THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 181 [No. 18. Vol. XI.] FEBRUARY 3RD, 1923. WEEKLY

The Radio Conference

ON the afternoon of Wednesday, January 24th, at the Institution of Electrical Engineers, was held the Annual Conference of Societies affiliated with the Radio Society of Great Britain.

It sometimes happens that with a well-established event the circumstances under which it originated may be overlooked. It may therefore not be out of place to consider for a moment what led to the inauguration of the Annual Conference of Wireless Societies, particularly for the information of those who have only during the past year begun to interest themselves in wireless matters.

The Radio Society of Great Britain, in former years known as "The Wireless Society of London," had taken upon itself the work of representing the amateurs and experimenters of Great Britain, to voice their wishes and feelings wherever it was necessary to give expression to them. In fact, one of the objects of the Society is to act as the champion of the amateur and experimenter in this country in protecting his interests wherever such action is necessary.

The idea of affiliation of Provincial Societies to the London Society was the outcome of the endeavour to represent in one voice the opinion of the amateurs all over the country.

The conference of delegates from provincial societies with the officers of the Radio Society of Great Britain, was very naturally a part of the general affiliation scheme, and therefore these conferences may be regarded as the means adopted for feeling the pulse of the amateurs. These Conferences present the opportunity for an expression of opinion, not only to form a guide to the Radio Society of Great Britain in its policy, but also to arrive at decisions regarding any action which the amateurs as a collective body may wish to take. The Conference may be said to result in direct action, since the very purpose of the Conference is for the expression of opinions of amateurs as a body, and it would be unreasonable to suppose that a definite resolution passed by that Conference would not be put into effect at the earliest possible moment.

It is perhaps well to emphasise that this Annual Conference has no power to concern itself with the internal organisation or policy of either the Radio Society of Great Britain or of any of the societies affiliated, and represented at the Conference. Mention is made of this point since, for amongst the delegates from affiliated societies at the Conference just held, there was one who apparently misunderstood the purpose of the Conference, and supposed, until corrected, that the delegates from other societies were invited to make suggestions regarding internal affairs of individual societies.

The Conference on this occasion was even more fully attended than usual. No doubt this is partly due to the very considerable increase in public interest in wireless during the past year. It is somewhat surprising that, after so busy a year, the items on the agenda for discussion should not have been more numerous than was the case.

A report of the proceedings of the Conference will be published in this journal in due course, but it is perhaps of interest to summarise briefly the matters which claimed attention, and, with this object in view, they will be considered in the order in which they were dealt with. The Radio Society of Great Britain had felt for some time that the views of the provincial societies on matters of importance could perhaps be more adequately expressed if conferences were held at more frequent intervals than once a year, and with this object in mind, some tentative suggestions were circulated to the affiliated societies for

their views in order that the matter might be discussed at the Conference.

The net result of the expression of these views, and the subsequent discussion at the Conference, indicated that the present arrangements were considered to be adequate for the time being, and many delegates spoke to the effect that their societies were well satisfied with the arrangements as they stood at present.

The next matter which was dealt with was the British Wireless Relay League. It will be remembered that in a recent issue of *The Wireless World and Radio Review* reference was made to the fact that the Manchester Wireless Society had requested that the subject of the British Wireless Relay League should be included on the agenda of the Conference in order that its organisation might be discussed and the way paved for fuller co-operation of all societies in the organisation of the League. The formation of such a League met with very considerable support from the delegates present at the Conference, and the Radio Society of Great Britain intimated its desire to associate itself with the development of the scheme. It was, however, pointed out that whereas in the U.S.A. the American Radio Relay League is a very large organisation formed expressly for the purpose of relaying messages from point to point, work of this nature would be more restricted in Great Britain. This is largely due to the fact that the area over which these transmissions are to be conducted is small in this country in comparison with the vast stretches of country in the United States of America. It was indicated, however, that a wider field was open, since co-operation in some such scheme had been invited by amateurs in France and elsewhere, and therefore, with the assistance of the American amateurs, and especially in view of the extraordinary success of the recent Transatlantic Tests, there appeared to be scope for the Relay League to develop on international lines.

Mr. P. R. Coursey who, as readers of this journal are aware, has conducted on this side the work of organising the Transatlantic Tests, indicated that there was much additional work which a Relay League could undertake beyond the mere relaying of messages, and his proposals will be given in the report of the Conference to be published later.

The subject of broadcasting was included on the agenda, and was divided under two headings: (1) How broadcasting affects the amateur licensed to transmit, and (2) the amateur licensed for experimental reception only. Many opinions were expressed on this subject, and it was generally recognised that the work of the amateur, particularly in experimental transmissions, had been considerably affected by the introduction of broadcasting, but at the same time it was realised that there were many compensations provided by broadcasting itself. In many cases of experimental work it was extremely valuable to have telephony transmissions on which one could rely, both as regards time and wavelength, and this was particularly useful in conducting experimental work with distortionless amplifiers, loud speakers, and other types of speech reproducing instruments.

Mr. Reith, General Manager of the British Broadcasting Company and a member of the Radio Society of Great Britain, was present and took upon himself to reply to some points which were raised. His remarks did much to clear up certain matters with regard to some of the difficulties which had arisen between the experimenter and the Broadcasting Company, and his clear statements satisfactorily defended the action of the Company. He emphasised the debt which the Broadcasting Company and the public generally owe to the work of the amateur and experimenter, and in his capacity as General Manager of the Broadcasting Company he assured the Conference that his Company, far from having any antagonistic feelings towards the activities of amateurs and experimenters generally, welcomed and valued their co-operation, and under no circumstances would the Broadcasting Company ever take any steps which would adversely affect the work of the experimenter.

For the first time in the history of these Conferences no special resolutions were passed, and no new proposals for the conduct of amateur activities were outlined. The first impression might be that on this account the Conference had not achieved so much as in past years, but on reflection one realises that it is a strong indication that there are no serious grievances to give voice to. It is of course realised by every amateur in the country that everything is not quite as it might be, but at the same time it is understood that, in all development and progress, perfection cannot be attained in the initial stages, and it behoves everyone to exercise reasonable patience and to contribute what he can to facilitate the tasks of others.

A Chat with "The Voice" at 2 LO.

AMIDST a sequence of telephone calls and visitors, Mr. Burrows was able to give *The Wireless World and Radio Review*, at Magnet House, Kingsway, the other afternoon, some ideas of his experiences to date.

"As broadcast wireless telephony goes, I suppose I can claim to be a veteran," he said. "My views on this subject were expressed in the *Year Book of Wireless Telegraphy*, 1918, and in an article written some months before. My first serious essay in this direction was a week's programme transmitted in North Atlantic at the end of July, 1920. The C.P.O.S. *Victorian* was then equipped with a 3-kilowatt telephony transmitter, and our concerts were heard at ranges up to 1,200 miles. As the *Victorian* was riding light, and I am not a good sailor, the voyage will remain long in my memory. The North Atlantic programmes were freely encored, ships from all points of the compass up to 600 or 800 miles 'chipping in' on 600 metres at the end of each item and passing an opinion. Needless to state, after the 1920 experience, it was somewhat irksome to have to sit tight in London and watch the growth of broadcasting in America.

Mr. A. R. Burrows whose voice at 2 LO is so familiar.

Copies of this picture can be obtained from the Publishers of The Wireless World. See announcement under Notes in this issue.

"We are hoping to show that England, though late, as usual, in starting systematically, will not be long in overtaking her rivals. By singular good fortune and with the collaboration of Mr. W. J. Crampton, the Covent Garden engineer, we were able to mark the opening of our official duties by arranging for the broadcasting of the excellent performances of Grand Opera by the British National Opera Company, Ltd., at Covent Garden. Mr. Crampton will be known to many of your readers as a most keen experimenter; his station has been heard, I understand, as far distant as Nice.

"Only an agreement amongst the principal members of the Broadcasting Company whereby the several companies sink their identity in the one title restrains me from mentioning those to whom we are particularly indebted for the technical success of the experiments. In view of the fact that we had no choice in the selection of sites for the two microphones employed, I think it may safely be classed amongst the most ambitious and most successful series of transmissions yet attempted on this or the other side of the Atlantic.

"The effect upon the British industry, I am told, has been very marked. This is very gratifying to one whose business it is to provide from behind the scenes such a standard of programme as will not merely maintain, but will intensify the interest now created.

"Have I had any unusual experiences to date? Yes, many of a most pleasant character, some amusing, and one or two sad. The most delightful, unquestionably, have been the nume-

rous letters of appreciation, seasonable cards and gifts to charities, to my staff and myself from 'children of all ages.' We broadcasters have struck a world of live fairies, open-hearted folk quite apart from the world as presented in everyday life. I can assure you that no day is too long in which to work for such a community. I only wish it were possible, too, to reproduce some of the hundreds of letters expressing in 'baby language' the delight our bedtime antics have given to the young folk.

"The Wireless Orchestra" at **2LO** *poses for "The Wireless World." Standing on the right is Mr. Stanton Jeffries, Musical Director of the British Broadcasting Company.*

"Wireless humour takes many forms. During the last week of Grand Opera we were threatened with shooting if we permitted interpolations during the performance of 'Valkyrie.' You noticed, perhaps, that there were no interpolations. This was not due to the threat, but to the fact that 'Valkyrie' did not lend itself to such treatment.

"Amongst the humours of broadcasting we can class many amusing criticisms in prose and rhyme, not excepting letters sometimes suspiciously feminine in origin respecting the identity and domestic life of those who take part in the wireless programmes. The erroneous suggestion, too, that we have come under church influence in our decision not to broadcast during the hours of Divine worship, has caused many a smile amongst those concerned.

"Midway between humour and the pathetic are to be found such things as requests in all good faith that we should broadcast messages to the planetary system, or jam certain other stations alleged to be exerting a malign influence over those within range.

"A few days ago as I was leaving for lunch, a stranger requested an interview on an urgent matter. He approached me in a most business-like way, stated that despite the character of his story he would come to the point at once. Would I kindly broadcast without delay the fact that his wife and £40,000, their joint property, had just been abducted?

"What are our plans for the future? Well, the first business is to get all the necessary stations functioning. Cardiff is practically ready, and may start any day. Glasgow will have a station working before the end of March.

"Our ambition then will be to so ring the changes in the style of programme that every popular interest will be catered for at reasonable intervals. We hope to settle our programmes a week and possibly a fortnight ahead, so that listeners-in can adjust their several engagements so as to meet their wireless

tastes. There is no form of entertainment under the sun that can claim the attention of its adherents seven nights a week and yet not surfeit them.

"Whilst the concert side of broadcasting will always have a strong appeal, I believe the permanence of this new development will depend rather on the manner in which the instructional and educational sides are developed. The wealth of romance yet untouched which lends itself peculiarly to treatment by wireless, is enormous; our task is to find persons capable of recognising the raw material, refining it, and able to present it in an attractive form.

"It may be taken for granted that the success of the Covent Garden experiment will lead to other equally important applications. We have shown that intricate musical sounds can be collected from a building without any interference with its structural or acoustic arrangements. How much less difficult should be the broadcasting by similar means of human speech, and how great the field here awaiting development.

"I would, however, ask indulgence in one respect. We are yet without permanent offices, owing to certain circumstances of a technical character. Until our new and permanent studio is ready, there are limitations upon our programmes which would not otherwise exist, difficulties which only arise when dealing with music on a large scale.

"*The Wireless World and Radio Review*, which I regard as specially catering for the experimenter, will perform a kindness if it permits me to express to those possessing transmitting licences, my high appreciation of the sacrifices which they must have made in foregoing transmission during broadcasting hours on the wavelength fringing the broadcasting band. No one is more sensitive than myself to the kindness of these experimenters, and I regret if in calling isolated defaulters to order, we may have attached to others in any one locality a suspicion that was unjustified. We would like the class of true experimenter to know that they have friends and not enemies in the staff of the British Broadcasting Company, who are appreciative of the fact that the progress made by Britain will be dependent to a marked degree upon the co-operation of all followers of this fascinating branch of applied science.

"Now I think it is time for a repetition of the old formula—except for this elaboration—2 LO, 5 IT, 2 ZY and 5 NO closing down."

EXAMINING BROADCAST INSTRUMENTS AT THE G.P.O.

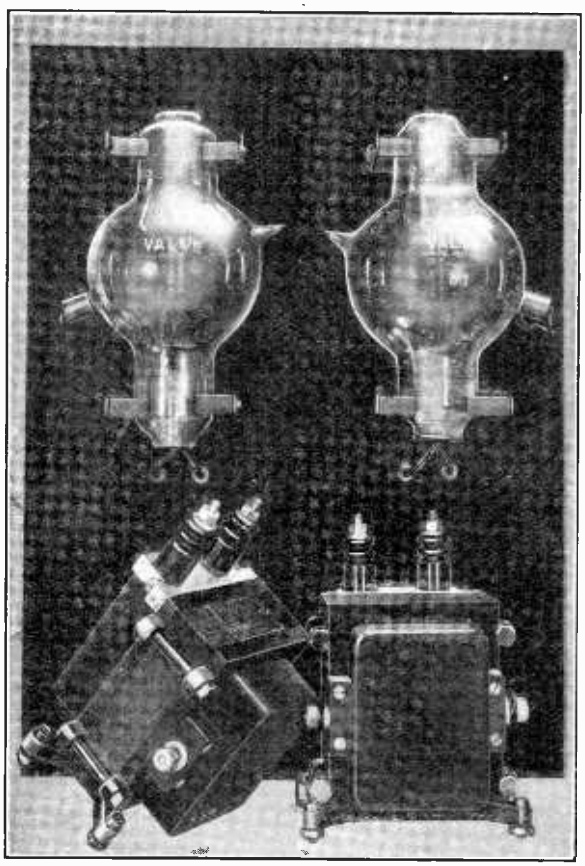
Some of the Apparatus submitted to the Post Office for approval by manufacturers of broadcast receiving equipments.

Experimental Station Design

XIX.—RECTIFIED H.T. FOR C.W. AND TELEPHONY TRANSMITTER.

IN the last instalment under this heading a description was given of the method of setting up a low power C.W. and telephony transmitter. The present article describes a method of obtaining the necessary high potential current required by such a transmitter, and is based on the principle of stepping up moderately high frequency alternating current and rectifying by means of suitable valves.

The first consideration is the transformer which provides the requisite current for heating the filaments of the rectifying valves. It is a low voltage transformer of course, but it is essential that very good insulation be provided between the primary and secondary, as the full high tension potential exists between these windings. Fig. 1 shows the general principles to be adopted in building up a transformer of this kind. Insulation is effected between the windings by means of an ebonite tube having a wall thickness of about $\frac{5}{64}$ in., whilst the secondary winding does not completely cover the primary winding in order to leave insulating surfaces at the ends. These surfaces can be further increased and insulation thus improved, if screw threads are cut upon them, the threads serving also for attaching the end cheeks of the secondary winding. Definite data as to the windings cannot be given, as it will depend upon the power and frequency to be employed, and must be estimated or calculated, final adjustment being made by experiment and the use of a series choke coil if required. The amount of iron employed in the design given is quite suitable for powers up to 100 watts on frequencies exceeding 250 cycles. The core wires of the two limbs are assembled centrally around the soft iron rod and are wrapped tightly together by means of a layer of adhesive insulating tape upon which the primary, which should be a wire having a double cotton covering, is wound. The end primary turns should be held in by means of tapes as was shown in the issue of September 30th last. Tape may also be wrapped over the primary winding, if necessary, in order to make the insulating tube fit tightly. The secondary winding is put on after the cheeks have been fitted in position, the end turns being secured by means of tapes as before. If the making of the screw threads is not convenient the cheeks may be held together by means of an insulating tube which fits over the top of them, and to which they are attached by a number of 6 BA screws. If



Rectifier Panel with a pair of step-up transformers, which when connected in series, provide a mid-point tap.

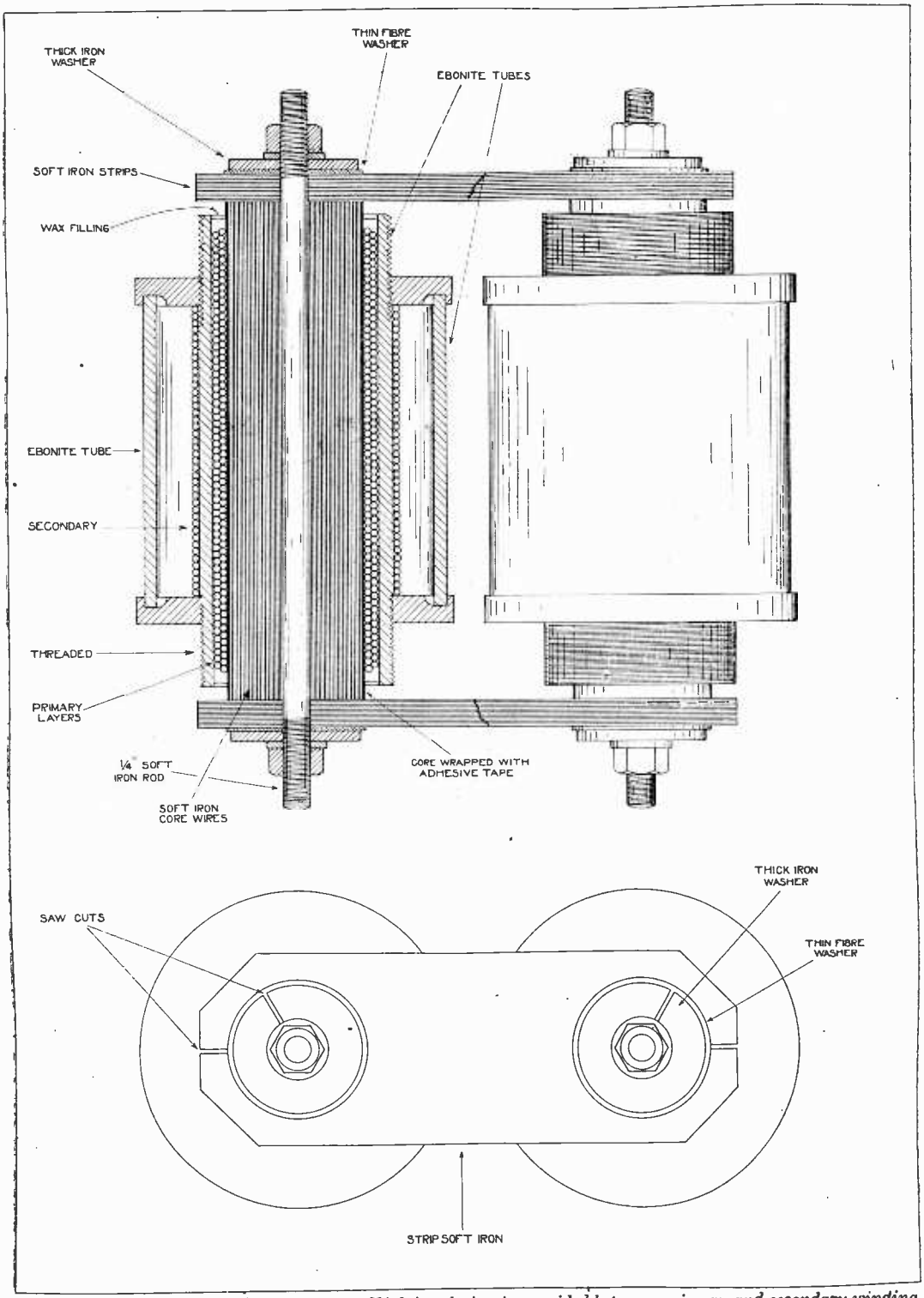


Fig. 1. Filament Heating Transformer. High insulation is provided between primary and secondary winding. Approximately half full size.

this latter arrangement is adopted the cheeks must be a good fit on the tube which covers the primary. With patience these cheeks may be made without a lathe by carefully filing down to scratch lines, and as the screw threads cannot be made without a lathe, it is assumed that a tube will be fitted over the cheeks and consequently the grooves on their inner faces will not be required. On the completion of the cores with the windings hot wax is run into the ends of the primary.

The end plates are cut from soft iron strip, which can easily be obtained in almost any width. Each plate is drilled in turn, and the saw cuts which are provided in order to minimise eddy current loss are made when the plates are clamped together in the vice. Stiff washers are placed under the end nuts, and in order to provide a little "give," thin fibre washers are arranged under them. There is no difficulty in assembling, if the core wires are all true to length, and there should be no difficulty in this respect as they can be purchased already cut to any exact inch.

A second transformer will be required to provide a step-up in potential. In outline it may be similar to the one described above except that the secondary winding will consist of a large number of turns of No. 30 or 32 S.W.G. single silk-covered wire. The secondary will consist of a number of flat disc windings about $\frac{1}{8}$ in. in width. These must

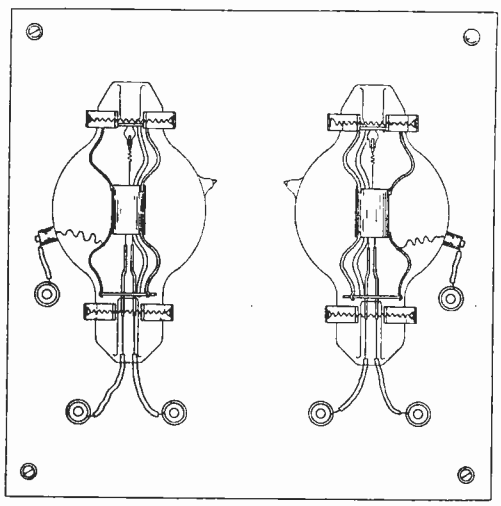


Fig. 2. Lay-out of Rectifier Panel.

be wound on a former consisting of spindle, spacing washer and two flat plates. A larger space must be given between the two limbs of this transformer in order to eliminate any chance of sparking across.

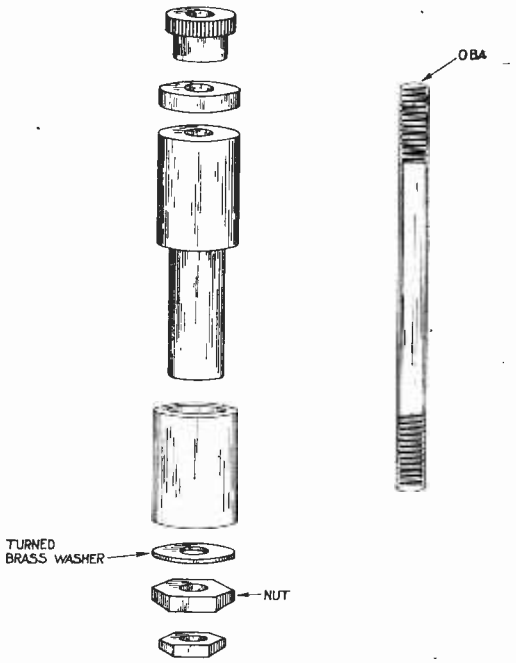


Fig. 3. Insulating Bushes.

The type of valve adopted for rectification obviously governs the design of the panel. The reader is recommended to adopt valves of liberal rating with regard to the power he proposes to use. The panel shown in Fig. 2 is arranged to carry valves rated up to 100 watts capacity, though they can be operated with a much smaller output. The panel is of polished slate, such as can be obtained from specialists in this class of work, and who advertise from time to time in this journal. Slate can be easily drilled with an ordinary morse drill and brace, though it should be remembered that the size of the hole will be slightly larger than the size of the drill with which it is made. This is important when making the holes which carry the ebonite bushes for the filament and plate leads. A design for these bushes is given in Fig. 3, being turned in ebonite. For simplicity ebonite tube $\frac{1}{2}$ in. in diameter, and having a $\frac{1}{4}$-in. hole, may be adopted, and the actual leads from the valves passed through these tubes, which must fit tightly in the holes made in the slate.

Holders for the valves are shown in Fig. 4, in which sufficient detail is included to show the method of construction. Fig. 5 is the

circuit diagram of the rectifier. The condenser shown across the secondary of the plate current transformer may not be necessary, as will be shown by experiment, and in any case should not have a value exceeding 0·0003 μF. The other condensers which are for the purpose of smoothing out ripple, must, like the one just mentioned, be capable of standing high potentials, and consequently should consist of a number of mica condensers assembled together and connected in series. If the reader attempts to make condensers of this sort himself, he must select the best ruby mica for the purpose. If it has a thickness of 0·002 in. then four condensers in series should be suitable for voltages not exceeding 1,800. The capacity of these condensers will depend upon the frequency of the generator and for a frequency of 300 cycles condensers having a value of 0·2 μF will suffice. One is cautioned against operating the rectifier without taking a load. If this is done there is a great danger of breaking down the condensers. The choke coil shown between the condensers may have similar core construction to that adopted in Fig. 1, but possessing only one winding of No. 28 S.S.C. on each limb, and if these windings are well insulated from

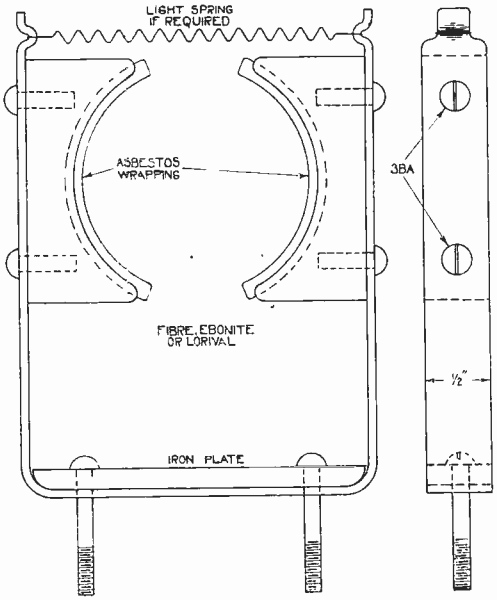


Fig. 4. Clips for supporting valves.

one another, better smoothing effects may be obtained by correcting one in each lead from the rectifier, making sure, by experiment, that they are correctly connected as to direction. The outfit described above might appear to involve a big expenditure, but the reader

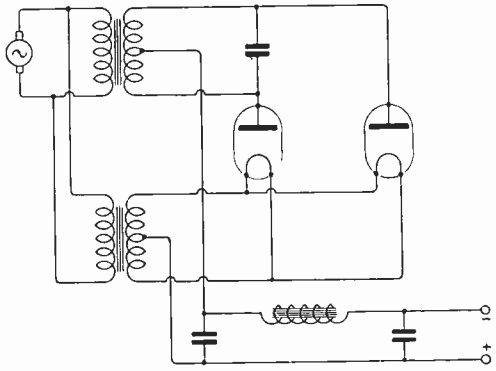


Fig. 5. Circuit of Rectifier.

whose purse is limited is reminded that there is still a great deal of second-hand high tension transformer apparatus on the market which is admirably suitable for stepping-up or choke purposes, or if rewound can be used for filament heating. Owing to the somewhat limited demand for this class of apparatus, the prices are by no means excessive. F. H. H.

Note.—Although it was the original intention in articles under this heading to give designs of special value to the beginner, departure has had to be made owing to the widespread demand for particulars of simple telephony transmitting apparatus. Now that the information has been placed on record, this space can in future issues be allotted to articles of a less advanced nature.

Dimensions of the Amateur Aerial

Although the regulations relating to dimensions of aerials permitted for amateur and broadcast reception purposes have been published in this Journal, and also frequently stated in replies to queries in the Questions and Answers columns, there still appears to exist some doubt on the matter. The maximum aerial length is stated as 100 feet, as measured from the far end of the aerial to the aerial terminal of the apparatus. Multiple aerials, consisting of a number of wires, each totalling 100 feet with the down lead, may be adopted, and from this point of view it would appear that when a "T" pattern aerial is employed, only one-half of the horizontal length is taken, in estimating an aerial arrangement conforming to the regulations.

Electrons, Electric Waves and Wireless Telephony—XVIII.

By Dr. J. A. FLEMING, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication. The articles are therefore copyright, and rights of publication and reproduction are strictly reserved.

4. Reception of Wireless Telephonic Speech.

We have then to describe the arrangements in the practical receiving apparatus. The use of a single rectifying valve or a crystal in the receiving circuit as already described is only suitable for short ranges of 10 or 20 miles, or so, from fairly powerful transmitters. In actual wireless telephony over great ranges it is necessary to employ amplifying valves to magnify the oscillatory currents in the receiving circuits.

We have already explained that this amplification can take place on the high frequency currents set up in the aerial wire and associated circuits by the carrier waves, or it may be effected after rectification of the high frequency

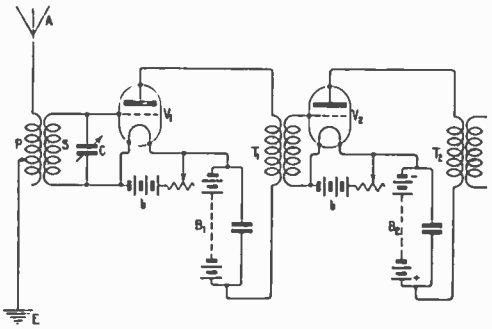


Fig. 96. Arrangement of two or more amplifying valves for magnifying the feeble oscillations in the aerial wire A. V_1, V_2, are the thermionic amplifiers T_1, T_2, the coupling transformers and B_1, B_2, the plate batteries.

currents into low frequency or speech frequency varying currents. The former is termed *radio-amplification* and the latter *audio-amplification*. In the case of radio-amplification the feeble currents set up by the carrier waves in the aerial wire *A* (see Fig. 96), are caused to induce other similar currents in an associated and tuned coupled circuit, comprising a condenser *C* and inductance coil *S*. A three-electrode valve has its grid and filament respectively connected to the terminals of the tuning condenser *C*.

The variations of potential thus produced in the grid cause similar changes in the plate current of that valve supplied by the high tension battery as already explained.

This plate current may include the primary coil of a transformer consisting merely of two insulated wires wound on a bobbin, but without any iron core.

The secondary circuit of this transformer may have its terminals connected respectively to the grid and filament of a second valve, and the same arrangements may be made for a third valve. If, then, the first valve and associated transformer magnify the grid-potential variations say 5 times, the coupling of two valves and transformers will magnify it 25 times, and a third set 125 times, and so on.

We can, in this manner use several amplifying valves for radio amplification.

If we employ two-coil transformers as shown in Fig. 96, we need then only one high tension battery or dynamo to supply the high potential for the anodes or plates of all the amplifying valves. It is then necessary to explain in the next place the methods by which the three-electrode valve operates as a detector of oscillations. The reader will bear in mind that the carrier electric waves which arrive from the sending station are high frequency electric waves of a certain wavelength and amplitude, or wave height. The effect of speaking to the microphone in the transmitting plant is to alter the amplitude of these waves, but not their wavelength. The amplitude varies in accordance with the wave form of the speech sound, so that we may say that the oscillations produced by the carrier waves in the receiving aerial consist of very rapid or high

frequency electric currents, which also have slow or low frequency variations of amplitude superimposed. These slow variations of current correspond to the speech waves made at the sending end. The radio-amplification increases or magnifies these currents all in the same ratio.

We have then to impress these slow variations upon a receiving telephone. It would be no use, however, to insert a telephone receiver in the plate circuit of the last radio-amplifying valve, because a telephone receiver contains a coil of wire of many turns wound upon the iron pole pieces of a magnet. Such a circuit has a very large inductance, which means that rapid changes of current cannot take place in it. Hence the telephone coil will not permit the passage through it of a high frequency alternating current. It offers too much *impedance*, as it is called, to such a current. Moreover, the mean value of these high frequency oscillations of varying amplitude is constant. We have therefore to insert in the valve receiving arrangement a rectifying valve to change these high frequency currents of fluctuating strength or amplitude into pulsating electric currents always flowing in one direction. This can be done by taking advantage of the form of the characteristic curve of the valve.

It has already been explained that when we give to the plate or anode of the valve a positive potential, electrons are drawn away from the filament, and this electron stream is generally increased by giving the grid a still greater positive charge. There is, however, a limit to this electron current which is fixed by the temperature of the filament, and it cannot be increased beyond a certain amount at any given filament temperature. This limiting current is called the *saturation current* at that temperature. Corresponding to this saturation stage the characteristic curve has, therefore, a bend or change of direction. In the same manner, if we give the grid a gradually increasing negative charge, and thus steadily diminish the electron flow from the filament, we find the characteristic curve at the lower end bends over. Suppose, then, that we give the grid of a valve a negative potential, say about 4 volts compared with the filament, and then superimpose on this steady grid voltage a feeble high frequency alternating voltage. It will be clear that when the small alternating potential makes the grid negative, the thermionic current or electron stream from the filament cannot be much reduced because the grid has already been made strongly negative. When the alternating potential applied to the grid is positive, then the electron stream is sensibly increased. The result, then, of imposing a feeble alternating potential on the grid in addition to a steady negative potential is to increase on the whole the electron stream from the filament.

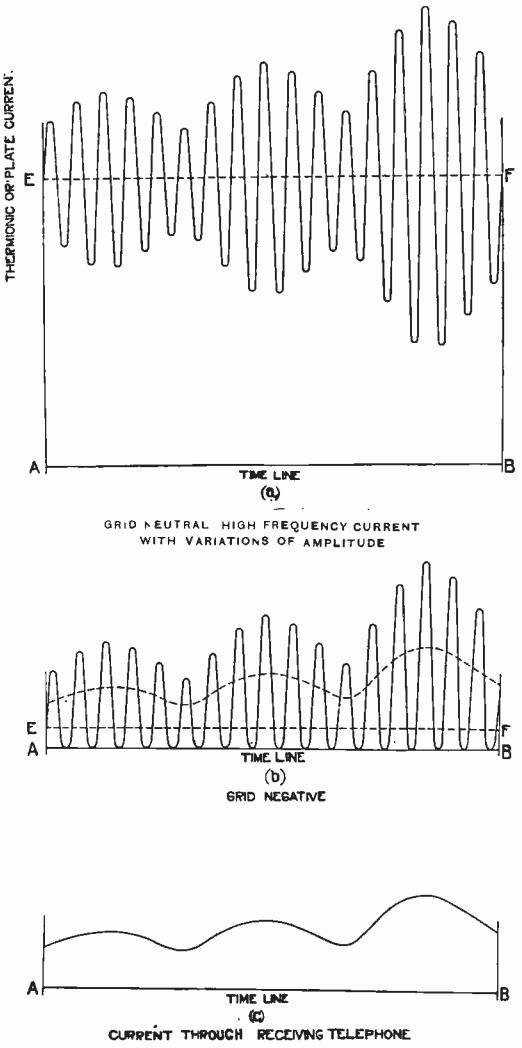


Fig. 97. *Diagrammatic representation of rectification and the mean value of the rectified currents which operate the diaphragm of the telephone.*

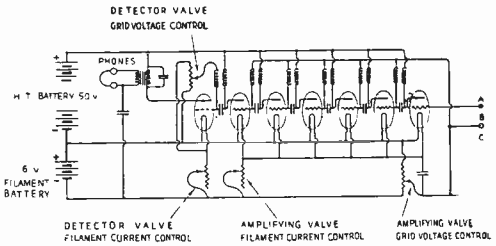
If, then, the alternating potential suffers changes of amplitude, as it does when the carrier electric waves are changed in height by speaking to the microphone in the transmitter, the electron stream of the detecting valve will experience similar increases in mean strength, although there are also rapid variations in the current. The actual changes produced in the currents will be best understood by a series of diagrams.

In Fig. 97 in the upper diagram (*a*) the ordinates of the curve represent the high frequency current in the receiving circuit as magnified by the radio-amplification. This current has low frequency variations of amplitude superimposed upon its high frequency, but the mean value of the current is always the same. The second diagram (*b*) shows the effect on this current of the detecting valve, the grid of which has a steady negative charge given to it. Since the electron current cannot then be much decreased, the effect of the additional negative charge given to the grid produced by the superimposed alternating potential is extremely small, but the effect of the positive charges is to increase the electron current.

The mean value of the current therefore fluctuates, as shown by the ordinates of the dotted line in diagram (*b*). If then the plate circuit of the detecting valve has included in it the coils of a receiving telephone, the rapid variations of current would produce no effect in the telephone, but the slow variations of the mean current cause the diaphragm of the telephone to vibrate, and its motions correspond to the slow or audio-variations in the amplitude of the carrier waves. Hence the receiving telephone will reproduce the speech sounds made to the transmitting microphone, the energy being conveyed by the carrier waves as above described. We can also employ one or more amplifying valves to increase the amplitude of the rectified low frequency speech current variations, which is termed audio-amplification.

For this purpose one or more three-electrode valves are placed after the detector valve, and have induction coils inter-connecting their grid and plate circuits exactly as in the case of the radio-amplifying valves. These induction coils or transformers may have cores composed of bundles of fine iron wires, which increases their effect, and has no disadvantage in the case of the transformation of low frequency oscillations. We can thus employ two or three audio-amplifying valves and put the telephone receiver in the plate circuit of the last valve, as shown in the diagram in Fig. 98.

A multiple valve receiver may therefore comprise two or three radio-amplifying valves, a detector valve, and one or two audio-amplifying valves. The Marconi Company have designed a seven-valve receiver, in which six of the valves are radio-amplifying, and the seventh and last valve the detector valve (see Fig. 99).



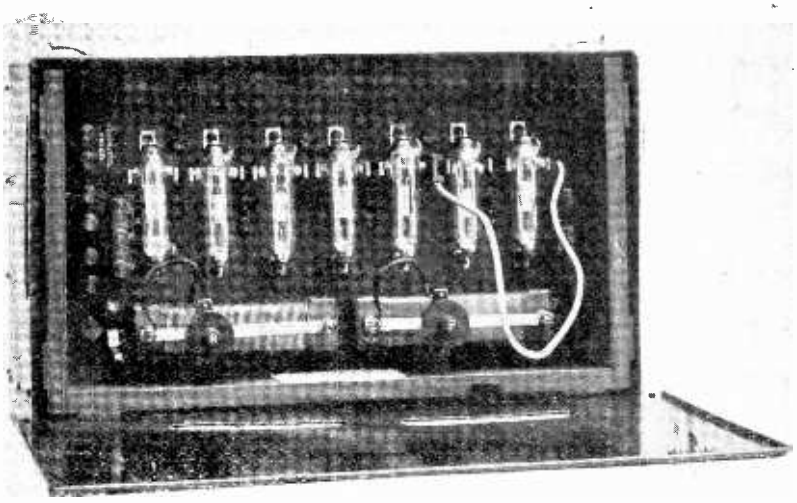
By Courtesy of M. W. T. Co., Ltd.

Fig. 98. Scheme of circuits of a seven-valve thermionic receiver with amplifying valves and detector or rectifying valve.

A simple form of valve-receiving circuit comprises a single detector valve, the grid of which is connected to one terminal of the tuning condenser in the receiving circuit, and also a single audio-amplifying valve with a telephone receiver in its plate circuit. The necessary negative potential is given to the grid of the detector valve by means of an arrangement called a *potentiometer*.

A long fine wire wound on a suitable support has its terminals connected to a few cells of a battery, which may be the filament heating battery. By means of a sliding contact we can connect a point on this wire to the grid, and by changing the position of this slider apply to the grid a negative potential, or two or three volts or more, as required, to bring the plate or electron current of the valve to that point on the characteristic curve which corresponds to the beginning of the lower bend of the curve.

In order that telephonic speech may be transmitted without distortion, it is essential that the radio-amplifying valves should have a characteristic curve which is nearly straight or flat in the central part. It is only under this condition that the complicated changes in the plate current will follow exactly the complicated changes in grid potential, and hence amplify without distorting the wave form of the

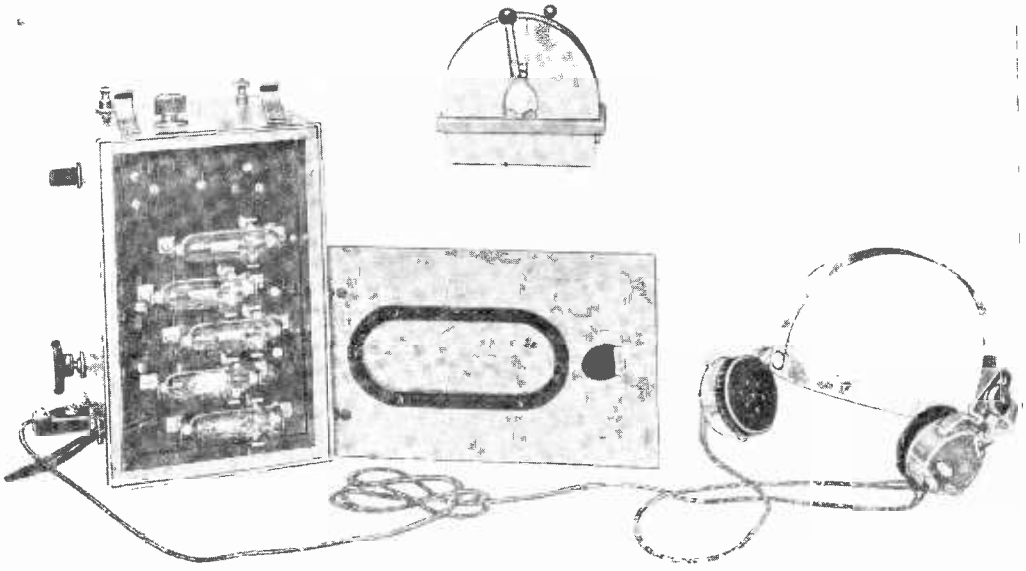


By courtesy of—M. W. T. Co., Ltd.

Fig. 99. A view of a seven valve receiver as made by Marconi's Wireless Telegraph Company.

oscillatory currents. This result is achieved by certain precautions in the design of the amplifying valves.

We have already explained that in a valve transmitter for wireless telephony there must be a valve, the plate and grid circuits of which are coupled inductively to produce high frequency oscillations in the plate circuit and radiate carrier waves from an associated aerial as in Fig. 101. We have then to modulate the amplitude of these carrier waves by means of a carbon microphone in accordance with the



By courtesy of—M. W. T. Co., Ltd.

Fig. 100. Aircraft receiving set comprising three high frequency amplifying valves, a detecting valve and one low frequency amplifying valve connected to the head telephones through an induction coil.

wave form of the speaking voice. One way of doing this is by coupling a microphone *M* inductively, that means by means of an inductance coil or transformer to the plate circuit of the generating valve as shown in Fig. 101. This method has disadvantages in practice.

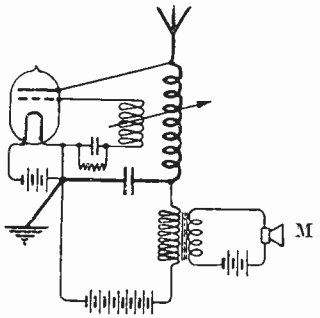


Fig. 101. *Circuits of a simple form of Wireless telephone transmitter with the microphone M inductively connected to the plate circuit of the valve.*

A better method of varying the amplitude of the carrier waves by means of the speech microphone has been called *choke control.* It has been found very suitable for the telephone transmitters of aeroplanes on account of its great simplicity.* It employs a power and a control valve, which both derive their filament heating and plate currents from the same low and high voltage batteries (see Fig. 102). The plate or anode of the control valve is connected to one end of a large inductance or choking coil having an iron core, marked *L* in the diagram. The high frequency currents set up in the aerial wire by the power valve cannot pass through this choking coil, but find their way to earth through a condenser *C*.

The steady or direct current from the high voltage battery marked H.T., can, however, pass through the choking coil. When speech is made to the microphone the potential of the grid of the control valve is varied, and also low frequency variations are produced in the plate current of the control valve. These changes of current strength produce large

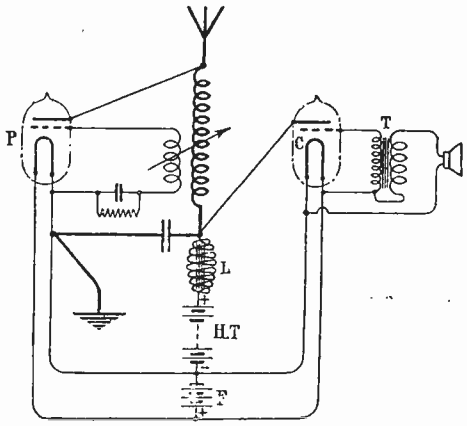


Fig. 102. *Arrangement of circuits in a wireless telephone valve transmitter called a "choke control" because it employs a choking coil L or large inductance.*

variations in the potential at the upper end of the choking coil *L*, which increase or diminish in a very marked and corresponding manner the plate current of the power valve. These surges react through the inductive coupling of the grid and plate circuit of the power valve upon the grid potentials. Hence the effect of speaking to the microphone is to make large percentage changes in the amplitude of the high frequency oscillations set up in the aerial, and therefore upon the amplitude of the radiated waves.

* See Major C. E. Prince, O.B.E., "Wireless Telephony on Aeroplanes."—*The Journal of the Institution of Electrical Engineers.* Vol. 58, p. 377. May, 1920.

(*To be continued*)

Elementary Lecture and Demonstration.

An Elementary Lecture entitled "Fundamental Principles of Radio Reception," with Experiments, will be given on Friday, February 16th, at 6.30 p.m., by Mr. Maurice Child at the Institution of Electrical Engineers, Victoria Embankment. This is the second of a series of Elementary Lectures arranged by the Radio Society of Great Britain.

gauge for two or three valves operated by a common rheostat. It should be wound on a piece of fibre of about 1/16 in. in thickness, carefully filed smooth at the edges, and if desired, file marks may be made for the purpose of holding the turns of resistance wire in position.

A cylindrical piece of wood or ebonite of about 1¾ ins. in diameter and ½ in. thick, may be employed to support the resistance winding. The fibre with the wire wrapped upon it should be bent tightly round the former, and care must be taken to avoid breaking the fibre by giving too much bend at one point. It may be attached by two No. 5 by ½ in. screws if the former is of wood, or by 4 BA screws if ebonite is used. These screws also serve to terminate the ends of the resistance wire.

The rubbing contact is made from a piece of phosphor-bronze spring, German silver, or hard brass. The end which makes contact with the resistance wire may be tapered in order that it may not short circuit too many turns, and if a bend is made so as to form a curved surface, the contact will have a smooth movement.

The spindle to which it is attached is reduced in diameter at its end by careful filing in order to present a shoulder. The small diameter portion is made to just pass through a hole in the contact arm, and then, by careful hammering, the spindle may be reverted to the arm.

Using a suitable flux, a wire may be soldered to the reverted end of the spindle for the purpose of making contact, and also to ensure a solid union between arm and spindle.

Other details of design will depend upon how the experimenter proposes to assemble the rheostat to his panel. If there is no objection to a number of screw heads appearing on the face of the instrument, three holes (tapped in the case of ebonite) are made in the former to which the resistance winding is attached. Alternatively, clearance holes may be made in this former, the panel itself being tapped to take the screws (probably 4 BA) which hold the former to the face of the panel.

The experimenter who does not desire to make use of tapped holes, can use long 4 BA screws with back nuts. The hole in the centre of the former being ½ in. in length, will serve as an excellent bearing for the spindle, which should be a good fit. If a split bronze washer is placed on the face of the panel and held down by the knob, it will help to pull the spindle forward, and so ensure a satisfactory spring contact between the contact arm and the resistance wire. The knob may be held by means of a small grub screw, or threaded on to the spindle with lock nut.

This type of rheostat is of easy construction, and it may be adopted by the man who constructs his own apparatus, as a standard fitment.

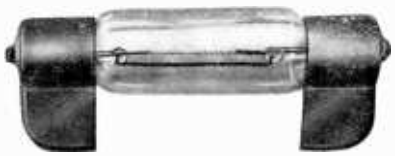
By increasing the diameter of the former, the length of the fibre strip this time having parallel edges, and winding with finer resistance wire, say No. 30 S.W.G., the same principle can be adopted for the construction of a reliable type of potentiometer.

Barretter Tubes.

A device of considerable interest to the experimenter, and largely used on the Continent, is shown in the adjoining photograph. It is a small tube with end connecting lugs and filled with hydrogen. In circuit between the lugs is a fine wire of a special alloy, the resistance of which rapidly increases with an increase of the current passing through it.

It will thus be seen that such a device, when connected in series with a valve filament, is very useful for limiting the amount of current that will pass, and consequently reduces the danger of burning it out.

These tubes are designed and rated to pass a given current, and the variation in current flow, over a wide range of battery potential is extremely small, so small in fact that the



A familiar type of Barretter tube of foreign manufacture.

filament brightness may be relied upon to be of a given degree, irrespective of the battery voltage, within certain wide limits.

C

A Simple Reinartz Tuner.

THE article on the Reinartz tuner, which appeared in the May 13th, 1922, issue, fired the writer's ambition to make up one of these tuners. This has turned out so well that probably other readers may like to benefit by the experience gained.

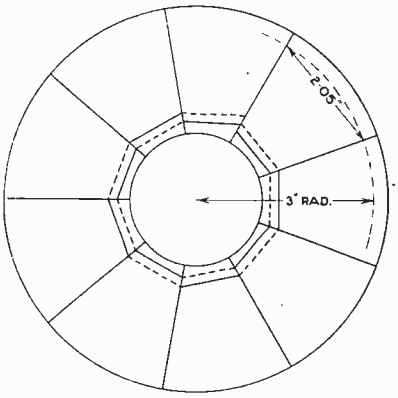


Fig. 1. Dimensions of card former.

First a coil was wound on a card, after the fashion described in "Experimental Station Design II," June 10th issue. A ¼ lb. of No. 26 D.C.C. was more than enough.

Lest anyone repeat an early error of the writer's, it should be remembered that the card must have an *odd* number of slots. Round a circle of 3 ins. radius, steps of 2·05 ins. produce nine equal divisions (other sizes in proportion).

The card actually used was of 3¼ ins. radius, and the slots were deep enough to start winding at ¾ ins. radius. The following procedure was gone through and reference should be made to Fig. 1 :—

Beginning, labelled "30"; wind 10 turns, tap and label "20"; wind 10 turns, tap and label "10"; next, 10 more turns, and then cut off and label "0" leaving enough wire to run to terminal "R.C. 1." Start afresh, labelling beginning "9"; 1 turn, label "8," and so on to "0" and leave enough wire to run to terminal "E and — T.C." Do *not* break the wire but wind on 24 more turns, label "24"; 6 more and label "30" and so on to 36, 42, 49 and 56.

The switch centre for the "24" to "56" tappings is connected to a terminal labelled "G.C."

The switch arm of the "0" to "9" tappings is connected to the terminal labelled "R.C.2" and that of the "0" to "30" tappings to a terminal labelled "P."

For telephony on 400 metres the tuner is ideal with two valves. When connected to an aerial of the usual amateur dimensions, and the three switches set at 56, 3 and 30; R.C. at about 0·00005 mfds., and C.C. at about 0·0001 mfds., the following come in very clearly at Shoeburyness, Essex :—**2 MT, 2 LO, 2 IF, 2 ON** and others.

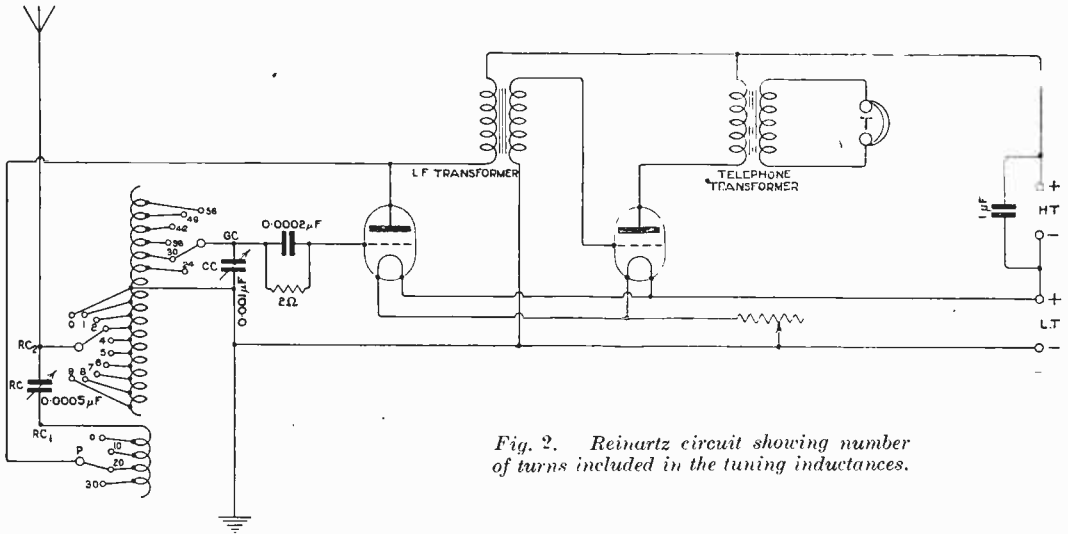


Fig. 2. Reinartz circuit showing number of turns included in the tuning inductances.

