able and impromptu lecture on "Testing the Capacity of Condensers." Although the lecture was delivered without prepared notes, Mr. Mulch disclosed an intimate knowledge of the subject and an exceptional familiarity with the use of equations for ascertaining the exact values of condensers and coils.

On November 13th ten members of the Society visited Marconi House, where the transmitting station of the British Broadcasting Company was demonstrated to them by Mr. Peterson, of the Marconi Company. They afterwards visited the Studio at 2 LO, where an interesting half-hour was spent. Mr. Carter, of the Chief Engineer's Department, acted as guide, and subsequently introduced each member to Mr. Arthur Burrows, who extended a cordial welcome to the visitors.

Hon. Sec., Mr. H. Hyams, 188, Nelson Road, Hornsey, N.8.

### BRIGHTON AND HOVE RADIO SOCIETY.

On Thursday, November 15th, the members had, instead of the usual lecture, a very interesting debate on the "Advantages and Disadvantages of High against Low Frequency Amplification." As was expected, the subject proved a very interesting one, and was much appreciated. Capt. Hoghton, the President, explained various problems that occurred during the debate.

Hon. Sec., D. F. Underwood, 68, Southdown Ave., Brighton.

### MANCHESTER RADIO SCIENTIFIC SOCIETY.*

On Wednesday, October 24th, Mr. C. G. Boullen gave a very interesting talk on "Battery Charging from A.C. Mains." The lecturer brought examples of rectifiers which had been found efficient in practice and which aroused the interest of the members present. This was followed by a short discussion on "Frame Aerials," opened by Mr. Bayley.

On Wednesday, October 31st, Mr. Jackson read a paper on "Battery Charging from D.C. Mains." This proved very interesting and instructive, and many members took the opportunity of asking the lecturer questions in connection with this important problem in wireless.

On November 7th, owing to the unavoidable absence of Mr. Southern, who was to have given a lecture on "Batteries," the chairman stepped into the breach and gave a talk about his own four-valve set, on which very good results have been obtained. He described with diagrams on the blackboard his special type of tuner panel, involving a vario-coupler device. This is extremely selective, and the lecturer recommended the scheme to any members interested.

A considerable number of visitors were present at the meeting on November 14th, and the Society hopes that more "listeners" will come down and become members in due course. A most interesting lecture, illustrated by blackboard diagrams, was given by the Treasurer, Mr. J. R. Halliwell, on "Re-radiation from Receiving Circuits." Prospective members are requested to communicate with the Hon. Sec. Meetings are held on Wednesdays at 7 p.m. until further notice.

Hon. Sec., G. A. F. Mercer, 116, Burton Road, Withington, Manchester.

### SYDENHAM AND FOREST HILL RADIO SOCIETY.*

Mr. A. E. Bowyer-Lowe gave a very interesting lecture on "Radio Measurements," on October 22nd, 1923. A demonstration was given on the new Bowyer-Lowe Wavemeter, and three coils were tested for wavelength; L.25 gave 270 metres, L.35 gave 370 metres, and L.50 gave 522 metres. The manufacturers gave on their cards: L.25, 130-375 approximate wavelength; L.35, 180-515 approximate wavelength; and L.50, 240-730 approximate wavelength.

The Society's aerial was next tested for capacity and found to be 0·00038 mfd.; this information will prove very useful to the Society, as the lecturer went on to say "that serious losses occurred if a condenser was used in series with the aerial of less than half the capacity of the aerial capacity."

Mr. Bowyer-Lowe was asked to give another lecture in the near future.

Hon. Sec., M. E. Hampshire, 139, Sydenham Road, S.E.26.

### REDHILL AND REIGATE RADIO SOCIETY.

The inaugural meeting of the session 1923-24 was fittingly made the occasion for a visit by Mr. L. F. Fogarty, Treasurer of the Radio Society of Great Britain, who delivered an able address on the subject of "Tuning Circuits and Aerial Efficiency." There was a good attendance of members, who followed the lecturer's remarks with the greatest interest. New members are coming in in very gratifying numbers, and the Secretary looks forward to a very useful and interesting session.

Hon. Sec., C. W. Johnson, Y.M.C.A., 111, Station Road, Redhill.

*Photo*: G. Phillimore (6 DF).

*A 30-watt military set in the field. A photograph taken during recent manœuvres of the 46th division of the Royal Corps of Signals.*

### SOUTH SHIELDS AND DISTRICT RADIO CLUB.*

On Friday, November 2nd, Mr. D. G. Bird gave an interesting and instructive lecture on "Aerials and Primary and Secondary Inductances." Although the attendance was not what could be desired, those members who were present enjoyed Mr. Bird's talk. Mr. R. J. Oliver, who was to have given a paper entitled "Testing W/T Apparatus," was unable to be present owing to business pressure.

Full particulars of membership can be had from the Hon. Sec., W. Smith, 34, King Street South Shields.