If speech is not clear, less reaction should be used.

A slight improvement has been made by adding a card (wound with 44 turns of No. 26 D.C.C. from ¾ in. to 1½ ins. radius) below the main card and connected in circuit at R.C. 1. Probably it would have been better to start the main card at 2 ins. radius, and wind the "0" to "56" turns on a second card, starting again at 2 ins. radius. This should make the addition of 44 turns to the "0 to 30" coil unnecessary.

The second valve is simply connected as shown in the diagram, Fig. 2.

Using the ordinary slab inductances it was found that the same circuit worked well up to 8,000 metres. No trial was made on higher wavelengths. Attention should be drawn to the fact that this circuit is liable to cause interference by radiation, though with a suitable adjustment of coupling of the plate circuit inductance and reaction condenser, the tendency to oscillate can be critically controlled.

The writer feels sure that he is not alone in being grateful for his introduction to the Reinartz tuner.

B. H. E.

The Ideal Home Exhibition

IN the last issue of *The Wireless World and Radio Review*, an announcement was made regarding the Ideal Home Exhibition.

This Exhibition, which is being organised by the *Daily Mai* , will be open from March 1st to 24th inclusive. It should be of special interest to those associated with wireless, since arrangements have been made for a section of the Exhibition to be devoted entirely to wireless exhibits, and every effort will be made to present wireless telephony to the public visiting the Exhibition in an attractive manner.

The organisers of the Exhibition have assigned to the National Association of Wireless Manufacturers the entire arrangements for the wireless section of the Ideal Home Exhibition, and the principal manufacturers of apparatus will be exhibiting. The interest of the wireless section will naturally centre around broadcasting, and for the special use of the wireless manufacturers there has been set apart a concert hall in the Exhibition with seating accommodation for 1,000, and here manufacturers will organise continuous free demonstrations of wireless telephony reception. Every opportunity will be given to the public to appreciate the value of wireless telephony in the home, and one feels confident that every visitor to the Exhibition will leave it with the impression that no home can be ideal unless the benefits to be derived from wireless telephony are taken advantage of.

The following is a list of some of the principal firms who will exhibit :—

Siemens Brothers & Co., Ltd.
Rogers, Foster & Howell, Ltd.
Igranic Electric Co., Ltd.
Radiophones, Ltd.
Marconi Scientific Inst., Co., Ltd.
Automatic Telephone Mfg., Co., Ltd., jointly with
Ashley Wireless Telephone Co., Ltd.
Dubilier Condenser Co. (1921), Ltd.
General Electric Co., Ltd.
Metropolitan-Vickers Electrical Co., Ltd.
Radio Instruments, Ltd.
Telephone Mfg. Co., Ltd.
Western Electric Co., Ltd.
S. G. Brown, Ltd.
The Wireless Press, Ltd.
Radio Press, Ltd.
Fellows Magneto Co., Ltd.
British Thomson-Houston Co., Ltd.
L. McMichael, Ltd.
Electric Appliances Co., Ltd.
Tingey Wireless, Ltd.
Burndept, Ltd.
C. F. Elwell, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Radio Communication Co., Ltd.
Sterling Telephone & Electric Co., Ltd.
A. W. Gamage, Ltd.
H. Stanley Prince, Ltd.
General Radio Co.
Alfred Graham & Co.
L. A. Coomes & Co.
Tomlinson (London), Ltd.

It will therefore be seen that the Exhibition is strongly supported by wireless manufacturers, and there will undoubtedly be displayed the finest selection of wireless receiving apparatus in the world.

This will be the seventh Exhibition under the name of "The Ideal Home Exhibition," to be organised by the *Daily Mail*, and it is a matter of interest that so important a part should be played in the coming Exhibition by wireless telephony.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Aberdeen and District Wireless Society.*

Hon. Joint Secretary, Mr. James S. Duthie, 148, Forest Avenue, Aberdeen.

During the month of December some very interesting lectures were given by members of this Society.

On December 8th, Mr. W. W. Inder, M.I.R.E., lectured on the valve, Mr. Robert Cumming presiding, and the lecturer was awarded a very hearty vote of thanks for his interesting and instructive lecture.

A beginning has been made with Morse practice under the tuition of different members of the Society.

On December 22nd a most interesting lecture was given by Mr. Newsam, manager of the Aberdeen Branch of Ediswan Electrical Company, on the construction, action, maintenance and care of accumulators. On the motion of the President, Dr. Fyvie, a cordial vote of thanks was accorded to the lecturer.

The Ilford and District Radio Society.*

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

A meeting was held on January 11th at headquarters, St. Mary's Hall, Ilford. Mr. J. E. Nickless, A.M.I.E.E., occupying the chair.

Mr. Grover gave a very interesting lecture on "Elementary Electrostatics." The characteristic curves of two valves were also plotted and Mr. Grover explained the practical uses to which such data could be put.

On Thursday, January 18th, a successful Concert and Demonstration of Wireless Telegraphy was held.

Mr. L. L. Vizard operated his five-valve receiving set and signals were made audible to the whole of the audience by means of a loud speaker kindly lent by Messrs. Radio Instruments, Ltd.

Lambeth Field Club and Morley College Scientific Society.*

(PHYSICS AND WIRELESS SECTION.)

Hon. Secretary, Mr. F. W. Ling, Physics Laboratory, Morley College, Waterloo Road, S.E.1.

On Saturday, January 13th, the members of the above Society held their first practical evening of the year. The meeting was a great success, and plans for the making of the Society's receiving set were fully discussed.

Messrs. A. E. and V. C. Perry and the Secretary helped several members by explaining how they could make their sets, also giving diagrams of the wiring. Several experiments and demonstrations were given during the evening and a L.F. panel which was being made as a part of a unit set was on view.

The next practical evening was on Saturday, January 27th, when the work on the Society's set was begun.

The Secretary would be pleased to hear from persons interested in wireless.

The Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

The above Society met on Monday, January 15th, when Mr. Wilck gave the first of his elementary lectures on "Electrostactics." This was followed by a descriptive lecture and demonstration of a Burndept "Ultra III" tuner, by Mr. Trussler, at which the concert from Marconi House was picked up and clearly heard all over the hall.

At the close of the meeting a committee meeting was held, and many points discussed, among these being broadcasting problems and the coming meeting of the Radio Society of Great Britain, to which the Society hoped to send three representatives.

Borough of Tynemouth Radio and Scientific Society.*

Hon. Secretary, Mr. J. S. Littlefield, 37, Borough Road, North Shields.

The Society's third annual Exhibition of wireless telegraph and telephone apparatus was held recently at the headquarters, Y.M.C.A. Buildings, North Shields.

The opening ceremony was performed by Councillor A. E. Hill, B.A., Vice-President of the Society, who congratulated the members upon the splendid results of their energies. Councillor Hill was supported by the Deputy Mayor of the Borough.

The Exhibition proved to be an unprecedented success, not only in the number of visitors, but also in the splendid array of exhibits, which were kindly lent by Messrs. Radio Communication Co., Ltd., Burndept Ltd., Mr. H. W. Sullivan, Western Electric Co., Ltd., North Eastern Instrument Co., "Chase Radio," and Radio Instruments, and in addition many members' exhibits.

The thanks of the Committee are due to all those who gave their valuable help in making the Exhibition such a success.

The Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. D. Whitehouse, 16, Todd Street, Manchester.

An ordinary meeting of the Society was held on January 10th at headquarters. In the absence of the Chairman, Mr. J. R. Halliwell took the chair. A discussion was opened on the subject of "Broadcasting," and members present gave their views.

The next meeting of the above Society was held on Wednesday, January 17th, with Mr. Boullen in the chair. As no lecturer had been appointed, the meeting was thrown open to general discussion on wireless matters, and many interesting experiences of members were discussed, including the reception of Covent Garden Opera in Manchester.

Proposed Doncaster Radio Society.

It is proposed to form a Radio Society in the Doncaster district, and all those interested in wireless are invited to communicate with Mr. Ernest F. Brett, 51, Highfield Road, Doncaster.

The Warrington Radio Association.

Hon. Secretary, Mr. W. Whittaker, 68, School Brow, Warrington.

A meeting of the Warrington Radio Association was held in the Y.M.C.A. Lounge on Thursday, January 11th, Mr. F. V. L. Mathias presiding. A very interesting address was given by Mr. W. Whittaker on "Morse Reception" following which Mr. B. Nadin discussed "Hints on Set Making." Both speakers were accorded a hearty vote of thanks.

Before the meeting closed, the Hon. Secretary mentioned that the committee would spare no efforts to make the demonstration on January 25th a great success.

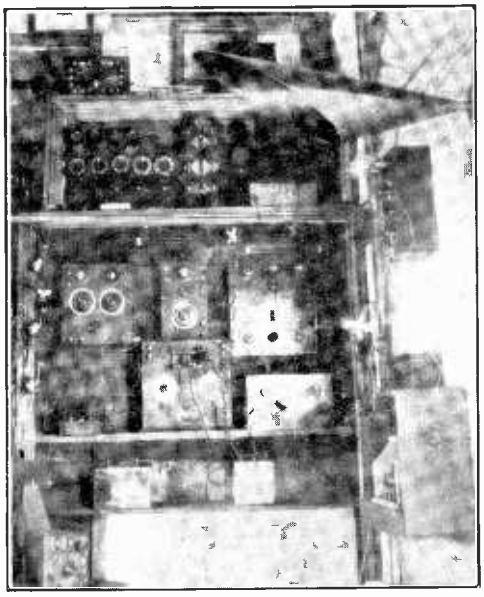
Birkenhead Radio Society.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton.

The fourth general meeting of the Birkenhead Radio Society was held at 36, Hamilton Square, on January 4th.

The chair was taken by Mr, Goodyear. After the usual morse practice, held from 7.15 to 8 p.m., a lecture on "Rectification" was given by Mr. Austin, one of the technical advisers of the Society. The lecture was given mainly for the junior members of the Club, of whom a good many were present. In the lecture given by Mr. Hill at the previous meeting, the production of high frequency oscillations was dealt with. Mr. Austin showed in his paper how these waves were rectified. He dealt with spark transmitters, showing first the action of a crystal in rectifying damped waves, and afterwards the action of a valve.

After the conclusion of this paper, the Chairman explained a few points which were likely to arise and give trouble to the younger members. Mr. Hughes then said, that if any of the members were in any difficulty with their apparatus either he or Mr. Austin would be only too pleased to give any assistance in their power.



Station of Mr. W. G. Fudger (The Picture Palace, Station Road, Godalming, Surrey). Since the photograph was taken the station has undergone considerable development.

Guildford and District Wireless Society.

Hon. Secretary, Mr. R. T. Bailey, 148, High Street, Guildford.

The above Society opened its new headquarters at 148, High Street, on Friday, January 12th, with a general meeting. Mr. S. G. Clarke was voted to the chair, as the Chairman, Ald. W. T. Patrick, J.P., was unavoidably absent. At the conclusion of business the members adjourned to a neighbouring café, where the Chairman (Ald. W. T. Patrick) had very kindly arranged for coffee to be provided.

The new rooms will very shortly be regularly open for members' use, and it is sincerely hoped all local amateurs will become members and avail themselves of the facilities which will be provided.

The Wireless Society of East Dorsetshire.

Hon. Secretary, Mr. E. T. Chapman, Associate I.R.E., Abbotsford, Serpentine Road, Poole, Dorset.

At a general meeting held in Wimborne Council Schools on Wednesday, January 17th, 1923, a unanimous decision was taken against the proposed amalgamation with the newly formed Bournemouth and District Radio and Electrical Society.

Meetings and instructional lectures are being held fortnightly in the Wimborne Council Schools on Wednesdays at 7 p.m., the date of the next meeting being therefore on February 7th. In the event of the rooms not being available on specified day, notice will be circularised by the Secretary.

Swansea and District Radio Experimental Society.

Hon. Secretary, Mr. Herbert T. Morgan, 218, Oxford Street, Swansea.

A very successful meeting of the above Society was held at headquarters, the Y.M.C.A., on Wednesday, January 10th, when a very interesting lecture and demonstration was given by Mr. D. W. Walters, of Gowerton, entitled "Hints on Tuning."

By permission of the Postmaster-General, an aerial was erected, and a wireless receiving set had been installed, and this was used by the lecturer for demonstration purposes.

The President of the Society, Capt. Hugh Vivian, occupied the chair, and gave a very encouraging address, prophesying a very bright future for the Society. Later in the evening, Continental telephony was listened to on a loud speaker.

The Society has a very interesting programme for the season, and all interested in wireless are invited to join.

Birmingham Experimental Wireless Club.

Hon. Secretary, Mr. A. Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

An instructive and enjoyable lecture was given before the above Club on January 12th by Mr. B. A. Matthews, the subject being "The Construction of Three-Valve Receivers." The lecturer gave a very successful demonstration with a three-valve set of his own construction, and the methods of wiring for various circuits were lucidly explained.

Mr. Matthews described his experiments with various circuits, and the means by which the apparatus had been evolved from the original single valve set by slow stages was of special interest to the new members present who are busily engaged on building sets of their own.

The North Essex Radio Society.

Hon. Secretary, Mr. F. T. Smith, Felsted, Essex.

Demonstrations and lectures organised by the above Society and conducted by the Secretary are being given in outlying districts in aid of charities. The last occasion was on Wednesday, January 3rd, when the hall at Felsted was crowded out, and a good sum resulted for the benefit of Dr. Barnardo's Homes.

The apparatus used on these occasions has been kindly lent by Mr. Gordon Castagnoli of Braintree. The audiences were much interested in the fact that the same instruments used for the demonstrations had also received American broadcasting, and some seemed desirous of continuing the performance until 1.30 a.m. on the chance of hearing **WJZ.**

Wanstead Wireless Society.

Hon. Secretary, Mr. A. B. Firman, 18, Clavering Road, Wanstead Park, E.12.

At the meeting of the society held on Thursday, January 11th, Mr. Hunt, B.Sc., a member of the Society, read an extremely interesting paper, his subject being the "Genesis of Wireless."

Aptly illustrated by descriptions of experiments and analogies, the lecture was much appreciated by all those present.

Members were reminded of Major Parker's visit to the Society on January 25th, when he delivered an extremely interesting lecture on "C.W. Oscillation and the Functions of Component Parts of a Receiving Set," and which was illustrated by lantern slides.

Meetings are held every Thursday evening at St. Gabriel's Church Hall, Aldersbrook Road, E.12., at 8 p.m.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. More, 175, Leavesden Road, Watford.

This Society has been very fortunate in securing the services, as lecturer, of Mr. Christie, late wireless instructor Royal Navy. His opening lectures, entitled "The Evolution of Wireless" and "Detectors," were followed on Friday, January 5th, by a lecture on the Fleming valve. He gave a brief survey of his previous lecture, describing the action of the coherer, the electrolytic detector, the magnetic detector and the crystal, finally bringing his audience to the two-electrode valve.

A most interesting and instructive lecture was concluded by some helpful hints on operating single valve sets, particular emphasis being laid on the control of reaction.

On Friday, January 12th, Mr. Christie, by special request, gave a lecture on the construction of receiving apparatus. He had brought a large number of home-made instruments, including basket coils, tuning stands, honeycomb coils and coil-winding machine, transformers, condensers and crystal detectors. The apparatus was splendidly constructed and Mr. Christie's excellent lecture was in keeping with the quality of his work. Subsequently the apparatus was passed round for inspection, and the lecturer answered several questions.

Members are reminded that the subscription for the current quarter is now due, and should be forwarded to the Hon. Treasurer as early as possible.

Eastern Enfield Wireless and Experimental Society.

Hon. Secretary, Mr. I. Dabbs, 315, High Road, Ponders End.

On Thursday, January 11th, an extraordinary general meeting of the above Society was held at the headquarters, the Falcon Inn, to discuss the programme for the present year.

After considerable discussion it was decided to have a programme of lectures and demonstrations of members' apparatus to commence next week.

The remainder of the time was devoted to general discussion, particularly on efficient earthing.

Wireless enthusiasts will be heartily welcomed at the Society headquarters any Thursday evening at 8 o'clock.

Mount Pleasant Radio Society.

Hon. Secretary, Mr. Walter R. Fleming, 156, Upton Park Road, Forest Gate, E.7.

On January 13th a meeting was held at headquarters, 21a, John Street, Theobalds Road, W.C.1., when the Secretary gave a lecture on "Primary and Secondary Cells."

The Society has obtained an experimental licence, and a crystal receiver with a three-valve amplifier has been purchased.

Several new members have recently been enrolled.

The Hornsey and District Wireless Society.

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

A general meeting of the Society was held on Monday, January 8th, at 8 p.m. The present accommodation of the Society being considered unsuitable, it was decided to transfer the headquarters to the Queen's Hotel, Broadway Parade, Crouch End, where more comfortable accommodation has been arranged. In future, meetings will be held there each Monday at 8 p.m. Mr. W. L. Carter was elected Chairman, and Mr. H. Hyams elected Hon. Secretary.

Applications for membership will be welcomed and full particulars supplied by the Hon. Secretary.

The Tottenham Wireless Society.

Hon. Secretary, Mr. R. A. Barker, 22, Broadwater Road, Tottenham, N.17.

The chief feature of the meeting held on January 10th, 1923, at 10, Bruce Grove, Tottenham, was an excellent lecture by the Chairman, Mr. F. A. Bourne, on the subject of "Crystal Detectors." Mr. Bourne not only fully explained the theoretical side of the question, but also fully explained the construction of a crystal set that everyone could make for themselves.

Presentations were made to the Society of a crystal set, set of coils and coil holder, and a battery of accumulators. It is hoped shortly to give a demonstration on wireless subjects for the benefit of the local public.

At the last meeting held by the above Society a very interesting lantern lecture was given by Mr. R. A. Barker, who gave a short biography of Senatore Marconi and Dr. Fleming, two of the pioneers of wireless telegraphy, and showed a number of slides illustrating the history of wireless. All the slides were kindly lent by the Marconi Scientific Instrument Co., Ltd.

Nottingham and District Radio Experimental Association.

Hon. Secretary, Mr. D. F. Robinson, 99, Musters Road, West Bridgford, Nottingham.

A meeting was held on January 4th. at Bennett's Garage, Shakespeare Street, Nottingham, Mr. Thornton being the Chairman.

Mr. Gill occupied the evening by explaining and demonstrating with a five-valve set, constructed by himself, and all members present thoroughly appreciated his efforts. The remaining time was given up to listening to the Birmingham Broadcasting Station, and altogether a most enjoyable and interesting evening was spent.

A cordial invitation is given to all wireless enthusiasts not yet members of the Society to the meetings held each Thursday at 7.30 p.m.

The Wireless Society of Hull and District.

Hon. Secretary, Mr. H. Nightscales. 79. Balfour Street, Hull.

There was a large attendance of members at the meeting held on January 8th, when a lecture was given by Mr. Lax. Mr. Lax went deeply into the question of the action of valves as rectifiers and amplifiers, and explained the characteristic curves of the various makes of valves which are at present on the market, as well as pointing out their advantages and disadvantages. By the aid of blackboard diagrams he then gave his hearers some interesting and useful information about the various circuits at present in use in connection with valve receiving apparatus, and at the close, ably replied to a number of questions which had been asked.

On the proposition of the Chairman, Mr. G. H. Strong, and seconded by Mr. C. B. Snowdon, the lecturer was accorded a hearty vote of thanks for one of the best lectures yet given. This was supported by Messrs. J. Brazendale and W. J. Featherstone, and Mr. Lax in replying, promised to give a further lecture and practical demonstrations at some future date.

The officials of the Society are hoping to see every experimenter and listener-in in Hull and District a member of the Society. Would-be members will be welcomed at the club-room, at the Signal Corps headquarters in Park Street, on the second Monday and fourth Friday in each month.

Any wireless operators who happen to be in the port will be made welcome at the meetings of the Society.

Sutton and District Wireless Society.

Hon. Secretary, Mr. E. A. Pywell, "Stanley Lodge," Rosebery Road, Cheam, Surrey.

The annual general meeting of the Society was held on Wednesday, January 10th, 1923. Mr. D. C. W. Howard, B.Sc. has now been elected Chairman for the coming year, and owing to the large increase in the numbers of members since the last election, another member has been elected to the Committee. At the conclusion of the business proceedings, Mr. R. E. V. Ely gave a very interesting lecture on X-ray work and was accorded a hearty vote of thanks.

A series of short instructional lectures will be given by various members at meetings during the next three months, and it is hoped that these meetings will be well attended. All interested in radio work of any description are given a hearty welcone and those desirous of becoming members can obtain full particulars from the Hon. Sec.

Cheltenham and District Wireless Association.

Hon. Secretary, Mr. E. Cole, A.R.I.B.A., 28, Milton Road, Cheltenham.

At the weekly meeting of the Association on January 15th, Mr. A. Moulder gave a short lecture on "Non-Radiating Circuits," and also an extremely interesting account of his experiences during the war as a Naval wireless operator.

It was mentioned that several of the members have been successful in receiving parts of radio concerts transmitted from America.

After the lecture the members listened in on the Association's four-valve set to **5 IT**, the Birmingham Broadcast Station.

Oldham Amateur Radio Society.

Hon. Secretary, Mr. W. Schofield, 92, Sharples Hall Street.

On Friday, January 12th, an interesting lecture on "Aerial Construction" was given by the Chairman, Mr. J. Everett, who dealt with the subject in a very thorough manner. He explained how the aerial poles should be erected, and how the stays should be arranged to withstand the strain of the aerial. The precautions to be taken against leakages to earth were not forgotten, and Mr. Everett showed several effective ways of making joints with copper wires.

It is gratifying to be able to report a steady increase in the membership of the Society, and anyone desirous of joining should apply personally at 56, Bottom o' th' Moor, Oldham, any Friday evening at 8.30 p.m., when the weekly meeting is held.

Bexhill and District Radio Society.

Hon. Secretary, Mr. A. J. Hill, 15a, Sea Road, Bexhill-on-Sea.

A successful opening meeting of the above Society was held on January 9th, at 15a, Sea Road, Bexhill-on-Sea.

Mr. A. J. Hill opened the meeting by explaining the object of forming the Society, and Mr. L. E. Owen gave an address on "Wireless from the Popular Standpoint."

A Committee (*pro. tem.*) was formed, Mr. S. L. Taylor being elected Chairman.

The Wireless Society of Winchester.

Hon. Secretary, Mr. Albert Parsons, A.M.I.R.E., 65, Cromwell Road, Winchester.

The meetings held at Tower House since Christmas have been of a practical nature. The Secretary occupied two evenings by showing various methods of hand-coil winding.

Members having since wound their own coils speak of having obtained good results from them, especially the kind termed by the Secretary as the one, two, three or four diamond coil, which present very little self capacity.

The Society has now erected an aerial of the approved P.M.G. type, being 60 ft. high and 40 ft. long, in a position free from any screening.

By kind permission of Mr. R. Ayton, M.I.E.E., the members recently had an extremely interesting evening at the local power station. It was an opportune time in that shops, etc., were closing, and the demand for power decreasing, such that the closing down of one turbine and dynamo for the night was witnessed among other features.

Members spoke highly of the cleanliness of the station and of the efficient organisation.

An addition has been made to the rules of the Society to the effect that holders of broadcast licences are to be classed as Associate Members. Membership is still growing, and anyone desiring to join the Society may obtain particulars from the Secretary.

Notes.

Broadcasting and Experimental Licences.

Some dismay has been caused among owners of portable wireless receiving sets by the discovery that a licence does not entitle the holder to use his apparatus at any other place than that stated on the licence. This fact does not appear to have been stated specifically in any new regulation, but apparently the Post Office authorities expect literal observance of the terms of the broadcast licence. The official attitude is that this limitation of the movement of private wireless apparatus is necessary if the Post Office is to maintain control. Movement is permitted, however, to agents of wireless firms, bona fide lecturers and demonstrators, these exceptions being covered in most cases by so-called "pedlars' licences." The issue of "experimenters' licences" for those who wish to construct their own sets is temporarily held up pending the introduction of a new class of licence which is under consideration. It will be remembered that this course was first advocated by *The Wireless World and Radio Review* (page 395, December 23rd, 1922).

Developments in Canada.

The plans of the Marconi Company with regard to the development of wireless communications in Canada involve the erection of a powerful station at Vancouver, British Columbia, which is estimated to entail an expenditure of two million dollars. This station, it is said, will be one of the giant stations of the world, exceeding in power any other Marconi station at present in existence, and will in effect make Western Canada an important factor in world wireless communication, linking it up on one side with Australia and the Orient and on the other with Europe.

Group of Officers and Committee of the Radio Society of Great Britain. Back row (left to right): Maurice Child, Philip R. Coursey, G. G. Blake, A. Hambling, Hugh S. Pocock. Front row (left to right): C. F. Phillips, Major N. Hamilton, Leslie McMichael (Hon. Secretary), Admiral of the Fleet Sir Henry B. Jackson, G.C.B., F.R.S. (Retiring President); F. Hope-Jones (Chairman), and L. F. Fogarty (Hon. Treasurer).

"Annales des Postes" to Become a Monthly.

The *annales des Postes, Télégraphes et Téléphones*, a bulletin of technical information issued by the French Ministry of Posts and Telegraphs, will appear in future each month, beginning with the January number. As a consequence the field which this valuable publication covers will be considerably increased. The annual subscription however will remain unaltered, viz., 24 francs for France and 27 francs for abroad.

Sir Oliver Lodge's Lecture on "Wireless Communication."

The Silvanus Thompson Memorial Lecture on "The Basis of Wireless Communication," to be delivered by Sir Oliver Lodge, F.R.S., at the Finsbury Technical College, Leonard Street, E.C.2, is to take place on Thursday, February 1st, and not on January 26th, as previously reported in the Press. Among the demonstrations to be given by old students after the lecture are the following :— Mr. Mordey, the oldest-known student, will show some effects of alternating magnetism : Prof. Coker will demonstrate the strains set up by cutting tools, as shown under polarised light ; Prof. Desch will project microphotographs of various alloys. Prof. Eccles will show novel applications of the thermionic valve, and the ladies will be entertained by a wireless concert, the reception being arranged for by Mr. Franklin. The plant of the College will be operated by present students.

Reception of Eiffel Tower Weather Reports.

A Wireless operator at Eiffel Tower, when sending out his weather report a few days ago, requested the recipients to send him postcards. The response resulted in several mail bags containing over 56,000 postcards.

Photograph of Mr. A. R. Burrows.

Mr. A. R. Burrows, an interview with whom is reported in this issue, is now so well known in wireless circles that it is thought that many readers may like to have a copy of the photograph which appears on page 589 of this issue, where he is seen announcing at **2 LO**. Arrangements have therefore been made to supply readers with cabinet size silver prints of this photograph, unmounted, at the price of 9d. post free. Application, with remittance, should be made to the Editorial Offices of this Journal.

Wireless Communication and Trade.

A special committee of the Federation of British Industries has forwarded to the Prime Minister a resolution urging the Government immediately to grant facilities for the rapid development of long distance wireless communication, adding that they are strongly of the opinion that this would be best accomplished by private enterprise. A system of cheap wireless communication, they maintain, is essential to the trade of the country.

Broadcasting Stations in Great Britain.

The erection of the broadcasting station at the Port Dundas Corporation's Electricity Station at Glasgow has been begun, and it is expected that broadcasting will be commenced early in March. Cardiff broadcasting station is said to be practically complete, and should be ready to begin transmissions by the beginning of February.

The Growing Demand for Broadcast Licences.

The public interest in wireless as a result of the successful institution of broadcasting is growing rapidly, as indicated by the number of licences issued. At the time of going to press it was reported that some 10,000 licences had been issued by the Postmaster-General in the past week, whereas the total number of such licences issued in the month of December was only 6,000.

The Radio Society of Great Britain Presidential Address by Dr. W. H. Eccles, F.R.S.

A Presidential Address was delivered by Dr. W. H. Eccles, F.R.S., before the Radio Society of Great Britain on Wednesday, January 24th, at 6 p.m., at the Institution of Electrical Engineers. The address was directed to the stimulation of research by experiments, and an indication of some useful lines of investigation was given. Publication will be given to this address in due course.

A Wireless Club for Ceylon.

A correspondent writing from Colombo states that a wireless club has just been formed, and is receiving strong support throughout the island. Permission to use wireless has not yet been granted by the Ceylon Government, but it is confidently hoped that this obstacle will soon be removed.

Annual Dinner of the Radio Society of Great Britain.

The Annual Dinner of the Radio Society of Great Britain was held as previously announced at the Waldorf Hotel, on Wednesday, January 24th, at 8 p.m. About sixty persons were present, including many members of the Society and delegates from affiliated Societies who had attended the Annual Conference earlier in the day During the dinner it was the pleasant duty of the retiring President, Admiral of the Fleet Sir Henry B. Jackson, to make a presentation to Mr. and Mrs. Philip R. Coursey of a clock in commemoration of the successful transatlantic tests, 1922. The presentation was from the members of the Committee of the Society as a mark of appreciation of the work done by Mr. Coursey, assisted by Mrs. Coursey, in the organisation of the tests, and particularly the transmissions from this side of the Atlantic. An announcement was made on this occasion which will be of great importance to all members of the Society. It will be remembered that at the November meeting of the Society a member, Mr. I. Davidson, made the suggestion that the Society should give a wireless medal annually. This proposal has received the consideration of the Officers and Committee of the Society, and the announcement was made that the medal will be given each year for the most important British achievement during the year.

Insuring Wireless Sets.

The risk of damage to wireless apparatus and of personal injuries arising to third parties therefrom has naturally given rise to insurance schemes. The Liverpool Marine and General Insurance Company, Ltd., who claim to have been the first to have drawn up a contract of this kind to meet the requirements of private persons, issue policies to provide compensation for damage to the wireless apparatus itself and to indemnify the owner in respect of claims by third parties as a result of personal injury or damage to property. Under the arrangement of this Company a premium of 7s. 6d. insures apparatus up to £50 in value and covers third party damage up to £500 (any one accident), including damage to property belonging to or under the control of the insured. Wear and tear, however, and such mishaps as the burning out of valves through wrong connections, are not insurable.

Radio Stations in West Africa.

Some 250 posts have been actually opened or are under construction in French West Africa, and it is proposed soon to link up French Africa with the Soudan and Egypt.

Calendar of Current Events

Sunday, February 4th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, February 5th.

9.20 to 10.20 p.m. Dutch Concert, from **PCGG**, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At 55, Fonnereau Road. Lecture on "Land Line Telephone Practice," by Mr. B. Waters.

THE NORTH LONDON WIRELESS ASSOCIATION. Lecture on "The Production of Oscillations by Means of the Neon Lamp," by Mr. E. H. Robinson.

Tuesday, February 6th.

Transmission of Telephony at 8 p.m. on 400 metres, by **2MT**, Writtle.

ROYAL SOCIETY OF ARTS.

At 4.30 p.m. At John Street, Adelphi, W.C. Lecture on "The Base Metal Resources of the British Empire," by Sir Richard Redmayne.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

At 7.0 p.m. At the Hotel Cecil, Strand, W.C. Annual Dinner and Reunion.

Wednesday, February 7th.

THE ROYAL SOCIETY OF ARTS.

At 8 p.m. At John Street, Adelphi, W.C. Lecture on "Electrical Resistance Furnaces and their Uses," by Mr. C. R. Darling, F.Inst.P.

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION).

At 6 p.m. At Savoy Place, Victoria Embankment, W.C.2. Experimental Demonstration. "The Measurement of the Electric Intensity of Received Radio Signals," by Mr. J. Hollingworth.

MANCHESTER WIRELESS SOCIETY.

At 7.30 p.m. At Houldsworth Hall. Elementary Lecture No. 3. By Mr. Y. W. P. Evans.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.

At Clare Hall. Elementary Instruction Evening.

EDINBURGH AND DISTRICT RADIO SOCIETY. At 8 p.m. At 117, George Street. Business Meeting. Lecture on "Wireless Transmission of Photographs," by Mr. F. Wyndham.

TOTTENHAM WIRELESS SOCIETY. Lecture on "Valves," by Mr. Kaine-Fish.

Thursday, February 8th.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.

At 8 p.m. Visit to Electricity Works.

ILFORD AND DISTRICT RADIO SOCIETY. Lecture on "Accumulators," by Mr. C. G. Rope.

HACKNEY AND DISTRICT RADIO SOCIETY. At the Y.M.C.A., Mare Street, E.8. Informal meeting.

Friday, February 9th.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY. At 7.30 p.m. At the Dept. of Applied Science. St. George's Square. Elementary Class.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY. Lecture (Part II) on "Inductance and Capacity." By Mr. W. G. Marshall.

BELVEDERE AND DISTRICT RADIO SCIENTIFIC SOCIETY. Discussion on "Proposed Transmitting Apparatus," opened by Mr. S. Burman.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company :—

London	**2LO**	369 metres.
Birmingham	**5IT**	420 ,,
Manchester	**2ZY**	385 ,,
Newcastle	**5NO**	400 ,,

Cardiff **(5WA)**, 395 metres, we understand is to be working by the time this issue appears.

Correspondence

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—A remarkable phenomenon that has been observed at my station many times during the past 12 years, was again repeated on the morning of December 20th, between 1 a.m. and 2 a.m.

It was the day of the great gale, and the barometer at the time stood at 28.7.

As frequently happens during these storm periods, there was considerable rise and fall in strength of some of what might be termed the nearer distant coast stations, but more pronounced than usual.

I was intercepting on 600 metres, and both **GMH** (Malin Head) and **FFU** (Ushant) were at work, the former communicating with Cullercoats, and the latter with ships. The strength of both stations was varying from moderate to very loud, but the curious point is this: *immediately* the Ushant signals began to increase, the signals of Malin Head would fade away, and *vice versa*, just as if they were at each end of a see-saw.

These two stations *have always behaved in exactly the same way* during periods of waxing and waning, as heard in London.

After many years' close observation, this is the only instance of consistency with regard to this phenomenon that I have come across.

Unfortunately, these investigations require a skilled knowledge of morse and an intimate acquaintance with all coast stations within 1,500 miles, as they can only be made on the 600 metres wave, where a number of stations in different directions can be heard simultaneously.

It will be interesting to hear if the interception of American amateurs was good on this date.

B. S. T. WALLACE,
P. O. Telegraphs.

Questions and Answers

NOTE.—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 the questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *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.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"A.C.W." (Chelmsford) *submits a diagram of his receiver and asks for a diagram of connections showing the addition of two note magnifying valves.*

A diagram of connections is given in Fig. 1. Suitable values are indicated in the figure.

"J.J." (Glos.) *submits a diagram of connections of his receiver and asks* (1) *What wavelength range will the receiver cover, the A.T.I. being wound with wire similar to the sample submitted.* (2) *Is the circuit suitable.* (3) *Is it necessary to use a variable condenser in the circuit.*

(1) The sample of wire submitted is No. 22 enamelled copper wire, and with an average aerial the coil should tune from 200 to 3,000 metres. (2) The circuit is a very simple one, and is quite correct. (3) A variable condenser having a maximum capacity of 0·001 mfds. can be connected in series with the aerial. A small increase in signal strength may be expected.

"WAVY" (Sussex) *wishes to make a basket coil suitable for the broadcast transmissions, and asks for particulars.*

We suggest you wind 40 turns on a 2" diameter former and use the aerial condenser in series. The reaction coil may consist of 30 turns on the same diameter former. The wire in your possession is fairly suitable, but it would be better to use No. 22 D.C.C.

"W.T." (Smethwick) *submits a diagram of his receiver and asks* (1) *Whether it is suitable, and* (2) *Suitable values for the high frequency transformer and reaction coil.*

(1) The diagram of connections is quite suitable although it is somewhat involved. (2) The primary, secondary and reaction coils may form part of a three-coil holder. If it is desired to use the plug-in type of high frequency transformer, the reaction coil may be made to rotate close to the top surface of the transformer. The battery required for the detector circuit may consist of two dry cells.

"A.F.W." (Morpeth) *asks* (1) *Is a potentiometer necessary to give the grid of the detector valve a suitable potential.* (2) *Is the circuit submitted and are the values given suitable.* (3) *Is a grid leak and condenser necessary.*

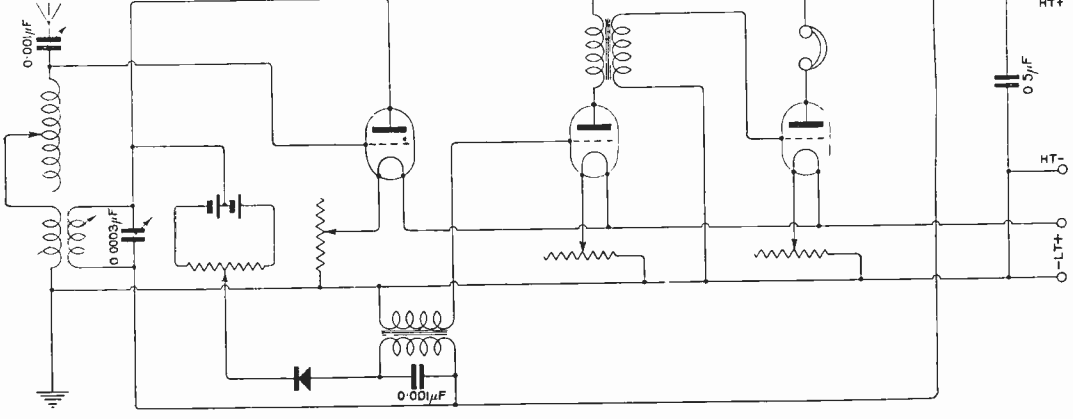


Fig. 1.

(1) It is not always necessary to use a potentiometer for controlling the grid potentials of valves. When a number of valves are used, there is an advantage in using a potentiometer, but with only a one-valve receiver, there would be no advantage gained. (2) We suggest you join the aerial condenser which has a maximum capacity of 0·001 mfds. in series with the aerial tuning inductance. A smaller inductance coil, which could be 4″ in diameter and 5″ long, wound full of No. 22 D.C.C. with 12 tappings, would be more suitable for short wavelength work than the large coil which you have at present. (3) A grid leak and condenser is necessary, and it would be better to connect a small fixed condenser across the telephone terminals. This condenser could be 0·001 mfd.

"D.N.B." (Beds).—(1) The wavelength of a frame aerial and condenser is calculated by the formula

$$\lambda = 1884\sqrt{LC}$$

where L is the inductance of the frame aerial in microhenries, and C is the capacity of the condenser in microfarads. Given the wavelength and the capacity, the value L may be calculated directly without difficulty. To increase the wavelength range of the aerial circuit you should add a few more turns and bring them to a switch for putting them in or out according to the wavelength desired. We suggest 18 turns, or you could increase the size of the frame to 4′ 6″, and use 15 turns with tappings. When using a frame aerial, it is generally better to use a number of H.F. valves, depending upon the stations whose transmissions you wish to receive. We suggest the use of 2 H.F., 1 detector, and 1 L.F. valves when the stations are rather far distant. For broadcast reception we think 1 H.F. 1 detector and 1 L.F. connected valves will be quite suitable. (2) A suitable scheme of connections is given in Fig. 2. The first valve is connected as a H.F. amplifier. A crystal detector

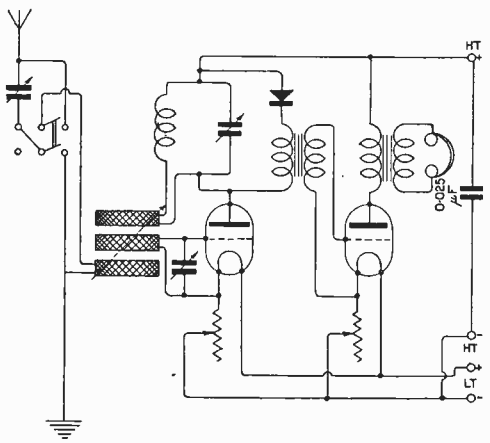


Fig. 2.

is joined across the anode circuit for rectification and the second valve is a note magnifier. The H.T. and L.T. potentials may be 60 volts and 6 volts respectively. The aerial tuning condenser has a maximum value of 0·001 mfds, and the closed circuit condenser 0·0005 mfds. The anode tuning condenser has a maximum value of 0·0002 mfds.

"W.B." (Barnsley) *asks for a diagram showing the connections of two H.F. valves with a crystal detector.*

See Fig. 3. Suitable values are indicated in the figure.

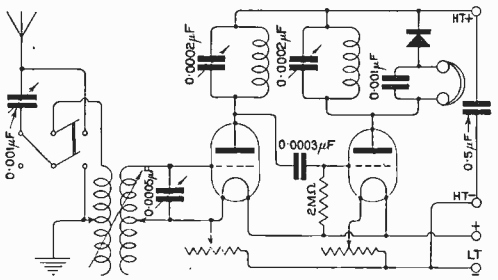


Fig. 3.

"C.W.R." (Kent) *submits a diagram of his receiver and asks* (1) *How to prevent oscillations being generated. The aerial coil and anode coil are widely separated.* (2) *How may the effects of A.C. lighting in the house be eliminated.* (3) *What type of receiver would the best for operating a loud speaker for the transmissions.* (4) *Why does placing an earthed body near the tuning condensers cause a greater wavelength change when receiving C.W. than when receiving spark signals.*

(1) It would be advisable to connect the potentiometer across the + and −L.T. The earth lead and one end of the grid leak could then be brought to the sliding point of the potentiometer and adjustments made to prevent the set oscillating. When the aerial and anode circuits are tuned to the same wavelength, oscillations are usually generated, and it is necessary to provide a small current in the grid circuit as a rule to prevent the oscillations. (2) Special attention should be paid to the lead-in aerial wire and the earth connection. The wires should be run well away from other bodies, and in the case of the earth wire, should be as short as possible and make connection with a good ground connection, which should not be used for any other purpose. The low frequency portion of the amplifier may be screened by being placed in a metal box. (3) We suggest you use one high frequency, one detector, and two L.F. connected valves for the reception of broadcasting. The signals could be sufficiently amplified with this combination to properly operate the loud speaker. (4) The reason why capacity effects are more noticeable when receiving C.W. signals is because C.W. signals are very much more sharply tuned than spark signals. Small changes in the capacity of the circuit, which cause small wavelength changes are thus more noticeable.

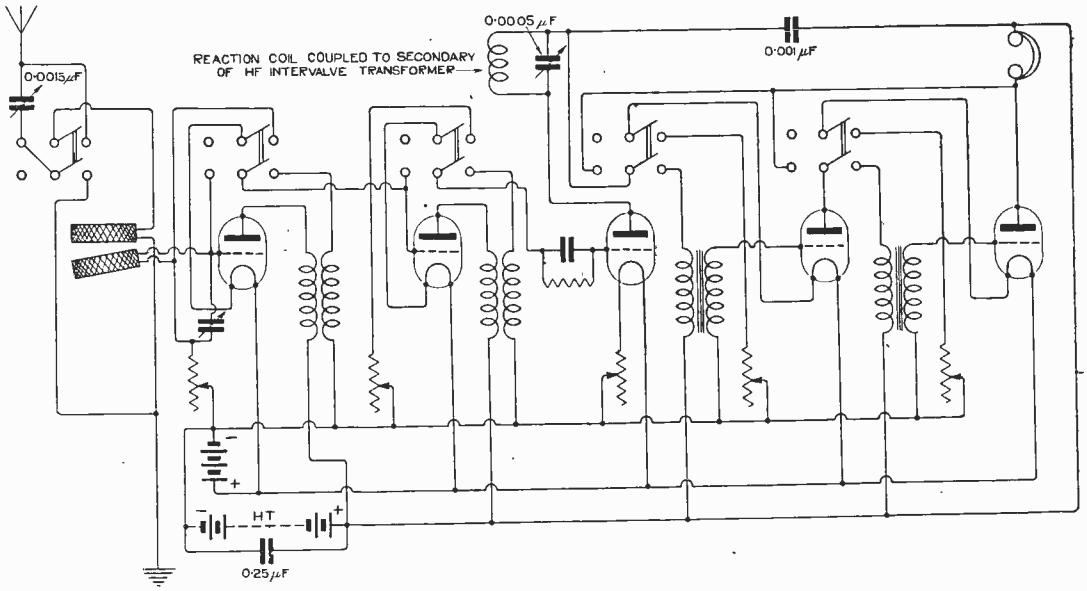


Fig. 4.

"J.B." (Sheffield) *asks for criticism of his set, particulars of which are submitted.*

The only modification required in the aerial circuit is that the tuning condenser will usually have to be connected in series instead of in parallel with the aerial tuning inductance. Fig. 4 indicates the method of connecting apparatus. We think you will require a five-valve set, but the sketch shows the switching arrangements in case you do not always require this number of valves to give signals of comfortable strength.

"S.F.W." (Berwickshire) *asks* (1) *Whether a "V.24" type valve is a good amplifying valve and a poor detecting valve.* (2) *If the "V.24" type valve is a poor rectifying valve, is there another valve having the general shape of "V.24" type valve which is a good rectifier.*

(1) The "V.24" type valve is a good amplifying valve, and is very useful for high frequency amplification. It is not such a good rectifying valve as other valves. (2) The "Q" type valve was specially designed for rectification, and is somewhat similar in shape to the "V.24" type valve.

"N.T." (Barrow-in-Furness) *submits particulars of his receiver and asks* (1) *Whether the circuit is suitable.* (2) *May Burndept type coils be used in place of the duolateral type coils in an Armstrong super-regenerative receiver.* (3) *Capacity of the variable condenser.* (4) *Whether it is necessary to get permission before one can erect an aerial across the street.*

(1) The proposed arrangement is fairly suitable although the reaction coil is coupled with the closed circuit coil, and unless care is exercised when making adjustments, oscillating energy will be transferred to the aerial circuit to the detriment of other people who are receiving. (2) Provided the inductance value of the Burndept coils is similar to the inductance value of the duolateral coils they may, of course, be used. (3) The capacity of the variable condenser is of the order of 0·0012 mfds. (4) You are obliged to secure the permission of the District Surveyor before you may erect an aerial across the street, but we believe there will be no objection provided the aerial is 30 feet above the street level.

"A.C.B." (E.15) *submits a diagram of a transmitting circuit, and asks for criticism.*

The circuit submitted is suitable, but you could hardly expect to get good telephone transmissions when using rectified 50 cycles alternating current, unless you have a very efficient smoothing system. The condenser across the secondary of the microphone transformer should be variable, as the adjustment of the condenser affects the quality of the speech transmitted.

"E.J.S." (Dorset) *asks advice as to the best method of erecting his aerial to avoid the power wires.*

We suggest you run the aerial at right angles to the power line, even although this means that the aerial must be 25′ above them. This construction would certainly be more satisfactory than the alternative arrangement.

"F.G.S." (N.8) *submits particulars of his receiver and asks for suitable sizes of A.T.I. and closed circuit inductance.*

The A.T.I. coil may consist of a winding 4″ long and 5″ in diameter, wound full of No. 22 D.C.C. Eight tappings should be taken, the first one after 1″ of winding, and the remainder may be equally spaced. The secondary circuit may consist of a winding 4″ in diameter and 5″ long, of No. 28 D.C.C., with eight tappings, equally spaced after the first $1\frac{1}{2}$″ of winding.

D

"**E.L.**" **(Devonport)** *asks* (1) *For the weight of wire to use as a primary and secondary winding on L.F. transformer.* (2) *Is the proposed arrangement for winding a coil to be used in the anode circuit of the H.F. connected valve suitable.* (3) *Why is it that when listening to some transmissions the carrier wave is heard very strongly and the telephony rather weakly.* (4) *For a diagram showing the connections of a potentiometer connected to control the grid potentials of the H.F. valves.*

(1) The primary winding may consist of 3½ ozs. of the wire in your possession, and the secondary 5 ozs. of the same diameter wire. (2) The proposed

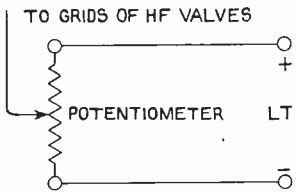


Fig. 5.

arrangement for building a coil to be used as a tuned anode coil is not very suitable. The self capacity of a coil constructed on the principle suggested would be very large indeed. We suggest you use an ordinary honeycomb winding. (3) The reason why you hear the carrier wave of the transmitting station very loudly and the telephony only faintly is due largely to the adjustment of the transmitting apparatus. Modulation is very incomplete, and the speech waves produce more or less a ripple upon the continuous waves transmitted. (4) The arrangement is given in Fig. 5. The grid connections are taken to the sliding contact of the potentiometer which is joined across the L.T. battery.

"**M.H.H.**" **(Birmingham)** *asks* (1) *For dimensions, gauge of wire, number of turns, and the number of tappings for a coil which will tune from 200 to 2,000 metres, with a 0·0002 mfds. tuning condenser.* (2) *For particulars of a suitable reaction coil to work with the above coil.* (3) *How much would the plate voltage be increased when resistance capacity coupling is used.*

(1) We suggest you make the coil 4″ in diameter and 7″ long, wound full of No. 32 D.C.C. Twenty tappings should be taken. (2) The reaction coil may consist of 150 turns wound on the 3″ diameter former which you have, with three tappings. (3) The high tension voltage should be approximately doubled, when a resistance of the order of 50,000 ohms is connected in the anode circuit.

"**F.S.R.**" **(Catford)** *asks* (1) *For a diagram of a three-valve receiver.* (2) *What is the natural wavelength of an aerial 40′ high and 45′ long.* (3) *What wavelength is obtainable when 45 turns of No. 25 D.C.C. from the basket coil are connected with the above aerial.* (4) *What is the capacity of a fixed condenser which consists of six plates of copper foil, 1½″ × ¾″.*

(1) See Fig. 5, page 356, December 9th issue. (2) The natural wavelength is of the order of 120 metres. (3) Without knowing the dimensions of the coil referred to, we cannot calculate its inductance and so get the wavelength to which it will tune when connected with the aerial mentioned in (2). The wavelength is probably 300 metres. (4) The capacity of the fixed condenser is roughly 0·006 mfds., but we cannot work it out exactly, as you have not given us sufficient particulars. We suggest you work this out for yourself. The capacity C mfds. of a fixed condenser is equal to

$$\frac{0{\cdot}0885\,KA\,(N-1)}{t}$$

where A equals the area of overlap in square centimetres.
K is the specific inductive capacity of the dielectric.
N is the total number of foils, and
T is the thickness of the dielectric in centimetres.

"**A.E.**" **(Ashby de la Zouch)** *submits particulars of a proposed arrangement and asks for criticism.*

The proposed arrangement for attaching the Skinderviken button to the receiver diaphragm is quite suitable, although a little experimental work will be necessary before the adjustments are correct. Four dry cells will provide sufficient current to energise the microphone and loud speaker. The low resistance telephone should have a resistance of the order of 60 ohms, otherwise a transformer should be used. On account of the steady direct current which will be flowing through the receivers, it will be well to reverse the connections to see that best results are being obtained.

"**H.G.**" **(N.W.6)** *asks which coils should be used when tuning in.*

When receiving broadcast transmissions, we suggest you use the No. 35 coil in the aerial circuit, No. 50 coil in the closed circuit, and No. 75 for reaction coil. It may be found the reaction coil is too large, in which case the No. 25 should be used. The amount of reaction required depends entirely upon the method of wiring up the set, and whether it has an inherent tendency to freely oscillate or not. The same ratio in general should be used throughout the range of wavelengths covered by the coils, although on higher wavelengths it will generally be found necessary to use a coil for the reaction circuit which is smaller than that used in the aerial circuit.

SHARE MARKET REPORT.

Prices as we go to press on January 26th, are :—

Marconi Ordinary	£2	10	0
,, Preference	2	4	0
,, Debentures	107	0	0
,, Inter. Marine ..	1	9	8
,, Canadian		11	0
Radio Corporation of America :—			
Ordinary		16	0
Preference		13	6

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 182 [Vol. XI. No. 19] FEBRUARY 10TH, 1923. WEEKLY

The Barrel Switch.

HOW TO USE IT IN WIRELESS CIRCUITS.

THE complicated circuits now so frequently adopted in wireless receiving work, bring about difficulties in the design of suitable switches necessary to make the required circuit changes.

The most reliable type of switch, carrying a number of contacts and capable of giving a variety of combinations is shown in Fig. 1. This type of switch is not receiving a great deal of attention in this country, probably

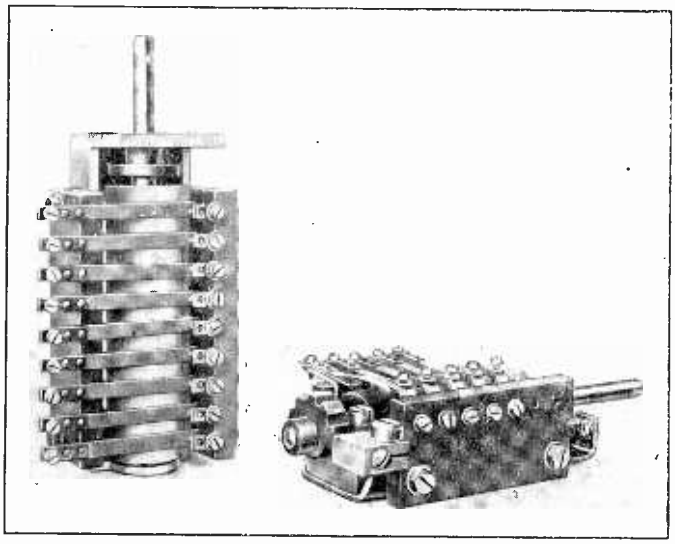


Fig. 1. *A somewhat elaborate barrel switch capable of a variety of combinations.*

Many types of switches are available, but most of them present difficulties with regard to the simultaneous changing of many circuits.

The mechanical construction of switches which have to carry a number of contact arms or make simultaneous contact at many points, must be so well carried out that they are necessarily costly.

because of the absence of a design embodying only few component parts.

A simple design suitable for experimental use is given in Fig. 2 and 3. It consists essentially of two ebonite plates which carry a number of contacts and held together by ebonite end pieces which serve as bearings for a revolving drum. On this a number of pegs are

arranged for forcing the lower springs, when required, in contact with the upper ones.

In constructing a switch of this type, the first consideration is to procure suitable springy metal for making the contact pieces and it is necessary, as these springs may be required to remain bent for a long while, that the metal employed should have properties which can be relied upon to restore it to its original position. Phosphor bronze or German

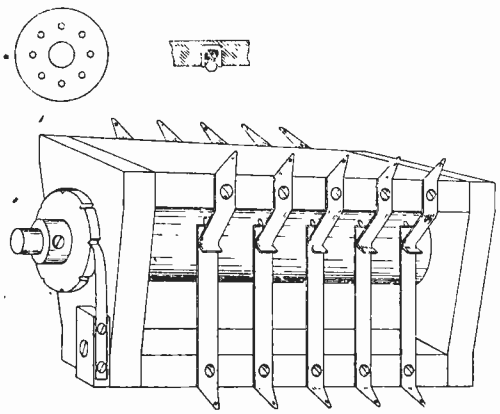


Fig. 2. A simple rotating switch.

silver of about No. 26 wire gauge should be adopted. The pieces are cut to length and drilled where required, and the tapering tag ends may be made by clipping or filing. The bends which are required can be made with round-nosed pliers in order to obviate an acute angle which is liable to cause a fracture after the contact pieces have been moved a few times. With this type of switch it is not essential that special non-oxidising contacts be adopted, as ample contact surface can easily be arranged, and fairly hard pressure can be made between the contacts. If it is thought advisable to fit special contacts, this can easily be arranged by drilling small holes in the spring pieces at the points of contact, and fitting in small pieces of silver wire, and hammering over. The design shown is fitted with a number of spring contacts on each side, so that many circuits may be changed out, but in certain cases it may be better to arrange contacts on one side only. Contacts should only be fitted at both sides when a large number of circuits have to be made or broken by a single movement of the operating handle. The spindle to which the operating handle is attached carries an ebonite cylinder, into which holes are drilled to carry small screw-in pegs. It is as well to drill a number of rows of holes in the cylinder and tap them so that the pegs can be inserted just where required, depending upon the circuit in which the switch is to be connected.

The best way of securing the ebonite cylinder to the spindle is by drilling a hole right through the centre and driving home a slightly tapered pin.

In order that the cylinder may move through a required distance from one change to the next, a disc of brass about 1 in. in diameter and $\frac{1}{8}$ in. thick may be secured by means of a grub screw to an extension on the spindle at the opposite end to the operating knob. The disc may have a number of slots cut around the circumference to which a spring can engage.

Alternatively, holes can be made in the face of the disc with the point of a large drill, and a ball may be pressed into the holes by a spring which is carried in the ebonite end plate. This arrangement will cause the spindle to revolve with a jerky motion, halting at each point at which a number of contacts are made.

The design shown in Fig. 1 is rather beyond the scope of many experimenters to make up. In principle it is of course similar to that just described, though it is perhaps more durable. Each of the springs is supported by a small brass bracket held to an ebonite support by a single screw and prevented from turning by being placed in a slot made in the ebonite. The other set of contacts are quite rigid, and consists of brass brackets held in slots in a piece of ebonite on the opposite side.

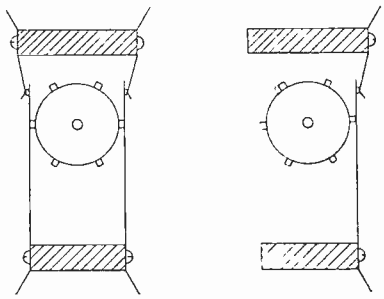


Fig. 3. Sectional view of simple barrel switches.

As it is lighter in operation, this type of switch may operate many more contacts than the one previously described, and as many as fifteen to twenty contacts may be arranged.

The cylinder which carries the pins is in this case about 1 in. in diameter, but if more positions are required, it may be extended to about 1½ ins. It cannot be made larger than this, for any increase in diameter will decrease the curvature, and consequently the closeness of the studs will be limited

The switch shown in Fig. 4 is of American manufacture and embodies an arrangement by which, when contact is broken with one spring, it is made with an opposite one as it is forced outwards. This is particularly useful as it may be desirable that certain contacts are made in all but one position of the switch, and with the previous type it would be necessary under such circumstances to insert pins in the revolving cylinder nearly the whole way round.

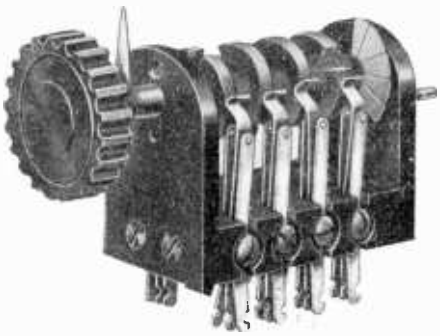


Fig. 4. A revolving switch of American manufacture.

Such a condition is required when switching in or out of circuit a number of valves. For instance, it would be necessary for the second valve filament current to be off in one position, whilst on in all other positions of the switch, which may be arranged for introducing the third, fourth or fifth valves, and so on.

One of the most useful applications of a switch of this sort, is for tapping out an inductance coil. It is possible, by means of a large number of contacts, to introduce inductance at either end of the coil so that the extent of coupling between the inductance which is being tapped and an adjoining one may remain at a suitable value, as the inductance value is changed. It is also possible to provide for short circuiting sections of the coil, such as is frequently the case when tuning to short wavelengths.

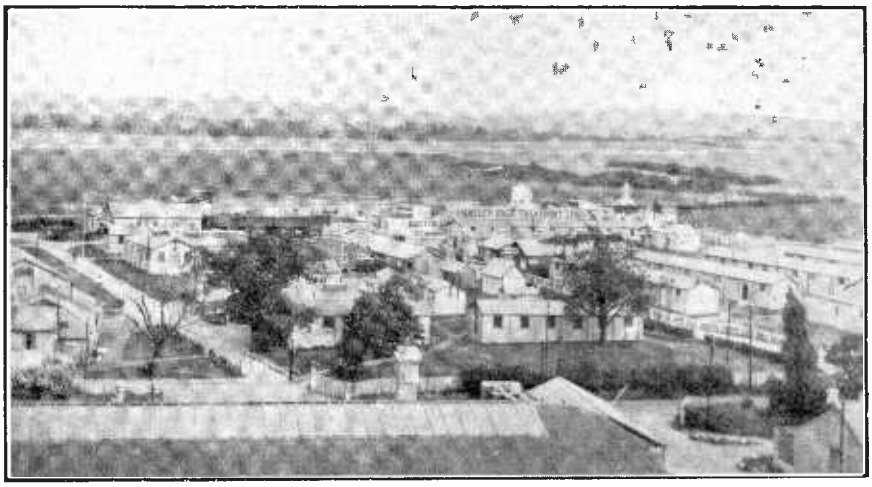
A barrel switch may be used to tap out simultaneously the tuned anode circuits of a multi-valve high frequency amplifier, and of course when used for switching any form of inductance, it may easily be arranged to avoid " dead-end " effects. There is no better way for switching multi-valve circuits than by means of the barrel type switch. It permits, if desired, the switching of grid circuits, which can scarcely be safely introduced with any other type of switch owing to insulation and capacity difficulties, and moreover, all the complicated operations, by introducing the required number of valves, may be effected by the turning of one handle. A switch of this kind is particularly suitable for making and breaking circuits as may be occasioned when changing over from receiving to transmitting apparatus, as one simple movement of a lever attached to the spindle can be made to change out a large number of circuits.

Barrel switches may be employed with advantage in the design of apparatus specially intended for broadcast reception, and be operated by persons not possessing a great knowledge of the principles of wireless reception. One handle may be arranged to revolve the cylinder, and in so doing change the proportions of inductance and capacity in the circuit in ratios which will produce the best results. The absence of contacts on the front of the instrument is another advantage particularly desirable in receivers of the broadcast type.

Further applications of the barrel switch will readily present themselves to the experimenter, and the designer of commercial type apparatus is reminded that such a switch might receive more attention now that wireless receiving circuits are becoming so involved.

Elementary Lecture and Demonstration.

An Elementary Lecture entitled " Fundamental Principles of Radio Reception," will be given on Friday, February 16th, at 6.30 p.m., by Mr. Maurice Child at the Institution of Electrical Engineers, Victoria Embankment. This is the second of a series of Elementary Lectures arranged by the Radio Society of Great Britain. An invitation to attend is extended to anyone interested.



General view of the Croydon Aerodome, the London Terminus of British Civil Air Routes.

The Applications of Wireless to Commercial Flying.

By "AERADEN."

TO the ever increasing number of amateurs in this country who so frequently listen-in to the conversations between the pilots and operators on the various air expresses and the traffic controllers on the ground, an explanation of what is actually going on will no doubt be welcome. They will be better in a position to appreciate the operation of an air route, and some of the problems which confront the aircraft radio-engineer to-day; and they will be enabled to comprehend the headway that has been made, at times against apparently insurmountable difficulties, since the close of the late war in building up, by wireless, a system of signalling which would form so valuable an aid towards establishing the airways on a basis at least comparable with those of the other methods of modern transport.

The average person, with little knowledge of the Morse code, who possesses a small receiving circuit will be most interested in the application of radiotelephony. The more enthusiastic amateur will want to know the ground which is being covered by the use of telegraphy. The more serious experimenter still will be looking for the technical applications of both branches of the work, and will expect to hear something of how aircraft are navigated by wireless.

Before remarking upon the adaptabilities of each of these three classes of wireless, it will be well to consider the factors governing them.

The modern passenger-carrying aircraft has an average cruising speed of 90-100 miles per hour, so that in the space of one minute it can have moved approximately a mile and a half. Under favourable weather conditions, when the pilot has an undisturbed view over many miles of country, this speed is such as to give the machine one of its chief advantages over other forms of transport, and it can continue its journey in perfect safety. Such a speed is not, however, either so fascinating or so useful when the air journey has to be carried out through low-lying clouds or mist, when the visibility is impaired, and it is not always possible to see distinguishing features and landmarks along the route. Sense of direction can become inaccurate, flying by compass difficult, and distance readily misjudged.

It is essential, therefore, that the most rapid means of communication possible must be arranged between the aircraft and ground stations, in order that navigational assistance, or other messages, may be passed to the pilot with the least delay.

Given that all enunciation is clear, and that signalling conditions are good, radiotelephony

possesses every advantage over Morse signalling or radiotelegraphy, for fulfilling this condition of speedy communication. There is nothing faster than the spoken word, and provided it is not misunderstood, whole conversations can be exchanged between ground and air in the same time that it would take to telegraph a single sentence. Conditions for wireless signalling in the air are distinctly different from those on the ground. There is the noise of the engine, the rush of the air, the rattling of metallic parts and the hum of the wind in the struts and stays. The pilot has in addition several things other than wireless which require practically constant attention, and from his point of view alone, it is more desirable to listen to speech which he can almost subconsciously follow and memorise than to Morse signals.

Signalling between the terminal aerodromes of the routes, comprising the messages giving details of the arrivals and departures of the various aircraft and information relating to them, together with reports on weather conditions at different points, is the other big consideration for which provision has to be made. On a busy route, and every air route is comparatively busy to-day, there are many such messages. Here great accuracy is essential, but rapidity not quite of such importance, and telegraphy is employed. The scheme is divided under the two groups of traffic signalling and weather signalling, each group having its own particular wavelength. All the traffic messages are passed direct from one terminal point to the others on 1,400 metres, while 1,680 metres is the wave allocated for the dissemination of the appropriate meteorological data.

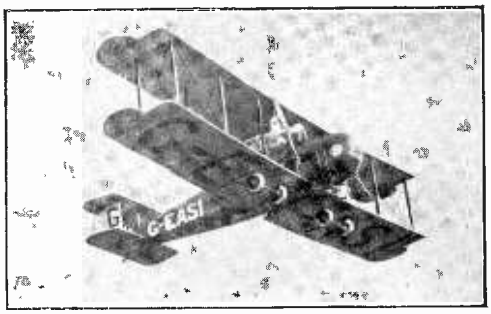
Assistance for navigation by direction finding methods is carried out on the wave upon which the aircraft communicate with the ground, and no doubt this wavelength is familiar to everyone who has ever heard the Croydon station. It is 900 metres.

The fundamental division the classes of work is, then, apparent.

RADIOTELEPHONY.

Bearing in mind that the application of radiotelephony on air routes is limited to conversations between aircraft and the ground stations, and, through the latter, the controlling staffs, let us consider its scope.

The airway is divided into lengths of no actual fixed mileage. The approximate

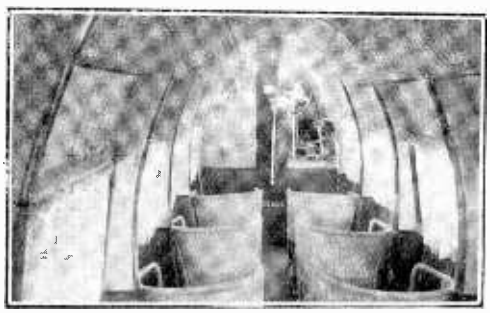


The "City of London." A similar machine flew the Atlantic from Newfoundland to Ireland in 15 hrs. 57 mins.

distance between any two ground stations happens, at the present time, to be in the vicinity of 100 miles, and a figure somewhat under this distance may be assumed to represent the greatest range at which aircraft will normally be required to converse with the different aerodrome stations. An aircraft equipped with transmission and reception apparatus, capable of ensuring certain working during any period of the flight and under any climatic condition, will therefore fulfil the requirement. The question of range is a difficult matter to decide, however, in connection with a known input energy. Range in transmission depends largely upon such factors as the enunciation of the speaker, which brings a very personal element into the matter. Cases have occurred where it has been impossible to understand the operator on a machine speaking only a few miles away, while, simultaneously, every word spoken by a pilot working an exactly similar instrument at a much greater distance has been heard perfectly. This is just as much a detrimental factor in radiotelephonic working as the development of a fault in the control or power circuits of the transmitting unit. Again, the range over which a given transmission can be intelligibly picked up varies considerably under different conditions. The pilot of the aircraft, apart from the disturbing noises already referred to, may be receiving on circuits which, owing to continuous shaking to which they may have been subjected, are experiencing interference from various sources; or he may be flying in a neighbourhood of localised atmospheric disturbance. He may not even be getting the best out of his receiver, for he has not the opportunity of absolute concentration upon the task of accurate tuning that is afforded to the ground operator. As

passenger-carrying aircraft increase in size and capacity, and as the present financial difficulties decrease, there is not the slightest doubt that it will be possible to employ operators in aircraft in precisely the same manner as they are at present employed in the Mercantile Marine. To-day, for reasons of general economy, the aircraft wireless operator exists practically entirely in imagination, and it is therefore a condition of the air pilot's licence that he should be capable of operating wireless in the air.

Range in this class of work can, then, be an elastic quantity and to ensure that every aircraft shall be in touch at the given maximum distance, the capability of the least efficient operator and aircraft set must be taken as the standard for that distance. At the same time matters must not be allowed to go to an extreme where excessive powers are employed for the desired range. Generally speaking, the ability of a given set in a given machine can be accurately gauged, and success therefore rests to a large extent in the hands of the man working it.



Interior of an Instone Air Liner showing the elaborate arrangements for the comfort of passengers.

In addition to enabling communication between ground and air to be effectively carried out, radiotelephony can in necessity permit of conversation between the per onnel of different machines, an event which may be said to increase the factor of safety of the air route. Of the few accidents which have occurred since the inception of the London Continental Airways one at least might be said to be directly attributable to a lack of information on the part of the pilot, and, had full advantage been taken of the use of wireless, might possibly never have occurred at all. An organisation is now in force whereby in operating along a given route, an aircraft must fly at least 100 metres to the right of it, and if wishing to cross, must do so at right angles, thereafter keeping to a distance of some miles on the opposite side. The purpose of such a regulation is, naturally, to reduce whatever chances of collision exist to an absolute minimum; but it will occur to the mind that, even so, with the additional assistance of wireless, and with the ability, if necessary, to speak to any other aircraft in the vicinity, the journey can be carried out in a far more satisfactory fashion. A pilot in doubt, who knows that another scheduled machine should be in his neighbourhood, can readily call that machine on his telephone and determine the height at which it is flying, at the same time giving information concerning himself. Each can then fly to give the other sufficient clearance.

The direction in which telephony renders its two most important non-navigational aids to commercial flying, are in checking the passage of aircraft over sections of the airway, and in furnishing the air personnel with weather reports and forecasts.

As an example of the former, consider the case of an ordinary passenger machine, of registered number G-EABC, which leaves Croydon for Paris let us say at 1005. The departure of this aircraft is known, of course, to the Controller of the Air Port, and he has taken the necessary steps to advise the port of destination, Le Bourget, and, as necessary, the intermediate aerodromes—Lympne and St. Inglevert. The wireless stations along the route then are told that G-EABC is on its way between London and Paris. When well away from the ground the person operating the wireless on the machine releases his aerial and the long stranded wire, many feet in length and carrying a lead plummet of nearly a pound weight, hangs beneath the machine. Croydon is then called and a message of the form :—

" G-EABC London for Paris,"

is passed. That ground station may be fully aware of the fact, having probably already been advised by the Air Port Traffic Officer, but the process of calling the station and receiving its reply constitutes at least a suitable test for the wireless apparatus on the aircraft. The news of the receipt of this signal by Croydon is at once passed to Lympne by radiotelephony, as :—

" G-EABC left Croydon for Paris 1005," which signal is acknowledged by the latter

station. When about 30 miles distant from Lympne the aircraft calls and reports :—

" G-EABC, London for Paris,"

which is duly acknowledged. And so the aircraft proceeds on its way, conversing, if possible, with the French stations in their own language, though, if the pilot or other person operating the telephone is unfamiliar with French, those stations can reply in English.

After G-EABC had once left Croydon, in the example under consideration, all communication with that machine would have been done through Croydon or Lympne on the 900 metre wave by telephony. Had the pilot wished to obtain information about the weather over the Channel or on the French side of the water he would have asked for the latest weather conditions in these districts when reporting himself to Lympne. Or, had it been known that it would be difficult or dangerous for him to continue the journey owing to very adverse weather at some portion of the route, he could have been called by the nearest ground station and ordered to land at a certain aerodrome. Abbreviated and long weather reports are made out hourly by each route aerodrome and exchanged with neighbouring aerodromes, so that any aircraft fitted for radiotelephonic working has merely to call the first aerodrome of any sector of the route that he is about to enter to learn exactly what weather he can expect in that sector. The abbreviated report gives him only a few important details, such as the visibility and height of the lowest cloud, while the long report furnishes him with a complete statement of current weather.

Had any trouble been experienced, or anything become necessary on the journey, he could have called a suitable station and informed the Traffic Officer of his requirements, and, upon landing some time later, any necessary arrangements would have been complete.

The chances of accident or loss of time on the airways due to negligence seem almost less than those upon the railways ; in fact, the percentage of fatal European accidents is apparently actually lower, comparatively speaking, on the former than on the latter. Perhaps flying is not so dangerous as some would have us believe ?

The routine of navigating aircraft by means of telephony will be discussed under the third section of this article, but there is one more application of the radiotelephone which is very important. At the present day telephony does not lend itself to more than a few simultaneous transmissions close together. The nature of a radiotelephonic transmission closely resembles that of the original spark system, and the desirable features of very sharp tuning, great selectivity and lack of mutual interference which are to be found in most C.W. systems do not exist. As a consequence but few telephony transmissions can usefully occur together without interfering with one another very seriously on a given wavelength, or on wavelengths of only a few kilocycles difference.

This latter application of radiotelephony, one which cannot, until such an objectionable drawback is eliminated be employed commercially, is known as " line-switching," and consists of connecting the ordinary line telephone system to the wireless circuits through a small exchange board, so that speech in one direction is relayed by radio. The advantages of such an arrangement are obvious. The manager of one of the aircraft firms can ring up the London Air Port, ask to speak to a certain pilot, and be told that he has already left for Paris, flying one of the regular expresses. If the matter is one of considerable urgency, he can be connected to the wireless station. The operator on watch can call the aircraft in question, and having established communication, switch the line telephone call through

Air Liner with Complement of Passengers about to leave the ground.

to the wireless, and manager and pilot can converse, the station operator changing from " send " to " receive " as requisite. Immediate " two-way " telephony by wireless, similar to that available on the line circuits, is not yet available, though it is probably but a matter of time before such an arrangement will be invented. It can be done now, but the apparatus necessary is as yet too cumbersome and costly to warrant its use on a commercial basis. Line switching will some day

open up possibilities of additional comfort and security to the air traveller. It will become possible for the passenger on the larger aircraft to pick up the telephone in his private cabin and ask the wireless exchange on board for parctically any number for many hundred miles round. He will be connected by wireless to a local radiotelephone station, and from thence relayed by line or wireless to the exchange of the number required, and the conversation will proceed as normally as the modern line call. Business men will be able to continue their daily routine while flying across Europe or the Atlantic, for the wireless telephone will certainly be developed along lines giving greater privacy in conversation; untappable radiotelephony will by that time have come also. There is practically no limit to the extent of such calls, for wherever there is a radiotelephonic instrument installed it will be possible to include it in the system. It is not a wild flight of imagination to conceive the passenger on the aerial liner over mid-atlantic to be speaking to the passenger on the express roaring along the Canadian prairies.

Already music of an excellent quality can be picked up nightly on the simplest receiving sets, and so, in the most distant future, the orchestra heard at dinner in the air liner's saloon will be the one playing many miles away at some central broadcasting station. After three years of hard pioneer work commercial flying is nothing like the impossibility that it at one time seemed. The small existing wireless telephone gives a range between ground and air of something like 150 miles. Who knows what it will have done even within the next decade?

Some Simple Methods of Controlling L.F. Valves.

ONE often wishes to have easy control over the number of valves employed in a receiver, and if switching arrangements are included for this purpose, a number of arrangements are possible.

Thus it sometimes happens that one possesses several pairs of low resistance telephones, and it is desired to switch them in circuit as required. The arrangement is very simple, and is given in Fig. 1 on the next page.

If it is desired to switch in a pair of high resistance telephones, as well as those of low resistance, the connections given in Fig. 2 may be used. The H.R. telephones are connected with a plug, and the jack is so connected that, with the plug out, the telephone transformer is in circuit. When the plug is inserted the H.R. telephones are joined in series with the telephone transformer.

When it is desired to use H.R. telephones

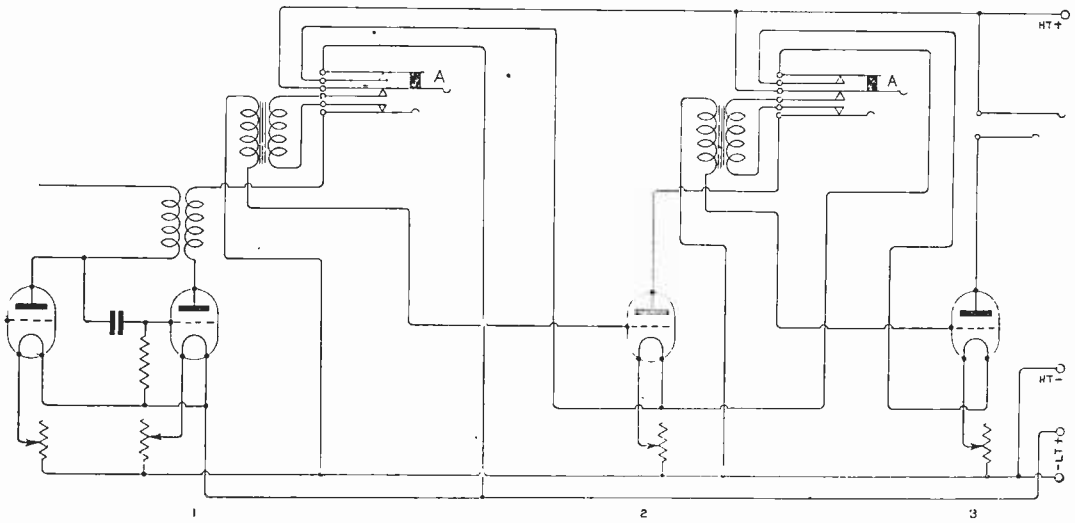


Fig. 6. Arrangement for switching more than two L.F. valves.

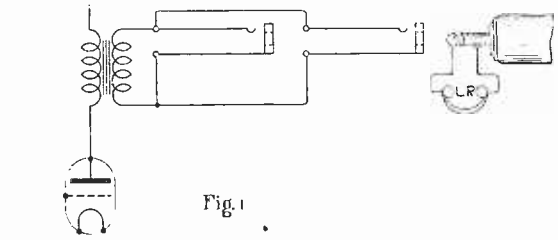


Fig. 1

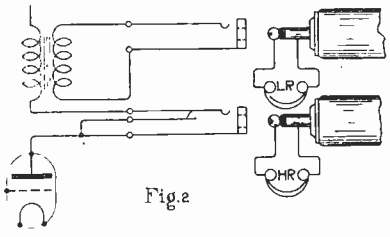


Fig. 2

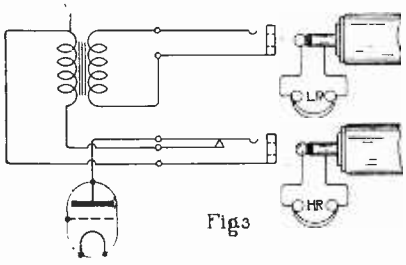


Fig. 3

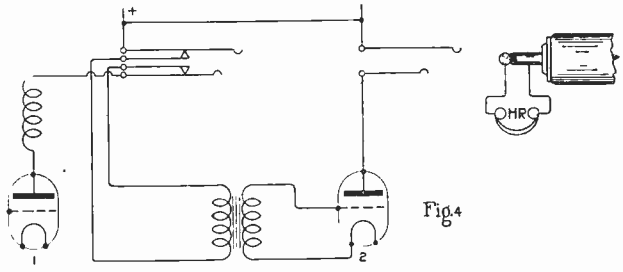


Fig. 4

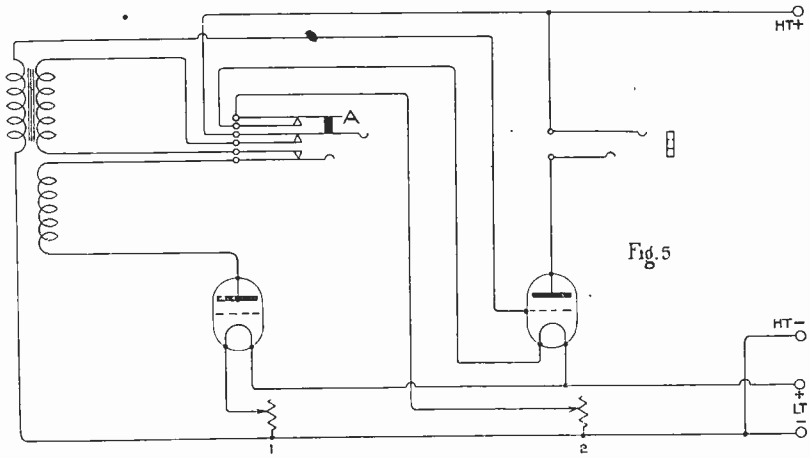


Fig. 5

Figs. 1 to 5. Various arrangements for controlling L.F. Valves.

alone, the connections in Fig. 3 may be used. When the plug to which the H.R. telephones are connected is inserted, the telephone transformer is disconnected.

In Fig. 4 are given the connections for plugging the telephones into either L.F. valve circuit. With the plug in jack 1, the intervalve transformer primary winding is disconnected, and the anode circuit is complete through the H.R. telephones.

Of course the plug may have connected with it a telephone transformer and L.R. telephones if required. With the telephone plug in jack 2, the valve circuit 1 is connected. This arrangement does not provide control of the valve filaments, which is an undesirable feature. If two more spring contacts are provided, the circuit Fig. 5 may be arranged. Here the springs "A" control the filament current of valve 2, so that when the telephone plug is in the valve 1 circuit, the filament of valve 2 is disconnected.

A slightly different arrangement should be employed when there are more than two L.F. valves. The arrangement is given in Fig. 6. Here it will be noticed the jack employed is identical with that used in Fig. 5, but the main filament current lead is connected with springs "A." When the plug is engaging the springs of valve 1 circuit, the filaments of valves 2 and 3 are cut off.

W. J.

Electrons, Electric Waves and Wireless Telephony—XIX.

By Dr. J. A. FLEMING, F.R.S

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication. The articles are therefore copyright, and rights of publication and reproduction are strictly reserved.

5. DUPLEX WIRELESS TELEPHONY.

Another matter of considerable importance in connection with wireless telephony is the arrangements necessary to allow the two correspondents to "cut in" and interrupt each other in course of a conversation. We know that when two people are conversing through a single speaking tube they have to be careful not to interrupt each other, for if both try to speak at once, or both listen at once, only confusion results. On the other hand, in the ordinary use of the exchange telephones we listen and speak at the same time. The listener can cut in with an interjection or question, or assure the speaker he is hearing, or ask for a word or sentence to be repeated. In the first forms of wireless telephony this cutting in was impossible. The aerial wire at each station had to be switched over from the transmitter to the receiver as required, and each correspondent had to be certain his distant colleague was ready to listen before he began to speak. This difficulty is to some extent obviated by the use of two slightly different wavelengths for sending and receiving, and the separation of the sending and receiving stations at each post by a certain distance. This was done in the case of the wireless telephone demonstrations across the North Sea conducted by Marconi's Wireless Telegraph Company between Southwold on the east coast of England and Landvoort, near Haarlem, in Holland, in 1921.

The distance between these places is 112 miles. At each place a transmitting and receiving station was established about 700 yards apart. Let us call these stations T_1 and R_1 in England, and T_2 and R_2 in Holland. The station T_1 telephones to station R_2 with a wave of 98 metres wavelength, and the station T_2 transmits to R_1 with a wave 94 metres wavelength. This difference of wavelength (4 metres) was found to be sufficient to prevent the transmitter "jamming" the near-by receiver on the same side. At each transmitting station there was a valve transmitter made as above described, and a transmitting aerial 18 metres high, in which was created an aerial current of 5—8 amperes, which was modulated by an ordinary telephone exchange microphone.

The total power taken up by the transmitter was about 5 kilowatts, and of this 10 per cent., or 0.5 kilowatt, was radiated from the aerial in the form of carrier waves. Underground wires were brought from the receiving station to the transmitting station, so that the actual speech and hearing on each side of the sea was conducted from one place, and the receiving valves could have their filament currents and high voltage circuits switched on from the speaking station. In this manner ordinary telephonic conversation was carried on perfectly.

The problem of duplex wireless telephony, meaning by that the ability of the two conversationalists to speak and hear at the same time and "cut in" as they please, cannot be considered as completely solved by the two-wave and separate station system, because such method could not be applied in the case of aeroplanes or ships for want of space. Accordingly the problem has engaged much attention. The difficulty of it will be realised when it is noted that in many cases where wireless telephony is of the utmost importance, as in speaking to or by aeroplanes from or to the ground station, only a single aerial is practicable on the aeroplane, and therefore the act of sending sets up strong oscillations in it, which,

if they have access to the receiving apparatus tuned for the same frequency, may completely jam the latter and set it out of order. Hence the real problem is to find a method of connecting the receiving apparatus to the aerial in such a fashion that the strong oscillations set up on sending shall not have access to it.

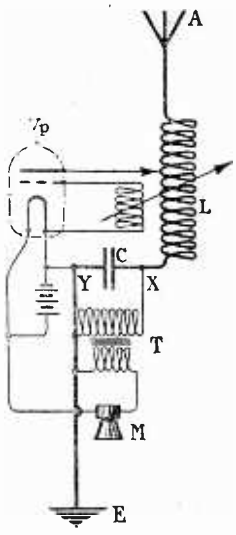


Fig. 103. *A type of quiescent aerial with valve transmitter in which the microphone M supplies the plate voltage in the act of speaking.*

One solution which has been suggested, but which is only an imperfect solution, is that often called the quiescent aerial. In this case the permanent high frequency oscillations are not maintained all the time in the sending aerial and modified in amplitude by the speech microphone on speaking, but the high electromotive in the plate circuit of the generating valve is applied only by the microphone when it is actually in operation by speech being made to it (see Figs. 103 and 104). The method, however, is not very successful unless a certain supplementary steady voltage is applied by a battery in the plate circuit of the generating valve. The reason for the imperfection is that the transformer in connection with the microphone takes a little time to build up the voltage in the plate circuit of the valve which is necessary to set up oscillations, and there is therefore a want of response unless there is a certain minimum of constantly maintained oscillations in the aerial, and the employment of these permanent oscillations defeats the very thing that it is desired to achieve, viz., the immunity of the receiver from the effect of the transmitter. We cannot, therefore, say that, as far as the confined space of aeroplanes is concerned, the problem of duplex telephony has been completely solved. As far as ground stations

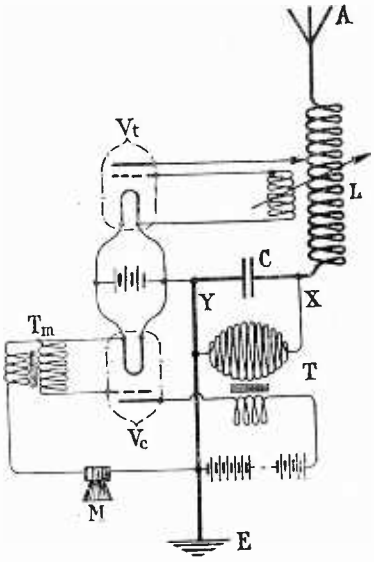


Fig. 104. *A type of quiescent aerial with valve transmitter. The microphone M controls the supply of plate voltage in the transmitting valve* V_t.

are concerned, it is worthy of notice that for not very great ranges with no very great differences in the wavelengths, for example, two wavelengths of 110 and 113 metres, and the transmitting and receiving stations only 100 yards apart, it has been found possible to conduct good duplex telephony.

6. Directional Short-wave Wireless Telephony.

Another question of great practical interest in connection with wireless telephony is the employment of very short electric carrier waves of a wavelength of only 12 or 15 metres, and of reflecting mirrors to make a beam of electric radiation like an electric searchlight. This "wireless beam" limits the lateral spread of the waves so that it conduces to privacy of speech. We have already explained in the section dealing with Hertzian waves that these waves can be reflected like rays of light from suitable surfaces.

In the case of an electric searchlight the arc lamp is placed in the focus of a parabolic silvered glass mirror, and this reflects all the rays falling on it in a direction parallel to the axis of the parabola (see Fig. 105). In the same manner, if we bend a large sheet of metal round two formers of wood so as to make a

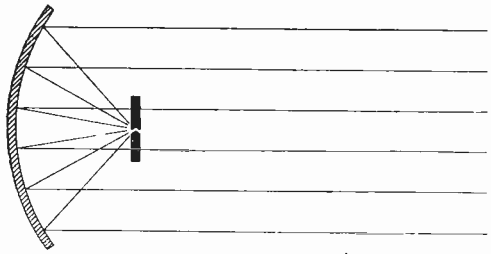


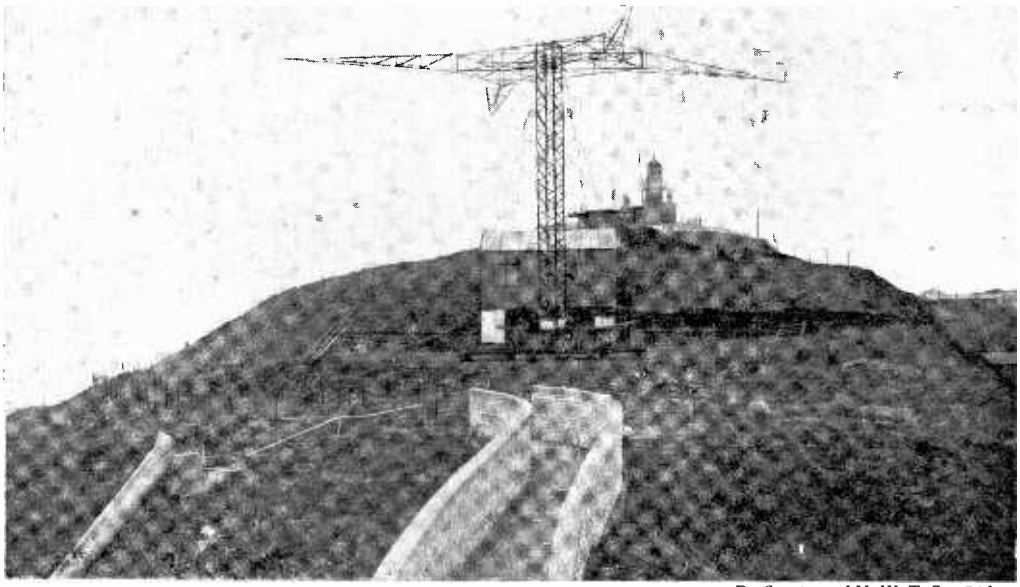
Fig. 105.

parabolic cylindric mirror, and place a Hertzian linear oscillator on the focal line of the mirror, then, provided the dimensions of the mirror are not small compared with the wavelength, we shall project a beam of electric radiation, or of Hertzian waves, parallel to the axis of the mirror.

Experiments of this kind were made many years ago by Hertz and other physicists, and in the early days of wireless telegraphy Senatore Marconi employed parabolic mirrors in the initial attempts to use Hertzian waves as a means of signalling.

It is not, however, very easy to produce continuous electromagnetic waves for the purposes of wireless telephony of wavelength much shorter than 10 to 15 metres. It is essential then that the dimensions of the mirror should be something of the order of 20 to 30 metres. If mirrors of solid metal were employed, these would not only be heavy to move, but would offer such surface to the wind that they would be dangerous to erect. It has been found, however, that if a number of wires are stretched parallel to each other on a frame, and at a small distance apart, this grid will reflect electric waves if the electric force in the wave is parallel to the direction of the wires.

Accordingly we can make a parabolic electric wave mirror which does not offer much surface to the wind as follows :—If we stretch a number



By Courtesy of M. W. T. Co., Ltd.

Fig. 106. *The Parabolic Reflector at Inchkeith, Firth of Forth, Scotland, as used for directional short wave wireless telephony.*

of wires parallel to each other round the edge of two frames of parabolic form placed at a distance, the wires being held in such positions that they lie on a parabolic sectioned surface, and if we place parallel to these wires, and on the focal line of the parabolic surface, a Hertzian linear oscillator, we can project a wireless beam (see Fig. 106). It is easy to construct such skeleton parabolic reflectors of considerable dimensions, and since the wavelength of the waves radiated from a linear oscillator, or two rods placed in line, is about twice the total length of the rods, we only require a linear oscillator of about 25 ft. or so in length to radiate electric waves of 15 metres wavelength.

Parabolic reflectors of this kind, with linear oscillators in their focal line, have been employed by Mr. C. S. Franklin in important experiments made for Marconi's Wireless Telegraph Company on directive short wave wireless telephony.* The carrier wave was 15 metres in wavelength, and the oscillations were generated by a couple of power thermionic valves having a power consumption of 700 watts, having 4,000 volts on their plate circuits, producing a plate current of 175 milliamperes. These valves created in a linear, or Hertzian oscillator, continuous oscillations of twenty million per second, and radiated a power of about 300 watts in the form of 15-metre electric waves. This oscillator was placed in the focal line of a skeleton wire parabolic mirror of about 30 metres aperture and a corresponding receiving aerial in the focal line of a similar reception mirror employed in reception by a usual amplifying valve detector.

After some preliminary and successful experiments at Carnarvon, a site was chosen at Hendon, and another at Frankley, near Birmingham, in February, 1921. These stations are 97 miles apart. With this plant telephonic speech was well conducted. Measurements indicated that the energy received with the directive mirrors up was about 200 times greater than when the mirrors were not used. Also it was found that very decided limitation to the lateral spread of the waves was obtained, so that places much outside the line of transmission could not overhear the speech.

It is quite practicable to employ still shorter wavelengths of less energy. Carrier waves, even as short as 4 metres in length, have been used for such reflector transmission of telephonic speech over seven miles. It is expected that the employment of this " wireless beam " in nautical wireless telephony will prove to be of great utility in giving ships direction and location during fogs.

As these articles are intended to deal only with the elementary principles of the subject, and to be within the range of knowledge of the general reader or would-be amateur in wireless telephony, it is not possible or necessary to extend them to cover more highly technical matters, such as long distance wireless telephony or the influence on it of such factors as soil absorption or atmospheric disturbances, which are sufficiently treated in various textbooks.

(To be continued.)

* For a full description of these experiments the reader is referred to *The Wireless World and Radio Review*, of May 20th, 1922, Vol. X, p. 219, and also to the Paper read by Mr. C. S. Franklin before *The Institution of Electrical Engineers*, May 3rd, 1922.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting of the Stoke-on-Trent Wireless and Experimental Society on Thursday, January 18th, Mr. L. F. Fogarty, A.M.I.E.E. (Treasurer of the Radio Society of Great Britain), gave a lecture on "Rectifiers."

Mr. Fogarty described the principles of rectification, and illustrated various types of rectifiers. The Nodon valve, the Ferranti rectifier, the "Acdic" rectifier, the "Tungar" rectifier, and several other rectifiers were clearly explained at length, and comparisons drawn between them.

A "Tungar" rectifier, and an "Acdic" rectifier were shown under working conditions, while a rectifier of the vibrating type was on view.

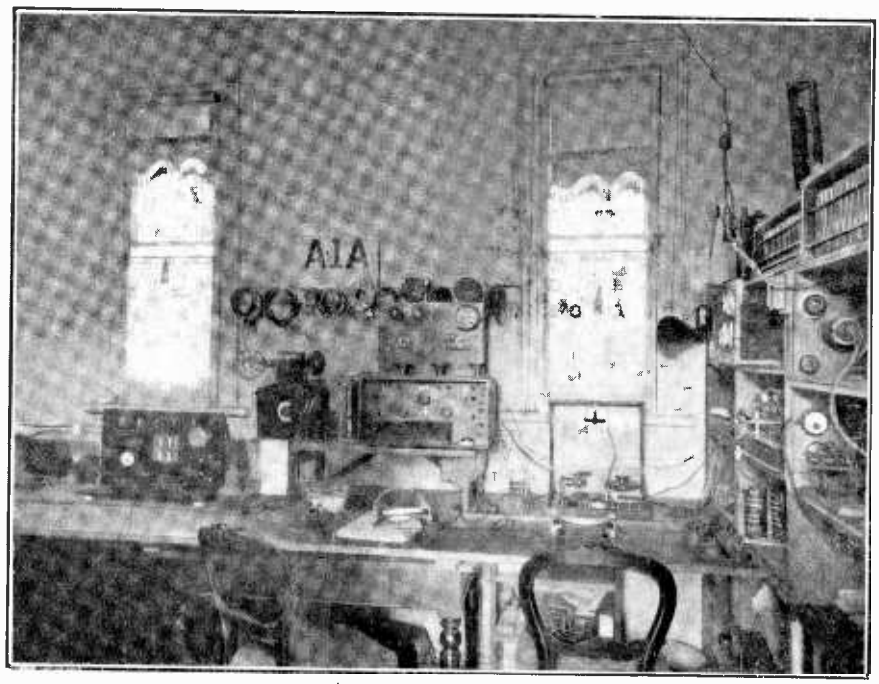
Mr. Fogarty's kindness in coming down from London was fully appreciated, and a hearty vote of thanks was accorded on the motion of Mr. Steel, seconded by Mr. Whalley, and supported by the Chairman, Mr. F. Jenkinson.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Bramley, Bradford.

A meeting was held on Friday, January 12th, with the President, A. Liardet, Esq., in the chair.

After the business had been despatched several new members were elected, and the meeting was then thrown open for general discussion, questions which had been sent in to the Secretary previously being dealt with first.



The receiving set of Mr. J. S. Streeter, Observatory Road, Cape Town, one of the first among the enthusiastic band of amateurs in South Africa to receive the overseas stations.

This discussion was participated in by various members and was much enjoyed.

Subscriptions are now due and should be remitted without delay to the Hon. Treasurer, Mr. E. Brown, 8, Glenholme Road, Manningham, Bradford.

Those wishing to join the Society can obtain application forms on writing to the Secretary.

Harwich Radio Society.

Hon. Secretary, Mr. P. Ashurst, 51, Mary Street, East Horwich, near Bolton, Lancs.

A successful meeting of the above was held on January 16th, when a committee was formed comprising the following:—Mr. Rivis, Dr. Sewell,

Messrs. C. Gray, Wynne Hopwood and F. Greenhalgh. It is hoped to hold future meetings in the club-room in the Reform Club as soon as the room is decorated. The arrangements for fixing the aerial over the club-room were left in the hands of Mr. Holt. Mr. Rivis delivered a lecture on "Aerials," which resulted in a lively discussion.

The membership is increasing steadily.

The Leicestershire Radio and Scientific Society.*

Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

The first meeting of the elementary section of the Leicestershire Radio Scientific Society was held on Monday, January 15th, 1923, at headquarters, the *Leicester Mercury* office, the chair being occupied by the Vice-President, Mr. H. E. Dyson. The inaugural address was delivered by the Chairman, who explained that the aims of the elementary branch of the Society were to foster an interest in Radio, to assist beginners and to furnish the parent Society with many enthusiastic and brilliant members. The President, Mr. C. T. Atkinson, followed with a lecture on "Elementary Wireless," which was highly commendable for its simplicity and lucidity. Illustrations and diagrams illumined the many points dealt with, and combined to make the lecture highly interesting and successful, and questions arising from the lecture were dealt with very thoroughly by the President. At the conclusion a hearty and unanimous vote of thanks was accorded the speaker.

The Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

At an instructional meeting held at the Grammar School on January 12th, the Hon. Treasurer lectured on "Some Apparatus Used in Telegraphy," paying particular attention to the Wheatstone bridge method of determining values of resistances and inductances, such as may be used in radio circuits. Insulation and ohmic resistance of an aerial system were considered, amongst many other very usual applications of the bridge for wireless purposes.

A general meeting was held at the Grammar School on January 19th, Mr. G. P. Kendall, B.Sc. (Vice-President) being in the chair. After the usual business had been discharged, the Chairman called upon Mr. H. F. Yardley, M.I.R.E., to give a paper and demonstration on "The Armstrong Super-regenerative Receiver."

The discussion which followed was keen and prolonged, many members relating their experiences and theories on the subject. Mr. J. Croysdale has been particularly successful with his circuit, having succeeded in raising U.S. broadcast and **8 AB** on a frame using two valves. The meeting was of the opinion that the radiation from the super-regenerative set was not nearly so bad as generally supposed, since the current limiting property of the valves would ensure that no excessive H.F. currents would flow in an ordinary aerial system, should such be used in place of a frame.

The Coventry and District Wireless Association.*

Hon. Secretary, Mr. T. Y. Fletcher, 60, Summerland Place, The Butts, Coventry.

Under the auspices of the above Association, an interesting and instructive lecture on the "Principles of Radio Telegraphy and Telephony." was delivered by Mr. Clinker, M.I.E.E., of the B.T.H. Works, Rugby, on January 17th, to an audience of well over two hundred people.

In introducing the lecturer, the Chairman. Mr. A. P. Young. O.B.E., M.I.E.E., M.I.A.E., told of the valuable pioneer work done by Mr. Clinker in radio-communication in all its phases, the results of which could be clearly seen and appreciated in all the apparatus which the lecturer demonstrated and explained.

Commencing with a lucid explanation of the basic laws relating to oscillation, it was shown by means of practical experiments and lantern slides exactly how these electro-magnetic oscillations which cause the wave motion in the ether are propagated, and passing on, the lecturer dealt with the various discoveries of the early pioneers of wireless and many other important points, chief among them being wavelength and tuning. "Direction Finding" by wireless was explained and demonstrated, and it was remarkable to note the precision with which the apparatus located the transmitting station, Leafield being the station in question.

At the conclusion a very hearty vote of thanks was accorded Mr. Clinker, after which members of the audience were able to inspect the apparatus at close quarters, whilst listening on a loud speaker to the Opera from Covent Garden.

The Wireless and Experimental Association.*

Hon. Secretary, Mr. G. Sutton, A.M.I.E.E.

The meeting of the Association at the Central Hall, Peckham, on Wednesday, January 17th, was mainly occupied by the consideration of the forthcoming meeting of the Radio Society of Great Britain and the election of delegates to attend that meeting to represent the Association.

Messrs. Knight, Joughin, Voigt and Webb were unanimously elected to attend the meeting, and the other members felt that their interests, and the interests of other amateurs in the vicinity were safe in their keeping. It was hoped that some means would be devised for making use of the Amateur Radio Associations in eliminating some of the valve noises which tend to spoil the enjoyment of the freedom of the ether. Communications with regard to membership and similar matters should be addressed to the Hon. Asst. Secretary, Mr. G. H. Horwood, 557, Lordship Lane, S.E.22.

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

An enjoyable evening was spent at the Society's club-room on January 16th. The first part of the evening was spent in listening to the broadcasting concerts on a Gecophone broadcasting receiver and loud speaker, kindly lent for the occasion by Messrs. George Garton and Son, Market Place. The demonstration was by Mr. Lynn, of the General Electric Company, Ltd., of Leeds. Mr. J. A. Badham was

Chairman. The opera selections from the Covent Garden Opera, transmitted from Marconi House, were very clearly received. During the second part of the evening Mr. W. H. Hirst, of Huddersfield, lectured on "Esperanto as Applied to Wireless." The lecture was concluded by a conversation in Esperanto, which was translated into English by Mr. Darnell.

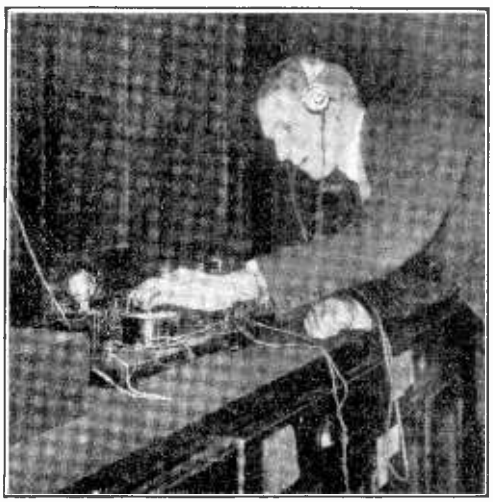
Bath Radio Club.

Hon. Secretary, Mr. Geo. J. Barron Curtis, 6, Pierrepont Street, Bath.

The above Club, although only a few months old, already possesses over seventy members, and is beginning to show signs of becoming one of the leading radio clubs in the west.

At the first meeting of the year, held at the Old Red House, New Bond Street, Bath, on Wednesday, January 17th, members spent a very interesting and instructive two hours.

Following the usual half-hour's buzzer practice, under the tuition of Mr. F. Bird (2 KP), the Chair-



Testing apparatus at the Post Office intended for broadcast reception. Instruments are carefully examined as to the generation of oscillations. It must be remembered that approval of apparatus by the Post Office implies no endorsement of efficiency.

man, Mr. J. G. Young, made some very interesting announcements.

The first of these was to the effect that the following gentlemen had kindly consented to be Vice-Presidents of the Bath Radio Club:—The Mayor of Bath (Alderman Cedric Chivers, J.P.), the Rev. Francis Hardy, M.A., Councillor A. H. W. Taylor, Messrs. F. C. Barber, E. Taylor, A. W. Cunninghame and W. S. Pearce.