### ISLE OF MAN RADIO SOCIETY.

On the opening night of the new session, Councillor G. Gilmore, Vice-President of the Society, occupied the chair, and in a short address he welcomed all members, old and new, to the Society, and its new Club-room. During the course of the evening a congratulatory message on the commencement of the Society's first complete session was broadcast from the Manchester Broadcasting Station. It might be of interest, both to members and others engaged in the hobby or science of radio, to know that a class, conducted by Mr. E. H. Vick, is held weekly at the Society's Club-room, Bowling Green Hotel, Derby Road, on Tuesday nights, at 7.30 p.m., at which progressive lectures on the science of radio, commencing with the elementary principles, will be given. Persons desirous of becoming members of the Society should present themselves for nomination at the Society's Club-room, at the address given above, on any Monday evening at 7.30 p.m., when they will be heartily welcomed.

Joint Hon. Sec.'s addresses, 4 and 14, Thorny Road, Douglas, I.O.M.

### DARWEN WIRELESS SOCIETY.*

On October 20th a party of members of this Society paid an enjoyable visit to 2 ZY, the Manchester station of the British Broadcasting Company.

The new headquarters of the Society were opened by the President, Major E. L. Carus, on Tuesday, November 6th, and during the evening a message of greeting was received from 2 ZY on the Society's apparatus.

On Wednesday, November 14th, the annual general meeting of the Society was held at the headquarters in Railway Road. The Hon. Secretary reported that the membership had increased from 28 to 77 during the last year, and that applications for membership were being received in very satisfactory numbers. The report of the Hon. Treasurer showed the Society to be in a very sound position, having regard to the fact that during the past year the headquarters had been furnished and an experimental six-valve set installed. The Chairman informed the members that the Mayor had kindly consented to be President for the coming year, an announcement which was received with great satisfaction.

The following officers were elected for the coming year: L. Nuttall, Chairman; T. H. Mather, Hon. Secretary; A. Grimshaw, Hon. Treasurer.

The headquarters of the Society are open Monday, Wednesday and Thursday, of each week from 7.30 p.m., and anyone desiring further information can obtain same from the Hon. Secretary.

Hon. Sec., T. H. Mather, 8, Hawkshaw Avenue, Darwen.

### STREATHAM RADIO SOCIETY.*

In the absence of Dr. J. J. Fox, O.B.E., F.I.C., who was prevented by illness from giving his promised lecture on "Polarised Light" at a recent meeting, a lecture was given by Mr. S. H. Naylor on "Valves and their Characteristics."

The lecturer also gave some useful information on direction-finding circuits.

Hon. Sec., S. C. Newton, A.M.I.E.E., "Compton," Pendennis Road, S.W.16.

### BARKING AND DISTRICT RADIO SOCIETY.

A new Society with the above name has been formed, and already possesses a membership of 53. An interesting

programme of lectures has been prepared. At recent meetings lectures have been delivered on "The Elementary Principles of Wireless" and "The Elementary Principles of Electricity and Magnetism" by Messrs. Crook and Bell respectively.

Hon. Sec., C. P. Willen, "Dalkeith," 16, Monteagle Avenue, Barking, Essex.

### SOUTH NORWOOD AND DISTRICT RADIO ASSOCIATION.

A lecture was given on Thursday, November 1st, by Mr. S. O. Pearson, B.Sc., on the subject of "Neon Tubes."

The members were greatly interested in the various methods in which Neon tubes can be applied to radio, particularly as rectifiers, introducing an induction coil for transmission purposes. Mr. Pearson had a good selection of apparatus to demonstrate with, and proved to be one of the best lecturers the Society has had for some considerable time.

Hon. Sec., C. H. P. Nutter, F.R.A., Radio Corner, 243a, Selhurst Road, Norwood Junction, S.E.25.

### RADIO ASSOCIATION OF IRELAND.

A well attended and representative general meeting of the Radio Association of Ireland was held in the Dolphin Hotel, Dublin, on November 6th, when the Association's programme was dealt with. The Secretary stated that it was the intention of the Committee to hold fortnightly meetings for the purpose of lectures, discussions, and, when possible, experimental demonstration and practical work.

The Executive report stated that the membership was increasing satisfactorily, many applications and enquiries coming in from the counties. Relative to branches, the Committee is in communication with interested parties at various centres with a view to forming branches of this Association.

A branch has already been formed at Cork, with Mr. R. N. Halliday as Hon. Branch Secretary.

Hon. Sec., H. Hodgen, Municipal Technical Institute, Kevin Street, Dublin.

### T.O.T. RADIO ASSOCIATION.

The second district meeting of the Trams, Omnibus and Tubes Radio Association was held on October 29th, at the Manor House offices of the Metropolitan Electric Tramways at Finsbury Park, N.4.

Mr. W. Legg, of Messrs. Siemens & English Electric Lamp Company, gave an instructive and interesting lecture on "Crystal and Crystal and Valve Receivers" and demonstrations of Messrs. Siemen's receivers.

At the conclusion of the lecture Mr. Sarre demonstrated a newly built up Reflex two-valve receiver working a small Amplion on one valve, and a large Amplion on two valves, and entertained those present with Lord Curzon's speech, which was clear and strong over the hall (45 ft. by 30 ft.), and could be heard audibly 80 ft. away.