The Chairman also intimated that the Club had been very fortunate in securing the services of Mr. Claude Wilcocks, of Warminster (2 FL) as Hon. Consulting Engineer.

Following the election of new members, a discussion ensued as to the advisability of adopting the Committee's proposal to hold a special social night in the near future to which ladies would be welcomed. The Chairman felt that the atmosphere of happy informality which would necessarily attend such a function would do much towards promoting that spirit of fellowship which the Committee are so anxious shall prevail at Club meetings. After a certain amount of opposition the proposal was carried.

Business over, the meeting settled down to enjoy an unusually capable lecture by Mr. L. E. R. Boxwell, of Bradford-on-Avon, Wilts. This lecture was the first of a series of six lectures which Mr. Boxwell will give to the Club, and which are intended to tell enthusiasts all they wish to know about their pet hobby in such a manner as to be perfectly comprehensible to the merest beginners.

A question-box was installed by means of which the Committee will deal with any questions which members may wish to be enlightened upon.

Bexleyheath and Welling Radio Society.

Hon. Secretary, Mr. J. O'Keefe, Spring Villas, Long Lane, Bexleyheath.

A meeting of the above Society was held on Thursday, January 18th, at 8 p.m., at the temporary headquarters, "The Hut," Welling, Mr. J. P. Pragnell being in the chair.

When the election of officers and committee took place, approximately thirty-five members were present.

The following officers and committee were elected for the present year:—President, Mr. W. Dickinson; Vice-Presidents, Mr. J. P. Pragnell and Mr. C. Haskell Thomas; Chairman, Mr. O. G. M. Atkins; Vice-Chairman, Mr. T. Griffiths; Hon. Treasurer, Mr. L. W. Smith; Assistant Hon. Secretary, Mr. C. Smith; Committee, Messrs. C. A. Beech, R. Forsdyke and J. Ripper.

The draft of the rules was passed and the amount of the yearly subscription decided, viz., 10s. 6d. per annum; Juniors 18 years and under to pay 5s. 6d. first half year and 5s. second half year.

Any wireless amateur or others wishing to join should write to the Chairman at "St. Aubyns," Burnell Avenue, Welling, or to the Hon. Secretary.

Meetings are held every Thursday at the temporary headquarters until further notice.

"The Hut," which has kindly been placed at the disposal of the Society (gratis) by Mr. Smith, High Street, Welling, is open Mondays, Tuesdays, Fridays and Saturdays, for the use of the members who wish to carry out experiments or to use as a workshop.

Norwich and District Radio Society.

Hon. Secretary, Mr. H. R. Greenfield, 160, Queen's Road, Norwich.

On Friday, December 19th, the above Society held its weekly meeting at the new headquarters, Bracondale House School, Bracondale, Norwich, by kind permission of the Principal, F. B. Williams, Esq.,

The Chairman of the Society, Capt. H. J. B. Hampson, in his opening remarks made mention of the excellent room that had been accorded to the Society, and asked for a vote of thanks to the Principal.

Mr. J. G. Hayward proposed, seconded by Mr. W. G. Hurrell, that the Society take immediate steps to become affiliated to The Radio Society of Great Britain.

During the evening Mr. J. G. Hayward gave an interesting lecture on "The Valve," and by the

aid of the blackboard and chalk gave diagrams to show the function of each part.

At the last meeting the members were asked to bring along various sets or parts that they had made, and as a result much interesting data was obtained by members describing their experiences

The Society is running a competition in the nature of an Aerial Hunt, the suggestion of Mr. C. H. Moore. The conditions are that members should find out the position of aerials erected in and around Norwich and report the discovery to the Secretary on postcards. The one who discovers most will be the winner. The first prize will be a valve kindly presented by Mr. J. G. Hayward, and the second prize an H.T. battery presented by Mr. C. H. Moore.

Hackney and District Radio Society.

Hon. Secretary, Mr. C. Phillips, 247, Evering Road, N.16. (*Letters only.*)

The weekly meeting of the Society took place on Thursday, January 18th, at the headquarters, Y.M.C.A., Mare Street, Hackney, E.8., when a good number of members were present. An interesting lecture on the Morse code was given by Mr. J. Wilson, an expert in telegraphy. At the close of his lecture, Mr. Wilson gave a preliminary lesson in Morse, and the Chairman announced that arrangements had been made to place the instruction on a proper basis. A half-hour lesson is to be given every week especially for beginners. and speed practice will also be given for others.

Although the Society has a fairly large membership, there are many Hackney residents with receiving sets who have not yet joined, and these are cordially invited to visit the Society. The new subscription came into force at the beginning of the year, and there is an appreciable reduction on the previous subscription.

The Society is greatly in need of outside lecturers on any subject connected directly or indirectly with Radio. Up to the present they have relied on members of the Society for this purpose. Anyone able and willing to give a lecture is requested to communicate with the Secretary. Expenses will be willingly paid.

It is hoped to organise in the near future a Social Evening and Exhibition of Radio Apparatus, particulars of which will be announced later.

Salisbury and District Radio Society.

Joint Hon. Secretaries, Messrs. H. F. Futcher and S. W. Johnson, 19, Fisherton Street, Salisbury.

This Society has now been formed, with Capt. J. E. Alcock as President and Sir James Macklin, Capt. A. E. Hussey, F. H.Trethowan, A. B. Randall, M.I.E.E., and his Worship the Mayor as Vice-Presidents, with headquarters at the Old Billiard Room, The Chough Hotel, Salisbury.

The inaugural meeting was held on Thursday, January 18th, when about 40 members and friends were present. Capt. J. E. Hobbs, of Wareham, gave an interesting and instructive description of a four-valve receiving set constructed by himself and using the tuned anode with reaction on the tuned anode coil, for which he claimed 20 per cent. extra efficiency over coupling the reaction coil to the A.T.I. as well as complying with the P.M.G. regulations, and making it impossible to interfere with anyone else by radiation. **2 LO**, **2 ZY** and **5 IT** were in turn successfully tuned in.

The Chairman, after proposing a vote of thanks to Capt. Hobbs, appealed to all interested in wireless to join the Society, the subscription being only 10s. Meetings are held every Thursday at 8 p.m.

The Thames Valley Radio and Physical Association.

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

A meeting of the Association took place on January 18th, Mr. G. Dowse being elected to the chair.

After the minutes were confirmed, the Hon. Secretary gave the meeting a report on the various local hospitals visited by members of the Association and the pleasure it gave to the patients of hearing the opera and concerts broadcasted by the B.B.C.

The association takes this opportunity of commending the idea to many other Societies who are near hospitals, as the trouble taken is well recompensed by the gratitude of those unable to hear such concerts by any other means.

The Chairman then called upon the lecturer to give his short address on "The Making of Radio Receivers," showing the members how, with a cigar box, two home-made basket coils and a crystal detector, he was able to receive perfectly **2 LO** on two sets of 'phones at the cost of a few shillings. He also showed a one-valve panel he had constructed on the lid of a cigar box, which left nothing to be desired in the workmanship and efficiency.

Mr. Dowse was heartily thanked for his lecture.

King's Norton and District Radio Society.

Hon. Secretary, Mr. Richard H. Price, 7, Hawthorn Road, King's Norton, Birmingham.

The first general meeting of the above Society was held at 8.p.m. on Thursday, January 18th, 1923, at Rowheath Farm, Selly Oak Road, King's Norton.

Eighteen members attended, and after considerable discussion, suitable rules were formulated, and the various officers and committeemen elected. Meetings of the Society are to be held regularly on alternate Wednesday evenings at 7 o'clock.

The Society has been fortunate in securing a room at Rowheath Farm, Selly Oak Road, for its meetings. A hearty welcome is extended to all enthusiasts living in the district. Full particulars may be obtained from the Secretary.

The Isle of Man Radio Society.

Joint Hon. Secretaries, Messrs. J. S. Craine, 6, Belmont Terrace, and J. P. Johnson, 16, Hildesley Road, Douglas.

A public meeting under the Chairmanship of the Society's President, Mr. F. R. Grundey, B.Sc., F.C.S., was held recently in St. Andrew's Schoolroom. The occasion was a demonstration and popular exposition of wireless by Messrs. E. H. Vick and A. L. Downward, and the extent of public interest in radio was evidenced by an attendance of probably some 250 people. It was hoped to render the Manchester Broadcast Concert audible to all present by means of a Magnavox loud speaker, but unfortunately a fault developed in the circuits just as proceedings were about to commence, and results entirely ceased. Later, however, the Magnavox found voice, and the last few news items and part of a musical item were heard.

A Broadcast Talk from a Wireless Pioneer.

Admiral Sir Henry B. Jackson discourses on the present position of wireless telephony and forecasts for the new method of communication an important future as an educative influence in civilised life.

THOSE who listened in to Broadcasting from 2 LO on the evening of Monday, the 29th January, will have enjoyed listening to a short discourse given by Admiral of the Fleet, Sir Henry B. Jackson.

Admiral Jackson is well-known as a pioneer in wireless work, and as President of the Radio Research Board. To readers of this journal he is perhaps better known as a President of the Radio Society of Great Britain, from which office he has just retired. Below is published, with the permission of Admiral Jackson, the address given from 2 LO.

"For one not habituated to addressing large but invisible audiences, the position I now occupy in front of this microphone is an important event in my daily life, especially as it is my first attempt to speak into a Radio telephone for other than experimental or testing purposes. Thinking of what to say on such an occasion has brought to my memory, for some inexplicable cause, an incident, entirely unconnected with Radio work, that occurred to me one night about twenty-five years ago, in which, however, I was a spectator only.

"I was serving as Naval Attaché to our Embassy in Paris at that time, but was visiting the Naval works in the vicinity of Nantes. Nantes has now an important Wireless Station whose URSI signals and call sign, UA, are probably well-known to some of those now listening to me this evening.

"There were strong demonstrations against the French Government at that time on account of the unfortunate 'Dreyfus Affair,' and I was amongst the crowd one evening in the streets of Nantes when their violent feelings almost caused a riot. Amongst the cries and yells from the mob, by far the most penetrating and most frequent were the words 'Conspuez Zola,' and 'A bas les Juifs!'

"Mounted troops charged the mob to disperse them and eventually did so very effectually. I, willy nilly, found myself swept with many others down a side street, and eventually found peace and something else to think about, in an open space. Here on one side was a whitewashed hoarding on which a bright circle of light was being thrown from a large magic lantern erected on a stand near to it.

A recent photograph of Sir Henry Jackson in his uniform as an Admiral of the Fleet.

"Suddenly, the sheet depicted moving figures, and I found myself watching for the first time what are now familiarly known as the 'movies.' The images were somewhat blurred and slow in their movements, but they were an early example of an advertising 'stunt' of the modern cinematograph. I think few of those present at this scene realised the enormous possibilities of development which have taken place in this industry since that date, and the influence it is now having on the character of many of those young people who spend so much of their time and pocket money at the picture palaces. Personally, I was much struck by the fidelity of this representation of moving life, which was better than I had thought possible at that date.

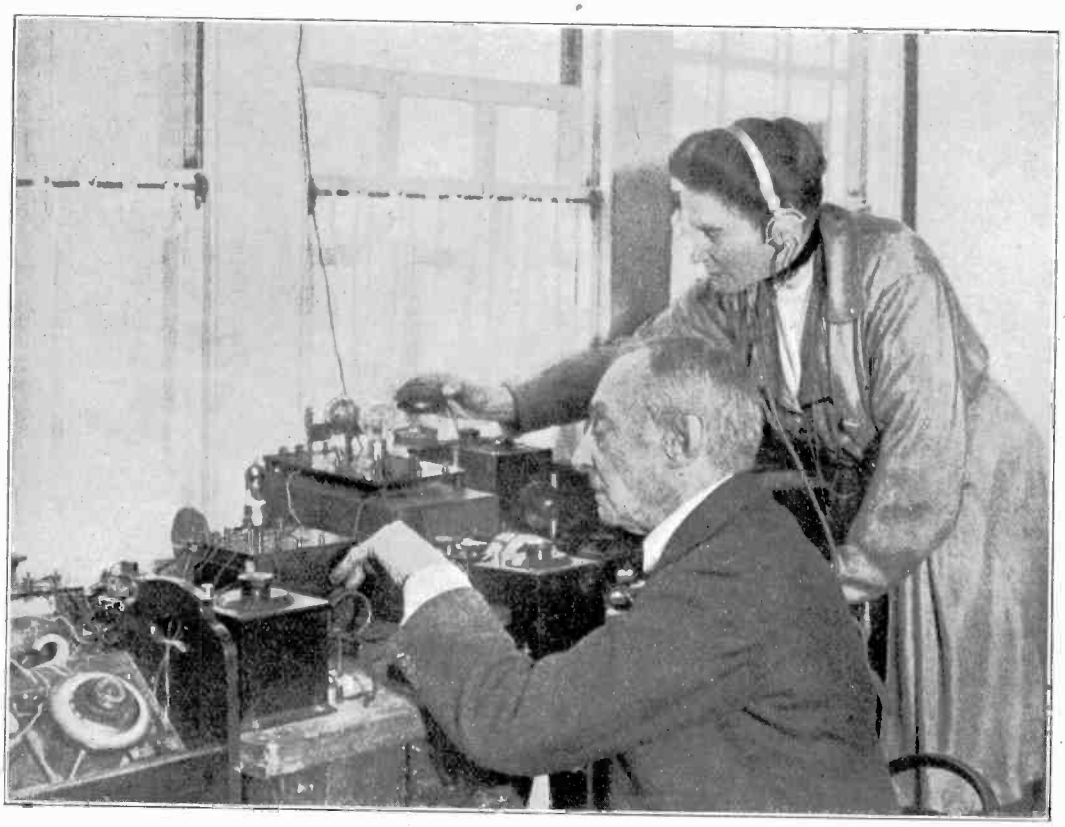
"There is in my opinion much that is in common between the cinema and the radio telephone, broadcasting speech and music. Different as they are in their methods of reproduction, yet they both depend for their existence on the electro-magnetic waves so thoughtfully provided by Nature. Both are popular means of entertaining large numbers of persons simultaneously at a moderate cost, and both are of educational value, because they can keep us informed of what has happened in distant places, whilst nearly everyone wants to know also how it is done. Those who manipulate apparatus must of necessity acquire this knowledge.

"The clarity of the tones now produced by radio telephony has already passed the stage of development of those shadowy 'movies' I saw that night in Nantes, and the modern cinematograph has probably neared perfection, at least in so far as black-and-white reproduction is concerned. These technical improvements are due to careful scientific and very practical research organised by those interested in commercial development.

"The cinema is now established as a successful business enterprise and may be left to its own efforts to maintain its popularity. It has an advantage in one respect over radio-telephony, in that it can use the electro-magnetic waves of light which are of a length which are not the subject of Government restriction.

"Radio telephony broadcasting had not yet had time to become a successful business enterprise, and is sadly restricted in the use of wavelengths it could but may not at present employ, for the reason that it has been forestalled by the previous Governmental allocation of most of these to its sister art of radio-telegraphy.

"The human ear, sensitive and flexible as



Admiral Jackson carrying out experimental work with a special direction finding set in his laboratory, assisted by Lady Jackson.

it is, is also very greedy as to the band of sound wavelengths it requires for intelligible speech, compared with the band of lengths of E.M. waves required by the eye for perfect vision. These demands add to the difficulties of radio-telephony.

"In spite of these difficulties, the British Broadcasting Company have brought their apparatus and organisation to a high state of efficiency in a very short time, and it now rests with them, and with the radio enthusiasts who listen in, to get the public to accept broadcasting as part of their daily life, and so with a good word here and there, timely spoken by their supporters, help the Company to bring it up to a standard level with that of the cinema. Radio-telephony in no way clashes with the cinema, though both are dependent on the same laws of nature for the production of their two very different effects.

"The cinema appeals to the eye only, is reproducible at will, and may therefore be used again and again for years to come. The deaf can get as much pleasure from it as those with normal hearing. The exhibition of the pictures, however, is concentrated, and cannot be broadcasted from one central station like the radiotelephone.

"From broadcasting, however, the blind can get as much pleasure as those with the acutest vision, and this is, I venture to say, one good reason of itself for supporting broadcasting, so as to add to the brightness of the lives of those afflicted with blindness. Opinions probably differ as to which can give the most pleasure to the normal individual. It is really a question of whether *sight* or *hearing* affects our senses the most, and also, for the mass, whether concentrated or scattered audiences will prove to be the best paymasters.

"Personally, I incline to the view that radio-telephony should have the greatest effect of these two on our feelings. The most striking drama on the screen often seems forced and mechanical, and being generally only a staged piece, leaves *me* cold and unsatisfied.

"But the *voice* or *music* actually being produced at the moment by living beings can also convey their own feelings and affect ours, who are listening to them, and this sort of telepathy which passes between us is a much more potent factor in this matter than the mere sight of past actions and gestures.

"Only time will show which will get the ascendancy, but whichever it may be, I hope you will join with me in hoping that British broadcasting will advance, in much less than twenty-five years, as fast as that first cinema I saw in Nantes so long ago.

"In conclusion, I wish the British Broadcasting Company every success in their plucky effort to popularise this art, and with the energy, scientific skill, and commercial ability at their disposal, I feel sure of their ultimate prosperity. I hope those who have listened to me this evening will do what they can to help not only for them, but also for the general benefit of the community."

The Experimental Licence.

The position of the wireless experimenter with regard to the Post Office licence to receive signals is somewhat vague at the present time, and consequently the following list of conditions which accompany the issue of the form of licence now in use may be of interest.

1. The licensee shall not allow the station to be used for any purpose other than that of receiving messages.

2. The station shall be subject to the approval of the Postmaster General, and shall be open to inspection at all reasonable times by duly authorised officers of the Post Office.

3. The combined height and length of the external aerial shall not exceed 100 ft.

4. The station shall not be used in such a manner as to cause interference with other tations. In particular between the hours of 5 p.m. and 11 p.m. on weekdays and all day Sunday, any oscillating valve or valve circuit employing magnetic or electrostatic reaction must not be directly coupled to the aerial or the aerial secondary circuit over the range of wavelengths between 300 and 500 metres. The use of separate heterodyne circuits coupled to the aerial or aerial secondary circuit over the range of wavelengths between 300 and 500 metres is similarly restricted.

5. The licensee shall not divulge or allow to be divulged to any person (other than a duly authorised officer of His Majesty's Government or a competent legal tribunal) or make any use whatsoever of any message received by means of his apparatus, except messages in connection with his experiments received from another experimental station, time signals, musical performances, etc.

6. A fee of ten shillings is payable annually in advance so long as the licence remains in force. The period covered by the first payment expires as follows:—

If the licence is taken out during the three months ended; 31st March—on the 31st December in the following year; 30th June—On the 31st March in the following year; 30th September—On the 30th June in the following year; 31st December—On the 30th September in the following year.

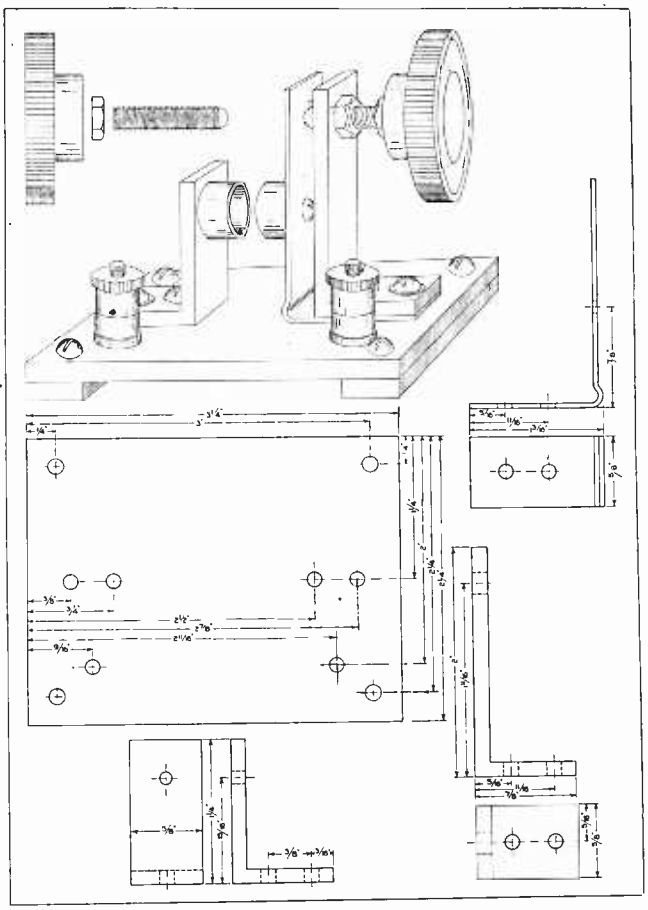
7. Any breach of the foregoing conditions will render it necessary for the permit to be cancelled.

Construction of a Crystal Detector.

A PAGE FOR THE BEGINNER.

THERE is considerable scope in the design of crystal detectors, and the extent of elaboration adopted will not necessarily produce greater signal strength, but only faci.itate critical adjustment. Several designs have been put forward in the *Wireless World and Radio Review* from time to time, but that shown in the accompanying diagram is specially arranged to suit the inexperienced amateur, and may even be taken as a preliminary exercise in wireless instrument making.

The base and its under supports are made from polished ebonite sheet 3/16 in. in thickness, carefully cut to size with a fine-toothed tenon saw and filed true. The edges may be finished by rubbing on a piece of emery paper secured down to a flat surface. It should be the aim of the elementary worker to make all edges and faces at exact right angles to each other, and to ensure this, a small steel square should be frequently applied to the work. The location of the holes should be accurately plotted out by means of a centre punch, a dot being marked on the ebonite to act as a guide for the point of the drill. Drilling is carried out with a morse twist drill and hand brace. A piece of strip ebonite or hard wood clamped tightly behind the ebonite base piece will prevent fracturing at the back while drilling.



Dimensional Drawing of the Component Parts.

In order to obtain good insulation, it is desirable that the polished surfaces should be removed, and this can be done by rubbing the surfaces down with fine emery paper. If the rubbing is done in small circles, it is possible to produce a fine matt surface free from scratches.

The right angle supports are made from angle brass, such as can be bought from most ironmongers. If a piece about 2 in. or 3 in. in length is obtained, two supports can be easily made by sawing through at distances to provide the required width, leaving a small piece over which may be placed in the scrap box and prove very handy for some subsequent job.

Each piece should be filed clean and square prior to the marking out of the position of the holes for drilling. Centre punch marks should be made, of course, to guide the point of the drill. The upper hole in the longer bracket must be made sufficiently large to give clearance

to the piece of 2 BA screw which passes through. A 2 BA nut is soldered over the hole so as to provide a thread. The surfaces to be soldered must be filed quite flat, and then treated with "killed salts," made by dissolving pieces of scrap zinc in strong hydrochloric acid. If the nut is held in position with a pair of pliers and the end of the bracket heated in a gas flame, it will be quite easy to make the solder run round the nut and fix it securely to the bracket. Any excess of solder can be shaken off while hot, and that which adheres to the surfaces can be removed by filing. The two brass pieces should be finished by rubbing down with emery cloth. A piece of emery cloth should be laid on the bench and the brass pieces drawn across it, whilst the less accessible faces can be rubbed with a file around which a piece of emery cloth is wrapped.

The spring piece is made from hard phosphor bronze, 1/16 in. in thickness and requires very little description except that it must be borne in mind that the bend should not be too sharp.

The crystal cups can easily be purchased with back screws. The knob also is of a type now on the market and has a threaded hole in the centre. The threaded portion can be sawn from a 2 BA screw and is held into the knob by means of a lock nut.

The most suitable crystals for use in this detector are zincite, which is dark red in colour, and copper pyrites, which has a greenish yellow metallic appearance.

The two crystals are secured in the cups by means of Wood's metal. This combination of crystals is known as the Perikon detector, which, in addition to being very stable, is simple to set to a sensitive adjustment.

Notes.

A Polish Honour for Senatore Marconi.

Senatore Marconi has been unanimously elected an Honorary Member of the Société des Radio-techniciens Polonais, and has accepted this honour.

French Stock Exchange Quotations to be Broadcast.

The Paris Bourse and exchange quotations, it is stated, are soon to be broadcast each day from Eiffel Tower.

Collaborators Wanted for Sheffield Experimenter.

Captain L. A. K. Halcomb, of South Dene, 106, Millhouses Lane, Sheffield, is anxious to get into touch with experimenters holding transmitting licences and living within about 60 miles of Sheffield, who would be willing to carry out some experimental work with him. He states that his station (5 DN) is licensed for 10 watts, and operates on a length of 200 metres using C.W. and telephony.

Week-end Wireless Service to United States.

Marconi's Wireless Telegraph Company announce that they have introduced a Week-end Wireless Letter Service to the United States at the rate of threepence per word without minimum. Telegrams sent by this service must reach Radio House, 2/12, Wilson Street, E.C.2, either by hand or post before midnight on Saturdays, and will be delivered in New York City on Monday by messenger. Week-end telegrams to destinations in the United States beyond New York City will be mailed without extra charge, but they must bear the full postal address.

Wireless Transmission of Letters.

The French Post Office, it is reported, has announced that after February 10th, "radio letters" will be accepted at all telegraph offices in France for transmission by wireless to the French colonies and certain foreign countries. The wireless rate will vary from 55 centimes (about 2d.) a word plus the ordinary postal rates.

The Wireless Dinner Club.

The second annual dinner of the British Wireless Dinner Club was held at the Trocadero Restaurant on January 27th, the President, Admiral Sir Henry Jackson being in the chair. About 130 members were present, the total membership being about 240. The organisation of the Club was discussed, and it was decided to broaden the qualification for membership, which at present is limited to those who were engaged as officers during the war in the services, so as to include all those who are actively interested in wireless engineering.

A Danish Experimenter Intercepts Communication between 2 KQ and 8 BM.

A correspondent writing from his station at Hellerup, near Copenhagen, reports that at 0920 (G.M.T.) on January 15th he heard communication between **2 KQ** and **8 BM**. His own station, he explains, is a four-valve set consisting of four parallel wires 32 ft. above the ground, the total amount of wire used in the aerial being 450 ft. **2 KQ**, the writer states, is one of the usual 10-watt stations, but **8 BM** was using one amp. in the aerial. The latter station's signals were loud enough to work the loud speaker over a fairly large room.

The New Broadcasting Stations.

The Cardiff station of the British Broadcasting Company, Limited, which it is hoped will be functioning by Monday, February 12th, will have the call letters "**5 WA**," and a wavelength of 395 metres. The Glasgow station of the British Broadcasting Company, which is expected to be in service about the middle of March, will have the call letters "**5 SC**" and a wavelength of 415 metres.

Silvanus Thompson Memorial Lecture.

On Thursday, February 1st, was held the first Silvanus Thompson Memorial Lecture at the Finsbury Technical College, with which the name of Dr. Silvanus Thompson was so long associated.

The first lecturer was Sir Oliver Lodge, F.R.S., who had been a close friend of Dr. Silvanus Thompson. Sir Oliver Lodge chose as the subject of his discourse "The Basis of Wireless Communication," and he traced the development of researches which ultimately resulted in the discovery of the possibilities of wireless as a means of communication.

The chair was taken by Sir Charles Parsons. Dr. W. A. Eccles, F.R.S., who is principal of the College, during the evening referred to the work of the lecturer and the Chairman, describing them as the "two immortals," one the immortal Physicist and the other the immortal Engineer.

The lecture was extremely well attended by an enthusiastic audience. Following the lecture was a demonstration and conversazione, whilst many water-colour paintings, the work of the late Dr. Silvanus Thompson, were exhibited.

Photo: E, O. Hoppé.

Sir Oliver Lodge, F.R.S., D.Sc., who gave the first Silvanus Thompson Memorial Lecture at Finsbury Technical College on February 1st.

Writtle Transmissions Discontinued.

It is announced that Writtle transmitting station has now been closed down by the Post Office authorities and consequently the usual Tuesday transmissions are no longer carried out.

The Manchester Wireless Exhibition.

The Manchester All-British Wireless Exhibition and Convention will open at the Burlington Hall, Burlington Street, Manchester, on Saturday, March 17th, and remain open until Saturday, March 24th. At this exhibition, which is being organised by Messrs. Bertram Day & Co., Ltd., of 10, Charing Cross, London, at the request of the Manchester Wireless Traders Association, radio apparatus and accessories of all kinds will be displayed and demonstrations arranged. In connection with the Exhibition it has also been decided to hold a Convention under the auspices of the Manchester Wireless Society.

Inspection of Wireless Licences

A warning has been issued by the Post Office authorities that action will be taken against owners of wireless sets who have failed to take out the necessary Post Office licence. Different areas will be selected in turn, it is understood, and all sets inspected by members of the telephone engineering staff armed with the proper authority.

The Writtle Concerts and their Organiser.

Wireless amateurs and the "first 100,000" broadcast "listeners-in" will learn with regret that they will no longer be entertained by those inimitable burlesques and parodies from the Writtle wireless station which have been enjoyed so much each Tuesday evening during the last twelve months.

These transmissions, it will be remembered, were inaugurated by the Radio Society of Great Britain and affiliated Societies, and conducted through the courtesy of the Marconi Scientific Instrument Company, Limited, from their station at Writtle near Chelmsford, in February, 1922, to provide British amateurs with material for experimental purposes which had not previously been available in this country, and they proved to be of great value to the 12,000 amateurs who were interested in wireless before the broadcasting boom set in

Captain P. P. Eckersley, who has contributed articles to this journal, is well known as the organiser of the Writtle transmissions. Readers will be interested to learn that he has been appointed Chief Engineer of the British Broadcasting Company, Limited.

Radio Society of Great Britain.

The following is a list of new members of the Society elected at the meeting held on January 24th:—Members: A. H. Baldry, E. C. Young, Charles H. Denny, Cecil Wilfred Clarabut, J. C. W. Reith, M.Sc., Major Frank Stanley Morgan, Stanley S. Dawes, J. Wright, A. C. Goddard, R. P. G. Denman, Charles Leazell, P. Charles Raphael, A. E. Basford, A. S. Brown. Associate Members: S. P. Beucher, Major Henry G. Harris, C. Percy Moss, H. Thorpe. The following Societies were accepted for affiliation: The Portsmouth and District Amateur Wireless Association, Norwich and District Radio Society, Ipswich and District

Wireless Club, Northampton and District Amateur Radio Society.

New Wireless Societies.

It is proposed to form in the Borough of Wednesbury a wireless society for experimenters and wireless enthusiasts, to be known as "The Wednesbury Wireless Society." An inaugural meeting will be held shortly, the date of which will be announced later.

All those interested are asked to communicate with Mr. J. H. Lavender, F.C.S., 49, Stafford Street, Wednesbury, as early as possible.

The Carlisle and District Radio Society has recently come into being, and already a strong committee has been appointed. The Hon. Secretary is Mr. Charles E. Crompton, 107, Warwick Road, Carlisle.

A Loud Speaker Used in the County Hall Experiments.

Owing to the acoustic difficulties experienced in the Council Chamber of the New County Hall, London, experiments have been carried out recently with the object of improving audibility. At a meeting at the County Hall, on January 30th, two microphones were arranged on the Clerk's table. The sounds were carried by wires and amplified by thermionic valves in the Press gallery, for the benefit of the reporters. The results, however, were not very satisfactory, partly owing to the conflict between the actual voice in the Council Chamber and the reproduced voice in the gallery; and partly to the fact that the valves amplified indiscriminately all the sounds received by the microphones.

Correspondence

In the first two letters of the following correspondence a phenomenon of particular interest at the present time is discussed by Dr. J. A. Fleming in the form of a reply to a suggestion put forward by Mr. Robert Tingey, whose letter appears below. The latter ventures an explanation of the successful use of low power which was one of the most striking features of the recent Transatlantic experiments. This explanation Dr. Fleming proceeds to criticise by analogy with waves in water and air. Dr. Fleming's plea for serious and systematic investigation of the problems involved will undoubtedly be endorsed by all wireless experimenters.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I was interested in an article in *The Times* in connection with the transatlantic amateur wireless telegraphy and telephony. In this article it suggested that the authorities in connection with the transatlantic telegraphy were taking this low power communication very seriously. It is a fact that very much greater ranges are being done on short waves and low power than were done last year, and it is not entirely due to the increased efficiency of the apparatus and the experimenters, and I have, up to date, seen very few suggestions to account for this extraordinary improvement. for after all there is an enormous difference between 1,500 watts and 350,000 watts.

I would like to suggest that this increase in range is due to the enormous increase in the number of high power C.W. stations which are operating throughout the 24 hours, and that these long wave stations are in some way acting as carriers for the short waves, or perhaps putting the ether in a more suitable condition for the transference of the short waves. If there be anything in this suggestion, these low power stations are not getting over on their own power alone, but are, in some way effecting the high power transmission on whose power they are relying for their communication.

This might also account for the extraordinary fading effect which is being experienced from all broadcasting stations from a distance. The fact that the rhythm of the fading is regular seems to point to some bad interference such as these stations might cause. For this increased range is not entirely limited to communication with the United States; quite exceptional distances seem to be attained in the British Isles on single valve reception.

I have not seen this suggestion made before, and I trust it is worthy of criticism, and may form an interesting discussion.

If this theory be in any way correct, then should the high power stations cease, the low power communications would not be possible over such distances.

If this suggestion is worthy of further consideration, the Radio Society of Great Britain could make some very interesting tests by collecting data from various amateurs throughout Great Britain and noting the different effects in different areas on low amplification receiving sets.

ROBERT TINGEY.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I am afraid it would take more space than you can spare and more time than I can give just at present to comment fully upon the letter of Mr. W. R. Tingey. He raises some interesting questions, but it is, to say the least, doubtful whether his premises are sound or conclusions justified. It is a safe rule in seeking explanations of natural phenomena to make sure of the facts first before troubling about explanations. Mr. Tingey states with great confidence that "very much greater ranges are being done on short waves and less power than were done last year, and it is not entirely due to the increased efficiency of the apparatus and experimenters."

This is a very sweeping statement, and would, I think, require a large amount of careful, widespread quantitative measurement of signal strength to establish. We all know that extraordinary distances are covered at times by low power transmitters, but this freak transmission is a very different thing from a general and universal improvement in range with standard apparatus and experimentalists of equal skill. Until the fact of such improvement is established, it seems hardly worth while to try to invent explanations or to controvert the suggestions of Mr. Tingey.

It is difficult to understand what he means by "long waves acting as carriers for short waves" in connection with radio working. We do not

find any such effect in studying waves on water or waves in air. Ripples do not travel further on an ocean surface tossed by storms into billows. The loud sounds of thunder, explosions, or the deep notes of a dozen brass bands would not enable a feeble whistle or shrill note to be heard at a greater distance.

Why, then, should long stray waves in the aether, 20,000 metres in wavelength, assist the propagation of the 300 or 400 metre wave allotted to amateurs ?

I do not wish to suggest that there are not causes at work promoting secular variation in signal strength. If observations on this matter had gone on long enough it is possible we might find that there are good and bad radio years, just as there are wet and dry summers, periods of sunspot, maximum and minimum, and good and bad harvests. But the first thing is to make sure of facts. This leads me then to make a suggestion. We have now an enormous number of competent, enthusiastic and scientific radio amateurs and workers all over the country, and radio societies and wireless clubs innumerable. The question is, can we not make better use of all this talent for combined scientific work and the advancement of knowledge, than by merely being content to listen-in for bed-time stories or broadcast concert music ? Would it not be possible to organise some programme of quantitative measurements on a wide scale on the subject of signal strength as received from certain broadcasting stations, and also a systematic study of atmospheric disturbances and the effects of locality ?

It was recently stated in *The Times* that London broadcast is better heard in Scotland than in Yorkshire, and that from Manchester better heard in Southampton than in London. Is this a fact definitely established ? If so, what is the reason ?

The broadcasting from fixed centres with standard transmitters, and with receivers scattered all over the country, makes it possible by suitable organisation to conduct invaluable team work in radio research. Let us hope that wireless broadcasting will not degenerate like the kinema and motion picture business into a mere amusement for the frivolous unscientific public, but that serious students may do serious work in connection with it.

The present Radio Society of Great Britain in London might find it possible to stimulate the provincial radio societies to unite in such work, and then perhaps might find it possible to hold an annual conference, something on the lines of the British Association Meeting, in various towns, once a year, where radio problems and results are described and discussed and wireless men and women might meet to exchange information and organise the new campaigns.

University College, J. A. FLEMING.
London.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—Now that International Amateur Radio communication is becoming an everyday affair, would it not be opportune to devise some means of distinguishing between stations located in different countries and having the same call letters ?

In an article which appeared in *L'Onde Electrique* of August, 1922, I proposed a plan to this effect and note that the American magazine "*Q.S.T.*" in its issue of December, discusses this plan at some length and puts forward some other interesting suggestions to the same effect.

What is the British amateur's point of view on this question ? Could it not be expressed by competent amateurs in the columns of your widely circulated magazine for the benefit of everybody ?

My plan is that when amateur stations use enough power to be likely to be heard abroad, they put the initial of their country before their call letters. Thus if anyone hears: "**F8AB** de **B2OD,**" he will at once know that French **8AB** is being called by British **2OD**, while had he heard : "**A8AB** de **C2OD,**" he would have immediately understood that he had picked up Canadian **2OD** calling American **8AB**

This seems to me the most practical solution of this problem, but no doubt there are many other good ways of dealing with it, and it would be very interesting to hear from those to whom they have occurred.

LEON DULOY.

"**F8AB,**" Nice.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I read with great interest a letter from your correspondent, Mr. L. F. Fogarty, in to-day's issue of *The Wireless World and Radio Review*, in which he says:—" I am convinced that it will ultimately be possible to operate a wireless receiving set entirely from alternating current, using some form of rectifier.

I have been experimenting for some considerable time in this direction and have come to the conclusion that the problem is to be solved by the direct use of alternating current rather than by rectification, since the necessary smoothing presents many difficulties. I am here referring, of course, to the filament current supply. No doubt the trouble could be overcome in part by the use of specially constructed valves, but this would not be of much use to the ordinary experimenter.

However, I am convinced that it should be possible to use ordinary valves with the filaments working direct from alternating current. In support of this view, I may say that for broadcast reception my receiver is operated entirely from alternating current. Once the receiver is correctly tuned and adjusted it is only necessary to connect it to the nearest lampholder, and switching on lights the filaments and also supplies the anode circuits with rectified and smoothed current. Little trouble is experienced with hum from a valve operating at radio frequency, but with detecting and audio frequency valves the problem is more difficult.

The results obtained, however, are encouraging, since the particular receiver employs low frequency amplification followed by a power amplifier. By placing one's ear to the mouth of the loud speaker it is possible to hear a slight amount of hum, but this is entirely drowned by the speech or music, the quality of which is not in any way affected. The circuits employed are more or less conventional, special arrangements being made to counteract the effects produced by the alternating current on the filaments.

PAUL D. TYERS.

Calendar of Current Events

Thursday, February 8th.

9.20 to 10.20 p.m. Dutch Concert from **PCGG**. The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.

At 8 p.m. Visit to Electricity Works.

ILFORD AND DISTRICT RADIO SOCIETY.

Lecture on "Accumulators," by Mr. C. G. Rope.

HACKNEY AND DISTRICT RADIO SOCIETY.

At the Y.M.C.A., Mare Street, E.8. Informal Meeting.

Friday, February 9th.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Elementary Class.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

Lecture (Part II) on "Inductance and Capacity." By Mr. W. G. Marshall.

BELVEDERE AND DISTRICT RADIO SCIENTIFIC SOCIETY.

Discussion on Proposed Transmitting Apparatus, opened by Mr. S. Burman.

BIRMINGHAM EXPERIMENTAL WIRELESS CLUB.

At 7.45 p.m. General Discussion on Wireless Troubles and Difficulties.

Sunday, February 11th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, February 12th.

9.20 to 10.20 p.m. Dutch concert, **PCGG**, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. S. A. Notcutt, B.A., LL.D.

WIRELESS SOCIETY OF HULL AND DISTRICT.

At 7.30 p.m. At Signal Corps Headquarters, Park Street. Paper on "The Construction of a Single-valve Set and Note Magnifier," by Mr. J. Brazendale.

Tuesday, February 13th.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.

At St. Margaret's Institute, Alexandra Road. Lecture on "Accumulators," by Mr. C. H. Garrood.

Wednesday, February 14th.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.

At Clare Hall. Lecture by Mr. P. Denison.

EDINBURGH AND DISTRICT RADIO SOCIETY.

At 8 p.m. At Heriot-Watt College. Lecture on "Capacity and Inductance," by Professor F. G. Baily, M.A., D.Sc., M.I.E.E., F.R.S.E.

STREATHAM RADIO SOCIETY.

Annual Dinner.

Thursday, February 15th.

9.20 to 10.20 p.m. Dutch Concert, **PCGG**, The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.

At 8 p.m. At Hitchin Road Boys' School. Practical Work and Experiments.

MANCHESTER WIRELESS SOCIETY.

At 7.30 p.m. At Houldsworth Hall. Lecture by Mr. J. Hollingworth, M.A., B.Sc.

STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.

Lecture on "A Two-Valve Broadcasting Set," By Mr. F. T. Jones.

THE THAMES VALLEY RADIO AND PHYSICAL ASSOCIATION.

At 8 p.m. Lecture on "Valves and Their Manufacture," by Mr. J. Wade.

Friday, February 16th.

RADIO SOCIETY OF GREAT BRITAIN.

At 6.30 p.m. At the Institution of Electrical Engineers. Victoria Embankment. Elementary Lecture (II), on "Fundamental Principles of Radio Reception," by Mr. Maurice Child.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Meeting.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

Lecture on "The Design of a Tuner," by Mr. G. B. Kendall, B.Sc.

Saturday, February 17th.

NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS.

At 6.30 p.m. At Holborn Restaurant, Newton Street, W.C.1. Annual dinner.

Monday, February 19th.

THE WALTON-ON-THAMES AND DISTRICT AMATEUR RADIO SOCIETY.

General Meeting at the Headquarters, St. Michael's, Burwood Park Road, Walton-on-Thames.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company ;—

London	**2LO**	369 metres.
Birmingham	**5IT**	420 ,,
Manchester	**2ZY**	385 ,,
Newcastle	**5NO**	400 ,,
Cardiff	**5WA**	395 ,,

The Cardiff station is expected to be working by about Monday, February 12th.

NEW CATALOGUES.

Messrs. J. H. Taylor and Company, Electrical Engineers, Macaulay Street, Huddersfield: Catalogue of receiving sets and parts, instrument wires, etc.

The Efandem Company, Limited, Electrical and Mechanical Engineers: Catalogue of patent spring clip connections for wireless apparatus.

BOOK RECEIVED.

THE RADIO YEAR BOOK. (London: *Sir Isaac Pitman & Sons, Ltd.*, Parker Street, Kingsway, W.C.2. Price 1s. 6d. net.)

Questions and Answers

NOTE.—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) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *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.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"A.B." (Taunton) *refers to the diagram given on page* 474, *October* 29*th issue*, 1921, *and asks* (1) *How the circuit may be arranged so that connections may be made with the last transformer of his valve receiver.* (2) *How are the resistance coils of a Wheatstone bridge usually constructed. Are the two resistances of* 10,000 *ohms shown constructed after the manner of a potentiometer with a slider.* (3) *The gauge, size and quantity of resistance wire to make the resistances.* (4) *What voltage is required to satisfactorily operate a* 10″ *spark coil.*

(1) The arrangement given in Fig. 1 will meet your requirements. The diagram is slightly modified to the arrangement and works very well indeed. (2) and (3) The coils of a Wheatstone bridge are usually doubly wound. The windings are wound

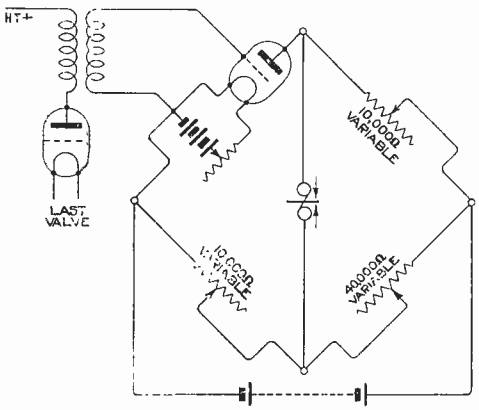


Fig. 1.

upon bobbins suitably mounted. The resistances shown in the diagram need not be continuously variable. The variation may be carried out with the aid of stud switches. We suggest you use No. 44 Eureka wire, which has a resistance of 2,800 ohms per 100 ft. (4) The voltage necessary for the successful operation of a 10″ spark coil varies slightly with different designs of coil, but we suggest you use 40 volts.

"R.W.S." (Manchester) *submits a diagram of his receiver and asks* (1) *Why the amplification is so small.* (2) *How to make tuning very selective.*

(1) The diagram of connections submitted is incorrect. The grid and filament of the first valve

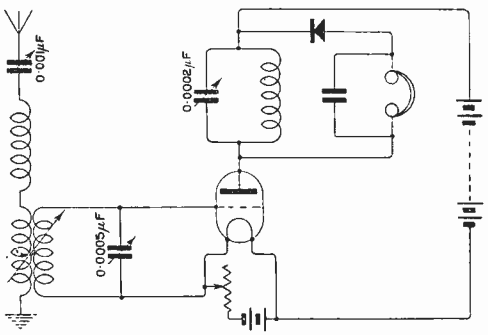


Fig. 2.

should be connected across the inductance only. If the connections are made to include the inductance and capacity, very little or no voltage will be applied to the valve. The anode winding should be tuned with a small condenser having a maximum value of 0·0002 mfds. The aerial condenser should have a maximum value of 0·0002 mfds. The aerial condenser should have a maximum value of 0·001 mfd. (2) We suggest you rewire the circuit according to Fig. 2. You will note that we have added a closed circuit comprising a coil and condenser. The condenser has a maximum value of 0·0005 mfds., and the coil should be similar in size to the aerial coil to which it is coupled.

"L.C.C.R." (N.13) *asks* (1) *For particulars of a number of tuning coils which will enable him to tune from* 150 *to* 30,000 *metres; the coils to be built upon the principle given on page* 392 *of the issue of December* 23*rd.*

We cannot give you precise instructions, because the inductance value of these coils depends essen-

tially upon the spacing of the wires, but you should have no difficulty in building up a set yourself, experimentally determining the most suitable values. The inductance values of a set of honeycomb coils could be taken as a basis to work upon.

"**EXPERIMENTER**" (**Glasgow**) *submits a diagram of his receiver and asks* (1) *For criticism of the diagram.* (2) *For suitable values for the aerial, closed circuit, reaction coil, and anode coil.*

(1) The arrangement is quite suitable, except that it would be better to use a closed circuit, but the anode coil should of course be tuned with a small variable condenser having a maximum capacity of the order of 0·0002 mfds. (2) The tuning arrangements which you have at present should be quite suitable, but we suggest the closed circuit coil should have 40 turns on a 2" diameter former, the No. 34 S.S.C. wire which you have by you being used. It would be better if you rewound all the coils, using heavier gauge wire—No. 22 for the aerial circuit, No. 24 for the closed circuit, and No. 32 for the reaction coil and the anode coil.

"**G.W.S.**" (**Atherstone**) *submits a diagram of a crystal receiver which he has constructed, and asks* (1) *Whether he may expect to obtain an experimenter's licence.* (2) *Could it be altered and made suitable for the reception of broadcast wavelengths with the addition of valves.* (3) *Does the direction of the aerial affect the strength of signals received to any extent.* (4) *What is reaction.*

(1) In view of question (4), we do not think you would obtain an experimenter's licence.

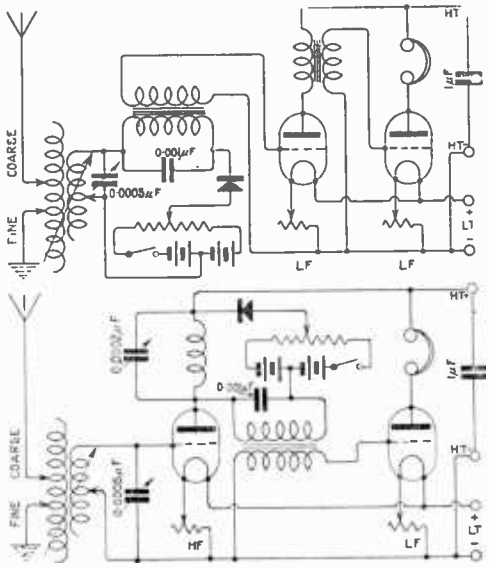


Fig. 3.

The experimental licence is granted to persons who in the opinion of the Post Office have sufficient knowledge to enable them to operate receiving apparatus without causing interference to other wireless users. Why not become a member of the local Wireless Society, where you would receive much help. (2) The receiver could easily be altered. In Fig. 3 the upper diagram shows how two note magnifiers are added to the receiver, and in the lower diagram one high frequency valve is connected with a crystal detector and note magnifier. (3) Outdoor aerials have slight directional properties. To receive the maximum strength

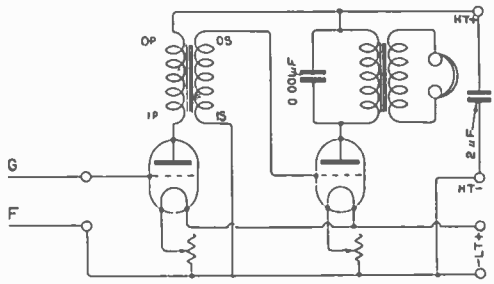


Fig. 4.

of signal, due consideration being paid to other factors, the lead-in end of the aerial should be nearest the transmitting station, and the direction of the horizontal portion of the aerial should point towards the transmitting station. (4) A valve is capable of amplifying, therefore more energy is available in the output circuit of the valve than is applied to the input. Reaction consists in transferring a small amount of the output energy to the input circuit, thus reinforcing the input signals. If reaction is carried too far, that is to say, if a large proportion of energy is transferred back to the input circuit, valves will generate oscillations, and if the input circuit is coupled with the aerial circuit, energy will be radiated.

"**VIC. E.**" (**Coventry**) *asks for a diagram of a two-valve low frequency amplifier.*

We would refer you to Fig. 4. The diagram is very straightforward and easy to follow.

"**A.J.**" (**Yorks**) *refers to the diagram on page* 387 *of December* 16*th issue, and asks* (1) *What is the dimension of the anode coil.* (2) *Is the anode coil a fixed inductance, or should it be tapped or inductively coupled with any other coil.* (3) *With the A.T.I. and C.C.I. of given dimensions, should it be possible to receive the broadcast transmissions.* (4) *What is the wavelength range of the station.*

(1) and (2) The anode coil X, together with the 0·0002 variable tuning condenser, should tune to the wavelength of the signals; that is, the coil X should have approximately twice as many turns with the same diameter as the closed circuit coil. The anode coil is fixed in position, and should not couple with any other coil in the receiver, otherwise regenerative effects would be obtained. (3) You should certainly receive the broadcast transmissions. (4) The wavelength range of your station is from about 200 to 8,000 metres.

"**A.S.P.**" (**London, E.C.3.**) *asks* (1) *For criticism of a proposed crystal set.* (2) *Whether a frame aerial may be used.* (3) *Whether he would get good results with a Reinartz tuner to tune up to*

8,000 *metres.* (4) *The best aerial which he can erect in his circumstances.*

(1) We suggest you build a set yourself and wire the components as indicated in Fig. 5. The aerial tuning inductance may consist of a winding of No. 22 D.C.C. on a former 4″ in diameter and 6″ long. The secondary tuning inductance may consist of a winding 3″ in diameter and 8″ long of No. 30 D.C.C. (2) It is useless to expect signals when the crystal set is connected with a frame aerial. We suggest you build an open aerial as advised in No. 4. (3) We suggest you do not build a Reinartz tuner, but a standard valve receiver. Particulars of many have appeared recently in these columns. (4) We suggest you secure a pole to the house and then erect a 35 ft. pole in the garden as suggested. The higher the aerial the better it will be for your purpose.

"H.C.H." (London, S.W.1.) *asks* (1) *For a diagram of a four-valve receiver using one H.F., one detector and two L.F. connected valves for a switch cut out of the first H.F. valve and provision for plug-in telephones into either of the L.F. valves.* (2) *What is the smallest current which will operate the P.O. telegraph relay.* (3) *The minimum number of valves required for recording Paris Spark signals.* (4) *Is a Brown adjustable telephone, rewound with No. 47 enamelled wire, useful for recording purposes as described in a recent issue of "The Wireless World and Radio Review."*

(1) The diagram given in Fig. 6 is quite suitable for your purpose. (2) The P.O. telegraph relay will operate well with a current of 0·2 milliampere. (3) We suggest you use a three-valve receiver for this purpose. (4) The arrangement suggested is quite suitable.

"H.W." (Manchester) *asks for advice regarding an experimenter's licence.*

We think your information concerning the conditions under which experimental licences are granted is incorrect. If you build your own set, you must possess an experimenter's licence. If the Post Office will not grant you an experimenter's licence, you are not allowed to use a receiver which you have built yourself, but must purchase one which bears the stamp B.B.C. If you hold

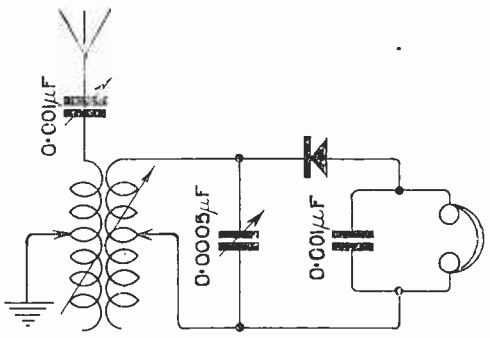


Fig. 5.

an experimenter's licence, it is a condition that you shall not cause your receiver to oscillate while listening to the broadcasting transmissions.

"R.W.McW." (Glasgow) *proposes to use a frame aerial and asks* (1) *Whether a three-valve receiver comprising one high frequency, one detector, and one L.F. connected valves would be useful.* (2) *Whether it would be better to use more valves.*

(1) We consider you will hear the local broadcasting stations using the three-valve set, but you will probably only faintly receive the transmissions from the more distant broadcasting stations, and we suggest that for good reception you add two high frequency connected valves. See circuit given on page 315, December 2nd issue. The frame in this case takes the place of the secondary tuning coil, and of course the aerial circuit is not required.

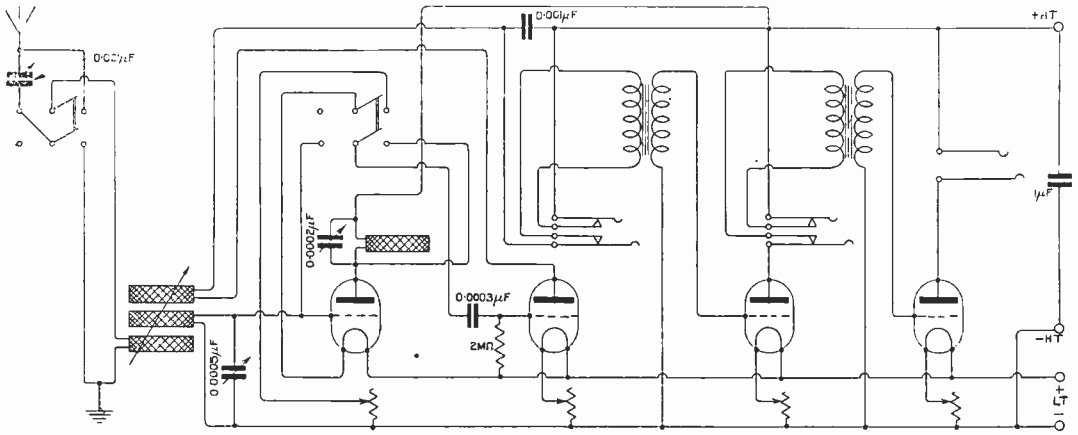


Fig. 6.

"D.G.K." (Herts) *asks* (1) *For a diagram of a five-valve receiver employing two H.F., one detector, and one L.F. connected valves. High resistance telephones are to be used, and it is desired*

to be able to switch on or off the valves as required. (2) *What are the dimensions of the tinfoil plates of the fixed condensers to be used in the receiver.*

(1) See Fig. 8. A number of arrangements similar to this have recently appeared. (2) The telephone transformer may consist of a bundle

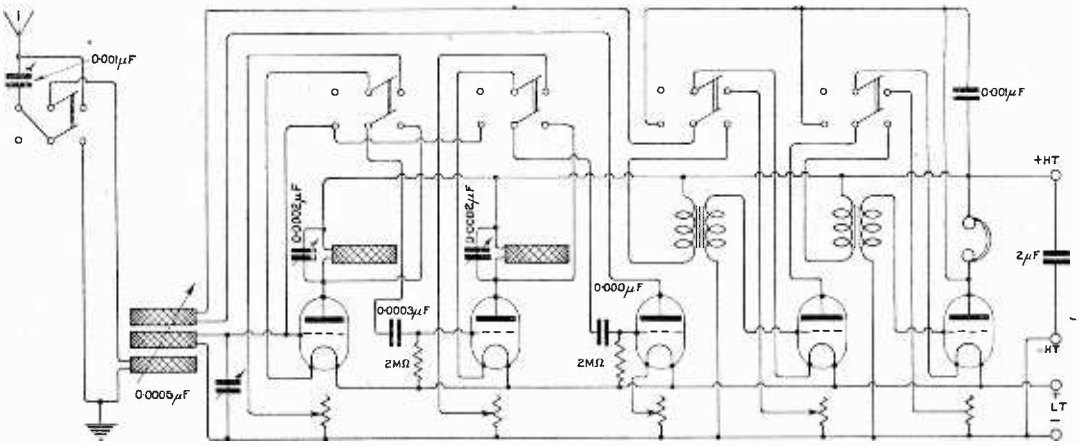


Fig. 7.

(3) *What are suitable capacities for the variable condensers.*

(1) A suitable diagram is given in Fig. 7. The tuned anode method of H.F. amplification is used. You will notice the grid-leak connections are made with + L.T. (2) 0·0003 mfd. condensers may consist of two plates with an overlap of 3 cm × 1 cm., the mica being 2 mils. thick. The 0·001 mfd. condenser may consist of six plates with an overlap of 2 cm. × 1 cm.; mica 2 mils. thick. (3) Suitable values for the variable condensers are indicated in the diagram.

of soft iron wires built up to a diameter of $\frac{3}{8}$" and 5" long. The primary winding may consist of 5,000 turns of No. 42 S.S.C. wire, and the secondary of 1,000 turns of No. 34.

"**R.A.M.**" **(Barrow-in-Furness)** *asks the number of turns required in honeycomb coils to tune in conjunction with* 0·00075 *variable condenser over a wide wavelength range.*

We suggest you wind 25, 35, 50, 100, 200, 500, 750, 1,000, 1,250, and 1,500 turns. For the smaller coils we suggest you use No. 22 D.C.C., and for the larger coils No. 26 D.C.C.

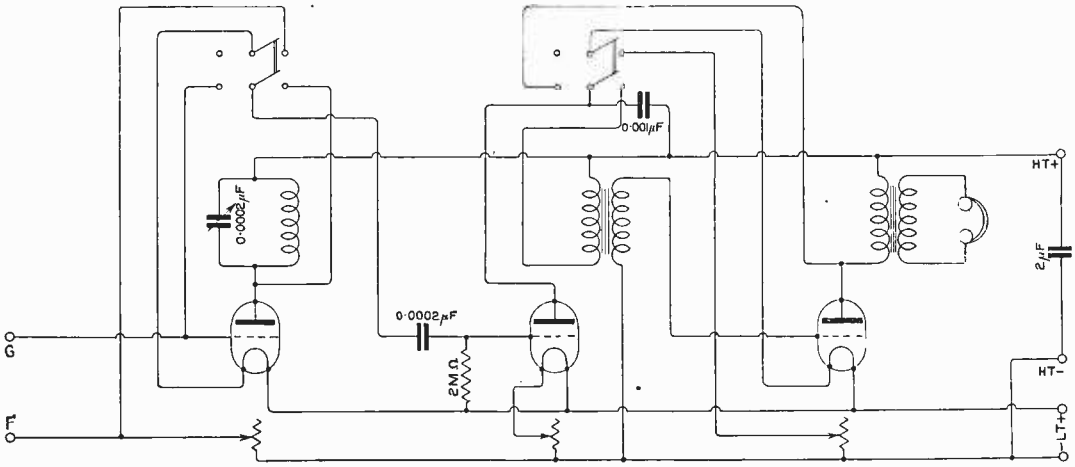


Fig. 8.

"**W.A.T.**" **(Sheffield)** *refers to the broadcast receiver described in this journal and asks* (1) *For a diagram showing how two double pole throw switches can be connected.* (2) *How to construct a telephone transformer.*

"**M.A.H.**" **(London, S.E.24)** *asks how to add a H.F. connected valve using a plug-in type transformer to his detector valve with switch for cutting in or out the H.F. valve.*

See Fig. 9. Suitable valves are indicated.

"F.A.M." (N.W.11) *asks* (1) *Whether it matters which way round the coils are connected in a three-coil holder.* (2) *Why is it signals appear quite as strong when no grid leak is used.*

(1) It does not greatly matter which way round the aerial and closed circuit coils are connected, but it does matter which way the reaction coil is joined. With one connection, the current flowing in the reaction coil will assist that flowing in the closed circuit coil, and with the reverse connection it will oppose the closed circuit. (2) You probably have a leak or a low insulation between the grid and filament terminals of the valve. This may happen through poor ebonite, or because of pencil marks, dust, dirt, and so on. The back of the panel should be cleaned, and lines scratched round the various terminals to prevent surface leakage. It is not satisfactory to work without the grid leak, because one does not know the value of the leak resistance.

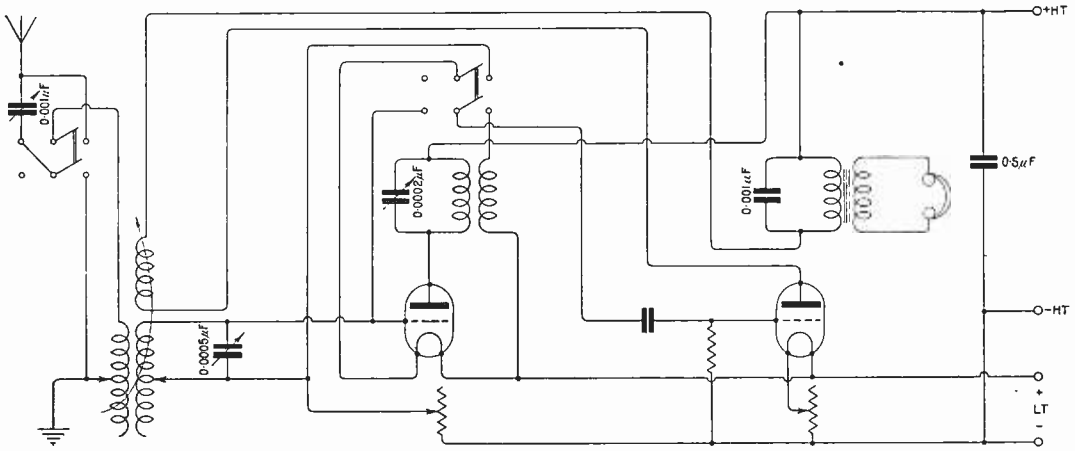


Fig. 9.

"Z.H." (Southall) *asks* (1) *What publication gives the definition of signal strength such as is used by a man reporting the reception of a certain station, strength R 6.* (2) *Is there any record of the smallest amount of power that has been amplified and received as a wireless signal.*

(1) The strength of signal referred to by R 6 is not a definite signal strength, in so far that it has no definite value. It is simply a convenient way of expressing a signal with an apparent intensity of a certain value. The signal strengths were referred to in this manner in the Army and Navy Signal Services, and convey sufficient meaning. (2) We have no record of the smallest amount of power that has been amplified and rendered audible by a valve receiver.

"N.B." (Lancs.) *asks* (1) *What size of duolateral coils would be required for British broadcasting.* (2) *Is the receiver (diagram of which is submitted) connected so that it is unlikely that oscillations would be generated in the aerial circuit.*

(1) We suggest you use Nos. 35, 50 and 75 duolateral coils. (2) The diagram submitted is quite suitable for the reception of broadcast transmissions and is not likely to set up oscillations in the aerial circuit if the reaction coil is coupled with the anode coil. If, however, the reaction and aerial coils are coupled together, you may be sure oscillations will be generated in the aerial circuit sometimes, and interference will be caused.

"E.T.W." (Lincoln) *asks* (1) *Suitable dimensions of an aerial tuning inductance.* (2) *A suitable secondary coil.* (3) *A suitable reaction coil.*

(1) The A.T.I. may be a coil 3" in diameter, wound with No. 18 D.C.C.; 144 turns may be used with tappings taken at every twelfth turn. (2) The secondary winding may be 2" in diameter, and wound with 250 turns of No. 22 D.C.C., with five tappings. The reaction coil may be 2" in diameter, and have a winding of 100 turns of No. 26 D.C.C.

"K.H.F." (India) *submits a diagram of his receiver and asks* (1) *Whether it is suitable.* (2) *Whether it is possible to reduce interference caused by a near-by power station.*

(1) We have examined the diagram of connections, and the connections are quite suitable. We would point out, however, that the inclusion of so many switches in the high frequency portion of a receiver is apt to seriously cut down the signal strength. (2) We suggest you use a frame aerial, or if you prefer to use the open aerial, to use the counterpoise in place of the earth. If trouble is still experienced, the low frequency portion of the amplifier should be screened by being placed in a metal box.

"E.J.M." (Derby) *asks* (1) *Whether the use of a Dewar type switch in the aerial circuit and as a stand-by switch, is likely to reduce signal strength.* (2) *Is the resistance capacity type of high frequency amplifier more efficient on long wavelengths than an impedance capacity amplifier.* (3) *Is* **8 AB** *transmitting. If so, at what times and on what wavelength.*

(1) Provided the switch springs are well spaced no serious losses are likely to occur, although the practice is not recommended. (2) When receiving very long wavelength signals, it is better to use the reactance capacity method of high frequency

amplification. (3) The French amateur station **8 AB** transmits at irregular intervals, and if you are interested in these transmissions, we suggest you communicate with him.

"E.J.P." (Kent) *asks* (1) *For a diagram of a two-valve receiver, comprising two high frequency valves with crystal detector.*

See the diagram Fig. 10. Suitable values for the condensers are indicated.

"N.E.K." (Belgium) *asks* (1) *Whether it is possible to replace high frequency transformers with tuning coils for reception up to 2,000 metres, and above that to use the resistance capacity method of high frequency amplification.* (2) *What values of inter-valve capacities should be used, the grid leak being 6 megohm.* (3) *What should be the H.T. voltage. "R" type valves are used.* (4) *Is it better to connect a low value capacity between the last high frequency and the rectifier grid.*

(1) We suggest you adopt the tuned anode method of coupling high frequency valves, up to a wavelength of 2,000 metres, above which use the resistance capacity method. (2) We suggest you employ coupling condensers of 0·0002 mfds. (3) The H.T. voltage applied to the high frequency valves should be of the order of 50 volts. The low frequency valves may have a much higher voltage, although in this case it is advisable to connect a few cells in the grid circuit, in order to ensure that the grids shall be sufficiently negative. When the anode resistances are used, the H.T. voltage should be increased to allow for the voltage drop through the resistance. (4) It is sometimes better to use a smaller coupling condenser between the last high frequency valve and the rectifying valve, but you should determine the best condensers by experiment.

"P.S.B." (Walsall) *submits particulars of his receiver, and asks for any suggestions.*

We suggest you use a different set of receiving coils when attempting to receive the London broadcast transmissions. It would be an advantage to tune the anode winding for the high frequency valve, and for this purpose a tuning condenser having a maximum value of 0·0002 mfds. should be used. In general, the smaller the value of this condenser the stronger will be the signals. The aerial tuning condenser is of suitable value, and all future adjustments should be made with the coils. We suggest you use "R" type valves with 45 volts on the anode of the high frequency and detector valves, and 60 volts on the anode of the L.F. connected valves.

"COIL" (Edinburgh) *submits particulars of the coils he has wound, and asks whether they have sufficient inductance to enable him to secure from 350 to 450 metres.*

We think the coils have sufficient inductance to enable you to tune over the required wavelength range, provided the aerial tuning condenser has a maximum capacity of 0·001 mfd., and the closed circuit contains a maximum value of 0·0004 mfds.

"G.E." (Cumberland) *refers to the figure of a former on page 130, October 28th issue, and asks how to connect the two windings.*

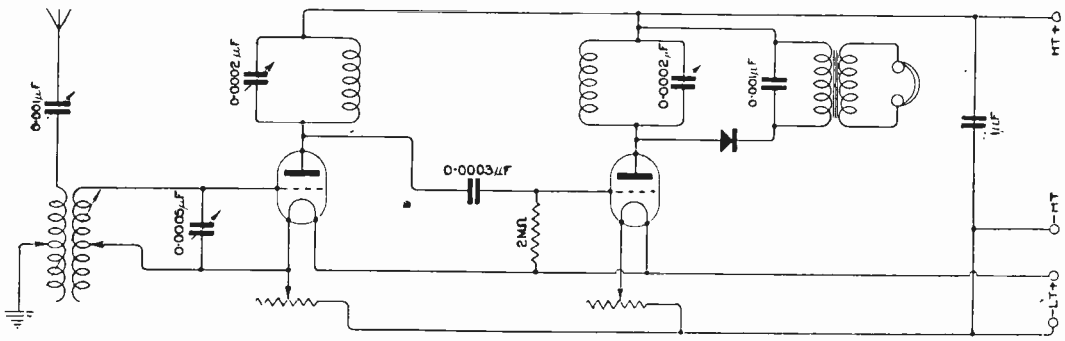


Fig. 10.

The winding should be connected in series, so that the two windings are wound in the same direction. The inductance will then be added. Alternatively, for smaller inductance value, the two windings may be connected in parallel.

SHARE MARKET REPORT.

Prices as we go to press on February 2nd, are :—

Marconi Ordinary	£2	12	6
,, Preference	2	3	9
,, Debentures	107	0	0
,, Inter. Marine ..	1	8	3
,, Canadian		11	3
Radio Corporation of America :—			
Ordinary		15	0
Preference		13	3

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 183 [No. 20. Vol. XI.] FEBRUARY 17th, 1923. WEEKLY

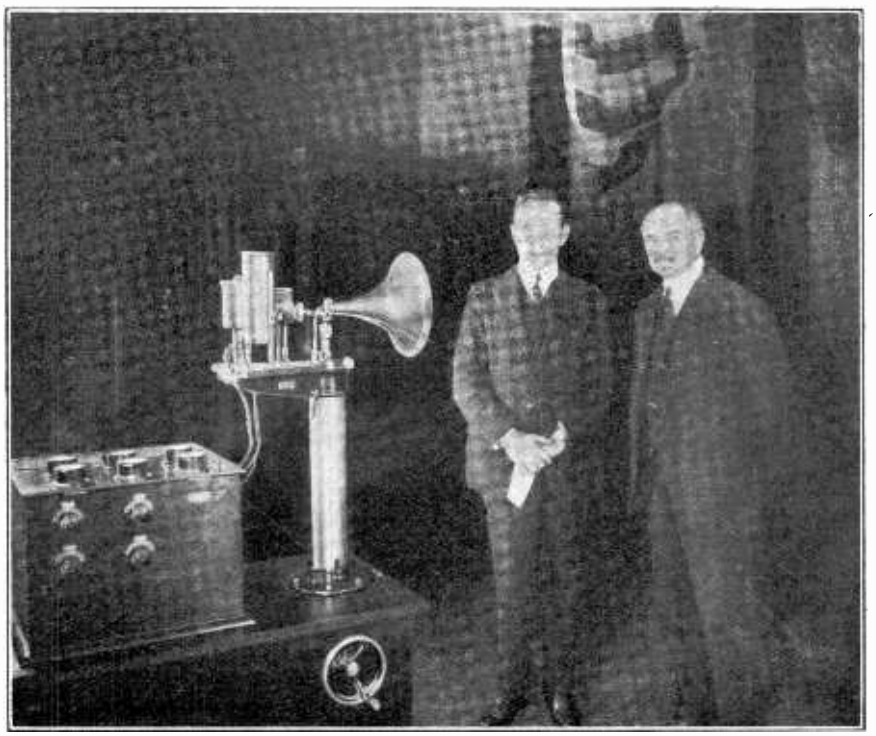
The American Broadcasting Station WGY

A description of this station is of special interest, as it is one of the American broadcasting stations frequently mentioned by British amateurs in their reports of Transatlantic broadcast reception.

THE accompanying description is intended to give some idea of the manner in which WGY, the General Electric Company's station at Schenectady, New York, operates.

The transmitting apparatus and the studio where the artists perform are not located in the same building, but are about three-fifths of a mile from each other.

The transmitting apparatus proper is located on the top floor of one of the factory buildings. A multiple tuned antenna has been erected

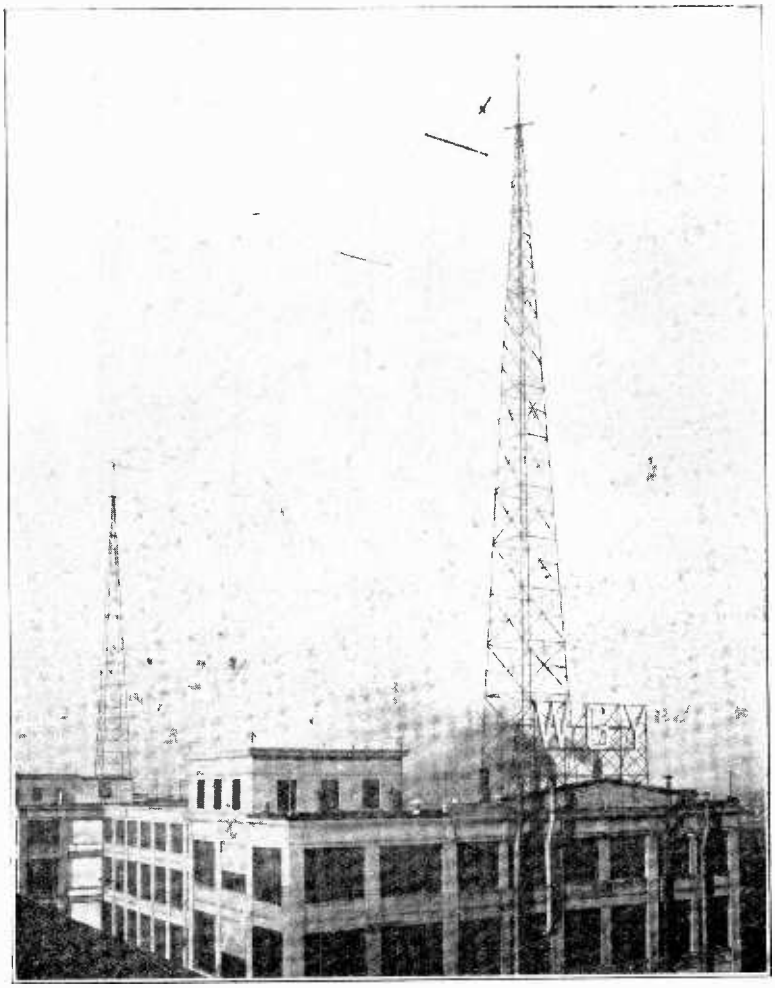


Senatore G. Marconi with Mr. E. W. Rice, Jr., Honorary Chairman of the Board of Directors of the General Electric Company, in the studio of **WGY**, *from which Senatore Marconi delivered an address to the American people, speaking through the microphone on the left.*

on the roof of this building. The antenna is 350 feet long and is supported at each end by a steel tower 180 feet high. A counterpoise system has also been installed a few feet above the roof. This consists of a network of wires that act as a " ground " for the antenna and results in a considerable decrease in the effective resistance of the whole antenna system.

The power supply for the transmitter is three phase, 60 cycles, at a potential of 110 volts. This source furnishes practically all the power for the entire equipment. Two types of vacuum tubes are used, namely, kenotrons or two element tubes and radiotrons or three element tubes. The filament of the kenotron is heated from the secondary of a step down transformer. A small direct current generator is used to supply the radiotron filaments.

The plate circuit of the radiotron power tube requires high voltage direct current at a potential of about 12,000 volts. This is obtained from the kenotrons which are connected through a suitable rectifying circuit to the secondary of the high voltage plate transformer. A filter system is connected in the rectifying circuit in order to remove the A.C. hum that would otherwise be present. The high voltage output of the kenotron rectifier then passes into the radiotron tubes, where by means of the proper oscillating circuits it is converted into radio frequency energy on a wavelength of 360 metres.



A general view of the antenna system of the American Broadcasting Station, **WGY,** *at Schenectady, N.Y.*

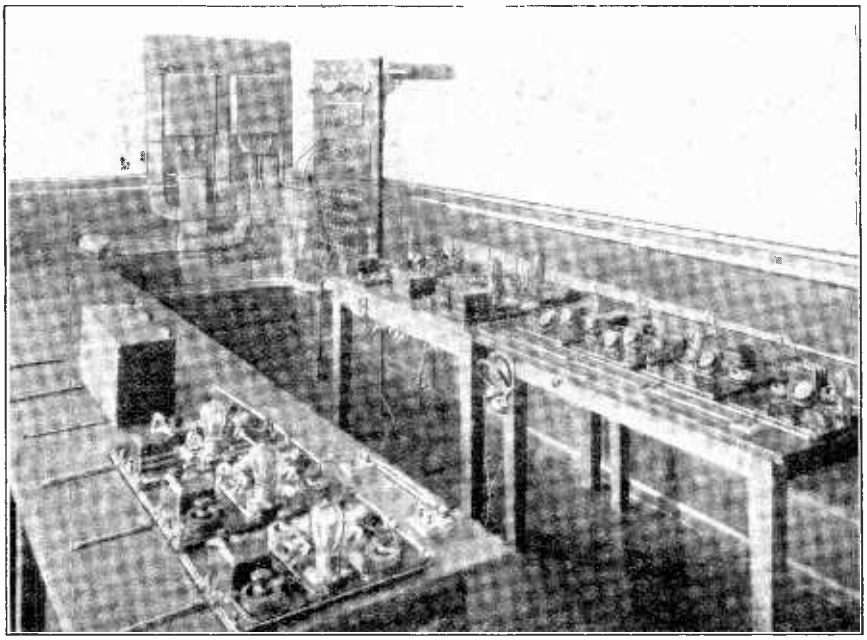
Three rooms are utilised at the studio, one being used as a reception room, one containing pianos, organs and other musical instruments, and the third containing the controlling and amplifying apparatus. The only apparatus located in the room where the artists perform are small microphones which are mounted on stands so that they may be placed in the best position for the particular selection to be broadcast. These microphones have been very carefully designed so that the true tone qualities of music, voice, etc., will be clearly reproduced. The minute current fluctuations set up in the microphones are then transferred to the apparatus room, where they pass to amplifiers. Various controls are provided on the amplifiers so that the degree of magnification may be varied at will.

The amplified current fluctuations are next transmitted over a pair of wires to the modulator tubes located in the transmitting station proper, which are so connected that they may control the antenna current by varying the plate potential impressed on the oscillator tubes. The censorship and supervision that is exercised over the broadcasting is of some interest. The studio director has at his disposal a control switch which cuts the microphones in or out of the circuit. As soon as this switch is closed a red lamp is illuminated, which warns those in the room that everything spoken will be transmitted to the invisible audience. The "censor," or man in charge of the amplifiers in the apparatus room, listens continually to the concert or selection being broadcast so that he may make any adjustments necessary to improve the tone quality of the transmission. The censor is also in telephonic communication with the transmitting equipment, keeping a constant watch on the operator, who in turn keeps a constant watch on his apparatus, and by means of an oscillograph can determine the amount of modulation which is taking place in the antenna circuit.

All circuit adjustments are, however, under the complete control of the censor and no changes are made without his consent.

It is interesting to note that this station has been listened to by a number of amateurs in this country, and in the issue of this journal for January 27th, on pp. 579 to 580, is given a list of some British stations which were successful in reception of American broadcasting. WGY is here mentioned as being heard by three amateurs, W. R. Stainton, Leigh, Lancs.; J. W. Partington, Camborne, Cornwall; and V. M. Cartnell, Southport. Other reports of reception have since been received from B. Caldwell, nr. Warrington, Lancs.; Colin Sarbuck, nr. Wigan, Lancs.; S. W. F. Cardell, Newquay, Cornwall; R. S. Smith, Erdington, Birmingham; and H J. Jarrold, Norwich.

Other Broadcasting stations heard include WJZ, Newark, New Jersey; WDY, Roselle Park, New Jersey; WEY, Wichita, Kansas; WDAC, Springfield, Illinois; WDAF, Kansas City, Kansas; WEAS, Washington, D.C.; WIP, Philadelphia; and WOR, Newark.



The Censor's room adjoining the studio. The Censor determines the quality of the music and directs the amplification necessary to carry the speech and music over wire lines to the transmission equipment three-fifths of a mile away.

The Antennæ.

THE TRANSMITTING STATION'S RADIATING SYSTEM.

IT is a matter for comment that while an experimenter will devote hours in making circuit adjustments in order to increase the current indicated by his aerial ammeter by a part of an ampere, little time or trouble is given to improving his radiating system—aerial, earth and counterpoise. From a consideration of the usual radiating structures it is apparent that in many cases great improvement is possible, and it is hoped in these notes to show why an improvement may be obtained and then to show the methods by which improvement may be achieved.

An antenna possesses resistance, capacity and inductance, and it is proposed to deal with resistance first.

Suppose we have a transmitter which is capable of putting 50 watts into the aerial circuit. The power radiated, which of course we desire to be as large a percentage of the 50 watts as possible, is equal to C^2R, where C is the current measured with a hot wire ammeter placed at the point of maximum current, *i.e.*, generally in the earth lead, and R is the radiation resistance. The radiation resistance in ohms is given by

$$1580 \left(\frac{h}{\lambda}\right)^2 \quad . \quad . \quad . \quad . \quad (1)$$

where h = the effective height of the aerial, and λ is the wavelength of the energy in metres. From this equation it will be noticed the radiation resistance is proportional to the effective height, and varies with the wavelength. Now the total resistance of the radiating system is R_T ohms, and is considerably greater than R. With an antenna of 25 ohms total resistance, the current will be $\sqrt{\frac{\text{watts}}{R_T}}$ which is in this case $\sqrt{2}$ or 1·41 amperes. If the radiation resistance for the wavelength of the energy is 3 ohms, the power radiated will be $C^2R = 6$ watts.

The efficiency of the antenna is $\frac{6}{50} \times 100\%$ = 12%. The resistance values used here of course include that due to the tuning inductance and condenser if one is used.

The current received by an antenna is given by the formula $h_s I_s = \frac{\lambda d R I_r}{377 h_r}$ . . . (2)

where I_s = current in transmitting aerial in amperes.
I_r = current in receiving aerial in amperes.
h_s = effective height of transmitting aerial in kilometres.
h_r = effective height of receiving aerial in kilometres.
λ = wavelength in kilometres.
d = distance in kilometres.
R_T = total resistance of receiving circuit in ohms.

The formula may be re-written

$$\frac{h_s I_s}{\lambda} = \frac{d R I_r}{377 h_r} \quad . \quad . \quad . \quad (3)$$

Now $\frac{h_s I_s}{\lambda}$ concerns the transmitter, and it is at once evident that I_s which is the aerial current should be as high as possible, and as in the radiation resistance formula above, h_s should be large. The factor λ appears in the denominator of the expression, and it would seem at first sight that the shorter the wavelength the greater the received signal current, other factors remaining undisturbed; but this is not so on account of absorption, which is far more serious at short wavelength than long. Formula (3) is accurate for short distances, say up to 40 or 50 miles, but beyond that range the effects of absorption cannot be neglected, and the expression for the received current is reduced by a quantity determined by the nature of the intervening country and other factors.

It will be seen that it is desirable to make the ratio $\frac{R}{R_T}$ as great as possible, as in this way the antennæ current is larger, and a larger proportion of the power delivered to the antennæ is radiated. The difference between R_T and R, which is wasted, may be called R_w, and is made up of a number of components.

We have first of all the ohmic loss, due to the ohmic resistance of the aerial wires, lead-in,

loading coil, and perhaps series condenser, and earth or counterpoise. The loss is manifest as heat, and is reduced by using conductors which have a low value of high frequency resistance. The second loss is due to dielectric absorption, and is brought about by imperfect dielectrics lying in the field of the antennæ. In addition we have losses due to eddy currents, leakage, and brush discharges.

Curves which may be drawn showing the variation of total resistance with wavelength, are similar to Fig. 1. The figure shows roughly how the resistances vary with wavelength. The copper loss, in which is included that due to eddy currents and skin effect, is slightly greater the higher the frequency, and is represented by curve (1). The loss due to imperfect dielectrics is proportional to the wavelength, the higher the wavelength the greater the loss, and is represented by curve (2). The radiation resistance is represented by curve (3), and it will be noticed, varies inversely as the wavelength. The total resistance is indicated by curve (4).

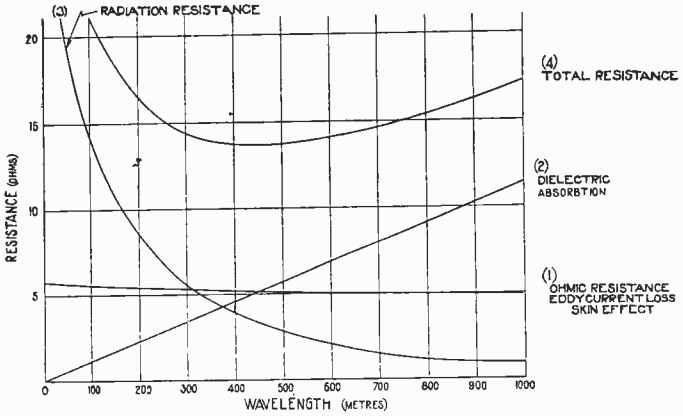


Fig. 1. The curves indicate the variation in antennæ resistance with wavelength. The sum of the magnitude of the resistances shown by curves 1, 2 and 3 at a given wavelength give the total antennæ resistance at that wavelength. In practice the total resistance only is measurable.

It is now proposed to deal with each source of resistance in turn and indicate, it is hoped, how the radiation efficiency may be increased.

From curve (1), it is seen that the high frequency resistance of the conductors used should be as low as possible, and in particular that due to poor contact with the earth. The wires used for the aerial should, when possible, be stranded, since the high frequency resistance of fine wires is not so greatly in excess of the direct current resistance as in the case of thick wires. A good conductor, though unfortunately expensive, consists of stranded copper woven round a central non-conducting core. The next best conductor is probably a stranded conductor of fine wires, the wires being properly woven so that each appears on the outside of the cable an equal number of times, and for those who cannot afford a great deal, ordinary stranded 7/18 copper. The wires should be enamelled to prevent corrosion, and the formation of a high resistance skin.

Proper attention should of course be given to the design of the loading coil and condensers when used.

The eddy current loss, which is caused by currents flowing in neighbouring conductors such as stay wires, metal masts, and the earth surface, may be reduced by inserting insulators in each end of the stay wires, mounting the mast upon an insulator, and by the provision of a really good earth and counterpoise. The construction of the aerial and lower capacity, which includes the earth and counterpoise, will be dealt with later. In general, losses due to the use of a metal mast may be neglected by the experimenter with a small station.

The lower capacity should be directly below the aerial wires, otherwise the earth below the aerial will be the cause of losses.

From curve (2) one should remember that such objects as trees, buildings, wooden masts, neighbouring walls, fences, and the insulators themselves are the cause of great losses. So far as possible the space around the aerial should be free from other objects, and care should be taken with the lead-in and lower capacity wires. The lead in should be as far removed from objects as practical, and ideally would leave the aerial and run directly to the lead-in insulator located in the roof of the building housing the transmitter. The lead-in is often a source of loss, particularly at the point of entry into the building.

The insulator should be large, so that the imperfect dielectric of the roof of the building is not the seat of losses.

The losses due to leakage and brush discharges also should be considered. Leakage

may be reduced by the provision of good insulators with high dielectric strength. The design should be such that the surface is long and irregular, so that dampness and rain will not cause surface leakage.

The brush discharge is reducible by the use of large diameter wires, but is very seldom the cause of loss with amateur transmitting plant.

The radiation resistance (3), it is seen, varies with the wavelength, and it is desired to make this quantity as high as possible by good antenna design. From the equations it is seen the effective height of the antenna should be as great as possible. With an antenna of a given height, the effective height is raised by attention to the preceding points. All things considered, it appears that maximum energy will be radiated when the wavelength

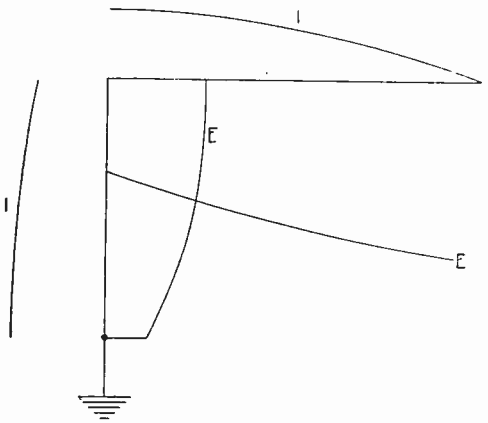


Fig. 2. The curves show the relative magnitude of the voltage and current along the unloaded antenna when oscillating.

used is of the order of 1·5 the natural wavelength. It is sometimes stated provision should be made for radiating at the natural wavelength of the aerial by connecting a series condenser to neutralise the effect of the added inductance which is essential for the transfer of energy from the oscillator to the aerial circuit. It does not seem to the writer that any advantage is gained, since the condensers generally used, besides being costly, are the seat of losses due to the ohmic resistance and dielectric loss.

The antenna, besides resistance, possesses capacity and inductance, and therefore a natural wavelength. The natural wavelength of a vertical antenna is a little over four times its length in metres. That of an inverted L aerial is from 4·4 to 4·8 times the length from the free end to the lower capacity, and that of a T type aerial is from 4·5 to 5·2 times the length measured from one free end to the centre point plus the length from this point to the lower capacity. In the case of the inverted L and T aerials, the capacity is largely due to the top portion, and the current in the down lead is almost uniform. It is not always satisfactory to calculate the capacity and inductance of the antenna on account of the dielectric present in its field, and the closeness of neighbouring buildings, etc. The capacity and natural wavelength may be measured, and it is then easy to find the inductance. It is pointed out here that lengthening the aerial wires increases the capacity and inductance, while putting more wires in parallel increases the capacity but reduces the inductance, the actual amount of variation depending upon the spacing of the wires. The wires should be preferably spaced six feet or more in the case of a flat-topped aerial. The increase in capacity is almost balanced by the reduction in inductance, so the natural wavelength remains unchanged or may be slightly increased.

The effect of loading an antenna is to change the wavelength at which it will radiate and the current and voltage distribution. When inductance is added the wavelength will be

$$\lambda = 1884 \sqrt{\left(L + \frac{L_o}{3}\right) C_o}$$

where λ is in metres, L = added inductance in microhenries, L_o = the low frequency inductance of the antenna and ω the low frequency capacity in microfarads. The capacity C_o is assumed to be constant at all wavelengths, although actually it varies a little. The quantity L_o may be obtained from a knowledge of the natural wavelength, and the natural capacity C_o, and is obtained from the formula

$$\lambda = 1199 \sqrt{L_o C_o}$$

It should be noticed that although two antennæ may have identical natural wavelengths one may have a larger capacity than the other, with the result that the addition of a given loading coil will result in the new wavelength being greater in the case of the aerial with the larger capacity. This is obvious from the wavelength formula.*

* The reader is referred to Circular No. 74 of the Bureau of Standards for further information dealing with the calculation of antennæ constants.

It is instructive to consider the voltage and current distribution in antennæ with a view to bringing out special points which should be borne in mind when constructing the antennæ.

The voltage and current distribution of an inverted L type antenna is given in Fig. 2.

The aerial is represented by the inverted L earthed at one end. The curves marked I represent the distribution of aerial current, its insulation should be such that it will safely withstand the voltage. The lead-in insulator obviously also requires to be able to withstand great potentials which it should be noticed may be greatly in excess of the voltage of the source of power. The line *a b* represents the pressure of the power supplied to the antenna, while *a c* represents that developed at the top of the coil.

In Fig. 3(ii) is indicated how the distribution

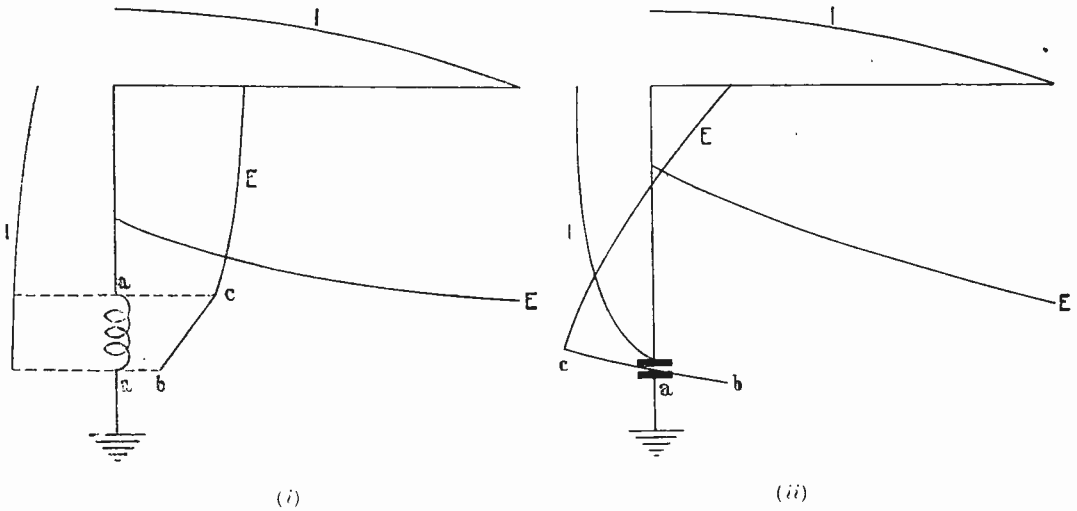


Fig. 3. The curves show the relative magnitude of the voltage and current when (i) the antenna is loaded with an inductance and (ii) loaded with capacity. The curves are instructive and should be examined.

the magnitude of the current being indicated by the distance from the line representing the antenna at the point considered. In the same manner the distance between the line representing the antenna and the curve marked E, indicates the magnitude of the voltage at the point considered.

It will be noticed the vertical portion has a nearly uniform current distribution, and the current falls off to zero at the free end. Here the voltage is a maximum, which emphasises the fact that great care should be taken with insulation at this point. When a series loading coil is connected, the conditions are roughly indicated in Fig. 3(*i*). It will be noticed the current in the coil is practically uniform, while the voltage across it is very high. The inductance should therefore be carefully designed to carry the current, and may be expected to change when capacity is inserted for the purpose of shortening the wavelength. It will be noticed the pressure *c a b* across the condenser may be very much greater than that applied as represented by *a b*.

The magnitude will depend upon the capacity of the series condenser and upon that of the antenna. If a relatively small value condenser is used the voltage developed may be expected to reach a high value. The point where the voltage curve E crosses the antenna line, called a potential node, depends entirely upon the ratio of the added capacity to that of the antenna. The larger the ratio, the lower down the aerial the potential node. It will be noticed the current has its maximum value at the potential node, and *vice versa*.

W.J.

(*To be concluded*)

An Experimental Single-Valve Receiver.

FOUR INSTRUMENTS COMBINED IN ONE.

By PERCY W. HARRIS.

THE beginner in wireless is frequently advised first of all to obtain a crystal receiver, so that he may learn the rudiments of the subject with the simplest apparatus, leaving the purchase of a more sensitive valve set to a later date when he feels more sure of his ground. There is much to commend in this advice, but the fact remains that few people relish having to abandon a set for which they have paid several pounds and spend still more money to start again with a complete valve installation. A discussion with a friend regarding this point led the writer to consider whether it would be simple to devise a small instrument that could be connected to existing crystal sets so as to allow the use of a valve. In thinking the matter over it was apparent that either high frequency or note magnification could be used.

To apply a note magnifier to an existing crystal set is of course a simple matter, as it is only necessary to attach the telephone terminals of the crystal set to the input terminals of the magnifying unit to obtain the desired result. Such an arrangement is satisfactory when the signals to be rectified by the crystal are already fairly strong, but the actual receiving range is not in any way increased by such an addition, as unless the signals are strong enough to pass the crystal they cannot be further magnified.

The other alternative is to precede the crystal by a high-frequency amplifying valve. This arrangement is far more satisfactory when the user is situated at some distance from the station he wishes to receive, as the signals can then be magnified up to a strength sufficient to pass the rectifying crystal. Strangely enough, high frequency units for attachment to existing crystal sets are rarely constructed by the amateur, although they offer an interesting field for experiment. The instrument described in this article is designed to precede any existing crystal receiver so that efficient high frequency amplification can be obtained over the whole broadcast band of wavelengths. With the addition of any good intervalve transformer it can be used for low frequency amplification after rectification, while it also forms a useful single-valve receiver without reaction. The fourth use of this little

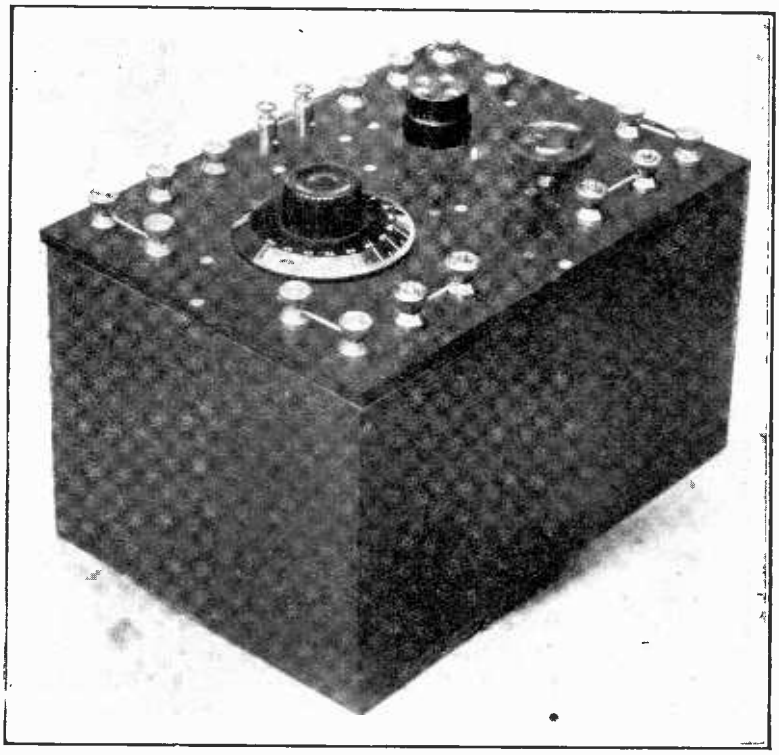


Fig. 1. Exterior view of the single-valve receiver.

instrument is as a short wave heterodyne, functioning from 100 to 225 metres or more.

Little need be said regarding the actual constructional work, as this is made clear in the photographs and diagrams. It will be noticed that tuning is effected by means of a variometer. This was purchased ready-made. Any variometer that will cover the broadcast band will do, but those who wish to construct it themselves will find the following data useful:—

Outer former, 4 ins. diameter ebonite tube.

Inner former, 3 ins. diameter ebonite tube.

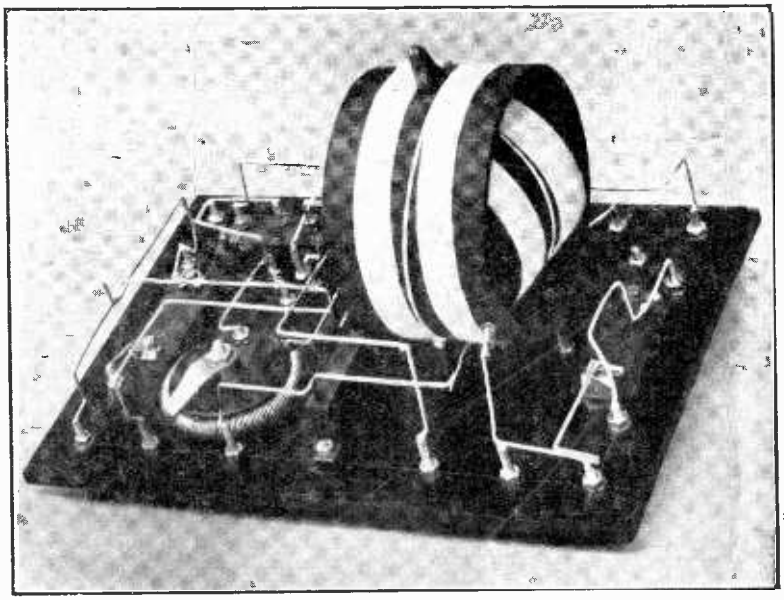


Fig. 2. Underside of panel showing method of wiring with stiff wire. Note: Since this photograph was taken the wiring has been slightly altered, and is now as in Fig. 4.

Outer former wound with 32 turns in two sets of 16 turns No. 22 double cotton covered wire. Separation between two sets of windings $\frac{3}{8}$ in.

Inner former wound with same number of turns in same way.

The rotor is carried on a split shaft to which the two ends of the inner winding are soldered. Contact with this shaft is made by means of rubbing spring contacts as shown. One end of the stator winding is connected to a terminal and the other *via* the spring contact to the shaft, the second spring contact making connection with the opposite end of the winding. The construction of a good variometer by the beginner is not easy, and in most cases a ready-made article is to be preferred.

A point of novelty in this instrument is the simple method of connecting a fixed condenser either in series or parallel. This method can be used equally effectively in any tuner. The writer does not remember having seen it described elsewhere, but it is certainly very convenient. Viewing the top of the panel, four terminals on the left will be seen. The two upper and the two lower can be joined with straps or wires. If when using the instrument as a single-valve receiver or a high frequency amplifier we open the top strap, connect the aerial to top terminal and the earth to the terminal immediately beneath it, leaving the lower strap in position, no condenser is in circuit. Opening the lower strap inserts a 0·0005 fixed condenser in series, while closing the top strap and connecting the earth to the bottom terminal (with the lower strap open) places this condenser in parallel with the variometer. The range of the particular instrument can thus be brought up to about a thousand metres. As the two middle terminals are connected together permanently, one may be dispensed with.

When used as a single-valve receiver the strap short-circuiting the grid condenser is of course opened. A second alternative grid condenser is provided, and can be substituted by shorting the first and opening a strap across the second. This, however, is designed for other uses, as will be seen later.

If it is desired to use the instrument as a high frequency magnifier, the grid condensers are short-circuited and the crystal receiver connected to the upper right-hand terminals. The lower right-hand terminals are arranged so that when a strap is across them a 0·0003 mfd. condenser is connected across the output terminals. This value was chosen as it corresponds with the capacity of the average amateur aerial, thus allowing the usual adjustments

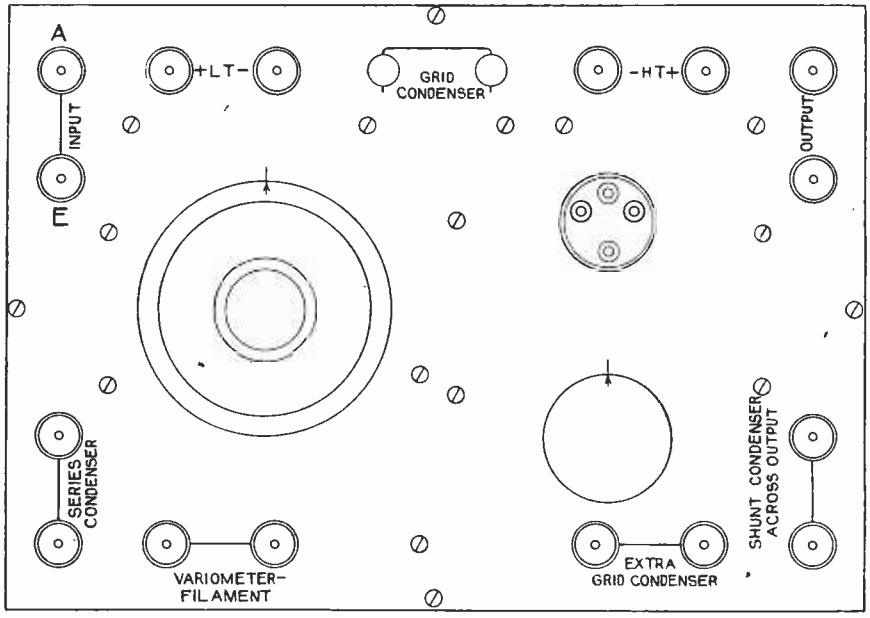


Fig. 3. Top of instrument showing terminal markings.

on the crystal receiver to be used If possible the inductance of the crystal tuner should be tuned to the wavelength desired without the use of this condenser. It is, however, very useful when the wavelength range of the crystal set is limited.