### ASHTON-UNDER-LYNE AND DISTRICT RADIO SOCIETY.

Owing to the small attendance of late, it has been decided to change the meeting night from Monday to Friday. It is hoped, in consequence of this step, that the Society will be better supported by its members.

Hon. Sec., James Hy. Marshall, 22, Warrington Street, Ashton-under-Lyne.

### BARNET AND DISTRICT RADIO SOCIETY.

On Wednesday evening, October 31st, Mr. H. K. Nield lent his five valve set, in which the members took much interest. An informal meeting for discussion was held on the following Wednesday evening, November 7th.

There is still room in the Society for new members, and the Hon. Secretary will be pleased to furnish enquirers with all necessary particulars. All radio enthusiasts, whether or not they are members of the Society, are welcome to attend the open meetings, which are held in the Radio Clubroom, Bells Hill, Barnet, on alternate Wednesday evenings, commencing at 8 p.m. At these meetings lectures and demonstrations are given by representatives of prominent radio firms.

Hon. Sec., J. Nokes, "Sunnyside," Stapylton Road, Barnet, Herts.

### BELVEDERE, ERITH AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

The Society's annual general meeting was held on October 30th, at the new headquarters, the "Radio Club House," Halt Robin Road, Belvedere.

The Chairman, Mr. T. E. Morriss, in his opening remarks, said that now the Society had built their own house, members would have better facilities for experimenting. He also hoped that with the new cage aerial, 60 ft. in height, the signals, both transmitted and received, would be improved.

After some discussion it was agreed that the Society shall in future be known as "The Belvedere, Erith and District Radio and Scientific Society."

At the conclusion of the meeting the Hon. Secretary was presented with a handsome silver coffee service to commemorate the occasion of his wedding in September last.

During the week ending November 10th three evenings were spent in the new headquarters. On Monday the first of a series of elementary lectures was given by the Hon. Secretary, the subject being the "Wireless Wave." Morse instruction was given on Wednesday, and on Friday "The General Principles of Valve Circuits" was the title of a lecture by the equipment engineer, Mr. S. Burman.

Hon. Sec., S. G. Meadows, 110, Bexley Road, Erith, Kent.

### BROMLEY RADIO AND EXPERIMENTAL SOCIETY.

The Society held a meeting at headquarters, The United Service Club, London Road, on November 5th, when a prize set competition was the feature of the evening. Some interesting sets were shown, and very good results were obtained.

The prize for valve sets was awarded to Mr. F. Barber, and for crystal sets to Mr. R. F. Jarrett, while Mr. C. E. Clinch received an additional prize for the most original gadget.

The Hon. Sec., L. R. Stephens, 73, Masons Hill, Bromley, will be pleased to receive any application for membership of this Society.

### TOWER HAMLETS RADIO SOCIETY.

Under the above title a new Society has been formed in the Borough of Stepney for the benefit of radio enthusiasts. The Presidency of the Society has been accepted by Sir W. Preston, M.P.

Prospective members should apply for particulars to the Hon. Sec., Bert Solomons, 410 Mile End Road, Stepney London, E.1.

### B.T.H. RADIO SOCIETY.

The B.T.H. Radio Society held its first meeting at the Liberal Association's Rooms, Gladstone Chambers, Regent Street, on Wednesday, November 7th. This took the form of a musical evening, which was much enjoyed by all present consisting of members and friends.

Some very interesting radio apparatus was on view, including a comprehensive range of valves. One item of special interest was a large water-cooled transmitting valve capable of dealing with very high power, namely, 10 to 20 kilowatts. To work this valve a filament votage of 21 volts is required at 51 amperes. It is interesting to note that this type of valve is used at the American broadcasting station (WGY), transmissions from which have several times been received in Rugby.

The Chairman, Mr. W. Forbes Boyd, expressed the thanks of the Society to the artists who had so kindly entertained them and to the ladies who had assisted with the refreshments, and at the conclusion of the meeting the Secretary, Mr. P. T. Harris, addressed a few words to the members of the Society, urging them to attend the future meetings and lectures as regularly as possible.

Membership is open to members of the B.T.H. Recreation Club, and the Secretary will be glad to receive the names of all desiring to join the Radio Society.

Hon. Sec., P. T. Harris, Radio Engineers' Section, Recreation Club, The British-Thomson-Houston Co., Ltd., Rugby.

### RADIO ASSOCIATION OF BROCKLEY AND DISTRICT.

At a recent meeting Mr. Thomas Hancock gave a detailed explanation and demonstration of his receiving apparatus, which consisted in the main of a three-valve set, comprising one stage of radio frequency amplification, detector and one stage of audio frequency amplification.

The tuner, a most efficient instrument, was made up from instructions given by Mr. F. H. Haynes in *The Wireless World and Radio Review* for July 14th. Mr. Hancock is to be complimented on the excellent workmanship of his set. All wiring was done on the "bridge, bare wire system," and was equal to the work of a professional. The Club apparatus, at present in the hands of the Technical Committee, will be ready at a very early date.