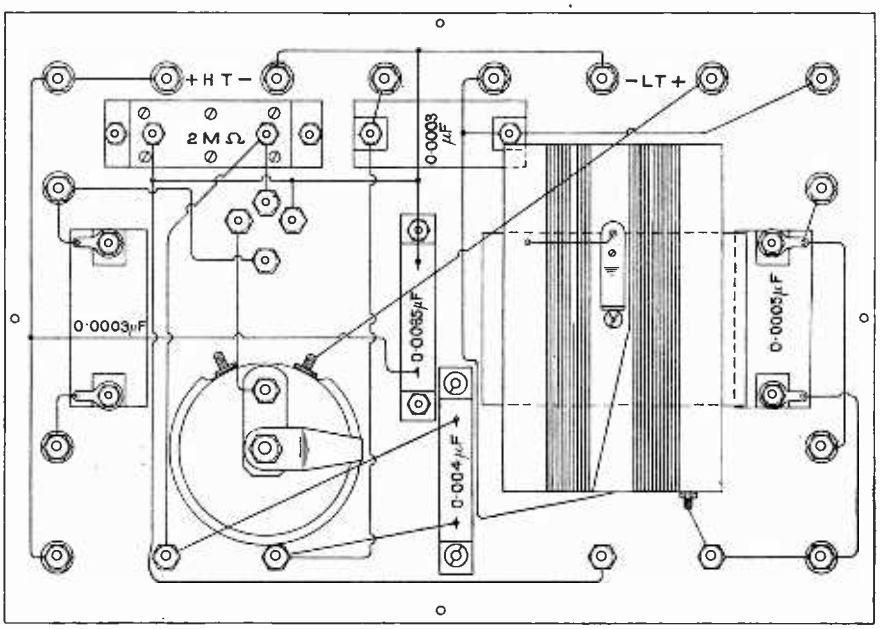


*Fig. 4. Wiring diagram of the **under**side of panel.*

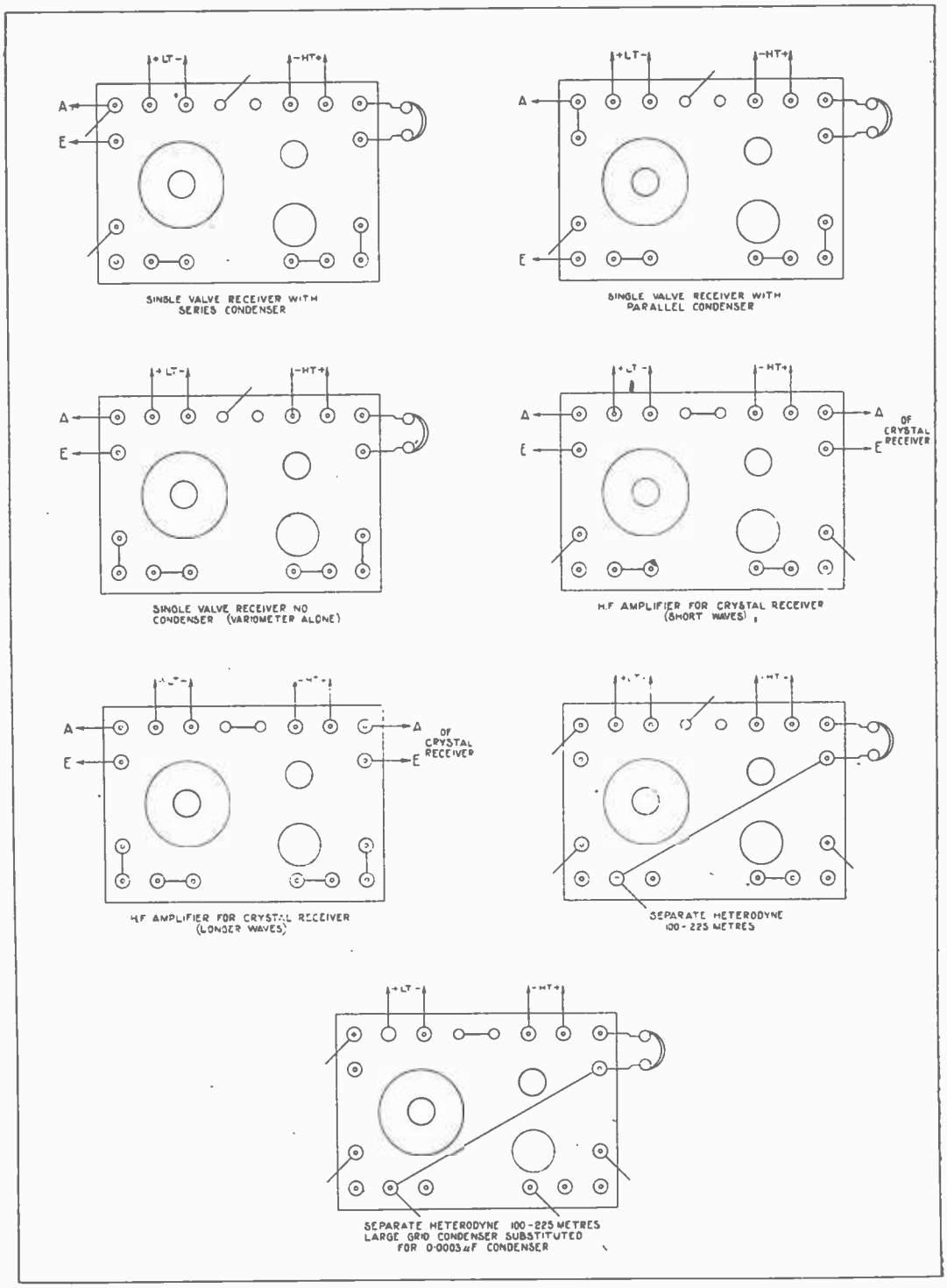


Fig. 5. Methods of connecting the instrument for various purposes.

To use this instrument as a note magnifier after rectification, the telephone terminals of the crystal set are connected to the input terminals of an intervalve transformer, while

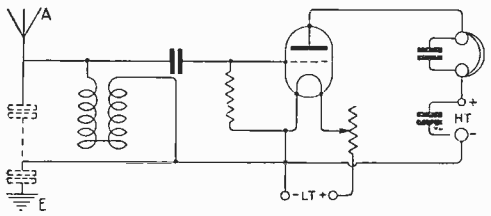


Fig. 6.

Theoretical diagram of set used as single-valve receiver.

the output terminals of the transformer are connected to the aerial terminal (strap open) and to the right-hand of the two terminals immediately beneath the variometer dial (strap open). The grid leak must be disconnected for this purpose. Terminals could have been provided to effect this disconnection, but as this use of the instrument is not often desired, they were not considered necessary. The grid leak is connected between the grid and the filament, and not across the grid condenser for a particular reason which will be seen in describing the heterodyne circuit.

The remaining use of this panel is as a separate heterodyne for short waves. The particular circuit is little used by amateurs in this country. It is known as the De Forest Ultraudion circuit, and is shown in the dia-

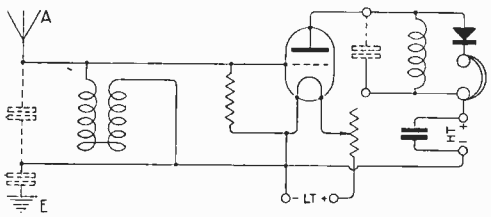


Fig. 7.

Theoretical diagram of set when used with crystal receiver as H.F. Amplifier.

gram. Unlike most circuits, connection is made from the variometer to the grid *and the plate*, not to the grid and the filament. If so connected, *leaving the phones in circuit and with the telephone shunting condenser cut off*, the set will oscillate freely, if not particularly vigorously, over the whole range of the variometer, using an R type with 60 volts on the plate. In the particular variometer the range is from 100 to 225 metres. If the valve is one which oscillates very readily, it is possible to use the 0·0005 mfd. aerial condenser in shunt, and thus increase the range considerably. However, the chief use of this heterodyne is round about 200 metres.

The grid condenser must be left in circuit when using this arrangement, so that the grid may be insulated from the plate voltage. For this reason the grid leak runs from grid to filament instead of across the grid condenser. The larger grid condenser was inserted to see what effect it would have used in this way. It is by no means essential, and the normal grid condenser functions quite satisfactorily.

Values are given for the various condensers actually used, these being available at the

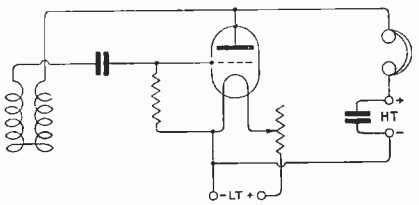
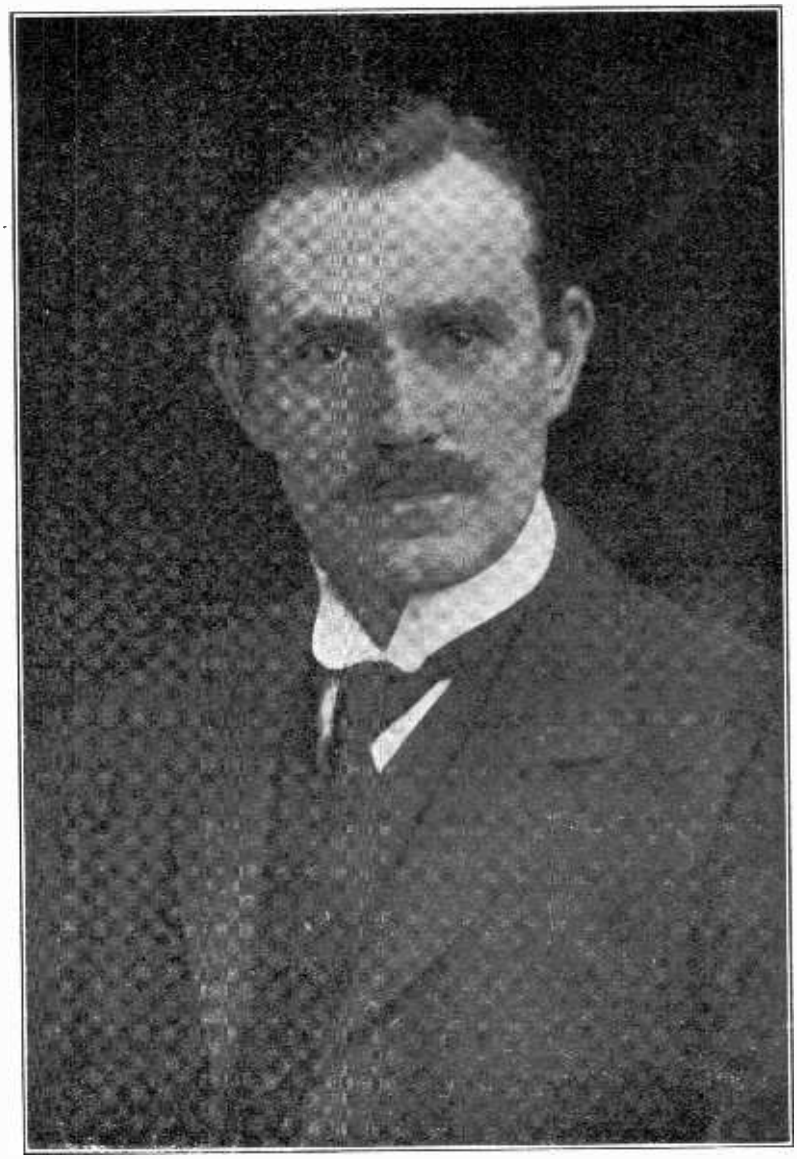


Fig. 8.

Theoretical diagram of set used as short wave heterodyne.

moment, but some may be altered without detriment to the working of the instrument. The aerial condenser can have a different value, and the condenser across the H.T. terminals can with advantage be larger. The shunt condenser across the output terminals should be kept at the value given, as this corresponds with the average aerial used. The additional grid condenser was the largest that happened to be available, and it would be interesting to experiment with several different values here.

Used on my own aerial as a H.F. stage in front of a single-slider crystal receiver, Birmingham can be heard distinctly, and on 600 metres the additional amplification is very considerable. No doubt readers will be able to find further uses for this little set, which in any case is handy to have available for experimental work.



Dr. W. H. ECCLES, F.R.S.
President of The Radio Society of Great Britain.

The Problem of Atmospherics and some Suggestions for Experimental Investigation*

By Dr. W. H. ECCLES, F.R.S.

It is my privilege, and duty also, to thank the Radio Society for the honour they have done me in inviting me to fill the chair. The previous occupants have been very distinguished men, and I feel it will be difficult to live up to their standard of strenuousness. The honour appeals to me especially because in this Society there are all types of lovers of wireless: there is the professional man, the scientific man, the commercial man, the experimentalist, and the person who merely uses wireless as a recreation; and there are also those who are not interested in wireless itself, but are interested in what it can give them—the "broadcasters." All these members are welcomed to this very catholic body, and therefore I think it gives the President of this Society a breadth of basis that no other society in wireless does give, no society in the world. This is especially true after the important change that has occurred this year in the name of the Society. As is usual in other cases of change of name, the implications are that alliances have been formed, that individual interests have been drawn nearer together than they were. The smaller wireless societies all over the country are now drawn somewhat closer than before, and a machinery is being built up by which a kind of parliament will sit under the auspices of the Radio Society; there they can make their complaints, their demands, their recommendations or suggestions.

Another important event in wireless as a whole has happened during the past year in the advent of broadcasting. Those of us who have been interested in wireless for many years, welcome the advent of broadcasting, and the proposals for more and more broadcasting, very cordially. Just as in other subjects, the greater the public interest taken in wireless the better for the subject. For one thing, the spread of knowledge is always beneficial. The number of people who will now be learning something real about wireless is augmenting extremely rapidly. Hitherto the powers of wireless have been very much exaggerated, for instance, in the ordinary press; but actual contact with wireless reception, which is being brought to the general public by broadcasting, cannot but help in showing the public what the limitations are, and will help to avoid the great disappointments which may occur by non-fulfilment of some of the promises that have been made with this wonderful subject of ours. Beside that, I think that this widening of the area of people interested in wireless which broadcasting has conferred, will undoubtedly enable the country to draw more persons of all ages into the stage of trying to invent, or trying to discover. It will help to get the boys with electrical minds into the right places, for I think there is no subject which teaches electricity so much as wireless, and there is no subject so important as electricity in our modern civilisation. For good or for bad, this modern civilisation of ours is becoming more and more electrical, and therefore we want more and more of our population trained electrically, and unless that is done, we, the nation, are sure to fall very much behind. I therefore think that it is of national importance to welcome the broadcaster, but at the same time it is also of national importance to make sure that the experimentalist retains the widest possible freedom for his receiving apparatus and his transmitter, and to ensure that there is no mutual interference between the two classes. They say that necessity is the mother of invention. I am not sure that I understand that, but I think I do know that research is the father of invention; and unless we can keep experimentation going with full vigour in this country, invention will be stifled. I remember that my old friend, Mr. Duddell, used sometimes to speak very despondently of the prospects of wireless in this country from the point of view of discovery and invention. It seemed to him, he used to say, that we were being far outdistanced in both discovery and invention, and that some vigorous campaign ought to be initiated to call the attention of the general public to this deplorable condition, as he called it. I have had that called to mind in recent months, in the progress of various visits I have made abroad. For instance, in America, during visits to a large number of stations—especially the big stations—it is noticeable that in these stations there is no invention of English origin of later date than 1904. The whole of the remaining inventions in the stations are non-English. The main inventions that we can see plainly in these stations are of course the Marconi elevated antennæ, which we may claim as partly English, and there is also the Lodge 1897 invention; and there is the Fleming valve of 1904. Except for these older inventions, we cut a very poor figure nationally in the American stations. In the French stations the same story can be told, and also in the Italian stations. I do not know what there is in the German stations, but I question if, excepting those inventions I have named, there are any English patents at all in use in any foreign-built stations. On the other hand, when you take the other side of the picture and visit a large English station, you find that there are certain English patents in use there, because of the natural fact that an inventor employed by the owner is specially favoured; but the great bulk of the inventions in use, even in an English station, Governmental or private, are of foreign origin. One might bring it home even more closely by mentioning the fact that the British Broadcasting Company's apparatus is largely of foreign invention;

* A Presidential address delivered before the Radio Society of Great Britain on Wednesday, January 24th, 1923.

and if you turn to your receiving apparatus, the same story must be told, with one or two exceptions, such as the Franklin back coupling patent, which has saved our face nationally to some extent.

Now that explains to you why I feel especially strongly that this Society ought to keep its policy fixed on free experimentation; that it ought to encourage its members to write and discuss as many papers as possible, to urge them to try and keep their apparatus and methods changing and moving; never being satisfied with the old; but always trying to improve or to find alternatives. If we can do that, we can till the national soil in such a way that from it there may sprout some man or men of genius who will restore our national prestige.

Now the first query occurring to many members of this Society who have not bothered to do much investigation or much invention will be the question, What shall we start upon? And I hope it will serve a useful purpose if I just run over two things that occur to me as problems capable of being handled with simple apparatus. There are innumerable openings, it seems to me, but I am going, in view of the fact that time is limited, to speak only of two of them. The first is the problem of atmospheric disturbance to wireless reception, and I am going to take it as an illustration of scientific investigation rather than from the point of view of invention. Then I will illustrate two or three simple possibilities to which I think future inventors and discoverers might turn as a beginning.

To deal with atmospherics first. What we must first do, I suppose, before recommending anybody to start work, is to summarise for them what has already been found out. It is always useful to know what has been done by your predecessors; it will at least save travelling over the same ground. Now a good deal has happened of recent years in connection with atmospherics, but I had better just point out that a good deal has been known about them since the very beginning of wireless telegraphy—in fact, before wireless telegraphy began, atmospherics were being received and remarked upon in laboratories. In 1895 people were tracking the storms over the continent of Europe by the aid of coherers. Later, the early wireless experimenters found their tape marked by blurred dot and dash signs in an irregular manner, and the cause of these markings was traced to be connected with thundery weather—thunderstorms passing across Europe, which caused more disturbance as they approached the observing station, and as they passed away less and less. So that it has been known for very many years that thundery weather causes atmospherics. But there are so many other possibilities that it is not right to say that all atmospherics are due to lightning. For instance, they might be due to the picking up of small meteorites, for these falling through the air and getting hot produce electric charges and discharges which will affect antennæ. There might also be violent electrical storms in the sun which could send "atmospherics" to us; and there might be (as the journalists thought a year or two ago) messages from Mars which might cause disturbances. These possibilities existed, and had to be gradually sifted out in the course of years.

One thing suggests that all atmospherics are due to lightning discharges near the surface of the earth. The statistics available show that the conditions giving good propagation of signals give rise also to many atmospherics as a rule, which seems to show that if the air is electrically clear, atmospherics can be gathered from a larger area, or in other words, the larger the area you can receive from, the more atmospherics there are to be picked up. This indicates that they are all lightning discharges relatively near the surface of the globe.

Another thing that points to the same fact is that long wave receiving apparatus is troubled more with atmospherics than short wave receiving apparatus in general. Now, it is well known that long waves do travel greater distances than short waves, which suggests that long wave atmospherics are often due to distant lightning discharges, and short wave ones due to near discharges.

But the matter has received a great amount of aid from the methods of directional reception which were developed during the war. The receiving frame with which one can point out the direction from which signals are coming, can also be used for detecting the direction from which atmospherics are coming; and particularly in America, a great deal of work has been done by direction finders with regard to atmospherics. To summarise the results briefly; on the Atlantic coast most of their atmospherics seem to come from the Allegheny mountains and from the Mexican mountains; on the Pacific coast they come mostly from the mountains quite near, and sometimes it is found in California that many are coming quite definitely from one mountain peak only a few hundred miles away. In Porto Rico, Austin has found that they come from the South American mountains and from Mexico. In France, a good deal of work was done in 1920 to 1922, and published about a year ago, in which storms were traced over Europe and the adjacent seas by the aid of direction finders, and it was proved that most of them were due to the front edge of cyclonic disturbances following their usual course across the continent.

Then again, there is the work of the Radio Research Board. Mr. Watt, working under the Radio Research Board, has analysed a great many of the statistics accumulated during the war from direction finding stations. When two or more stations reported that atmospherics were bad from a certain direction, the lines could be drawn on a chart, and the point of origin found. This enabled Mr. Watt to give a formula showing how the angle from which atmospherics come varies with the time of day and the season.

Well, there are a great many other observations: it would be tedious to enumerate them all; but this is the kind of conclusion to which I, in going through them, have been driven, and which I am going to suggest some of the members of this Society might gradually, as opportunity allows, carry through the testing stage. I will first generalise, and say that apparently all atmospherics of importance originate in mountainous areas, and especially where high land dips suddenly to the sea, as in Mexico, the Andes, the Rocky Mountains, and also in Central Africa, and in Western and Eastern Africa. All those produce very considerable atmospheric disturbances at certain times of day and at certain seasons, and from such obser-

vations as I have been able to collect, the striking thing is the influence of the position of the sun on the display of atmospherics. But suppose I take first our English summer season. Most of the atmospherics are local. They are due, as has long been known, to the sudden rising of moist air through unstable conditions of the atmosphere. When the air rises, it cools and expands, the moisture condenses, and in that process electrical effects occur which charge large masses of air, and these charged masses produce local atmospherics in discharging. I dare say you have heard the description of the English summer as three fine days and a thunderstorm? Well, this is fairly true, and in summer you will find that our atmospherics come from all sorts of directions, according to where the storms are moving. The only directions that do stand out prominently are the Vosges, the Alps, and perhaps the Pyrenees to some extent. There are days on which the atmospheric conditions are stable, when there is no thundery weather in Europe, and then atmospherics come from more distant places, usually somewhere in Africa. Consider, now, the spring or autumn season, when the sun travels along the equator. As it passes over India a certain amount of atmospherics is picked up in England, apparently from this west coast of India. As it gets nearer to Africa, the eastern African mountains and the Abyssinian mountains get to work, and the electrical discharges that occur there are also picked up. When the sun gets to the west side of Africa, the whole of the continent has been heated, and the air which begins to flow in from the Bight of Benin is forced to rise by the mountains, and you can pick up with your direction finder in England atmospherics from this part of Africa.

The next great maximum seems to be due to a time when the sun is fairly near the extreme western side of Africa, the mountains on this coast come into play, and the atmospherics appear to come from this direction. Later in the day there is a lull, but later still, when the sun has traversed South America, a lot of atmospherics come from the Andes and the Mexican mountains. They can be located by the ordinary direction finder so far as direction goes, but the distances they are from England, of course, cannot be determined. I am merely suggesting from what I have seen, that as the sun moves round the equator and warms the air on the land, the consequent meteorological phenomena produce atmospherics in England. This heating of the land areas has an enormous effect on signals, I may say. I was told, in fact, when I was in France a little while ago, that a station in the Argentine can receive signals from the American naval station in the Philippines during certain parts of the day from the easterly direction, that is the short way, namely, 165°. At another part of the day it receives from the opposite direction the longer way round the globe. A study of the times of the day when these phenomena occur shows that immediately the sun gets round to the Indian side of the globe, and begins to heat up the continent of Africa, the signals stop going across the continent of Africa and take the longer way round across the dark Pacific—it is a much longer way round, amounting to about 30 degrees. This shows that heated land has a great influence on the propagation of waves, and I am importing this little illustration to justify what I said about atmospherics. I may say, by the way, that in the Argentine the direction of atmospherics is mostly from Africa when the sun is over the South Atlantic, and is mostly from Central America when the sun has passed 20 or 30 degrees across the Pacific.

Consider now the season when the sun travels along the Tropic of Capricorn, that is our English winter. There are very few local atmospherics. The whole field is open for the observation of distant atmospherics. It is found that as the sun goes along the tropic, India sends a few atmospherics, while the high plateau north of the Rand, or perhaps the more northerly area, sends enormous quantities. The sun, when it comes over the west coast later in the day, causes that coast to come into operation, and later the South American mountains play their part; perhaps the Mexican also assist, and we may receive atmospherics from that direction. Thus the changes of season from winter to spring, etc., move the source of atmospherics, and it seems to be for that reason that the seasonal directions in atmospherics have been found. I am describing this theory in order to make the suggestion that those who have leisure to make directional observations of atmospherics would find here a very interesting subject of a scientific character, which of course has its bearing on the commercial operation of stations, but could be treated as a purely scientific problem here at home. This reminds me that one thing wanted very much for this purpose is an instrument which would record the direction from which atmospherics are coming. Suppose one has two equal frame or coil antennæ fixed in perpendicular vertical planes, with precisely similar detecting apparatus. Let the indicating apparatus be designed with a single pen capable of motion in two perpendicular directions by the respective receiving sets. An atmospheric perperdicular to one frame would be arranged to move the pen parallel to the other frame. Then, of course, the pen would move in an intermediate direction when the atmospherics were coming from any direction inclined to both frames.

I think it ought to be possible to develop an instrument which would write with a pen in this manner if one ignored the small atmospherics and only recorded the big ones. We should then have a sort of sundial operated by atmospherics produced by the progress of the sun along a parallel of latitude as it crossed the mountain chains and coastal lines of the globe.

Now that is one subject that occurred to me, and which I have treated very lightly, as a subject open for investigation by amateurs. Amateurs have already contributed a considerable amount to the work of the British Association Committee. A great deal of the information I have given you just now is the results of the analyses of the records made in various parts of the world by the amateurs who were working for the British Association in 1912, 1913 and 1914.

Now to come to quite a different matter, let me give an illustration of the kind of thing which could be done by amateurs in ordinary laboratory wireless in the course of the next two or three years. It has occurred to me that we have become slaves to the habit of using the Morse code, especially the Morse code with dots and dashes, and it seems to me to be worth while questioning whether dots

and dashes are the best means of sending signals either under good conditions or through atmospheric disturbances. For instance, Bright's telegraphic apparatus which I remember seeing some thirty or forty years ago, used to have two bells in it. When a dot came, one bell—the right-hand bell—would ring, and when a dash came the left hand bell would ring. Of course, they did not use dots and dashes, they used lefts and rights, and the dot was just as long as the dash. It was simply a matter of the ear detecting a high note or a low one. Now I am told by expert telegraphists that that method of signalling was quicker than dots and dashes. It is obvious, besides, to the engineer that there must be less power expended in a code in which the dash is no longer than the dot. The present day heterodyne system of reception seems to lend itself remarkably fully to a scheme of that kind, and so I thought I would set up and-listen to a piece of apparatus which would give me, instead of dots and dashes, a high note and a low note. I have on this table two simple oscillating sets which have come straight from my laboratory, so adjusted that one generator is a transmitter, the other a receiver. An extra coil is associated with the transmitter, so that when a key short circuits portions of it we get two notes. It seems to me that if two friends in wireless touch would set up such a system of signalling, they could find out by experiment whether it was quicker than longs and shorts, and whether it passed easily through atmospherics. Thus they might bring about a reform in the ordinary methods of wireless signalling. (*At this point a demonstration was given of this method of signalling, when two different notes were produced.*)

Someone to whom I was speaking about it thought that it would require a musical ear, and it is perhaps because it requires a musical ear that longs and shorts are used. I don't know if this next method, which I suggest as a possibility, requires a more musical ear. It is a three-note method in which the middle is the steady note. The higher frequency gives the dot, and the lower frequency gives the dash. Now *that* note is steady all the time the station is going, and the distant receiver will be tuned to that note. Now, if we move the key to the right you get a dot. A dot means a departure to the right, and a dash would mean a departure to the left, so that if you sound the letter A—dot and dash—it is a little tune. Now I find that I can learn these tunes faster than I can learn new combinations of longs and shorts. It takes a few months to learn to read fast longs and shorts, and only patient trial can decide whether this proposed code can be learned more quickly. If it is easier for the beginner to learn it may shorten the training of operators, and, best of all, there is a possibility that it gets through atmospherics better than the dot and dash method. This is a thing that could be very easily tried out by any two people who could arrange to co-operate on such a job. It is a thing that no commercial company would undertake to do because a commercial company does not like to disturb business by making a revolution in its method of transmission, and having to re-train all its operators. A commercial company will plod along with what it has got, so long as it is not forced by progress to change it. This is a thing which may necessarily have to be done by amateurs. That leads us on to other systems. It would cumber our table too much to bring the three-note system which I have tried over; but you *can* use three notes, and you can get a very short code with three notes. I mean that you do not need to have four efforts in letters such as L, which in Morse uses a dot, a dash, and two dots; but you can do everything with at most three efforts if you have a three-note system. But that requires a more musical ear than this last one.

The next thing that suggests itself to everyone is to use chords—that is to send two notes at once. To send two tones means that you are sending on two wavelengths, wavelengths which are only 5 metres apart in some of these cases, and it is very difficult to detect them except by the ear. The range of wavelength taken up is not so great as is usually monopolised by the spacing wave method, so that I do not think any objection arises to sending chords, except that very few people can identify chords rapidly. I suppose a little training—a little teaching—would enable a person to identify a sufficient number of chords to make up a code. But there is a system of chords that requires no musical ear for identification. At any rate, everybody I know, musical and unmusical, can identify the kind of chord I am going to suggest. I have known people who did not know "Home Sweet Home" from "God Save the King," who could distinguish the chords I am going to mention. These chords are called vowels. If you sound any note and then superimpose upon it a certain two frequencies, making a chord of three notes, then you get a vowel. I have a paper here, which was written quite recently by Sir Richard Paget, and he gives the combinations of notes that make the different vowels. I think he has taken the analysis of the vowels further than anyone else. Now it seems to me that it would be possible to transmit a vowel, and I therefore designed an electrical circuit, which I tried on Monday. It gave me two vowels quite well. It gave me the vowel "ah," and when I altered the setting it gave the German modified ü. I wanted to make other vowels before attempting to show it; and if one can succeed in making several vowels, and I think it is quite feasible to make any vowel by this system, it would be possible to signal by saying "a, o, oo," and so on, because any two vowels could represent any letter of the alphabet by a sort of biliteral cipher. The vowels can be produced either by the voice or by a machine. In that way you get a briefer system than those I have already mentioned. The vowels are easily recognised. In wireless telephony, for instance, it is the vowels which come through best. I dare say most of us have experienced on the ordinary telephone the annoyance of obtaining the wrong number. The number 4375 is asked for, and you get 4379. The thing that has misled the operator is the vowel in the five and nine; it is the vowel that carries, and the consonants cause all the confusion. If we could abolish consonants, and signal by a new vowel system, we might achieve something worth doing. I make this final suggestion as another illustration of something that could be accomplished by members of the Radio Society of Great Britain.

C

Electrons, Electric Waves and Wireless Telephony—XX.

By Dr. J. A. FLEMING, F.R.S.

7. WIRELESS TELEPHONE TRANSMITTERS.

We may in conclusion make a brief reference to the construction of large transmitters intended for broadcasting and to improvements in thermionic valves employed as generators of powerful oscillations. No other type of generator is at the present time so suitable for this purpose. High frequency oscillations of great power can be produced by dynamo machines called high frequency alternators, but the regulation of their speed which is necessary to produce carrier waves of perfectly constant wavelength and amplitude by them, requires some rather complicated apparatus, and it is not nearly so easy to modulate the amplitude by a speech microphone as is the case with the thermionic valve. Again, we can produce oscillations by means of an electric arc of a certain kind called a Poulsen arc, but this type of generator is liable to irregularities which, though not seriously disadvantageous to its use as a generator of oscillations for radiotelegraphy, are a decided impediment in the employment of it as a generator in wireless telephony.

The thermionic valve, on the other hand, gives or can be made to produce oscillations of perfectly pure simple harmonic wave form and therefore carrier waves of the same type.

Furthermore, the thermionic valve as a generator of oscillations is perfectly silent and the amplitude of the oscillations produced by it very easily controlled by the speech microphone. It is for all these reasons an ideal oscillation generator for wireless telephony.

We have already described in a previous section the manner in which the three-electrode valve is employed to create electric oscillations and these explanations need not be repeated here.*

There are, however, great differences in construction and power consumption between valves used as amplifiers and valves used as generators of oscillations, which must be explained. The valve as a generator must have a considerable output of power, that is, we must be able to draw off from the circuit connecting the plate or anode of the valve and the filament an amount of electrical power which is only limited by our requirements. This implies that the so-called plate current must be, relatively speaking, large.

But the internal resistance of the valve, that is, of the space between the filament and anode cylinder, is also large, amounting to some thousands of ohms, generally speaking. Hence it requires a high voltage to drive the required plate current across the vacuous space that is to compel the negative electrons to move away from the filament and through the apertures in the grid and strike the plate or cylinder.

Then again, this impact of torrents or millions of electrons bombarding the anode cylinder or plate heats it very quickly and may in fact soon make it red hot. Hence special construction is necessary to prevent this heat from cracking the glass or loosening the sealing-in wire which makes connection between the anode cylinder and the external plate circuit.

On referring back to Fig. 93, which shows the view of a large transmitting valve of a very usual type, it will be seen that there is a large glass bulb which may be even of the size and shape of a Rugby football, has two re-entrant glass tubes at the ends which are closed at the inner ends, and at the outer ends are sealed to the bulb.

Around these re-entrant tubes are clamped metal collars, one of which carries the large cylinder made of sheet nickel, which forms the anode, and the other of which in a similar manner carries the inner cylinder of nickel wire gauze which forms the grid of the valve. This latter re-entrant tube carries also the tungsten wire filament.

* See article XIII., *The Wireless World and Radio Review*, December 30, 1922 (page 433).

The current is conveyed to and from this filament by platinum wires sealed through the glass tube and similar platinum sealing-in wires are employed to connect the external circuits to the cylinder and the grid. The filament wires have to carry fairly large currents up to 10 or 20 amperes, but the sealing-in wire to the cylinder has only to carry currents from about one-tenth to one ampere or so, and the grid requires feeding with a much smaller current.

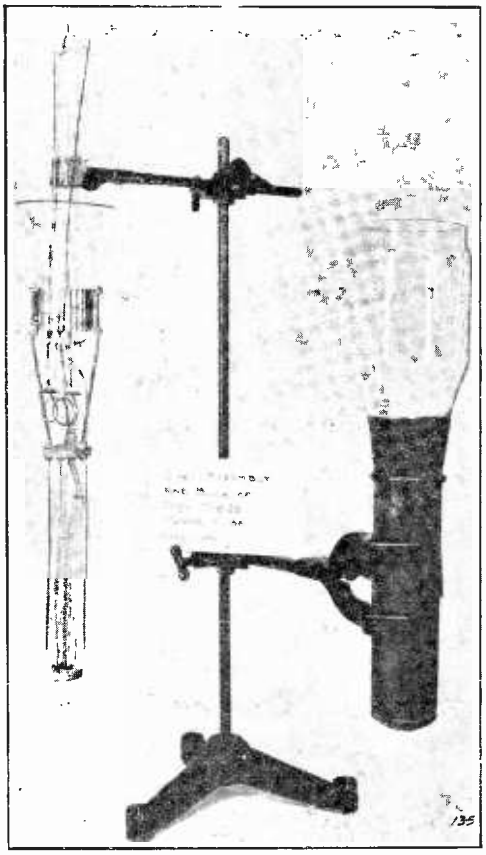


Fig. 107. The arrangement before sealing in the re-entrant glass tube carrying the filament and the grid.

The electron power is supplied to the valve in the form of direct current. Direct current at rather low voltage, 20-25 volts or so, is employed to incandesce the filament. Direct current at high voltage, 1,000 to 10,000 volts or so, is supplied to the plate circuit to create the electron stream. We then draw off from the plate circuit high frequency alternating current.

In large valves 70 to 80 per cent. of the power supplied can in this manner be recovered. The deficit is expended as heat in the valve. Hence a large valve yielding say 5 kilowatts or 7 horse power would take in 7 kilowatts or 10 horse power, and the difference or 2 kilowatts is transformed into heat.

This heat must be radiated, and therefore large valves get fairly hot. One of the problems connected with large valve manufacture is to obviate any danger from the cracking of the bulb, which is liable to happen with glass bulb valves.

It must be remembered that these valves have to be very highly exhausted of their air, in order that no sensible amount of air may be left to be ionised by the electrons emitted by the filament, for this would create positively electrified ions or molecules of oxygen or nitrogen which have lost an electron, and these would be attracted to the filament very strongly, and would bombard it and soon destroy it.

It would occupy too much space to describe the methods by which the extremely high vacuum required is made in these valves. One result of this, however, is to create a very great air pressure on the outside of the bulb which, in a large valve, may amount to two or three tons. Hence if such a valve breaks it generally does so with a rather startling explosive noise. Invention has therefore, of late years, been directed to the problem of constructing a high power valve which shall be less fragile and liable to accidents than a glass bulb valve. In other words, to make a valve which shall be more of an engineering job than the present glass bulb type.

It has been found possible to make the bulb of pure silica (flint) in place of glass. This material has so small an expansion with temperature that a silica bulb can be made red hot and then be plunged into cold water without cracking.

A still more important improvement, however, has come to us recently from the United States in the form of a thermionic valve of which the greater part of the bulb is formed of sheet copper. The copper not only forms part of the bulb but also constitutes the anode cylinder, and can be kept cool by cold water.

The foundation of this improvement is the technical discovery of a method of sealing copper to glass in such fashion that it does not crack away on cooling or subsequent heating.

The reason the expensive metal platinum has hitherto been used for wires which must be sealed airtight through the wall of a glass bulb is that platinum possesses three essential qualities for this purpose. First, it has nearly the same coefficient of expansion with heat as lead glass. In the second place, hot platinum is "wetted" by molten glass; that is, sticks to it, and lastly, platinum is not oxidized when heated in a blowpipe flame, but retains a bright and clean metallic surface.

No other metal has been found which possesses all these properties, but the discovery was made some years ago that if copper is kept unoxidized in a flame containing reducing gases, it is when very hot "wetted" by molten glass, which sticks to it. Copper, however, has not the same coefficient of thermal expansion as glass and the only way to attach a copper tube to a glass tube of the same size is to give the copper a sharp knife edge.

If then a sort of copper thimble is made, closed at one end but with the edge of the open end made sharp like a knife, this thimble can be sealed airtight to a glass tube of the same diameter as the thimble, and the joint will not crack away in cooling and can be made vacuum-tight. The glass tube terminates in a re-entrant portion through which are sealed wires to which are sealed the wires which carry the ends of the filament of the valve and also the leading-in wire for the grid.

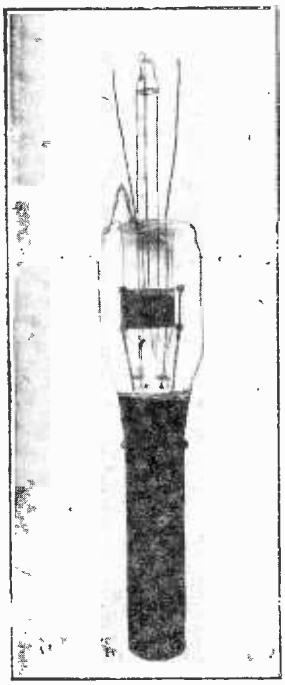


Fig. 108. The complete instrument.

Fig. 107 shows the arrangement before sealing in the re-entrant glass tube carrying the filament and the grid. Fig. 108 shows the completed instrument. The copper tube part (shown in black in the diagrams) forms at the same time the anode cylinder and also part of the bulb.

Externally it is surrounded by a water jacket, as shown in Fig. 109, by which it is kept cool by circulating water.

Valves of this description, of a size to yield 10 and 20 kilowatts output or 14 horse power, have been already made, and valves to yield 100 or 150 kilowatts may soon be obtainable. At the present time broadcasting in connection with wireless telephony is conducted by large valve transmitters comprising a number of glass bulb valves, which are connected so that their plate currents are added together.

Fig. 109. The valve anode inserted in a water circulated cooling jacket.

The high voltage required for the plate currents is obtained by rectifying by means of two-electrode valves as already explained, a low frequency alternating current of high voltage (7,000 to 10,000 volts). A single ordinary carbon microphone, such as is used in an ordinary wire telephone, is employed to modulate the grid potentials of one or more three-electrode valves called the control valves, and the correspondingly modulated plate current of the control valves which fluctuates in accordance with the wave form of the speech sounds made to the microphone, is employed to modulate the output current of the generator valves. The result is that the height or amplitude of the carrier waves radiated from the sending aerial fluctuates also in accordance with the speech currents sent through the microphone. We have already explained the manner in which these radiated waves create corresponding but much feebler currents in the receiving aerials, and are made to reproduce the speech sounds in the receiving telephones. The development of wireless telephony, and especially the public use of broadcasting, introduces a new factor into modern life which is bound in time to make its effect felt.

The purpose of these articles will have been fulfilled if the broad general principles of the art have been elucidated sufficiently for the instruction of the general reader.

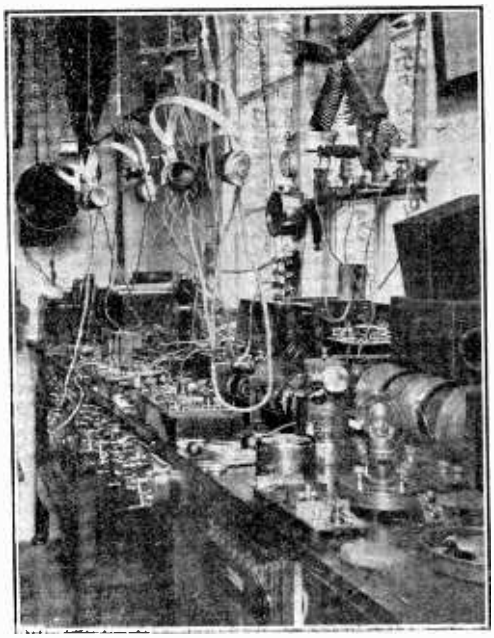
Notes.

Automatic Wireless Reception at Sea.

The Cunarder *Berengaria* has been fitted out with the Creed apparatus for automatic reception and transmission of wireless messages which will thus appear continuously recorded on paper tape in ordinary Roman characters as in the familiar tape machine.

Wireless Telephony on Trains.

The successful reception of wireless telephony in motor cars travelling at high speed has already been demonstrated and experiments carried out recently show that even on express trains and in spite of tunnels and varying topography reception of wireless entertainments is now practicable. By an arrangement between the Marconi Company and the London, Midland and Scottish Railway Company, an experiment was carried out on the 5.30 p.m. express train from Euston to Liverpool on February the 6th. A special saloon was fitted up with outside and inside aerials, the former being merely a length of wire fixed temporarily on the roof of the train and the latter an ordinary frame aerial. It was found, however, that the dynamo used for electric lighting on the train caused bad interference and the outside aerial had to be abandoned. Using the frame aerial, while travelling at between 60 and 70 miles an hour, at 6.12 an amateur transmitter was picked up, though his voice was rather faint. London was picked up about 50 miles out from Euston and at 7.30 the Birmingham Broadcasting station was received. The news bulletin and other broadcasting items, it is reported, were clearly heard throughout the journey and there was no noticeable interference from passing trains. The experiments were carried out by Captain G. R. Willans, manager of the Marconiphone Department, and Mr. G. S. Hagate, technical manager to Captain Willans, in the presence of Mr. J. D. Billington and Mr. C. N. Heath, who represented Mr. F. A. Cortez Leigh, of the Electrical Engineers' Office at Euston.



The wireless cabin of Alderman Fentum Phillips, of Guildford, in which an interesting feature is the unusual provision to ensure efficient insulation. The walls are insulated from the floor with felt. A cork carpet is laid on this flooring an inch thick; while the work benches are insulated by glass insulators filled with paraffin wax.

The Opening of Cardiff Broadcasting Station.

By the time this note appears if all goes well, the new station of the British Broadcasting Company at Cardiff will be in operation. This station to which the call letters 5 WA have been assigned, and which operates on a wavelength of 395 metres, is to be formally opened at 7.30 p.m. on Tuesday, January 13th, by the Mayor of Cardiff, who will officially inaugurate the service. The station will actually begin operations at 5 o'clock with a children's programme, followed by the weather report and a news bulletin. Ordinarily at 7.30 the musical programme will begin, including operatic, instrumental and vocal music, and a Sunday programme will be given from 8.30 to 10 p.m. The opening of the Cardiff Station marks the completion of five of the eight stations contemplated in the original broadcasting scheme. The sixth will be opened at Glasgow on or about March 19th.

The Demand for Wireless Licences

An extraordinary increase in the number of licences issued by the Post Office has been noticed in the past few weeks. In November 3,000 licences for broadcast reception were issued, and in December 6,000. In a single week in January, nearly 10,000 licences were granted, and the estimated total for the month is placed at about 25,000. The applications for experimental licences are also showing a remarkable increase. In the last week of December 3,500 applications were received, while in January licences were issued at the rate of about 6,000 a week, and in the last week of that month the figure had risen to 11,000. Taking into account the number of licences already issued it is calculated that the total number of wireless sets now licensed is in the neighbourhood of 60,000.

The Amateur Experimenter's Licence.

In a recent letter to the London *Evening News*, Mr. Leslie McMichael, Hon. Secretary of the Radio Society of Great Britain, offered a suggestion to those amateur wireless enthusiasts who are anxious to construct their own sets, but are faced with the difficulty of furnishing the necessary evidence as to their fitness to hold the experimental licence issued by the Post Office. "Without laying down any hard and fast rules," Mr. McMichael says, "it

would be strong *prima facie* evidence of genuine intention to do experimental work if the applicant could tell the G.P.O. that he had definitely joined either the special grade of Associates of the Radio Society of Great Britain or that he had joined one of the Affiliated Radio Clubs in Greater London or the Provinces, of which there are now some 150."

A Broadcasting Station for Dublin.

A wireless telephony transmitting station is shortly to be erected in Dublin. It will be entirely a Government enterprise and will probably be situated in Phœnix Park.

A Wireless Journal for the Trader.

An announcement of considerable interest, and we might add, importance, arises from the new venture of the proprietors of this journal, namely, the production of another weekly, to be known as *The Wireless and Allied Trades Review*. The first number will bear the date of March 3rd. It will be for the trade only, and we suggest that all readers of *The Wireless World and Radio Review* connected with the trade should make a point of obtaining a copy. This new journal will supply information relating to everything which affects the interest both of the manufacturer and the retailer.

An Impost on Wireless Apparatus for South Africa.

Wireless telegraph apparatus and broadcasting sets imported into South Africa are to be taxed 20 per cent. *ad valorem*, subject to a rebate of 3 per cent. *ad valorem* on the products of the British Empire.

Measuring Instruments for Wireless.

A folder entitled "Handy Instruments for Everyday Use," giving information for instrument users about its line of portable ammeters and voltmeters, which are especially well suited for radio testing, has recently been issued by the Westinghouse Electric and Manufacturing Company.

A World List of Scientific Periodicals.

Definite plans were made at a meeting of the Conjoint Board of Scientific Societies held on January 24th to prepare and issue a list of all scientific periodicals containing the results of original research. At present no accurate list of the many thousands of such periodicals written in many languages exists, and no single library contains even a large proportion of them. The list, which will probably be published before the end of the year, will be compiled by the Keeper of Printed Books, an official connected with the British Museum.

Australian Manufacturers' Association Formed.

Australian manufacturers of wireless instruments, traders and others interested have formed themselves into an association for the development of wireless in Australia. The first President is Mr. G. A. Taylor, who is a well-known figure in connection with wireless matters in the Commonwealth.

Wireless Heard on U.S. Tube Railways.

The New York correspondent of *The Times* reported recently that engineers of the Interborough Rapid Transit Company, with a receiving set only 18ins. long and 7 ins. wide and a loop aerial 4 ft. high, captured part of a concert being given in New York while their train was travelling at 40 miles an hour under the bottom of the East River. Later they caught the programme of the Kansas City broadcasting station 1,300 miles away. During most of the time the engineers heard with perfect clearness, though there was considerable interference by induction from passing trains and the motors in the train on which they were travelling.

The Imperial Wireless Chain Report.

The Cabinet Committee appointed recently to consider the question of the completion of the Imperial Wireless Chain have now finished their duties, and agreed upon their report which is ready to be presented to the Cabinet. It is understood that the report favours the employment of private enterprise for the undertaking.

A CORRECTION.

Electrostatic Capacity in Radio Circuits.

In the issue dated January 27th, on page 573, formula (2) should read :—

$$Z = \frac{1}{\sqrt{\left(\frac{R}{R^2 + \omega^2 L^2}\right)^2 + \left(\frac{\omega L}{R^2 + \omega^2 L^2} - \omega C\right)^2}} \quad \ldots (2)$$

and the last line of the same column should read :—

"we get $Z = 2992$ ohms at 100,000 cycles per . . . ."

BOOK REVIEW.

METAL TURNING MADE EASY. (London : *Cassell and Co., Ltd.*, La Bello Sauvage, E.C.4. pp. 152. 177 Illustrations. Price 1s. 6d. net.)

Belonging as it does to the well-known series of "Work" handbooks published by Cassells, this volume needs little in the way of introduction. "Metal Turning Made Easy" is a companion volume to "The Simple Lathe and Its Accessories," published a short time ago, and its object is to provide a handy, up-to-date guide to modern lathe work practice for the amateur's or the professional's workshop. The various operations of turning, boring, drilling, screw cutting, and gear cutting in the lathe, and the subsidiary processes connected with them are explained in detail in eleven chapters, and clearly illustrated by numerous drawings and photographs. It is evident, on even a cursory glance, that the information presented in this little volume is drawn from a fund of sound and practical experience. Among the subjects treated and not indicated by the title are the turning of scallops, ovals and curves; turning ebonite; and the measurement of turned and bored work. An index of subjects adds the finishing touches to an attractively produced volume.

BOOK RECEIVED.

THE SIMPLE LATHE AND ITS ACCESSORIES. (London : *Cassell & Co., Ltd.*, La Belle Sauvage, E.C.4. Illustrated. Price 1s. 6d net.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

The Thames Valley Radio and Physical Association.*

Hon. Secretary, Mr. E. A. Rogers, 122, Wood Street, London, E.C.2.

A most enjoyable evening was spent with the staff and patients of Queen Mary's Hospital for Disabled Soldiers on Tuesday, January 23rd, at Roehampton.

On behalf of the Association, Messrs. Driver, Davy, Harris and Rogers took up the receiving set and gave one of the most perfect reproductions of the broadcasting concerts that have yet been heard, although they had to use a capacity earth in the room, owing to the strong hum received through the ordinary earth due to the many heavy electrical cables in the grounds. About 200 were present.

During an interval the Birmingham station was heard, in which the patients were thoroughly interested.

At 9 p.m. Mr. Appleton Smith, G.O.C. Pierrot troupe, introduced the members who were kindly adding to the enjoyment of the evening, viz., Miss Betty Southam, Miss Wrightson and Miss Sunley, whose personal attractions were only exceeded by the charming way they rendered their songs and parts, and Messrs. N. and A. Smith.

A group of the Uitenhage (South Africa) Radio Society with their receiving apparatus on the occasion of a recent field day.

The thanks of the Association are tendered to the above-mentioned ladies and gentlemen for helping to provide such excellent fare for the most worthy of our institutions, and to the manufacturers of the Easi-Fix aerial used.

Meetings take place at the Hut, Wigan Institute, every Thursday, at 8 p.m.

The Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

The Society met at 8 p.m. on January 22nd, at St. Mary's Schools, when Mr. Campion demonstrated his home-made four-valve receiver. Very strong signals were received from **2 LO, 2 OM,** and the Radiola near Paris, on a Brown's loud speaker and relay used in conjunction with Mr. Campion's set.

Mr. Trussler exhibited a small crystal receiver and a junior Marconiphone made by Mr. Brown.

Later the Committee met and discussed the final arrangements for the sending of the delegates to the Radio Society of Great Britain. The elementary Morse class was taken by Mr. Field twenty minutes before the close of the meeting.

The Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The eighteenth general meeting of the Belvedere and District Radio and Scientific Society was held at the Erith Technical Institute on Friday, January 19th.

The Secretary read the minutes of the previous meeting, and reported that the official transmitting authority had arrived, and that the call signal allotted to this station is **5 OY.** The making of the various components is being proceeded with, and it is hoped that very shortly experimental C.W. and telephony transmission will take place from this station.

It is proposed shortly to hold a dinner as the first social function of the Society. Various items in connection with this were generally discussed at the meeting.

The next meeting of the Society was held on Friday, January 26th, when Mr. S. Burman read the second part of his paper on "High Frequency."

At the conclusion of the paper the Chairman (Mr. T. E. Morriss), after making a few appropriate remarks, passed a vote of thanks to Mr. Burman for his very interesting paper.

The Secretary gave a report on his visit to the annual conference of the Radio Society of Great Britain and Affiliated Societies, held in London on January 24th, where he and Mr. C. E. Morriss acted as delegates for the Society. He mentioned that no decision was arrived at with regard to the suggested quarterly Radio Conferences to be held in London and provincial centres.

The Ilford and District Radio Society.*

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

At a meeting held on January 25th, Mr. A. F. Welch lectured on "Wireless Waves and Harmonics." The lecturer dealt with the question

of harmonics in a most able manner, and certainly cleared up some of the more obscure points relating to this subject. Mr. Welch also lectured on "Atmospherics," and dealt in particular with the "Heaviside Layer."

The Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I. 49, Cholmeley Park, Highgate, N.6.

On Friday, January 12th, a lecture was given by Mr. J. F. Stanley on "The Historical Development of Radiographic and Radiophonical Communication." The early attempts at communication without wires were first described, and although these experiments had nothing to do with radio they were certainly wireless. The investigations of Hughes, Hertz, Maxwell and others were fully dealt with, and later on the work of Sir Oliver Lodge.

On January 13th, the occasion of the broadcasting of the opera "Faust," a public demonstration was given, and many people, on hearing the wonderful clearness of the words and music, decided to make wireless sets of their own.

On January 19th a very successful sale of apparatus was held. Several members brought along all their spare junk, and a brisk trade was done.

The West London Wireless and Experimental Association.*

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

The first meeting after the Christmas vacation was held on Tuesday, January 9th. Morse practice was taken by many present. Messrs. H. S. Walker (2 OM), A. Pike (2 YR) and A. Rolfe, of the Hounslow and District Wireless Society, visited the meeting by invitation of the committee, for the purpose of talking over the "impossibility of carrying out amateur transmission and experimental work generally, during the hours of broadcasting, on the 440 metres wavelength." After hearing their views, it was decided to await further suggestions from their Society.

At a meeting held on January 16th, after the reading of various items of correspondence, the meeting was thrown open for general discussion to give the members present an opportunity of exchanging their views in connection with any experiments made during the last week or two.

It is hoped shortly to hold a social evening of entertainment, and the committee have left this in the hands of Mr. Mullings, who is sure to make the experiment a successful one, and further announcements will be made later in respect of this venture.

Several well-known lecturers and demonstrators have been approached in regard to demonstrating before this Association in the near future.

The Secretary will have much pleasure in replying to all applications as regards objects of and subscriptions to the Association, and it is hoped that possessors of the many new aerials appearing in the district will come forward for membership.

Walthamstow Amateur Radio Society.*

Hon. Secretary, Mr. R. H. Cooke, 49, Ulverston Road, E.17.

The Society, on Monday January 15th, gave a demonstration to the Walthamstow Literary and Debating Society, at the Hut, Y.M.C.A., Church Hill.

A crowded audience enjoyed radiotelephony from 2 LO through Mr. Pearson's home-made three-valve set with loud speaker. Mr. Allan, of the Radio Society, answered many questions from the audience, as did Mr. Pearson and Mr. Trott. Councillor V. L. McEmtee, the local M.P., and other local notabilities, were greatly interested in the apparatus displayed, and a host of new friends and many new members were made.

On Thursday, January 18th, Professor E. M. Baker, B.Sc., M.I.E.E., gave a lecture on "Telephony and Broadcast Reception." Members gathered in great force to hear what proved to be a splendid exposition of the theory and practice of radiotelephony. The lecturer spared no pains to make his points absolutely clear, both with diagrams and formulæ. The club is now well over 100 strong, and a very fine body of earnest workers are to be found in its ranks.

The Southend and District Radio Society.*

Hon. Secretary, Mr. A. L. Whur, 4, Wimborne Road, Southend-on-Sea.

On Friday, January 26th, 1923, at headquarters, 76, Queen's Road, Southend-on-Sea, a most interesting lecture was given by Mr. Percy Barnes, M.R.S., on "Transformers and Induction Coils." Various methods of making them and the uses to which they are put were explained by the lecturer.

Afterwards, a demonstration and lecture was given by Mr. A. C. Hugh, on his set, consisting of one H.F., tuned anode valve, one detector valve, and two L.F. valves, using a reaction coil coupled to the tuned anode valve. The concert at 2 LO by Australian artists was received on the loud speaker.

The Chairman, Mr. D. L. Plaistowe, announced that the P.M.G. had granted the Society's application for a portable transmitting and receiving licence, and that the station call of the Society is 5 QK. Arrangements will be made as soon as possible to make a portable experimental transmitting and receiving set.

Proposed Wireless Club for Wimbledon.

A wireless club is to be formed in Wimbledon. All those in the district who are interested in wireless are invited to communicate with C. G. Stokes, Esq., 6, Worple Avenue, Wimbledon, S.W.19, or E. W. Webb, Esq., 14, Denmark Avenue, Wimbledon, S.W.19.

The Liverpool Wireless Society.*

Hon. Secretary, Mr. G. H. Miller, 138, Belmont Road, Anfield, Liverpool.

The annual general meeting of the Liverpool Wireless Society was held at the Royal Institution, Colquit Street, Liverpool, on Thursday, January 25th, Mr. E. B. Grindrod occupying the chair.

The Secretary read a report of a special impromptu meeting of the Society, which met to discuss the question of a new and up-to-date receiver, and it was unanimously decided that the Society's present apparatus, being somewhat prehistoric (the Society having been established before the war), it was now urgently necessary to have a special "whip round" for the necessary funds. One of the members present very kindly

offered to provide the greater portion of the necessary funds, and guaranteed a cheque for £50, which was handed over the following day. Promises were also made by the members present at this impromptu meeting to the extent of £23. and the Secretary was then instructed to write to the members not present inviting them to join in the subscription list. As an expression of appreciation of the generosity of the principal donor, Mr. C. R. Honiball, this gentleman was elected the first Honorary Life Member of the Society.

It was decided to put the receiver in hand without delay, and after some discussion the type was finally decided upon. This will be built by one of the members of the Society, and will comprise two H.F. valves, detector valve, and three L.F. valves. Separate controlling switches and filament rheostats are to be provided for each valve. Tuned anode H.F. coupling will be employed up to 2,600 metres, and resistance capacity from 2,000 to 25,000 metres. Provision will also be made so that the apparatus, by use of switches, can immediately be converted to plug-in tuned H.F. transformer coupling up to 2,600 metres. A three-coil tuning system will be employed. and the whole set will be of the very highest quality of construction possible, and will fit into a sloping mahogany cabinet, with drawers to lock up at the base to hold the necessary short-wave and duolateral coils, plug-in transformers, etc.

The election of officers for the present year then took place and there was no important change other than that of the position of Hon. Secretary, Mr. C. L. Lyons, who regretted that it would be impossible for him to offer himself for re-election. Mr. G. H. Miller was unanimously elected in his place. Votes of thanks were passed in favour of the retiring Hon. Secretary's efforts, and in favour of the new Secretary for accepting the appointment. Mr. N. D. B. Hyde declined to serve on the committee during 1923, and consequently retired, and Mr. C. R. Honiball was elected in his place. Mr. S. W. Philpott was also elected to serve on the committee as the representative of the broadcast licencees of the Society.

Cheltenham and District Wireless Association*

Hon. Secretary, Mr. Eric Cole, A.R.I.B.A., 28, Milton Road, Cheltenham.

At the weekly meeting of the Association on January 22nd, Mr. W. G. H. Brown **(5 BK)** gave an extremely interesting lecture on "Transmission," illustrated by blackboard sketches and diagrams, and some of his transmitting apparatus rigged up temporarily at the lecture hall.

He gave practical demonstrations of spark, tonic train, and C.W. transmission, and also lucidly explained telephony transmission, the various methods of modulation being made quite clear to members.

Mr. Brown also described his experiences listening for American broadcasts.

A vote of thanks was passed to the lecturer for an extremely instructive evening.

The Hon. Secretary pointed out at the conclusion of the meeting that subscriptions for 1923 were now due and should be paid to the Hon. Treasurer.

Birmingham Experimental Wireless Club.*

Hon. Secretary, Mr. A. L. Lancaster, c/o Lancaster Bros. & Co.,Shadwell Street,Birmingham.

An interesting lecture specially designed for those just taking up wireless broadcasting, was delivered at the Digbeth Institute on January 26th, by Mr. Jennings, the subject being "The Working of Broadcasting Sets." Mr. Jennings ably traced in simple terms the theory of the electron and its bearing on modern wireless—describing the propogation of magnetic waves and the means we have of reception both by crystal and valve apparatus. The object of tuning and the methods used and also the meaning of inductance and capacity were clearly explained.

The lecture was closely followed by the members present, and a hearty vote of thanks was passed to Mr. Jennings.

The Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. B. Whitehouse, The Grotto Café, Manchester.

On Wednesday, January 24th, the Society, at the regular weekly meeting, was favoured by a visit from Mr. Bell, of the Metropolitan-Vickers Electrical Co., Ltd. (better known, perhaps, locally as Mr. "X" of **2 ZY**), who came down to discuss with the members the transmissions from the broadcasting station at Trafford Park.

The Hon. Treasurer, Mr. J. R. Halliwell, opened the discussion by explaining the reasons for inviting Mr. Bell. He said that the Society had felt for some time that co-operation between its members and the men of the Research Department of Metro-Vickers could not be anything else but beneficial to British broadcasting, and this feeling had prompted the invitation. Mr. Halliwell made some excellent criticisms of the transmissions, and desired it to be understood that everything he said was in the nature of constructive and not destructive criticism.

The Chairman, Mr. G. G. Boullen, then called on other members to continue, and several gentlemen gave their opinions and made suggestions whereby they thought the programmes could be improved. Certain members had been deputed to make careful observations of **2 ZY's** strength, clearness, etc., over the preceding week's concerts. Mr. Lomas gave a very interesting account of his experiences in reception.

Mr. "X," who was received with much applause, then proceeded to deal with the many questions asked in a very able manner. He outlined some of the many problems which had to be solved and said that gradually they were being overcome. He then dealt briefly with the history of the station, and informed his audience that it had been erected and run chiefly by local men, and had been built up as it were from first principles.

Mr. J. E. Kemp then rose, and in proposing a vote of thanks, said that he felt the Society had been honoured by Mr. Bell's visit, and much good was bound to result from the interchange of ideas which had taken place. He further proposed that Mr. Bell be forthwith made an honorary member. These propositions were suitably seconded and passed unanimously.

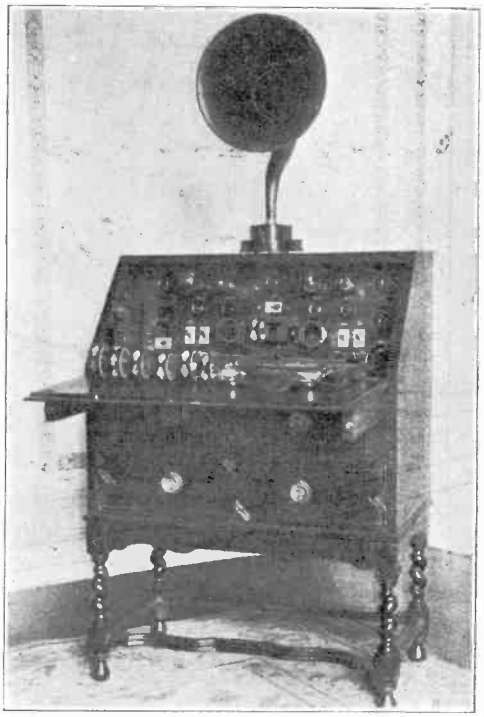
Meetings of the Society are held each Wednesday at 7 p.m. at the Grotto Café, Todd Street.

An Amateur-Built Cabinet Receiver.

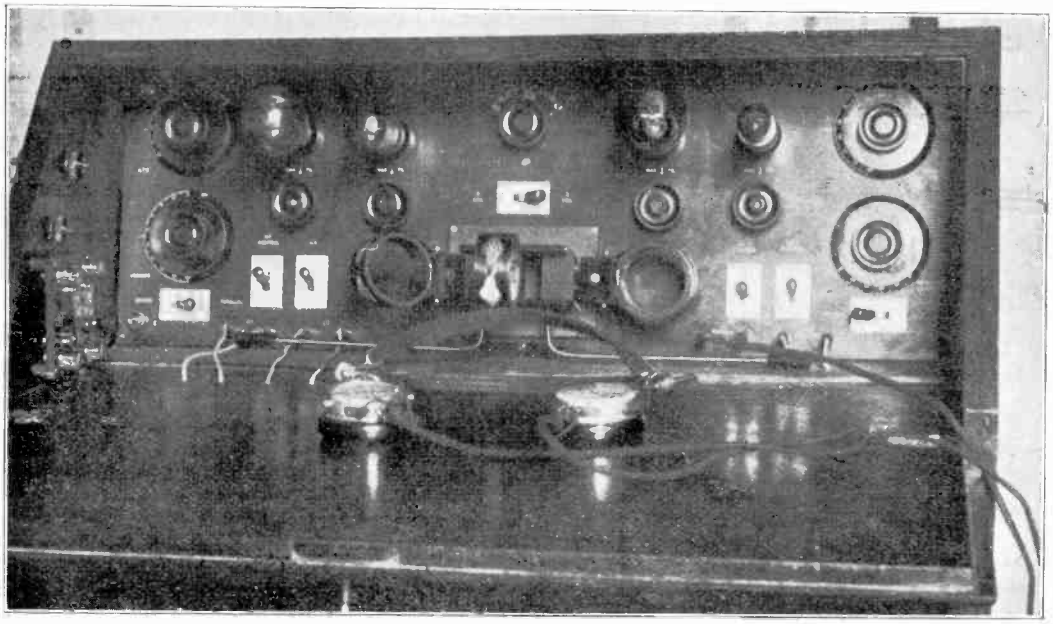
The accompanying photographs of the receiving equipment of Mr. A. G. Foster, of West Hampstead, indicate the degree of perfection that can be achieved by the amateur worker.

The apparatus, as will be seen, has been designed especially for experimental reception. Switches are suitably arranged for providing any combination of high and low frequency amplifying circuits The tuning range is covered by means of interchangeable plug-in coils and a series parallel aerial circuit switch. Extension handles from the coil holder bracket permit of critical coupling adjustment, and the tuning can be accomplished step by step as additional circuits are brought into operations by the key switch. Various types of valves are employed, according to the circuits in which they are connected.

The fine arrangement of the outfit not only greatly facilitates manipulation, but allows of the intrusion of the experimental apparatus into the drawing-room.



The Cabinet Receiver.



The Layout of the Apparatus.

"A.G." (Folkestone) *submits a diagram of his five-valve receiver and asks* (1) *Is the circuit correct.* (2) *Would a variable condenser across the reaction coil be an improvement.* (3) *Can we suggest any improvements.* (4) *Should he be able to receive* **PCGG** *transmissions.*

(1) The proposed circuit is not correct. The anode of the detector valve should be connected through the reaction coil to the primary of the low frequency transformer, and the low frequency transformer should be shunted with a 0·001 mfd. fixed condenser. We would point out that the telephones are joined so that the whole of the anode current from the valve passes through them. We assume this to be a clerical error. (2) A variable condenser connected across the reaction coil would be helpful, especially when receiving long wavelength signals. (3) We suggest you connect a switch in the aerial circuit for connecting the aerial tuning condenser in series or parallel with the aerial tuning inductance. A closed circuit is very useful and should be coupled with the aerial tuning inductance. It may be tuned with a 0·0005 mfd. condenser. It would be better to use a filament rheostat in the filament circuit of each valve, instead of using one to control the filament current of them all. (4) We consider you should have no difficulty in receiving **PCGG** transmissions.

"A.D.La T." (Yorkshire) *submits a diagram of his receiver and asks* (1) *For criticism of circuit.* (2) *The most suitable way of connecting a separate heterodyne circuit for receiving long wavelength C.W. signals.* (3) *Is proposed arrangement for using reaction suitable when receiving short wavelength signals.* (4) *Why is 6 volts recommended for the L.T. battery when most valves operate with 4 volts across the filament.*

(1) We suggest you employ a reaction condenser with a maximum capacity of 0·00005 mfds. The aerial tuning condenser may have a maximum value of 0·001 mfd., and the closed circuit 0·0005 mfds. The primaries of the high frequency intervalve transformers should be tuned with a small variable condenser; one having a maximum capacity of 0·0002 mfds. would be suitable. The by-pass condenser labelled "B" may have a value of 0·0005 mfds. The remainder of the circuit is quite suitable. (2) We suggest you connect the heterodyne with the third high frequency transformer. The small coil from the heterodyne should be coupled with the secondary coil of the high frequency transformer. A very loose coupling will in all probability suffice. (3) The small reaction condenser should be connected with the grid of the second valve when receiving short wavelength signals. (4) It is generally necessary to use a 6-volt accumulator for the L.T. supply, since most valves operate best when the potential across the filaments is 4 volts. When the valve is old, a little over 4 volts is required, and in order to provide this voltage and also to allow for the voltage drop in the wiring and the filament resistances, it is necessary that the filament supply should be 6 volts.

"CIRCUIT" (Co. Dublin) *asks* (1) *How many yards of No. 50 S.S.C. copper wire are required for a resistance of 2,000 ohms, and what is approximately the weight of this wire.* (2) *How many yards of No. 47 S.S.C. wire are required to give a resistance of 2,000 ohms, and what is the approximate weight.* (3) *and* (4) *Which is the correct way of connecting the two windings of a telephone receiver together.*

(1) 200 feet of No. 50 copper wire gives a resistance of 2,000 ohms. The weight of 200 feet of this wire will be approximately 0·2 ozs. (2) 800 feet of No. 47 copper wire has approximately a resistance of 2,000 ohms. The weight is approximately 2·6 ozs. The No. 50 wire will just fill up the bobbin having the dimensions given. (3) and (4) The correct method of winding is indicated in your Fig. 1.

"H.W." (York) *refers to a receiver described in the issues of September 16th and 23rd, and asks how it may be modified.*

We suggest you construct the receiver exactly as described in the articles referred to. It is not satisfactory to make alterations to a receiver before one has had experience with reception.

"K.V.W." (Devon) *asks* (1) *For particulars of a variometer.* (2) *What is the Customs tax on imported French "R" type valves.* (3) *Whether a list of amateur transmitting stations is published.*

(1) A variometer was described on page 317 of the December 2nd issue, to which we would refer you for particulars. (2) We have no knowledge of the duty payable on imported French "R" type valves. (3) A very complete list of amateur transmitting licence holders is published by the Wireless Press, Ltd., and may be obtained from the Mail Order Department, The Wireless Press, Ltd., 12/13, Henrietta Street, London, W.C.2.

"HALENDER" (E.17) *asks* (1) *Whether he should use a telephone transformer in the anode circuit of the last valve of his valve receiver.* (2) *Which is the input side of a transformer.*

(1) Under the circumstances, we think it would be better if you connected the telephones directly in the anode circuit, and no serious harm will result. It is not very helpful to wind a transformer having a ratio of 1 to 1, as you suggest. (2) The input side of a transformer, when applied to an intervalve transformer, is the side which is connected in the anode circuit, and is labelled the primary. The output side of the transformer which is the secondary, is connected with the grid and filament, or the input circuit of the next valve.

"H.T.S." (Cornwall) *submits a diagram and asks* (1) *For criticism.* (2) *Whether it would be approved by the P.O.* (3) *How to obtain an experimental licence.*

(1) The diagram submitted is quite suitable as no reaction is shown. (2) The P.O. would probably approve of a receiver wired according to this diagram. (3) We suggest you communicate with the Secretary of the G.P.O., London.

"JOHN R.G." (Oundle) *asks* (1) *Whether aluminium is a suitable substance upon which to wind a variometer winding.* (2) *At what speed must a motor connected with the Johnsen Rahbek loud speaking amplifier rotate.*

(1) Aluminium is not suitable for the former of a variometer. The fact of its being insulated with wax paper will not make it suitable. We suggest you use dry wood or ebonite. (2) The best speed

for the motor of the Johnsen Rahbek loud speaker should be determined by experiment. The diameter of the agate cylinder is $\frac{5}{8}$". 30 revolutions a minute is suitable.

"RADIOMAD" (Salisbury) *submits particulars of his aerial, and asks whether it may be improved in any way.*

We suggest you erect a two-wire aerial at right-angles to the telephone wires; the length of the aerial will then be 45'. The aerial should be as high as possible.

"J.W.H.C." (Manchester) *asks* (1) *Why signals are as loud whether connected to earth or disconnected.* (2) *Why adding H.F. connected valves does not materially increase the signal strength.* (3) *What is the tuned anode method of high frequency amplification.* (4) *Is it possible to make a loud speaker with the aid of a microphone.*

(1) The reason why a connected or disconnected earth lead from your receiver does not affect the signal strength is because the earth lead is so long. We suggest you reduce the lead to 6'. Owing to your peculiar situation, however, we think you would find the signal strength improved by using a frame type aerial. The frame may be 4' square wound with 10 turns of No. 18 D.C.C. The wire should be spaced $\frac{1}{4}$" and the last five turns should be tapped and taken to a switch for coarse tuning. The two leads from the frame aerial will then go to the filament and grid connections of the first valve. The frame aerial should be tuned with a variable condenser having a maximum value not exceeding 0·0005 mfds. (2) With the modification suggested in (1), the addition of H.F. connected valves will greatly increase the signal strength provided the tuning in the anode circuit of the added valves is suitably carried out. (3) The tuned anode method of H.F. amplification employs a tuned coil in the anode circuit. When the tuned circuit has a frequency corresponding with that of the signal to be amplified, the impedance of the circuit is very high, consequently large potential variations are set up across it. These are transferred to the grid of the next valve through the grid condenser. The leak is connected between the grid and the filament to stabilise the normal grid potential. Many diagrams showing the methods of connecting high frequency valves by means of tuned anode coils, have been recently given; in particular we would refer you to page 601, February 3rd issue. (4) It is not always possible to construct a loud speaker. However, the receiver may be connected with one side of the microphone, the other side being secured to a rigid framework. The primary of the transformer and a few dry cells should be connected in series with the microphone and the transformer secondary connected with the telephones. See Microphone Amplifier on page 130, October 28th issue.

"C.F." (Northwood) *submits a diagram of connections and asks* (1) *For criticism.* (2) *Is the aerial (particulars of which are submitted) likely to be useful.* (3) *Is it necessary to secure adjustments for a portable receiver or will an ordinary experimental licence suffice.*

(1) The diagram of connections submitted is correct, and is quite a standard circuit. (2) The proposed aerial is not very suitable, and we think you would get far better results from a frame. The frame should be 4' in diameter wound with 10 turns of No. 18 D.C.C. The wires should be spaced $\frac{1}{4}$", and the last five turns brought to a switch. (3) When applying for an experimental licence, you are asked whether the receiver is to be portable or whether it is to be used as a fixed station. We therefore suggest that you apply to the G.P.O. for permission to use a portable receiver.

"W.G." (Durham) *asks how an intervalve transformer works.*

When a transformer is connected in a circuit, variations in the primary voltage are reproduced in the secondary circuit. If the primary voltage is an alternating voltage, the secondary circuit will deliver an alternating voltage. If the primary circuit contains a steady direct current, superimposed upon which is an alternating voltage, only the alternating voltage will appear in the secondary circuit, because the voltage of the secondary circuit is induced by the varying current producing a varying flux which cuts the secondary winding. A continuous current flowing through the primary circuit cannot cause a voltage across the secondary winding. The primary voltage and secondary voltage are 90° out of phase. When no load is connected to the secondary of the transformer and a voltage is applied to the primary, the current flowing in the primary circuit, which magnetises the primary winding, is 90° out of phase with the primary voltage: the current is lagging 90°. The secondary voltage is in phase with the magnetising current, and the phase of the secondary current is determined by the nature of the load upon the secondary. If the secondary winding is inductive, the secondary current will lag behind the secondary voltage. If the secondary circuit is purely resistance, the secondary current and voltage will be in phase. The primary current lags behind the applied voltage simply because of the predominance of inductance in the circuit. The lag of the current behind the voltage is in no way affected by the frequency of the applied voltage. The product of the volts and amperes measured in the D.C. circuit supplying energy to the valve gives the apparent watts in the circuit. The true watts would be given by the product of the reading of a hot wire ammeter and D.C. voltmeter. When the D.C. current is pulsating, the D.C. ammeter will indicate an average value, while the hot wire ammeter will indicate the R.M.S. value. The ratio between the apparent watts and the true watts depends upon the adjustment of the valve circuit.

SHARE MARKET REPORT.

Prices as we go to press on February 9th, are :—

Marconi Ordinary	£2	14	0
,, Preference	2	5	0
,, Debentures	107	0	0
,, Inter. Marine ..	1	9	0
,, Canadian		11	0
Radio Corporation of America :—			
Ordinary		15	6
Preference		13	0

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

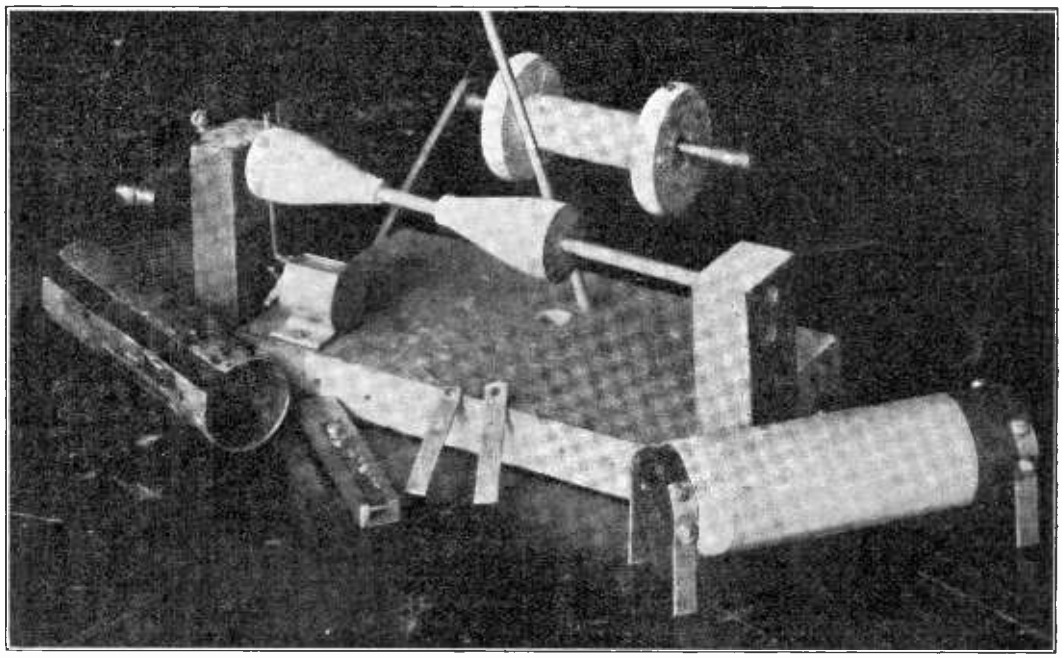
No. 184 [No. 21 Vol. XI.] FEBRUARY 24TH, 1923. WEEKLY

Semi-Aperiodic H.F. Transformers.

By J. H. REEVES, M.B.E.

THESE notes are the outcome of an attempt to build a multivalve H.F. amplifier to cover the broadcasting band and under. They formed the subject of a lecture given to the Kensington Radio Society.

The nature of the method was formed on the writer's experience in the use of a Marconi seven-valve amplifier Type 55D. The band claimed for this instrument runs from 1,500 metres to the upper limit. It was designed not so much for high efficiency per valve,



A photograph showing all the equipment necessary in constructing the transformers and a finished transformer on the right. Note the cyclometer mounted on the base to register the number of turns when winding. On the right are the jigs for cutting and drilling the ebonite tube and brass connectors.

but rather to give great ease of working over a wide range. It is a fact that this instrument has given good results down to 600 metres, and the writer's argument was that if an amplifier with optimum point in the neighbourhood of 4,000 metres will give good results down to 600 metres, what will be the result of constructing one on exactly similar lines with an optimum of 900 metres? The reader is forewarned that he may have to use one more valve, possibly two, than he would have to do in the case of a tuned reactance capacity, or of the multi-pointed self-tuned reactance capacity coupling, but on the other hand, if he wishes to use several H.F. valves in cascade, for instance for use with a small frame aerial, he will most probably agree that the cost of the extra battery power required is still outweighed by the elimination of that

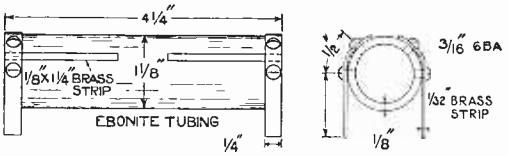


Fig. 1. The body carrying the transformer windings.

bugbear of the tuned anode multiple circuit, *i.e.*, its extreme liability to self oscillation.

The writer experimented with the popular four-pin type of disc transformer, but found against this the mechanical difficulty of making the body, and more particularly the difficulty of turning out three or more identical in electrical properties.

The type to be described is cheaper to make, irregularities in mechanical construction are unimportant, while with ease any number can be made almost identical electrically. The form requires a reconstruction of the panel, though by means of an adapter it can be used on a panel fitted with valve sockets, but an experiment will later be described from which it would appear that the capacity of the four pins and the four sockets, almost infinitesimal as they are, can produce markedly observable effects.

The transformer is of the two-layer cylindrical type, very tightly coupled, and wound with high resistance fine wire. The body is formed of tubing $1\frac{1}{8}$ in. diameter, walls $\frac{1}{8}$ in. thick and of length $4\frac{1}{4}$ ins. The writer used ebonite, but thinks possibly other material may be better electrically. This body is supported on four legs made from brass strip $\frac{1}{4}$ in. $\times$ $\frac{1}{32}$ in., and these are held in small spring clips of a type which has been advertised in this journal.

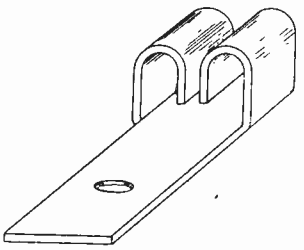


Fig. 2. Three clips to support the transformers.

The body is shown in Fig. 1. and the clip in Fig. 2. It will be seen that to the legs are soldered fine brass strips projecting along the body parallel to its axis. These may be of tinned wire, and form the base on which is soldered the winding wire. The length of these depends on whether the body is to be wound full (900 metres), about half full (400 metres), or with about 100 turns (200 metres).

The making of this body presents no great difficulty to one whose hands are skilful, but even to such the work is greatly facilitated by the use of two jigs, one to form the body (Fig. 3), the other the legs.

Jig 1.—The tube was rubbed smooth with fine emery cloth, oiled. A piece of fairly stout brass tubing was found of internal diameter

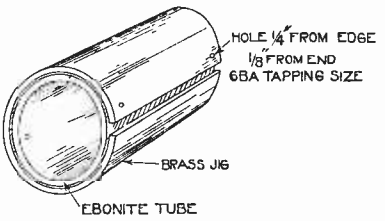


Fig. 3. The jig for the body.

just under $1\frac{1}{8}$ in. A length of $4\frac{3}{8}$ ins. was cut off, and the ends trued by a file or against an emery wheel, till the length was exactly $4\frac{1}{4}$ ins. This jig was then fixed in a large vice as nearly as the eye could gauge parallel to the jaws, and then, aided by one jaw as a guide, a longitudinal cut was made with a hack-saw which was thus closely parallel to the axis.

The edges of this cut were filed smooth, and then, slightly expanding the cut tube, it was slipped over the ebonite tube, which was then cut so that a small length projected at each end. The ebonite ends were now similarly trued to the guide of the brass surround. Next, at the same distance from one cut edge of the brass and $\frac{1}{8}$ in. from each

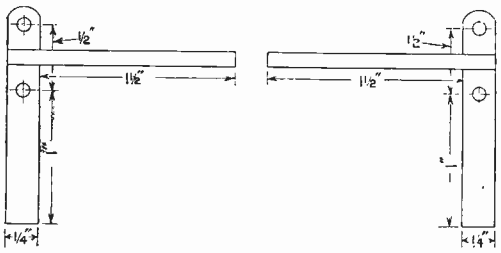


Fig. 4. The legs with arms soldered on.

end, two centre-punch marks were made, and at the opposite ends of the cross sectional diameter through these marks two others were made. Through these, four holes were drilled 6 BA. tapping size. The inner tube was pushed out by sliding over the main ebonite tube and the first body was ready, with the jig in position to make another.

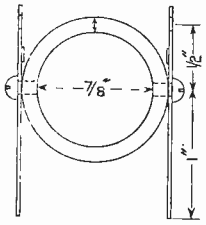


Fig. 5. End appearance with legs fitted.

Jig 2 (Fig. 4). This is to help make the legs identical. A full description is unnecessary and it is not difficult to construct from brass strip. It will be found that when the two holes have been drilled (6 BA clearance), the burr formed will prevent the finished legs from dropping out. A pair of small flat-nose pliers will get over this difficulty and for this reason the opening must be somewhat deeper than the $\frac{1}{32}$ in., the thickness of the leg, and the upper flap must be flexible. When one or two dozen legs have been made the ends are rounded or trued by file or emery wheel and the thin arms soldered on as in Fig 4.

To the body, four legs are now attached with screws 6 BA, 3/16 in. The end appearance now is as in Fig. 5.

The legs being carefully squared with the body, the top ends are bent round the circumference and the four remaining necessary holes are drilled and tapped 6 BA and screwed home. Any ends of the 3/16 in. screws which project internally are filed off, and the body is now ready for winding. For this a device is required as shown in Fig. 6, and in the photograph.

It may seem at first sight that this winding will be difficult. This is not the case and after a little practice a rate of about 100 turns per minute can be reached. In practice there is a little trouble in getting the first few turns to lie close together, but it is simpler to let this irregularity alone and when the coil is finished to press the erring turns into contact with the rest.

The next step is the testing and measurement of the transformer.

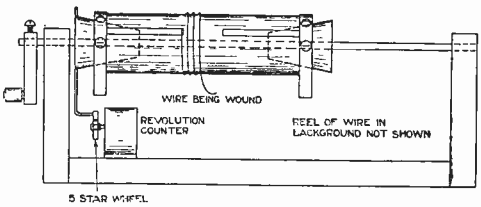


Fig 6. The winding device.

The method used gave results good enough to form a working basis. A small panel was put together of one H.F. and one detector valve. No connections were made beneath the panel except as regards L.T. battery and potentiometer, but all the terminals of the parts were brought up to the top so that changes of connections could be made easily.* The arrangement is shown in Fig. 7.

A buzzer wavemeter must be supposed to be some distance on the left. The transformer under test was put in the clips, a suitable coil was inserted on the left and its shunt

* Since this was written these transformers have been tested on another panel with very low capacity valves and the difference of the optimum wavelength far exceeded expectations. This shows the necessity of calibrating every transformer on the panel and with the valves with which it is to be used.

condenser placed at zero. The tuning condensers on the panel were disconnected. The wavemeter was now tuned in and the magnitude of the sound in the telephones was noted. The buzzer wavelength was now increased step by step and the receiver tuned in to each adjustment. If correct wavelengths had been selected the strength of signals rose fairly rapidly to a maximum and then with further increase of wavelength the strength began to fall away.

Maximum strength of signals should be accurately noted and if the assumption be correct that the energy of the oscillations were the same at all wavelengths—an assumption probably untrue—the result would give the absolute optimum point for each transformer, and the rates of falling off on either side of this point would give an estimate of the useful range over which the transformer could be used. Even if not absolutely correct, this method does give a useful and fairly close approximation. While certain of these measurements were being made another phenomenon was noted. Under a certain potentiometer adjustment the system broke into self oscillation *over a limited swing* of the tuning condenser, above and below which the buzzer note came through clearly. By careful manipulation of the potentiometer this swing could be limited to about 10 degrees and even less, and finally eliminated. The point of greatest ease of self-oscillation was credited as being that of the natural wavelength of the transformer in its setting, and the fact that various points as thus determined agreed well with the optimum point as found by the former method, seems to indicate that the respective theories are in the main accurate.

In this connection an interesting point was noted, and as this led to winding throughout with high resistance wire, it may be described. It was found that some coils would not oscillate under any adjustment of the potentiometer, so a reaction coil was brought into use and by its means, in conjuction with the potentiometer, the measurement by self oscillation could always be made. Now at the start both layers had been wound with fine copper, but as the band of efficient amplification proved very narrow, H.R. wire was substituted for the primary winding and two transformers were wound identical in number of turns, but in one the secondary was copper, in the other it was H.R. The latter was markedly more difficult to get to oscillate, but the efficiency of the former at optimum point, which was about the same, was somewhat higher. As the writer is prepared to sacrifice some efficiency in eliminating his great bugbear, oscillation, all secondaries are now wound with H.R.

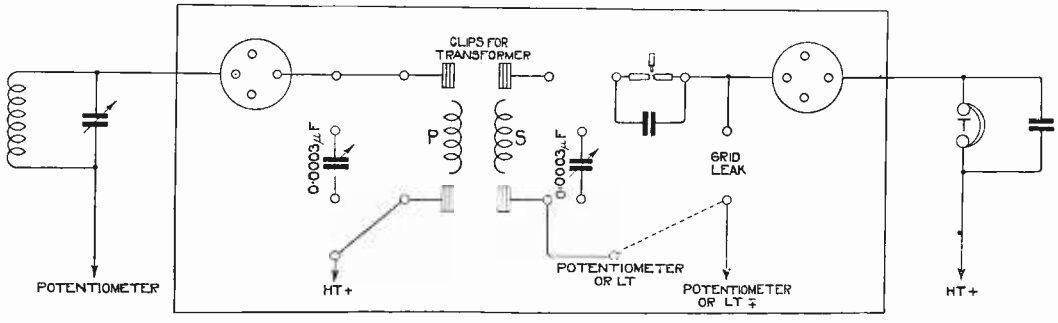


Fig. 7. The circuit used for testing wavelength ranges.

Another point which has been partially investigated is that of winding more turns on the secondary. The writer will in a further instalment of this article give numbers of turns, but he warns the reader that experiments will be related showing that even minute capacity effects may completely alter the optimum point of the same transformer used on two different panels, *e.g.*, one transformer adjusted on the writer's panel for work at 400 metres was found on a friend's panel to be at its best, and wonderfully good at that, on ship signals.

(*To be concluded*).

Making A Simple Crystal Receiver.

A CONSTRUCTIONAL ARTICLE FOR THE BEGINNER.

SIMPLICITY, without sacrificing efficiency, has been the foremost consideration in the design of this crystal receiving set, and the arrangement can be recommended as embodying the best principles of crystal reception.

The design is arranged so as not to be beyond the skill of the beginner, and to come within the scope of those without experience in wireless constructional work. It is intended for the man about to start in wireless, and who is desirous, in the first instance, of receiving broadcast.

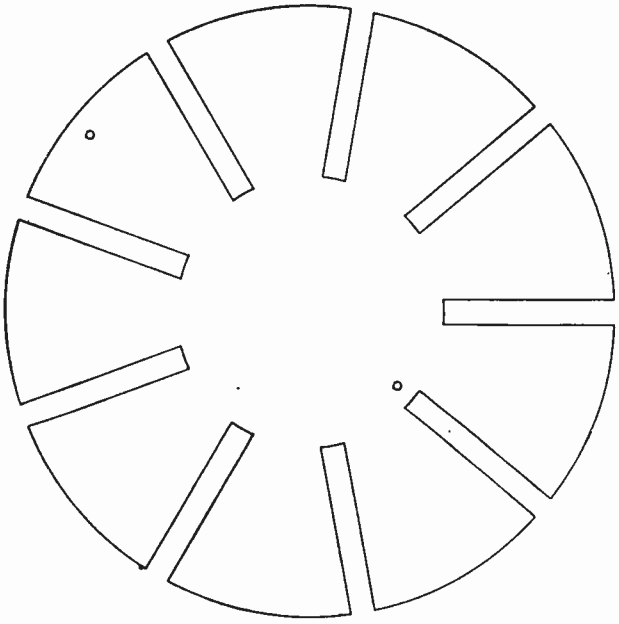


Fig. 1. The card on which the wire is wound. It is drawn exact full size.

The materials required are as follows :—

Piece of wood ½″ thick.
Polished ebonite sheet 1″ × 6″ × ¼″.
4 ozs. No. 26 D.C.C.
2 cards.
1 condenser 0·0003 microfarads.
1 „ 0·001 „
A crystal detector.
Shellac varnish (about 1 gill).
18 brass screws No. 4 × ⅝″ round-headed
6 brass screws No. 4 × ½″ countersunk heads.
3 „ „ No. 6 × 1¼″ round-headed.
4 4BA terminals with back nuts and washers.
2 lengths (nearly 1 yard each) of " Sistoflex " insulating tubing.
6 ft. No. 20 bare copper wire.

The total expenditure on materials should not exceed ten or twelve shillings.

The winding of the two inductances is the first step in the construction of the receiver. The dimensions of the coil on which the wire is wound appeared in an article on " Experimental Station Design," in *The Wireless World and Radio Review* of June 10th, 1922, and from which article Figs. 1 and 4 are reproduced. A card should be placed beneath Fig. 1, and all of the corner points pricked through so that it can be cut exactly to the shape indicated. It should be observed that an odd number of slots is employed. Care must be taken that the slots are not made too deep, for any cuts which are too long will considerably weaken the segments and probably cause them to break off during winding. Two holes are pricked through at the points shown, and by mounting the reel of wire on a spindle it is quite easy to wind the wire in and out of the slots until it resembles Fig. 4. The wire should be pulled quite tightly while winding, and the card flattened out from time to time as may be required. Two inductances will be needed. One of the inductances is attached to a strip of wood about 9 ins. long and ½ in. wide by ⅜ in. in thickness, by means of two of the ½ in. screws. A disc of cardboard is placed over the inductance prior to attaching it to the wooden arm so as to hold it securely, and reduce the liability to bend. Two small holes are drilled through the arm prior to securing the inductance, in order to pass the leads.

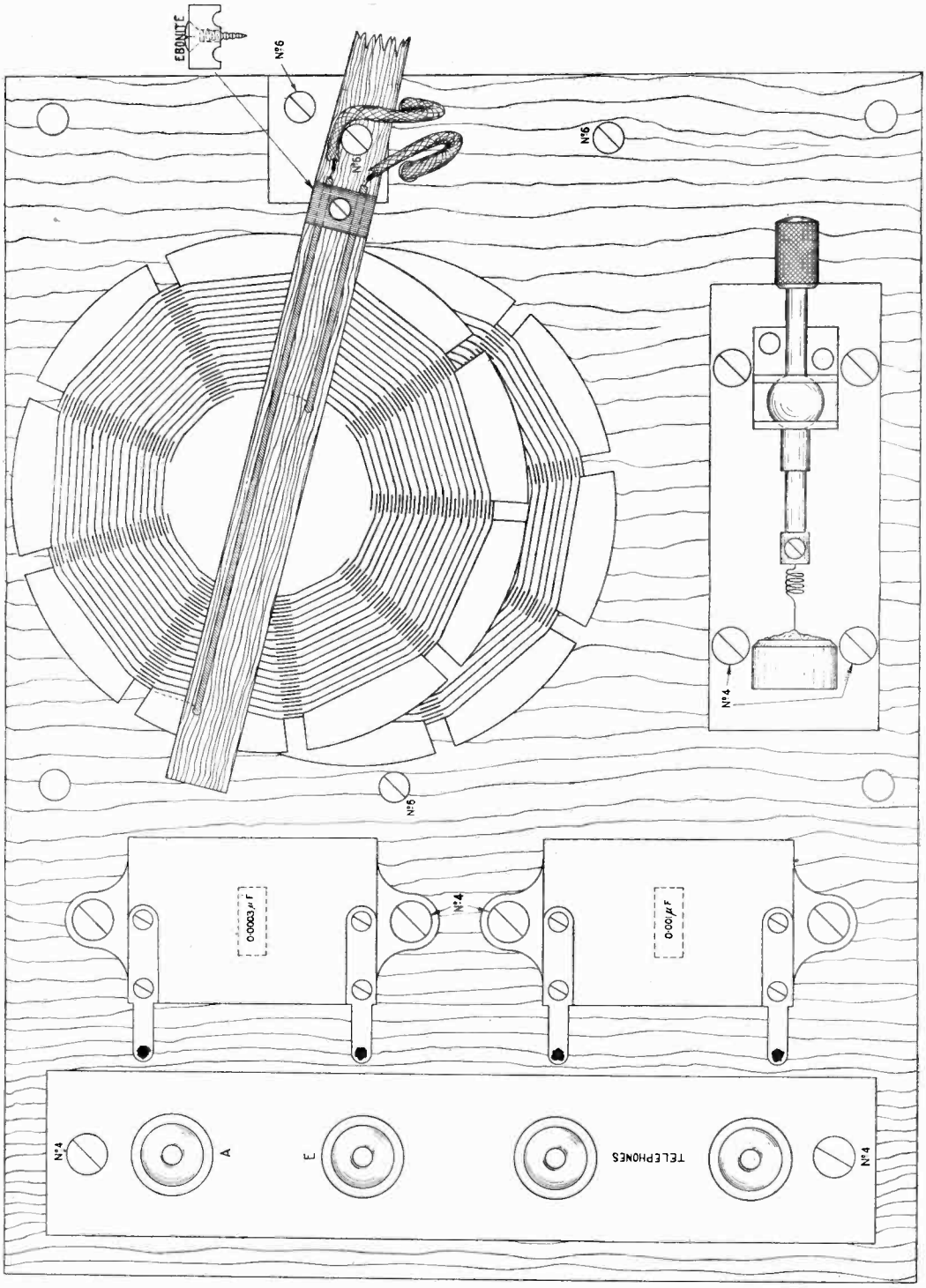


Fig. 2. The layout of the complete receiver.

It is just as well to mark out the positions for all the holes in the base and arm in the first instance and drill them, in order to reduce the chance of splitting, after which a coat of varnish will make the surface of the wood more durable and improve its insulating properties, which is particularly desirable where it is in contact with the inductances.

The terminal strip may next be constructed. The ebonite is sawn to size by marking it with a scratch line and cutting with a fine toothed saw. The edges may be finished by filing. Six holes are drilled at the points shown in Fig. 5 by means of a small hand brace and morse twist drill, and breaking away of the ebonite at the back may be avoided by drilling down on to a piece of hard wood and pressing the ebonite tightly in contact with it. To those unaccustomed to working in ebonite, it should be borne in mind that it is a fairly brittle substance, and must not be allowed to vibrate during sawing or filing, neither must it be subjected to heavy pressure while drilling.

The polished surface, which may possibly tend to destroy the insulating properties of the ebonite, may be removed by rubbing with emery cloth, and by careful treatment it is possible to give the ebonite a good matt surface which considerably improves the appearance. The terminals are held in position with back nuts.

If parts only are purchased for the crystal detector, it will be necessary to make up an ebonite piece for assembling it and insulating it from the main wooden base.

The dimensions of the base can be seen in Fig. 2, and the construction is left to the ingenuity of the reader according to his experience and the tools in his possession. It should be noted that the grain of the wood is parallel with the long slot, and cross pieces are arranged to reduce the chance of splitting. The wooden base may be rubbed down with glass paper and the corners given a slight rounding or bevelling, after which, treatment with shellac varnish will add to the appearance and insulation.

The method of assembling the components on the base is clearly indicated in Fig. 2. The lower inductance is secured to the surface of the board with three of the $\frac{1}{2}$ in. screws,

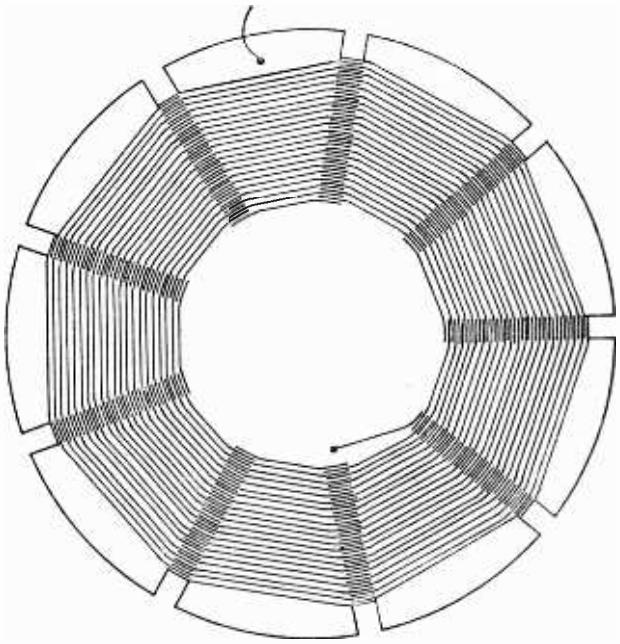


Fig. 4. A wound tuning coil.

and the leads pass through the wood for wiring up. The wiring is shown in Fig. 6, and a wiring diagram representing the circuit in a form in which the connections of wireless apparatus is usually represented, is shown in Fig. 3

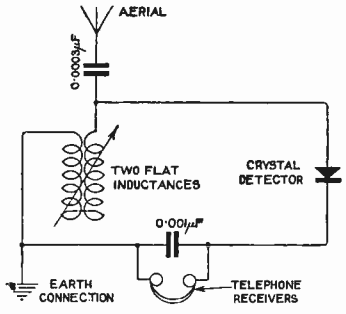


Fig. 3. Circuit Diagram.

A difficulty which the beginner will experience in operating a receiver of this sort, is the sensitive setting of the crystal detector. The best way of doing this is to arrange a buzzer and battery close to the receiver, and to vary the crystal detector until the buzz is loudly heard in the telephones.

Crystal receivers, although entirely satisfactory for broadcast reception, do not give very loud signals, and hence it is necessary

for the highest grade of telephone receivers to be employed, and the beginner is strongly advised to procure those of reliable manufacture. A good test when purchasing telephone receivers is to moisten the tags and touch them together. If the receivers are really sensitive a strong click should be heard. The resistance of the receivers should be between 2,000 and 4,000 ohms.

Should the reader be unacquainted with the best method of erecting an aerial, he is referred to an article dealing very thoroughly with the subject which appeared in the issue of this journal of May 27th, 1922.

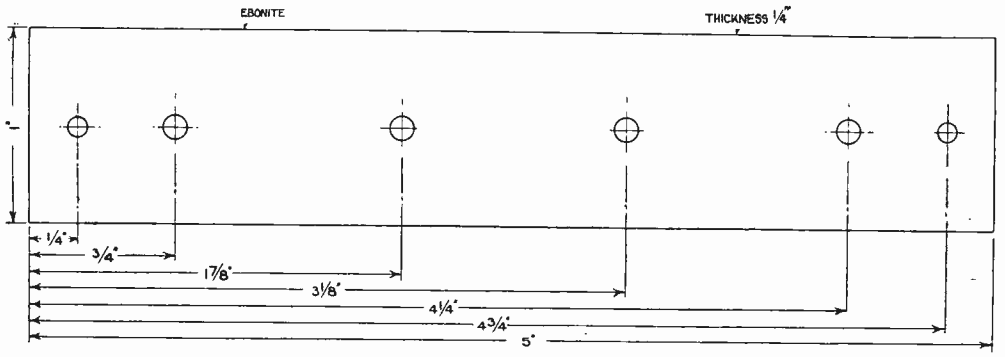


Fig 5. The ebonité piece for mounting the terminals. The thickness is ¼".

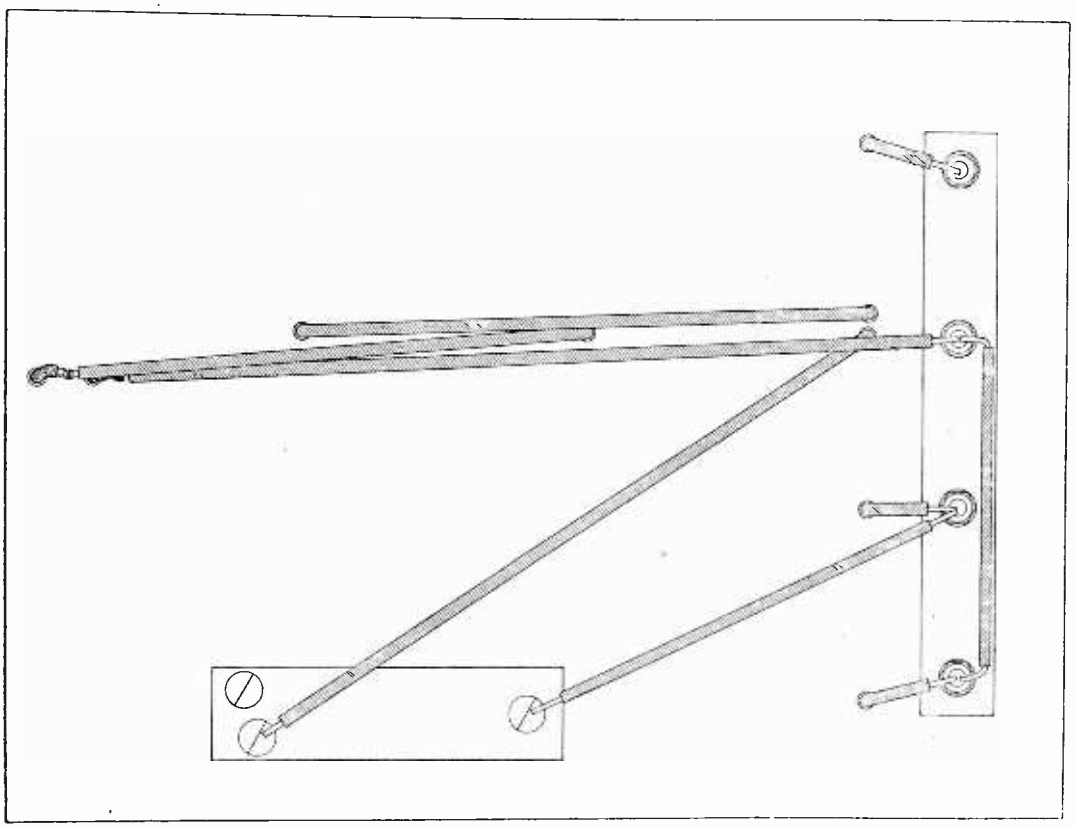


Fig. 6. Underside of receiver showing wiring.