Applications for membership will be warmly welcomed by both the Hon. Sec., at "Grove House," Brockley Grove, Brockley, S.E.4., and the Hon. Asst. Sec., at 2, Henslowe Road, East Dulwich, S.E.22.

### BIRKENHEAD RADIO SOCIETY.

An exceedingly interesting and informative lecture on "Direction Finding" was given by Mr. Maddocks, of Heswall on November 1st. Direction finding during the war formed the chief theme of the lecture, the lecturer dealing with its use to determine the whereabouts of enemy craft before coastal wireless stations were erected by the Admiralty for that purpose.

Hon. Sec., A. H. Readc, 24, Shrewsbury Road, Oxton, Cheshire.

### KING'S COLLEGE (LONDON) WIRELESS SOCIETY.

The new session opened on Wednesday, October 3rd, and at the general meeting held on October 22nd, the following officers were elected for the year:—President, Professor Ernest Wilson, M.Inst.C.E., M.Inst.E.E.; Chairman, Frederick L. Hogg; Hon. Sec., P. Barnes; Treasurer, A. C. Bishop.

Several new members have been enrolled.

On November 7th the Society paid a visit to the General Electric Company's Research Laboratory at Wembley, and this proved a decided success, over 50 members being present. A number of visits and papers have been arranged, and the Society should have a highly successful session.

Hon. Sec., P. Barnes, King's College, Strand, W.C.2.

## DESCRIPTION OF EXHIBITS

# ALL-BRITISH WIRELESS EXHIBITION

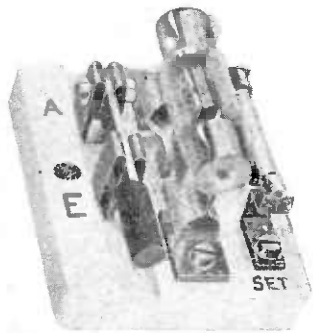
**November 8th-21st, 1923.**

**Messrs. Siemens Bros., & Co., Ltd.**

Amongst the many interesting exhibits on this stand were the Siemens type S.B.39 Broadcast Receiver, which is a three-valve set fitted with a loose-coupled aerial circuit. This arrangement reduces interference to a minimum, and in view of the fact that high frequency amplification is

*The Siemens Loud Speaker.*

made use of, the loose-coupling arrangement extends the receiving range. A switch is provided for taking the third low frequency valve out of circuit. The set is self-contained excepting for the filament battery. It covers a wavelength range of 300/2,800 metres, and consequently is

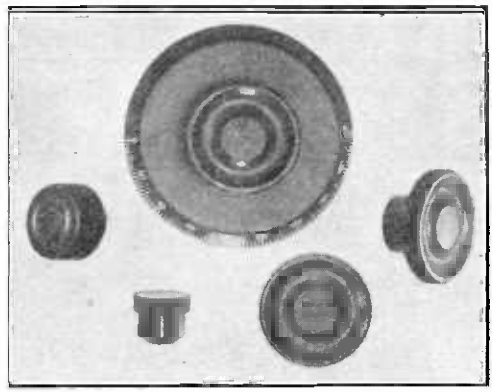



*Aerial protection device of Messrs. Siemens.*

suitable for the reception of Continental telephony. The grid potential is controlled by means of a potentiometer, and this set must be regarded as one of the most efficient three-valve sets. A set of much simpler design is the "V.C." receiver. A two-valve low frequency amplifier, "S.B.36" is a well-designed instrument intended for operating a loud speaker. Siemens' Loud Speaker is well known, and other products include inductance coils, telephone receivers, reliable aerial protection devices, dry cells, batteries and ebonite, all of which are manufactured by this Company at their Woolwich works.

**Messrs. The Solidite Manufacturing Co., Ltd.**

This Company's stand contained much of vital interest to the manufacturer generally, and moulded insulating parts of all kinds could

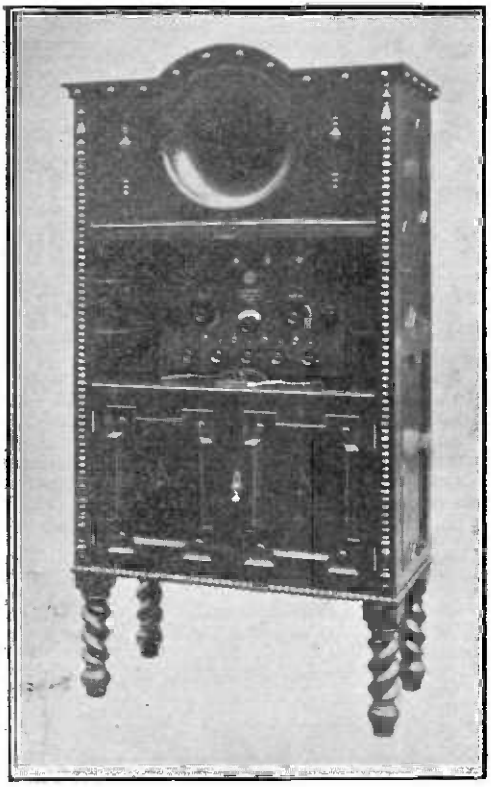


*Mouldings of high-class finish by Messrs. Siemens Bros., Ltd.*

be seen here in great variety. This Company makes a speciality of supplying mouldings to drawings or models, and their products include knobs, valve-holders, sliders, transformers, condenser parts, etc.

**Messrs. The Peto-Scott Co., Ltd.**

The exhibits indicated how carefully Messrs. Peto-Scott have set about the work of providing reliable instruments and components at moderate prices, to meet the requirements of the discriminating experimenter. The "P.2" Eliminator is a



*Pelmer set manufactured by Messrs. Peronet, Ltd.*

very interesting instrument, and has an efficient rejector arrangement, simple to manipulate, and effective for the purpose of eliminating jamming. Among other well-known products of this Company may be mentioned a special Leclanche cell which

*Crystal set by Messrs. W. Vanstone, Ltd.*

is now available for operating valves of the dull emitter type.

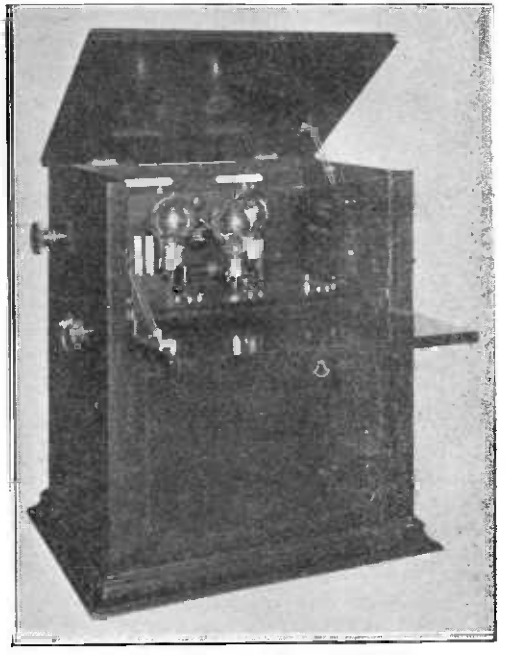
The "Petocite" crystal is claimed to be unusually sensitive.

A useful book which is issued by this Company is full of practical information and contains about 100 circuit diagrams.

*No. 4 valve set of Messrs. The Telephone Manufacturing Co., Ltd., Hollingsworth Works, West Dulwich, S.E.21.*

**Messrs. The Telephone Manufacturing Co., Ltd., Hollingsworth Works, Martell Road, West Dulwich, S.E.21.**

The products of this Company included a complete range of receiving apparatus, four types



*The New Marconiphone "V.3."*

of crystal sets, eight types of valve sets, head telephones and loud speakers. From the many

types of receivers it is possible to select a set to meet the most discriminating requirements, according to the technical details which may be required, and at a price to meet the pocket of the purchaser. There are many original features in the design of these sets.

**Messrs. W. Vanstone, Ltd., 61, Chandos Street, W.C.2.**

The exhibit included several models of "Stanophone" receivers, with various combinations of detector and amplifying valves; also a well-finished crystal set designed on the correct lines. Simplicity of operation is the aim in these sets. Messrs. Vanstone also manufacture an interference eliminator for the purpose of minimising jamming from a local broadcasting station or other sources. A complete range of reliable accessories was amongst the products of this Company.

**Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2. Stand No. 101.**

Their exhibit included a greatly improved modification of the earlier model of the Marconiphone crystal junior and selling at a low price; a Marconiphone valve crystal—a very neat and compact set having a considerable range and produced in a form which makes it very handy and portable; the Marconiphone V.2—a two-valve instrument capable of receiving all the British broadcasting stations from any part of the British Isles; a Marconiphone V.3—a highly selective three-valve receiver possessing sufficient amplification to operate a loud speaker direct at moderate ranges; the Marconiphone V.3 De Luxe, it being the V.3 model embodied in a cabinet of special design and incorporating a loud speaker and all batteries, etc. The Marconiphone V.4 is a super-sensitive long-range four-valve receiver.

**The Western Electric Co., Ltd., Connaught House, Aldwych, London, W.C.2. Stand No. 100.**

As patentees and manufacturers of the Wecovalve (the new pea-nut type valve which operates off a single dry cell), the Western Electric made a special exhibit of this valve and the new Weconomy sets which incorporate them.

A complete line of new loud speakers and also cabinet sets de luxe was exhibited. The apparatus included Wecovalve detectors and amplifiers, frame aerial sets, and Weconomy combined crystal and amplifier sets. Wecovalves were shown with their stocks and adaptors, and the well-known Western Electric headphones.


*Two views of Exhibition stalls.*

A description of some of the exhibits must not be closed without a reference to the arrangements of the Exhibition. The accompanying photographs show two views of the hall which the National Association of Radio Manufacturers reserved for the stands of their members. The Exhibition should do much to induce a brisk trade, particularly over the Christmas period, and we wish every success to members of the N.A.R.M. and those others who shared in their enterprise. Finally, a word of appreciation should be made to Messrs. Bertram Day & Company, who so ably organised the Exhibition on behalf of the trade.

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# Questions & Answers
## Solutions of Readers' Difficulties

*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor,* **The Wireless World and Radio Review,** *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) All questions will be answered through the post. Those of general interest will also be published. (4) Every question, except those under (5) below, should be accompanied by a postal order for* **1s.**, *or* **3s. 6d.** *for a maximum of four questions, and also the coupon taken from the advertisement pages of the current issue. (5) For the benefit of those readers who would rather not pay the charges, a free Questions and Answers Coupon will be placed in the advertisement pages of the first issue of every month. This coupon should accompany the question submitted, together with a stamped addressed envelope. The free coupon is valid for the current week only. (6) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents. (7) Four questions is the maximum which may be sent in at one time.*

**"RESEARCH" (Birmingham)** *asks (1) For criticism of aerial mast. (2) For particulars of telephone transformer windings.*

(1) The arrangement is satisfactory and should not require staying from the top, provided that all other stays are taut. (2) Wind the primary first with 10,000 turns of the No. 40 D.S.C. wire which you have at hand, insulate well, and then wind on 1,000 turns of No. 34 S.S.C. The depth of winding will depend upon the skill with which it is wound. We do not know of a simple book on transformer design, but would recommend you to look up the series of articles on L.F. transformers in the "Wireless Theory" section of this journal, commencing with article XVI, in the issue of July 21st, 1923.

**"BUFF" (West Ham)** *asks (1) For the direction of the aerials of* **2 LO, 5 IT, 2 ZY, 5 WA.** *(2) Power used by these stations and by* **WJZ.** *(3) If a three-valve set (one H.F., rectifier, one L.F.) is giving maximum results if* **2 ZY** *is received at a strength between R1 and R3.*

(1) We would point out that directional effects are not very marked in aerials of the dimensions used for broadcast transmissions, and that in general these aerials are designed to eliminate any slight directional effects that they might possess. (2) The power used by the British Broadcasting stations is of the order of 1½ kW., and that of **WJZ,** 5 kW. (3) A set of this type using reaction should give a strength of at least R5 with **2 ZY** at that distance.

**"C.S.P." (Princes Risboro')** *asks (1) The use of a grid leak. (2) In what respects the plate currents of H.F., rectifying and L.F. valves differ, and why. (3) What would be the effect of substituting in a receiving set a variable condenser of 0·0005 μF for one of 0·00036 μF maximum capacity. (4) Why the proximity of a hand to a receiving set affects the conditions under which the set will oscillate, and why the apposition of a book or piece of metal will not produce the same effect.*

(1) The grid leak holds the grid at a suitable normal voltage. It is customary to connect the grid leak directly between the grid and filament. (2) We are afraid we could not do justice to this point in the space at our disposal, and we recommend that you look up the question in textbooks such as Bangay's "Elementary Principles of Wireless Telegraphy" and "The Oscillation Valve." (3) The wavelength range of the circuit will be increased and if the condenser is used to tune a tuned anode circuit, the tendency of the set to break into self-oscillations will be less when the maximum capacity is being used. (4) The capacity to earth of parts of the circuit are increased by the proximity of the hand. In the case of the book and piece of metal, the capacity to earth is not changed.

**"J.F.J." (Taunton)** *asks how to build a ½ kW. spark transmitter, for which, if successful, he intends to apply for a licence.*

We regret we cannot help you in these circumstances.

**"R.L.S." (Geneva)** *asks (1) For a diagram of a receiver using simultaneous H.F. and L.F. amplification. (2) Whether an iron balcony running the whole length of his aerial and 3 ft. from it will seriously affect signal strength. (3) Whether a certain make of coil is as efficient as basket or duolateral coils. (4) Why the filament resistance is invariably connected on the negative side of the L.T. supply.*

(1) Full details of this type of circuit will be found in the issue of May 12th, 1923 and subsequent issues of *The Wireless World and Radio Review.* (2) The presence of the iron balcony will most

certainly adversely affect signal strength. Aerials should always be removed as far as possible from conducting masses. (3) The coil you mention is duolateral wound, and would be, if anything, slightly less efficient than a coil of the basket type. (4) The negative grid bias is slightly increased when the filament resistance is connected in the negative lead.

**"R.S." (Birmingham)** *asks how a valve can act as a high frequency amplifier when connected to the previous valve by a grid condenser and leak, and why the valve does not act as a rectifier under these circumstamces.*

A certain amount of rectification does actually occur at successive stages of a resistance capacity or tuned anode H.F. amplifier, but it can be kept at a minimum by suitably choosing the values of grid condenser and leak at each stage so that the grids have a suitable normal operating potential.

**"A.T.I" (New Malden)** *wishes to rewind a cylindrical inductance* $3\frac{1}{4}$*" diameter and 5" long, in order to tune from* 180 *to* 2,600 *metres when used as an A.T.I. with a* 0·0005 $\mu F$ *condenser in series or parallel.*

It is difficult to give exact details of the dimensions of an A.T.I., but you will not be far wrong if you rewind the former with No. 28 S.W.G., S.S.C., and take 15 tappings equally spaced.

**"D.W.T." (S.E.15)** *asks* (1) *What relay devices are necessary to operate a buzzer on signals from* **FL, GNF, OST,** *etc., received on a crystal set.* (2) *If L.F. amplification is necessary, or whether a Weston moving coil relay alone is sufficient.* (3) *The name of station (spark) with call letters* **CGH.**

(1) An article in *The Wireless World* of February 5th, 1921, page 768, describes a sinple method of relaying morse signals, which would probably best suit your particular requirements. A buzzer would substitute the morse inker in the local circuit of the relay. (2) At least two stages of L.F. amplification would be necessary to obtain consistent results. The Weston relay might be used in place of the relay mentioned in the article. (3) "The Year-Book of Wireless Telegraphy and Telephony" gives the call sign as that of the ship *Booral.*

**"H.N." (Darlington)** *has constructed an inductance coil which, when used as an A.T.I., shunted by a variable condenser of* 0·0003 *mfd. capacity, gives a wavelength range of* 300 *to* 1,500 *metres, and asks why the maximum wavelength obtainable should be only* 600 *metres when the coil is used to tune the anode circuit of a H.F. amplifying valve.*

The coil gives a higher maximum wavelength when used as an A.T.I. because in this position the wavelength is increased by the capacity and inductance of the aerial itself. If the coil is used in a closed circuit such as the anode tuning circuit and it is desired to cover approximately the same range, turns must be added to make the quantity $L \times C$, where $L$ = the inductance of the coil in $\mu$H and $C$ the capacity of the condenser in $\mu$F the same for the aerial and anode circuits. Try using in the anode circuit a coil having twice the number of turns of your present coil.

**"N.G.D." (Welwyn)** *wishes to design a chemical rectifier and asks for data regarding the area of electrodes, volume of electrolyte, etc.*

The rectifier should be designed to conform with the following conditions:—Current density at electrodes, 0·1 amps. per square in.; volume of liquid, 3·0 quarts per amp; maximum P.D. across each cell, 150 volts. Where the current to be rectified is large, it may be found more convenient to use two or more cells connected in parallel.

**"R.M." (Rothesay)** *asks when the aerial tuning condenser should be used in the "series" and when in the "parallel" position.*

The A.T.C. should be used in parallel when it is required to increase the wavelength given by a particular A.T.I., and in series when it is required to receive below this wavelength. There is a distinct advantage in using the A.T.C. in series for wavelengths below, say, 600 metres; since the value of A.T.I. required to tune to a given wavelength and consequently the potential difference available for transfer to the receiver will be greater.

**"H.J.J." (Exeter)** *asks if the small dull emitter valves now available will give as good results as the ordinary receiving valve.*

The dull emitter valves will give good results when used as H.F., detector, and first L.F. valves, but it may be found necessary in the case of the smaller valves to connect two in parallel for the final stages of L.F. amplification when it is required to operate a large loud speaker.

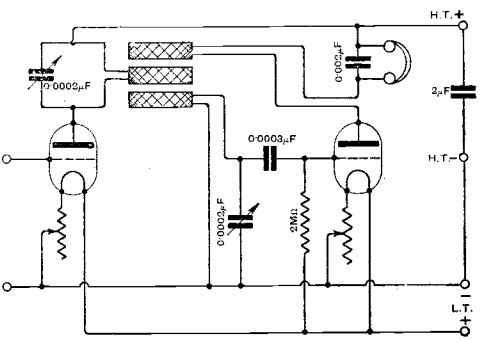


*Fig.* 1. **"P.K.C." (Southport).** *A transformer coupled valve with reaction, using a three-coil holder.*

**"P.K.C." (Southport)** *asks how a three-coil holder may be used to couple a detector valve to the preceding H.F. valve.*

Two of the plug-in coils should be used respectively as primary and secondary of the H.F. transformer and the third should be used as the reaction coil and coupled to the transformer secondary. The diagram in Fig. 1 will make clear the method of connecting the coils. When the transformer coupling is loose, both windings must be tuned to the wavelength of the incoming signal. This method of H.F. coupling is highly selective and may be used with advantage where local interference is experienced.

"**H.W.**" **(S.E.4.)** *asks* (1) *How to make variable grid leaks specified in the Flewelling circuit* (*April 21st issue*, 1923). (2) *Data for a Neutrodyne receiver* (*April 21st issue*, 1923) *to operate on* 2,600 *metres wavelength.*

(1) The variable grid leak described on page 550 of *The Wireless World and Radio Review* of July 28th, 1923, should meet your requirements. (2) There is not much advantage to be gained by using the Neutrodyne circuit on wavelengths above, say, 1,000 metres. We recommend that you use the resistance capacity method of H.F. coupling for this wavelength.

"**SOUND**" **(Teddington)** *referring to the resistance coupled L.F. amplifier described in the issue of May 19th, 1923, asks* (1) *and* (2) *If* 50 *plates are required in each of the intervalve coupling condensers.* (3) *The capacity of the above condensers.*

(1) and (2) Fifty plates are required in each condenser. (3) The capacity will depend upon the nature of the paper used; it should be of the order of 0·05 $\mu$F.

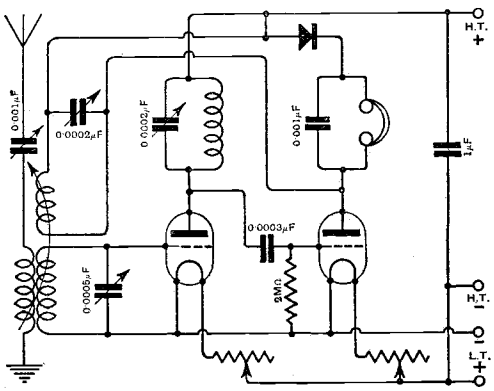


*Fig.* 2. "**A.T.**" **(Co. Cork).** *A receiver with two stages of H.F., tuned anode coupling, and crystal rectifier.*

"**A.T.**" **(Co. Cork)** *asks* (1) *For comment on a loose coupler described.* (2) *For a comparison of the "tuned anode" and "transformer coupled" methods of H.F. amplification.* (3) *The range of a receiver using two stages of H.F. amplification with crystal rectification.*

(1) The tuner described should be quite efficient, and would give a wavelength range of approximately 200 to 650 metres. (2) Of these two methods the "tuned anode" is probably the better from the point of view of efficiency. A circuit diagram is given in Fig. 2. (3) If reaction is employed, the range should be at least 300 miles with a good aerial.

"**H.A.M.**" **(Liverpool)** *asks* (1) *For dimensions of anode tuning coils to tune to* 600 *metres maximum for use in Circuit No.* 60 *of "The Amateur's Book of Wireless Circuits."* (2) *Whether Circuits* 60 *and* 55 *in the above book could be combined by the use of change-over switches in the anode circuits.* (3) *Value of anode resistances for use with "V.24" valves.* (4) *Whether serious loss of efficiency would result from the use of switches regulating the number of valves used.*

(1) You might wind the anode tuning coils on cylindrical formers, 3" in diameter, using 150 turns of No. 30 S.S.C. Eureka resistance wire on each. About ten tappings equally spaced will give all the flexibility required. (2) Yes. (3) The value depends upon the voltage of the H.T. battery. Resistances of 50,000 ohms with 75 to 100 volts H.T. should give good results. We note that you propose using resistance coupling above 600 metres; it would be better if you arranged to change over at 1,000 metres instead, as this method of coupling works best above that wavelength. (4) Unless great care is exercised in the layout of the wiring, serious losses are likely to be introduced as a result of the use of switches in a H.F. amplifier, especially on short wavelengths.

"**V.H.K.**" **(Port Elizabeth)** *wishes to add a valve to his receiving equipment for long wave reception, and asks whether it would be better to use it as a separate heterodyne, giving accurate tuning, or as an additional stage of H.F. amplification.*

We doubt whether full advantage would be gained by the closer tuning to be obtained by using a separate heterodyne, on account of the large damping which generally exists in long wave coils, and we should therefore recommend that the valve be used as a H.F. amplifier.

"**C.W.R.**" **(Bloemfontein)** *asks* (1) *Whether it is necessary to increase the H.T. voltage when changing over from "tuned anode" to "resistance capacity" H.F. coupling for long wave reception.* (2) *Whether H.F. couplings other than the above would be preferable from the point of view of stability and ease of adjustment.*

(1) When resistance capacity coupling is used, the H.F. voltage should, in general, be doubled. (2) We think that the methods mentioned in Question (1) would be preferable, provided that semi-aperiodic anode coils are used on short wavelengths.

"**K.A.C.**" **(N.W.10)** *asks questions about the "Five Circuit Receiver" described in May 26th issue*, 1923.

(1) In Fig. 10 of the article, the peg j 1 is not required. (2) You might omit the 0·001 $\mu$F near the crystal detector and note whether it affects the working of the set. (3) and (4) The relative position of crystal and output is immaterial.

"**W.D.C.**" **(Gateshead)** *points out that the H.F. tuning condensers in Fig.* 4 *of the article on "An Interesting Seven-valve Receiver" in "The Wireless World and Radio Review" of June 16th,* 1923, *are across the secondary instead of across the primary as mentioned in the text.*

The tuning condenser may be put in either of these two positions. We would, however, recommend you to follow the circuit diagram given in Fig. 4 of the article.

"**W.J.T.**" **(Norbiton)** *asks* (1) *For the meanings of several telegraphic code prefixes.* (2) *The stations having certain call letters.*

"The Year-Book of Wireless Telegraphy and Telephony" (Amateurs' Edition) contains most of the information you require.