Transatlantic Tests.

RESULTS OF BRITISH AND FRENCH TRANSMISSIONS, 1922.

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

AS has already been announced in these columns, during the second part of the Transatlantic Tests between December 22nd and 31st, British and French radio amateurs transmitted test signals to America and Canada. All the British stations which were allocated special transmitting periods were given a code word in order to verify their receptions. The French transmitters also had code words, but arranged their three-hour periods as free-for-all times during which any of their transmitters were free to operate.

Some of the results of the American receptions were reported by radiogram *via* New Brunswick and Carnarvon during the tests. The texts of these messages as received are as follows :—

December 23rd.

"OUR STATIONS JAMMED NO SIGNALS REPORTED HEARD FROM ENGLAND OR FRANCE TWENTY SECOND. SCHNELL."

December 24th.

"HEARD TWO FOX ZED TWENTYTHIRD STOP OTHERS BADLY JAMMED BY OUR TRANSMITTERS STOP NO FRENCH SIGNALS REPORTED. SCHNELL."

December 25th.

"TWENTYFOURTH SIX AMATEURS REPORT FIVE WATCH SAIL CODE VERIFIED XMAS MESSAGE COPIED STOP ALSO NOUGHT ONE FIVE SIX GREENWICH FIVE SAIL WATCH THIRD* TRANSMITTING CODE ASSIGNED FIVE WATCH SAIL CONGRATULATIONS STOP NO FRENCH SIGNALS RECORDED. SCHNELL."

December 27th.

"ADDITIONAL TWENTYFIFTH HEARD FIVE WATCH SAIL CODE VERIFIED MESSAGE RECEIVED STOP TWENTYSIXTH HEARD FIVE WATCH SAIL STOP NO FRENCH SIGNALS. SCHNELL."

December 28th.

"ADDITIONAL REPORTS FIVE WATCH SAIL TWENTY FOUR AND TWENTYSIX CODE VERIFIED STOP TWENTYSEVEN FRENCH EIGHT ABLE BOY COMPENSATED WAVE PROBABLE. SCHNELL."

December 30th.

"NO BRITISH FRENCH SIGNALS TWENTYEIGHTH STOP TWO FOX ZED NO FRENCH TWENTYNINTH. SCHNELL."

December 31st.

"THIRTIETH FRENCH EIGHT ABLE BOY HEARD ONE HOUR STEADILY CODE VERIFIED NO BRITISH SIGNALS. SCHNELL."

* Probably a mistransmission for HEARD.

January 1st.

"THIRTYFIRST NO BRITISH OR FRENCH SIGNALS REPORTED FINAL REPORT TOMORROW.† SCHNELL."

From the above it will be noted that the reception of two British stations is reported in addition to one French, but the accuracy of some of these claimed receptions has been doubted, since the British station **2 FZ** was not in operation during the tests.

The official report of the receptions has, however, now been received from the traffic manager of the American Radio Relay League, under the following covering letter which may perhaps be of interest as throwing a little light upon the conditions under which the tests were carried on :—

To the Sub-Committee of
The Radio Society of Great Britain.

Gentlemen, we congratulate you !

The Transatlantic Tests were highly successful, and on behalf of the members of the American Radio Relay League, I beg to extend our cordial thanks for your superb co-operation in making the tests successful.

Your reception reports were far in excess of anything we had ever hoped to get from your amateurs. No one dared even dream of such splendid work. Our reception was badly jammed by our own stations, but we offer no alibis, your stations performed much better than ours in reception of signals. Our amateurs did not observe the periods of quiet air as we expected. As far as future Transatlantic Tests are concerned, we do not believe it will be necessary to repeat our transmission to you, as you have demonstrated beyond any question of doubt that you can copy our signals almost at will. However, we would like to have another chance at copying your signals at some future date. In that respect it is only fair to say that transmission on wavelengths of 440 metres is subjected to severe jamming from ship and shore stations which continually use that wave, and their sparks cause tremendous interference. We rather listen on wavelengths between 160 and 290 metres simply because wavelength bands above 290 metres are being used for some other service and interference is to be expected.

Before listing our reception reports by days, the following corrections are to be made :—

December 23rd, the reception of **2 PO** is reported. Can you verify transmission of any British station signing **2 PO** ?

December 25th, add reception of French **8 AB** and British **2 JZ**. We are under the impression that **2 JZ** in this particular case may have been British **2 FZ**.

December 26th, add reception of British **2 FZ**.

† NOTE.—No additional radio report was received.—P.R.C.

December 29th, cancel report of reception of British **2 FZ.**

December 31st, add reception British **5 WS.**

Cordially yours,

F. H. SCHNELL.

January 10th, 1923. (*Traffic Manager.*)

The corrections noted at the end of this letter are corrections to the above radiograms, which corrections were incorporated in the official report sent with the letter, and which reads as follows :—

TRANSATLANTIC AMATEUR RADIO TESTS, 1922.

Reception report by days, with call letters of receiving stations, types of receivers and tube equipment, and names and addresses of successful receiving stations.

December 22nd, 1922.

No signals reported (many of our transmitting stations were confused because of G.M.T., and therefore continued testing).

December 23rd, 1922.

G.M.T.	Heard	Heard by	Remarks.
0218	**2 FZ**	**9 DRR**	Sending "test." Wave about 200 metres. Receiver-super - regenerator and two-step A.F. amplifier.
0333	**2 FZ**	**3 HS**	Sending "test" (receiver - detector and one-step A.F. amplifier).
0345	**2 FZ**	**8 AMD**	Sending "test." Wave about 250 metres.
0400	**8 AB**	**8 FQ**	Receiver - detector and one-step A.F. amplifier. Wave about 240 metres.
?	**2 PO**	**8 FQ**	Wave about 180 metres.
?	**2 FZ**	**2 BML**	Also other British stations heard, but jammed by our transmitters.

December 24th, 1922.

0156	**5 SW**	**1 RU**	(The writer listened at **1 RU** with the owner, and both of us distinctly heard the code letters **AFGCX** (assigned to **5 WS**) and the sign **5 SW** several times. Apparently the transmitting operator was confused. The signal was perfectly clear, steady and easily readable on regenerative tuner, detector and one-step A.F. amplifier. The manipulation at the transmitter was perfect machine-like precision.
0200	**5 WS**	**3 BEC**	Code verified.
0220	**5 WS**	**2 BBB**	Code verified. Wave about 215 metres. Receiver-Reinartz, and one detector tube.
0220	**5 WS**	**1 ANA**	Code verified. Message to American amateurs received. Beverage antenna, Reinartz tuner.
0230	**5 WS**	**1 XP**	Code verified. Three-step R.F. detector and one-step A.F. amplifier.
0230	**5 WS**	L. D. Warner.	Code verified. Wave 200 — 210 metres.
?	**5 WS**	**1 BFG**	Code verified.
?	**5 WS**	**1 BQD**	Code verified.
?	**5 WS**	**1 OR**	Code verified.

December 25th, 1922.

0150	**8 AB**	**8 FQ**	Wave 240 metres.
0435	**2 FZ**	**2 BSK**	Wave about 200 metres.
0435	**2 FZ**	**2 GK**	Wave about 200 metres. Receiver-Reinartz tuner, detector one - step A.F. amplifier.
0440	**2 FZ**	**8 FQ**	Wave about 200 metres.
0440	**2 JZ**	**8 FQ**	(Probably **2 FZ.**)
0445	**5 WS**	**1 ANA**	Code verified.

December 26th, 1922.

0025	**2 FZ**	**2 CQO**	Wave about 245 metres. Sending "V's." Receiver-Grebe Cr.9, detector and one-step A.F. amplifier.
0154	**5 WS**	**1 MO**	Sending "Radio Society of Great Britain." Receiver-regenerative tuner, detector and one-step A.F. amplifier. (K. B. Warner and the writer listening. Manipulation of transmitter not quite

G.M.T.	Heard	Heard by	Remarks.
			up to standard. Characters were hard to copy, although signal was good and steady.)
		December 27th, 1922.	
?	2 FZ	1 ANA	Fading in and out.
		December 28th, 1922.	
0432	?	1 ANA	Code unreadable o/c jamming.
		December 29th, 1922.	
—	—	—	No signals.
		December 30th, 1922.	
0310-0410	8 AB	C.A. Service.	Code verified. Wave about 190 metres. 25 cycle plate supply. Signals readable for 1 hour. Receiver - regenerative, detector and two-step A.F amplifier.
		December 31st, 1922.	
0453	5 WS	3 ADP	Detector.

Summary.

2 FZ Heard by	5 SW Heard by	5 WS Heard by	2 PO Heard by	2 JZ Heard by	8 AB Heard by
8 AMD	1 RU	1 BFG			
9 DRR		1 BQD	8 FQ	8 FQ	8 FQ
3 HS		1 OR			C.A.
2 BML		1 XP			Ser-
8 FQ		1 ANA			vice.
2 BSK		L. D. Warner.			
2 GK		3 BEC			
2 CQO		2 BBB			
1 ANA		1 MO			
		3 ADP			

Location of Receivers.

Call.	Name.	Adress.
1 ANA	R. B. Bourne ..	Chatham, Mass.
1 BFG	E. B. White ..	Belfast, Me.
1 BQD	G. M. Mathewson	Newport, R.I.
1 MO	F. H. Schnell ..	Hartford, Conn.
1 OR	Plymouth Radio Club.	Plymouth, Mass.
1 RU	R. S. Miner ..	Hartford, Conn.
1 XP	L. W. Bishop ..	Athol, Mass.
2 BBB	G. C. Engel ..	Ridgewood, N.J.
2 BML	H. H. Beverage ..	Riverhead, L.I.,N.Y.
2 BSK	E. St. John ..	Schenectady, N.Y.
2 GK	A. G. Kastenmayer	Schenectady, N.Y.
3 ADP	J. W. Burn, ..	Chester, Pa.
3 BEC	A. M. Young ..	Radnor, Pa.
3 HS	F. Kral	Washington, D.C.
8 AMD	E. L. Murrill ..	Lewisburg, W.Va.
8 FQ	F. A. Baumgarten	Pittsburg, Pa.
9 DRR	R. S. Rose ..	Marquette, Mich.
2 CQO	H. M. Zimmerman	Elizabeth, N.J.
	C. A. Service ..	South Manchester, Conn.
	L. D. Warner ..	Schenectady, N.Y.
	(Signed)	F. H. SCHNELL.

Since receiving this report enquiries have been made in order to ascertain if possible whether the reported reception of **2 FZ** could possibly have been receptions of some other British station having a call sign which might be misread as **2 FZ**, such, for instance, as **2 FQ** or **2 FP**, both of which stations were transmitting during the tests, but the times of these reported receptions do not apparently fit in at all with the times of any transmissions made from this side, and it can therefore only be concluded that some confusion has arisen in these receptions. Possibly the signals that have been reported in this manner may have really had their origin at an American transmitting station or else a transmitter has been employing an incorrect call sign.

The reported reception of **2 JZ** is also apparently in error, since **2 JZ** was unable to operate his station during every night of the tests and did not transmit any signals at all on the date reported.

No British station having the call letters **2 PO** was taking part in any of the individual transmissions in this country, and no station having these call letters can be traced in any of the published lists of British amateur transmitting stations.

It therefore appears that the only British station unquestionably heard in America with verified code words and other transmission was the special station of the Radio Society of Great Britain, **5 WS**, which was erected at Wandsworth for the tests, and that the only French station heard was **8 AB**, which is operated by M. Deloy, at Nice, France.

A general description of the erection of this special station, **5 WS**, has already been published,* and a technical description of the arrangement of the installation will be given shortly.

It is also of interest to know that two other reports have been received of the reception of the test signals sent out from this country, one report emanating from the operator of a vessel bound from New York to Europe, and the other from the operator of a station at Reykjavik, Iceland. These reports are as follows:—The ship operator was listening-in on a receiver using a single detecting valve, the fundamental wavelength of his relatively large ship aerial being reduced by means of a series condenser. Signals from **5 WS** were first heard on the morning of December 24th, when the vessel was 900 miles East of New York, and therefore approximately 2,500 miles West of London, taking a Great Circle measurement. On Christmas morning, at about 2,200 miles from London, **8 AB**, a French station, was heard, and signals from a British amateur station were intercepted, sending Christmas greetings, the call letters of this station being doubtful, but thought to be **2 SH**. It is interesting to note that this was probably the

**Wireless World and Radio Review*, Vol. XI, pp. 525-527, January 20th, 1923.

case, as **2 SH** located at Highgate, North London, was one of the British stations which was allotted an individual period during the tests. On the morning of the 26th, signals were again heard, including the code word **MUPZN**, which was apparently of British origin. This code word was the one allocated to British **2 OM** located at Brentford, Middlesex. At this time the vessel was approximately 1,900 miles from London. On the morning of December 27th, when the vessel was another 200 miles nearer England, signals from **5 WS** and **2 SH** were again copied. On the morning of December 28th **5 WS** was heard again by the vessel which was then another 200 miles nearer England. On December 30th, when still some 1,100 or 1,200 miles away, signals from the following British stations were heard :—

2 AW Wakefield, Yorkshire.
2 OM Brentford, Middlesex.
2 SH Highgate, London.
5 MS Manchester Wireless Society.
5 WS Radio Society of Great Britain.

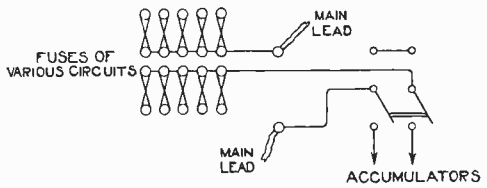
A French station **8 RRX** was also heard.

The operator at Reykjavik, Iceland, who was only able to listen-in on one or two nights, as the set was borrowed, reported that, using a single valve only, the signals from **5 WS** including the code word, were heard on December 24th, while later on the same morning the code word of **2 AW** was heard also.

Doubtless the American listeners had many sources of interference with as had also the British amateurs listening for their signals in the first part of the tests, and as several stations in this country had been granted by the Post Office special permission to use a transmitting power comparable with that employed by the American amateurs, the difference in the receptions in the two countries would seem probably to be due to the much greater use of radio-frequency amplification on this side. The general use of low-power transmitting stations in this country has doubtless been the cause of the development of the most sensitive type of receiver equipment suitable for the reception and amplification of short wave length signals.

Accumulator Charging.

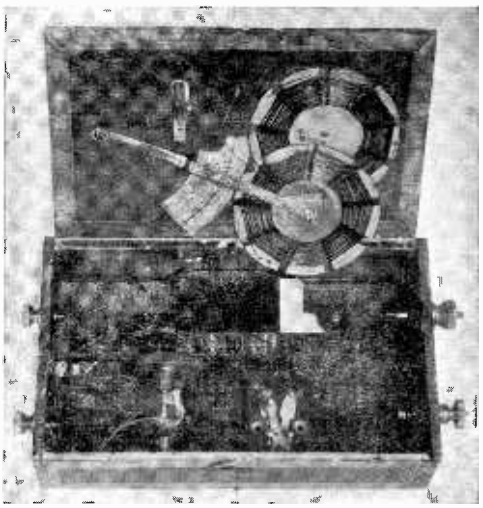
Where D.C. mains exist for house lighting it is possible to disconnect one of the main leads at the fuse-board and connect the accumulators to be charged in series with the supply. The lead which is at earth potential should be the one utilised, though the precaution should always be taken of well insulating the accumulators from earth, as a slight difference in potential may arise where a heavy current is passing along the mains.



This method of accumulator charging is costless and ensures a slow charging rate. The very slight diminution in the amount of light given out by the lamps in circuit is imperceptible. By means of a double-pole two position switch it is possible to connect the accumulators without interrupting the lighting. An article dealing with accumulator charging from D.C. mains appeared in the issue of January 27th, 1923.

Amateur Crystal Receiver.

A very simple yet effective receiver made up by a reader after studying an article in this



Official Crystal Receiving Set built in a cigar box and employing variometer tuning.

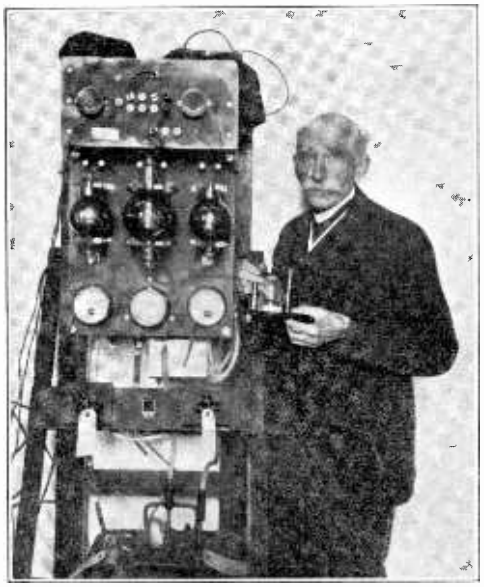
Journal. The principle is very similar to that employed in a constructional article for the beginner which appears on another page.

Dr. Fleming on the Thermionic Valve

A TALK BY THE INVENTOR ON ITS DEVELOPMENT AND ITS APPLICATION TO WIRELESS.

THE following is an address which was broadcasted from the London station of the British Broadcasting Company (2 LO) on the evening of February 16th by Dr. J. A. Fleming, F.R.S.

"Although it is my privilege at frequent intervals to address large audiences in scientific lectures, it is a new and interesting experience to speak by wireless telephony to an audience of hidden hearers scattered over a wide area, not one of whom can be seen or heard by the speaker. Wireless telephony is the very last word in the application of scientific knowledge to increase the convenience and pleasure of human life, and it is capable of being made a powerful impliment of popular education. Its development is entirely the result of the invention of a wonderful instrument, the thermionic valve, which is a veritable Aladdin's Lamp, annihilating distance and making all the world a theatre through which a single voice can reach. There are many to whom it is a sufficient pleasure merely to have music or speech from distant places laid on in their homes like gas or water for quiet enjoyment. They do not feel any curiosity to know how it is done or what were the stages of invention and discovery by which this modern miracle has been made possible. Others, however, are desirous to understand if possible, the means by which the astonishing feat is accomplished of listening-in without any wire connection to the singers at a distant opera or a concert performed perhaps hundreds of miles away.



A recent photograph of Dr. J. A. Fleming, F.R.S.

"As the earliest stages in the invention of the wireless valve were made by me at University College, London, between 1889 and 1904, it may interest some of those who are now listening to these remarks of mine by means of valve receivers, to have some short account of the beginnings of that invention.

"In 1882 the electric incandescent lamp so familiar to us all, was perfected by Edison and Swan. The first lamp consisted of a carbon filament or thread enclosed in a glass bulb from which all the air was pumped out. When an electric current was sent through the thread it glowed with a brilliant light. It was soon found that the bulb became blackened on the inside as the lamp was used, and the filament or thread was after a certain time burnt through at some place by excessive heating. In the course of my experience as scientific adviser of the Edison Electric Light Company, I noticed that in some lamps there was a clear line on the glass bulb on which no blackening took place, which indicated that the carbon particles had been shot off from the overheated point in the filament in straight lines. The undamaged half of the hairpin-shaped filament by intercepting this shower of carbon atoms caused a sort of shadow or line of no black deposit to be produced on the inner surface of the bulb. A little later on I found that these particles thus shot off were all electrified with so-called negative electricity, that is the kind of electricity produced by rubbing a stick of sealing wax with a bit of flannel.

"At that time it seemed that these charged particles were atoms of carbon, but we did not know then that chemical atoms are built up of still smaller particles called electrons.

" For the sake of those who are not scientific, a few things may be mentioned which are definitely established by countless experiments in modern chemistry. All material substances we know are composed of little particles called molecules. A molecule may be described as the smallest portion which has the distinctive qualities of that substance. Thus a molecule of table salt is the smallest possible part which has the properties of salt. But molecules in turn are built up of atoms of elementary substances. We are acquainted with about 82 different kinds of atoms, and little groups or bunches of these form all the vast variety of substances we know, just as little groups of selections of the 26 letters of the alphabet build up all the thousands of different words we write.

" It used to be thought that atoms were not capable of being divided. The very word atom comes from two Greek words signifying not able to be cut up. The great discovery was, however, made about 1898 or 1899, by Sir Joseph Thomson, the present Master of Trinity College, Cambridge, that chemical atoms of matter are built up of still smaller atoms of electricity called electrons, and it was soon found that the incandescent filament of an electric lamp is sending out vast numbers of these little electrons. An atom of matter is a very small thing—it would take about 25 million of them, put in a row like marbles, to make up the length of a single inch. But an electron is as much smaller than a chemical atom as a grain of dust is smaller than the dome of St. Paul's Cathedral.

" The next step of invention was made in 1904, when I placed around the filament of an electric lamp a cylinder of metal sealed inside the bulb, and found that a current of negative electricity could be sent from the filament to the cylinder but not in the opposite direction. This at once gave us a means for converting the feeble but rapid to-and-fro motions of electricity in an aerial wire, which are set up when electric waves from a distant transmitting station strike the aerial wires, into a current of electricity all in the same direction by including in the circuit such a lamp with cylinder round the filament. I therefore called the instrument a valve because it acts, as regards electricity, as a valve in a pump acts for air or water. It is now called a thermionic valve.

" Next a word must be said as to the processes of wireless telephony. At the transmitting station there are special kinds of valves called three-electrode or transmitting valves, which create in the aerial wires at the broadcasting station powerful to-and-fro or oscillatory or vibratory electric currents. These in turn create in all surrounding space effects called electric carrier waves, which fly out in all directions. At the broadcasting station there is also a device called the microphone, which picks up the sound of the speaker's voice or of the music and causes the carrier waves to be increased or diminished in amplitude or strength in accordance with the ever varying amplitude or pressure of the air waves of the speaking voice. When the modulated carrier waves strike the aerials of listeners they produce in them electric currents which are a feeble copy of those in the transmitting aerials. If, then, the receivers contain a rectifying valve or a crystal detector, these pulsatory currents are converted into a flow of electricity all in one direction through the receiving telephones, and this causes them to emit a sound of the kind made to the transmitting microphone.

" Subsequently to my invention of the two-electrode valve, De Forest, in America, introduced the grid or spiral of wire placed between the filament and the metal cylinder, which converted it into a so-called three-electrode valve. This enabled the valve to amplify electric oscillations as well as rectify or detect them. In its most recent types, which are the outcome of the work of many able inventors, the valve can perform three duties—it can detect electric vibrations, amplify or magnify them, and also create them, and it can truthfully be described as the master weapon of the radio engineer. Without it wireless telephony would be only the occasional feat of experts. With it wireless telephony has become the everyday amusement of thousands of amateurs in their own homes."

Radio Society of Great Britain.

At the next Meeting, to be held at 6 p.m. (tea at 5.30 p.m.) on Wednesday, February 28th, at the Institution of Electrical Engineers, Mr. Philip R. Coursey will describe the Society's station used in the Transatlantic Tests.

The second of a series of lectures, especially arranged for associates, took place on February 16th, when Mr. Maurice Child gave an elementary lecture and demonstration. Much benefit can be derived from these attractive instructional lectures by those new to wireless. Associateship is open to all interested in the subject, and the annnal subscription is five shillings.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Kensington Radio Society.*

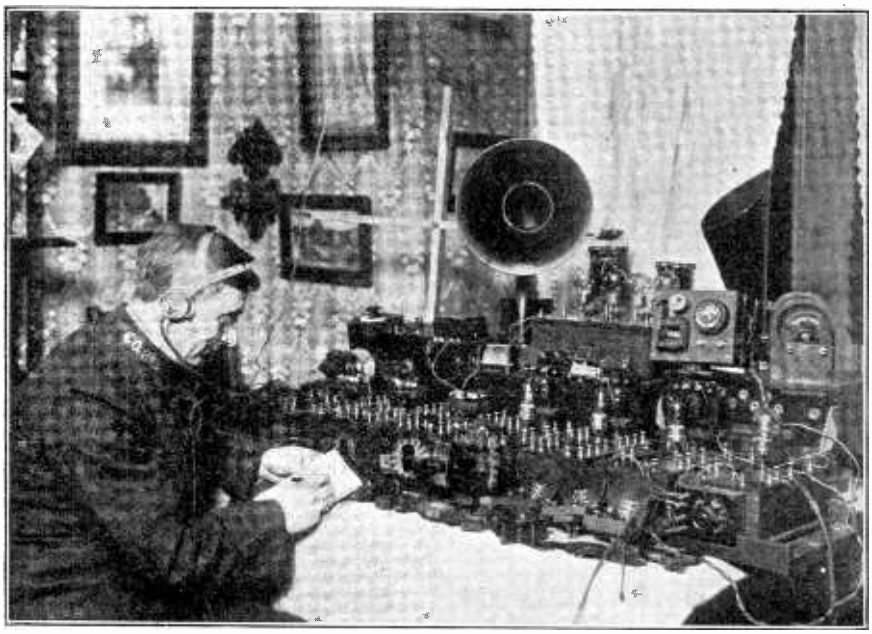
Hon. Secretary, Mr. John Murchie, 2, Sterndale Road, West Kensington, W.14.

The annual meeting was held at headquarters on January 4th, when the Secretary presented a report of the Society's activities during the past year.

The new President, Mr. J. H. Reeves, M.B.E., gave an address and followed this up by a lecture on his experiments with the design of H.F. transformers for short wavelengths. Later, a most interesting discussion took place on the points raised.

The minutes of the last annual meeting were read and confirmed. The balance carried forward was £5 15s. 1d.

The present officers submitted their resignations and the following were elected for 1923:—President, Captain C. T. Hughes, R. E.; Vice Presidents, Lt.-Col. K. E. Edgeworth, D.S.O., M.C., Mr. A. F. Hogg, M.A., F.C.S., Mr. A. Vinycomb, D.Sc., Mr. W. L. McPherson, B.Sc., Mr. W. T. James, Mr. Goldstone; Hon. Secretary, Mr. H. J. South,; Hon. Asst. Secretary, Mr. A. G. Beeson; Hon. Treasurer, Mr. G. Powling; Librarian, Mr. P. Smith; Custodians of Apparatus, Mr. M. A. G.



Police Constable William Wooding of the Metropolitan Police Force with his home-made seven-valve set unit and four-valve amplifier on which he has received broadcast telephony from America.

The Hon. Secretary will be pleased to give particulars to any person desirous of joining the Society (whether in the possession of a broadcast or experimental licence).

Woolwich Radio Society.*

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.

The annual meeting of the above Society was held at the Y.M.C.A., Woolwich, on Friday evening, January 26th, 1923, at 8 p.m. Captain C. T. Hughes, R.E., Vice-President, being in the chair. Beeson and Mr. F. Cameron; Committee, Messrs. Houghton Frazer, Potter, F. W. Smith and Cameron.

A hearty vote of thanks was passed to all the gentlemen who had rendered valuable services during the year, and to Mr. Ellam and Mr. Morley for gifts of apparatus.

The result of the competition organised for the crystal set of home construction which was the most simple and efficient, was then announced. The first prize, a pair of Brown's H.R. telephones,

was awarded to Master F. Edwards; the second prize, a W. & M. variable condenser, to Mr. G. Dowling; the third prize, a complete aerial, to Mr. F. W. Smith.

Intending members are welcomed at any weekly meeting on Wednesday evenings at 8 p.m., at the Y.M.C.A., Thomas Street, Woolwich.

The East London Radio Society.*

Hon. Secretary, Mr. S. D. Simmons, 60, East Ferry Road, London, E.14.

On Tuesday, January 30th, two interesting short lectures were given in the Lecture Hall, Woodstock Road, E.14, by Mr. A. J. Alexander and Mr. J. Keens.

Mr. Alexander gave a lucid description of a non-radiating two-valve (H.F. and Detector) set, from which he had had excellent results. He impressed upon the members the necessity for all amateurs holding experimental licences, to use some such circuit as this when conducting experiments during broadcasting hours.

Mr. J. Keens followed with very informative details as to the construction of an accumulator H.T. unit.

The Secretary of the Society will be pleased to hear from all amateurs in the district, and visitors to the Lecture Hall, Woodstock Road, E.14, will receive a cordial welcome any Tuesday or Friday evening after 7.30 p.m.

Ramsgate, Broadstairs and District Wireless Society.*

Joint Hon. Secretaries, Mr. F. Harrison, "Rochester Cottage," St. Lawrence, Ramsgate (Ramsgate), and Mr. F. C. Marshall, 6, Ramsgate Road, Broadstairs (Broadstairs and District).

During the month of February, Mr. James Hunt, who has been elected to the Committee, gave some very interesting lectures on "Transformers" with practical demonstrations. Mr. Hunt, who has evidently studied his subject with much care, has been keenly followed by the members week by week, and all state that much valuable information has been received. Mr. Hunt has been cordially thanked by the Society for the trouble and time he has devoted to making his lectures so lucid and instructive. The Society is pleased to state that Mr. Hunt has received with great clearness the American Concert transmitted on Saturday, January 20th, from WJZ, which included music and a speech on the "Ruhr Question" by a Mr. Abbott, the concert being transmitted from a Studio at 11, West 49th Street, New Jersey City.

The Society's membership shows an increase over that of last month, and the membership list is now nearing fifty. Mr. W. R. Greatwich of "St. Benets" Ramsgate, has been elected a Vice-President of the Society.

Wolverhampton and District Wireless Society.*

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

An exceedingly interesting and instructive lecture was given to the above Society by the Vice-President, W. E. Fisher, Esq., D.Sc., on Wednesday, January 31st, entitled "Oscillations," a large number of wireless experimenters being present.

Dr. Fisher, in his discourse, treated the subject of oscillations from several standpoints, including those of sound and light, mentioning that most of our ideas on the subject have been evolved from sound, giving as illustrations the vibrations of a tuning fork or of a fiddle string, and explaining that the medium through which vibrations pass fixes the speed, also pointing out that the transmission of light across space proves that there is a medium.

The lecturer went on to say that we cannot have an electric current without an effect on space. Emphasis was laid on the fact that there was a marked resemblance between the transmitter and the receiver, and that good radiators were also good absorbers.

The theory of the wave motion was dealt with in a most scientific manner, showing why wireless waves differed from other kinds, and the reasons for the use of long and short wavelengths, etc.

The appreciation of the audience was shown by the applause and the thanks accorded to Dr. Fisher at the conclusion of the lecture.

Smethwick Wireless Society.*

Hon. Secretary, Mr. R. H. Parker, F.C.S., Radio House, Wilson Road, Smethwick, Staffs.

At a meeting held at the Society's headquarters on January 12th, the syllabus of forthcoming lectures was discussed, some sixteen lectures, visits and field days being arranged.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. Moore, 175, Leavesden Road, Watford.

On Friday, January 26th, the above Society made a break in the usual programme of lectures, and gave a wireless demonstration at headquarters, a four-valve set with Amplion loud speaker being kindly lent by Mr. Christie for the occasion.

The fact that the large room used by the Society was packed with visitors proves the popularity of the subject in the town.

Mr. Christie commenced proceedings at 8 p.m. with a general survey of the basic principles of wireless telephony. Later on 2 LO was tuned in and music and speech were plainly audible all over the room.

In view of the popularity of this demonstration, the Society propose giving others in the near future.

Haileybury College Wireless Society.

Hon. Secretary, Mr. D. H. Carter.

This Society was formed last term (October, 1922) with Dr. Thomas, M.A., B.Sc., LL.B., Ph.D. as President; J. C. Yule, Esq., as Vice-President and Hon. Treasurer and D. H. Carter as Hon. Secretary. Other members of the Committee are Messrs. R. R. C. Armour, R. Griffith, C. H. Lankester, H. R. Mappin, J. B. Miller, and R. F. Wilson. The total membership for the greater part of last term was 87.

The object of the Society is educational, and with this end in view, lectures were held fortnightly last term; and this term an aerial is to be at the disposal of members, on which to use their own and the Society's apparatus.

Cricklewood Radio Club.

The first meeting of the above club in their new rooms at the old Billiard Hall, St. Peters' Church was held on February 3rd, at 8 p.m.

The Chairman, Mr. James C. Fisk, in opening the meeting, set forth briefly for the benefit of new members the objects of the club and promised

attractions in the shape of lectures, experiments, and demonstrations each week. At 8.45 p.m., Mr. H. Stopher of the Technical Committee was called upon to give the first of a series of progressive lectures which proved to be very instructive.

The Wisbech and District Radio Society.

Hon. Secretary, Mr. A. Hopkin, 13, Victoria Road, Wisbech.

The above Society has been formed, and those interested who reside in the district are invited to join.

Swansea and District Radio Experimental Society.

Hon. Secretary, Mr. Herbert T. Morgan, 218, Oxford Street, Swansea.

On January 24th at their headquarters, the Y.M.C.A., a very interesting lecture on "The Thermionic Valve" was given by Mr. H. Mactaggart, of the General Electric Company.

He concluded his lecture by answering many questions and clearing up debatable points. The lecturer also referred to the four-electrode valve, and has promised a demonstration and lecture on this valve at an early date.

Leeds Y.M.C.A. Wireless Society.

Hon. Secretary, Mr. N. Whiteley, Y.M.C.A., Albion Place, Leeds.

A meeting was held at headquarters at 7.45 p.m. on January 22nd, with Mr. G. Boocock in the chair. After the minutes of the previous meeting had been read and accepted, the Chairman called upon Mr. Toynbee to give his paper entitled "Accumulators, their Construction, Action and Treatment." Mr. Toynbee dealt with his subject in an exceedingly able manner, and at the close dealt with various questions asked regarding the Edison Nickel Cell, etc. The lecturer was thanked with much enthusiasm.

To stimulate an interest in telegraphy, Mr. Whiteley then gave an interesting description of commercial working, and announced the formation of a Morse class.

The meeting room has now been fitted up with all the necessary tools and appliances, and work has been commenced on the Society's four-valve set, so that operations can be commenced when the licence arrives.

The next meeting was held on January 29th, at 7.30 p.m., the chair being taken by Mr. G. Boocock. The evening was devoted to general discussion, one item, the proposed aerial, bringing forth a storm of suggestions. The club-room is situated in the basement of the building, and does not hold a very ideal position for the use of an outside aerial. Experiments will be made with frame aerials and also lighting mains.

Mr. R. H. Toynbee was elected Chairman for the ensuing month.

The following are the present arrangements:—Monday nights, at 7.30, lecture or discussion; Wednesday nights, at 7.30, workshop night and Morse class; Saturday afternoon and other times as required, workshop practice.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

A meeting of the Radio Society of Birkenhead took place on January 18th. Buzzer practice was held at 7.30, taken by Mr. McKinlay, a skilled operator, and at 8 p.m. the Chairman, Mr. King, called upon Mr. McKinlay to deliver a lecture on accumulators. The lecturer, in a very able manner, described the action and construction of an accumulator, showing the difference between the dry battery and the accumulator.

Mr. McKinlay has very kindly presented the Society with some excellent diagrams of various ship sets. A very lively discussion took place after the lecture, and many questions were asked as to the mysterious fading effect of **2 LO** which is experienced in these parts.

Hoylake, West Kirby and District Wireless Association.

Hon. Secretary, Mr. J. D. Wood, 7, Grosvenor Road, Hoylake.

A general meeting was held at the Green Lodge Hotel, Hoylake, on January 22nd, when the chair was taken by the Vice-President, Mr. S. Evans, A.M.I.E.E. In the course of his opening remarks, Mr. Evans referred to the ladies' meeting held on February 5th, when through the courtesy of Mr. G. V. Wall, members and their lady friends were enabled to listen-in to a concert from one of the B.B. Company's stations. The Chairman then called upon Mr. Waygood, A.M.I.E.E., to give his lantern lecture on "Transformers."

The lecture, with its many excellent lantern views, was thoroughly appreciated by all present, a detailed and lucid exposition being given of the theory, construction, and evolution of the modern transformer. Among the lantern views of large transformers was one of a three-phase transformer weighing 2 tons 17 cwts., which is cooled by immersion in a tank containing 5 tons of oil. The terminals on this transformer measure 8 ft. in length and are built in the form of a condenser in order to cope with the pressure of 100,000 volts.

Questions were answered by Mr. Waygood at the conclusion of his very informative lecture. Mr. J. H. Harley proposed a vote of thanks, which was seconded by Mr. S. Evans, who also proposed a vote of thanks to Mr. S. H. Cocks for his handling of the lantern.

The Portsmouth and District Wireless Association.

Hon. Secretary, Mr. S. G. Hogg, 9, Pelham Road, Southsea.

Undoubtedly the best resolution this Association could have made to begin the New Year was its application for affiliation to the Radio Society of Great Britain.

At the annual meeting of the club held in December, Mr. J. H. C. Harrold, A.M.I.R.E., was elected President of the Club for the present year, and at the meeting of the Association held on January 24th Mr. Harrold delivered his Presidential address.

After returning thanks for his election as President, Mr. Harrold promised to do his utmost for the club, and be worthy of the honour of the Presidential Chair. He then gave a short address on wireless telegraphy in general, explaining the advancement that it had made. Upon request, the President then explained that a single aerial is preferable, but there are limits to the heights to which they may be erected. There was a tendency to erect them as high as possible, which, however, only increased the number of spark signals, and decreased the C.W. signals.

Meetings are held at the Club-rooms, situated at The John Pile Memorial Rooms, 44, Fratton Road, Portsmouth, on Wednesday evenings at 7.30 p.m.

C

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

An interesting evening was spent by the members of the Huddersfield Radio Society on Tuesday, January 23rd, in listening to Mr. J. L. Goss's explanation of the Society's receiving set. Mr. J. A. Badham occupied the chair, and there were about 30 members present.

Mr. Goss stated that the set had been designed and built by the technical committee. Three valves were employed, and provision was made for the addition of two more valves. The set was housed in a polished mahogany cabinet, and each valve was mounted on a separate panel, in order that any combination of circuits could be tested. The tuning unit was separate, and of the well-known three-coil type. This was designed and constructed by Mr. J. W. Jowett, of the technical committee. The moving of the tuning coils was operated by heavy brass gears, and all terminals, switches, and other fittings were nickel plated. The instruments worked exceedingly well, and Manchester broadcasting could be heard with the 'phones on the table.

A vote of thanks was proposed by Mr. P. Priest.

Durham City and District Wireless Club.*

Hon. Secretary, Mr. E. H. Chapelow, 2, Brierville, Durham.

At the meeting held on January 26th the Chairman announced that on account of business changes, Mr. G. Barnard had tendered his resignation. Pending the annual general meeting, the Committee have appointed Mr. E. H. Chapelow, of 2, Brierville, Durham, to succeed to the office. Mr. Chapelow is a well-known local citizen, and will commence his duties with the best wishes and active support of his club colleagues.

Mr. Chas. Donaldson, of the Postal Service, gave a lecture on the "Electron Theory." The lecturer gave much valuable information, and concluded by giving some very interesting illustrations of the uses to which "wireless" was put during the war. A hearty vote of thanks was accorded to Mr. Donaldson at the conclusion.

Radio Society of Wallasey.*

Hon. Secretary, Mr. C. D. M. Hamilton,. 24, Vaughan Road, New Brighton.

The annual general meeting, held on December 20th, 1922, brought to a close a most successful session. The election of officials for 1923 was arranged, and the vacancies were filled as follows:—President, Mr. J. C. Mason; Vice-President, Mr. F. Cowan; Hon. Treasurer, Mr. W. F. Mills; Hon. Secretary, Mr. C. D. M. Hamilton; Assistant Hon. Secretary, Mr. W. Smith; Committee, Messrs. Bellas, Martin, McBride, Taylor, Roscoe and Wood.

The Presidential address was delivered on December 27th, Mr. Mason selecting "Ohms Law" as the subject of a most interesting lecture.

January 3rd was an open night, the evening being devoted to the settlement of various difficulties advanced by the members.

Mr. Roberts very kindly gave a continuation of his lecture, "The Earth in the Aether and Unsolved Problems" on January 10th. As usual Mr. Roberts' lecture raised many points of interest which were discussed at length.

On January 16th a valuable lecture on "Direction Finding" was delivered by Mr. R. H. Taylor.

The Working Mens' College Wireless Club.

Hon. Secretary, Mr. A. Fryatt.

A dance was given by the above club on January 5th, 1923, to aid the club's funds, and thanks to the efforts of members of the College and their friends, it was a great success.

With the proceeds it is proposed to install a powerful receiving set, and to convert the present cabin into a cosy parlour in order that members can invite their friends to listen in on specified evenings to the broadcasted performances now being given by Marconi House and other stations in England.

The club greatly appreciated the broadcasting of the Covent Garden Opera, which was splendidly received.

All who wish further particulars of the Club are asked to communicate with the Secretary, at the Working Men's College, Crowndale Road, N.W.

The Hinckley and District Radio Society.

Hon. Secretary, Mr. W. Bliss, The Haven, Cleveland Road, Hinckley.

The recently formed Society held its first meeting on January 16th at the premises of Messrs. W. Ward & Son, who have placed a room at the disposal of the Society until suitable accommodation is forthcoming. Rules of the Society had previously been drawn up by the committee, and these were explained to the meeting and copies distributed.

The Secretary reported that several prominent gentlemen had been approached with a view to their election as Vice-Presidents, but there had not been time to receive replies.

The question of securing permanent premises was discussed, and the Secretary instructed to ascertain whether a room was available at the Grammar School. Several new members were enrolled, and it was decided to form a Morse class.

Meetings will be held on alternate Tuesdays.

St. Bride Radio and Experimental Society.

A meeting was held on Tuesday, January 9th, at St. Bride Foundation Institute, Bride Lane, E.C.4, when a Formation Committee was established to make preliminary arrangements, draft rules, etc. The Committee met again on Tuesday, January 23rd, and have now completed all the details necessary to place before a general meeting. This meeting, which will be held at a date in the near future, will be preceded by a short address and demonstration by an influential gentleman who has kindly consented to become President of the Society. Due notice will be given in the technical Press, but anyone interested should send his name to the Hon. Secretary at the above address, when notice of meeting will be posted.

Proposed Radio Club at Grays (Essex).

In connection with the proposed formation of a radio club for Grays and District, a meeting was held at the Victoria Hall, Grays, on February 1st. It is hoped that all wireless enthusiasts in the district, whether already possessors of sets or not, will communicate with Mr. L. Freeman, of the Empire Theatre, Grays, and help to make the club the success it already promises to become.

Notes.

The Opening Ceremony at 5 WA.

The opening of the new Cardiff Broadcasting station **5 WA**, and the formal inauguration of the Service, was performed by the Lord Mayor of Cardiff, Alderman Dr. J. J. Biggs, on the evening of Tuesday, February 13th.

The Mayor of Cardiff speaking into the microphone on the occasion of the opening of the Cardiff Broadcasting Station. Among those present are :—Sir William Noble, Lord Gainsford, Mr. Cory and Mr. J. C. W. Reith.

The Progress of British Broadcasting.

With the addition of the Cardiff station (**5 WA**), which was opened on February 13th, there are now five broadcasting stations in operation in Great Britain. The sixth will be the Glasgow station, which is expected to be opened on Monday, March 19th. This station will have the call letters **5 SC**, and will carry out transmissions on a wavelength of 415 metres. There is also some talk of establishing a station at Plymouth in accordance with the Postmaster General's original plan, but up to the present no decision has been reached.

Reserve of Air Force Officers.

The Air Minsitry announces a decision to expand the reserve of officers by the entry as officers of a number of ex-officers of the Flying Services and others with special qualifications for flying and technical duties. The Air Ministry is accordingly prepared to receive applications for enrolment from officers who served as pilots in the R.F.C., R.A.F. or R.N.A.S. in the war, and gentlemen qualified as civilian pilots or possessing technical qualifications, including wireless telegraphy and signals. Full details and forms of application may be obtained from the Secretary, Air Ministry, Kingsway, W.C.2.

Bamberger Broadcasting Station (WOR).

Experimental telephony transmissions will be made commencing at 12 p.m. (New York time) on February 23rd, with a view to bridging the Atlantic. A special concert is being arranged, and it is hoped on this occasion that reports of successful reception will be forthcoming from experimenters in Europe.

The 450 metre French Telephony.

L'Ecole Supérieure des Postes, Télégraphes et Téléphones de Paris, is conducting, from its technical laboratory, special telephonic transmissions. This laboratory conducts research work in all branches of wireless telegraphy and telephony. At the present time the experiments consist in trying out from the point of view of volume and quality all possible types of wireless telephone transmitters, and in order that these tests shall be as exhaustive as possible, transmissions of all kinds, such as speech, music, and songs, are included in the programmes. The transmissions take place regularly on Tuesday and Thursday evenings from 7.45 to 10 o'clock, and on Saturday afternoons from 4.30 to 7.30. The wavelength used is 450 metres with 500 watts in the antenna. The transmissions commenced on January 23rd last. Many reports are received in this country of these transmissions, whilst in Paris and neighbourhood reception is excellent on a crystal. This station is proposing to transmit lectures of an educational nature, which will undoubtedly be very much appreciated.

Four Broadcasting Stations Received on a Crystal Set.

A Burnham-on-Sea reader, Mr. L. Lott, using a Pericon crystal receiver only, has succeeded in hearing four of the five British Broadcasting Stations. Birmingham and Manchester, as would be expected, were heard loudest with Newcastle fainter, but as far as the music was concerned fairly distinct. These results were obtained by using a single-valve circuit with no reaction, and then changing over to the crystal. Another experimenter, Dr. Burns, President of the Burnham, Highridge and District Wireless Society has also been successful in receiving three of the five stations on a similar circuit.

Death of Professor Röntgen.

Professor Wilhelm von Röntgen, the well-known German physicist and discoverer of X-rays, has died at Munich at the age of 78. Röntgen was born at Lennep in Rhenish Prussia, and became Professor of Physics in the University of Würzburg in 1885. It was while carrying out some experiments with the Crookes tube that Röntgen discovered the existence of what he called "X"-rays,

Professor Wilhelm von Röntgen.

and which are now associated with his own name. It was readily perceived by Röntgen himself and many other physicists that his discovery must give a new turn to the then current view of the constitution of matter. Other workers correlated this and subsequent discoveries with their own observations in electrical science, and the movement may be said to have culminated in the epoch-making discoveries of Bragg and Rutherford and our present achievements in wireless telegraphy and telephony. The application of Röntgen rays to the treatment of disease is a familiar feature in present-day surgery and their use in the industries as a means of examining opaque bodies for internal structure and defects is extending rapidly.

Wireless Sets Wanted for Hospitals.

The good work carried on by the Alexandra Musical Society in providing entertainments for the wounded soldiers and sailors still in hospital and other sick persons in hospitals and sanatoria demands the greatest support and encouragement. Wireless entertainments have been successfully introduced, and have met with great appreciation and the President of the Alexandra Musical Society, The Rt. Hon. Lord Leigh, makes an appeal for gifts of wireless receiving sets for the hospitals of the West Midlands, etc. Firms willing to help in this direction should write to Mr. E. C. Thomas, 249, Albert Road, Aston, Birmingham.

Wireless Developments in Brazil.

Rapid developments in radiotelephony are expected to take place in Brazil with a consequent wide demand for receivers. Radio apparatus hitherto entering Brazil has mainly been of German or United States origin. Importers of wireless apparatus are at present required to obtain a special permit issued by the Department of Transportation and Public Works, but the Government has been approached upon the question of abolishing or modifying such restrictions so as to admit of a wider market for radio apparatus. A wireless service has been established between the Republics of Brazil and Mexico under treaties concluded between the two states. German enterprise, it is reported, is seeking to obtain a concession for the introduction into Mexico of radiotelephone broadcasting.

A party on the Euston to Liverpool express train listening to a broadcast entertainment. The experiment was carried out by Captain G. R. Willans, of the Marconi Company.

The Sterling Telephone Company's Booklet.

Publication No. 342 of the Sterling Telephone and Electric Co., Ltd., Tottenham House, Tottenham Court Road, London, is an illustrated catalogue of this well-know firm's radio receiving sets from crystal to multivalve.

A Leeds Firm's New Branch.

The British Wireless Supply Co., Ltd., of Leeds, has added to its branches showrooms at 64, Frith Street, Shaftesbury Avenue, London, where demonstrations are held daily, and a full line of the firm's manufactures can be examined. This concern has also opened a new experimental laboratory and test department at Virginia Mills, Leeds.

Messrs. Burndept's New Catalogue.

In the form of a well printed and artistic booklet, Messrs. Burndept, Limited, of Eastnor Works, Blackheath, S.E.3, have issued a catalogue of the amateur and experimental receiving equipment manufactured by them. Descriptive details and numerous illustrations make this publication, the price of which is 1s., an attractive and useful guide to all who are interested in wireless.

A Handy New Terminal.

The Birmingham Products Co., of 11, Summer Row, Birmingham, are manufacturing a new type of small terminal which is particularly useful in experimental work.

A Year Book for the Amateur and Experimenter.*

THE enormous increase in the serious interest taken in Wireless in all its branches has added to the ranks of the Amateur and Experimenter to such a degree that it was felt that a Year Book specially devoted to their interests was not only desirable but absolutely necessary. The publishers of *The Year-Book of Wireless Telegraphy and Telephony*,† have therefore filled the gap with a special edition devoted solely to these interests. Its 864 pages are chock-full of wireless interest arranged in a systematic and concise form facilitating easy reference to any Wireless Want.

In addition to the usual Year Book contents there is a complete Historical Survey of Wireless from its birth up to the present day, written by J. St. Vincent Pletts, a well-known authority on Wireless. A specially compiled section giving the Laws and Regulations of the countries of the world regarding Amateur, Experimental and Broadcast wireless shows at a glance the position of the Amateur, the Experimenter and the Broadcast Receiver, with regard to the laws of the particular country in which he is domiciled. A Directory of Wireless Traders, included at the end of this section, should prove of considerable value to those who wish to purchase either complete sets or accessories for making up their own instruments.

Every listener-in wants to know who and what the signals are that he is receiving; the Directory of the World's Wireless Stations, containing every known land, ship and air station, in conjunction with the specially drawn map section, printed in two colours, forms the most complete and detailed information yet published. Ready reference is obtained at a glance to any station from its call letters, or *vice versa*.

Similarly, a section containing the most up-to-date information on Hydrographic, Meteorological, Time and General Signals, with explanation and tabular transmission lists for every country of the world, enables any such signal to be recognised and decoded. The section has been prepared by W. G. W. Mitchell, whose articles in this journal have been so much appreciated.

Direction Finding is a subject of growing importance, and is taken care of in a special section where an instructive article by R. L. Smith-Rose is followed by the Regulations and Procedure in force for Direction Finding in the various countries of the world. "Recent Progress in Automatic Reception," "Aerials," "Valve Design and Manufacture," and "Multiple Aerial Arrangements," form the subject matter of the four special articles specially written for this Year Book. A complete Patent section, with an article on the Valve Patents of 1922 and British and American Patent Specifications for the past year, give the Patent situation to date.

Progress in Aviation Wireless has been consolidating during the past year, and an article by an official of the Air Ministry gives, in a clear and interesting manner, the position of Wireless in its relation to Civil Aviation. Much other useful information combines to form an Aviation Section.

Ready reference to data for necessary wireless calculations is difficult and involves, usually, perusal of several publications. A Useful Data Section giving Definitions, Foreign Equivalents, Useful Tables and Graphical Symbols for Wireless Diagrams, should do much to obviate this and bring to hand much that takes precious time to search for.

Company Notices, Biographies, Obituary Notices, a Literary Index, and a Code Section are self explanatory from their titles, and are more complete than has yet been possible to produce in the advance of the science and practice of Radio.

Mentioned last, but by no means least in importance, is the extensive Amateur and Experimental Section in which the Editor of *The Wireless World and Radio Review* gives a *résumé* of the Amateur and Experimental situation. This is followed by a Directory of the World's Wireless Societies, Call Signs and particulars of British and French Experimental Transmitting Stations, and a List of Regular Transmissions.

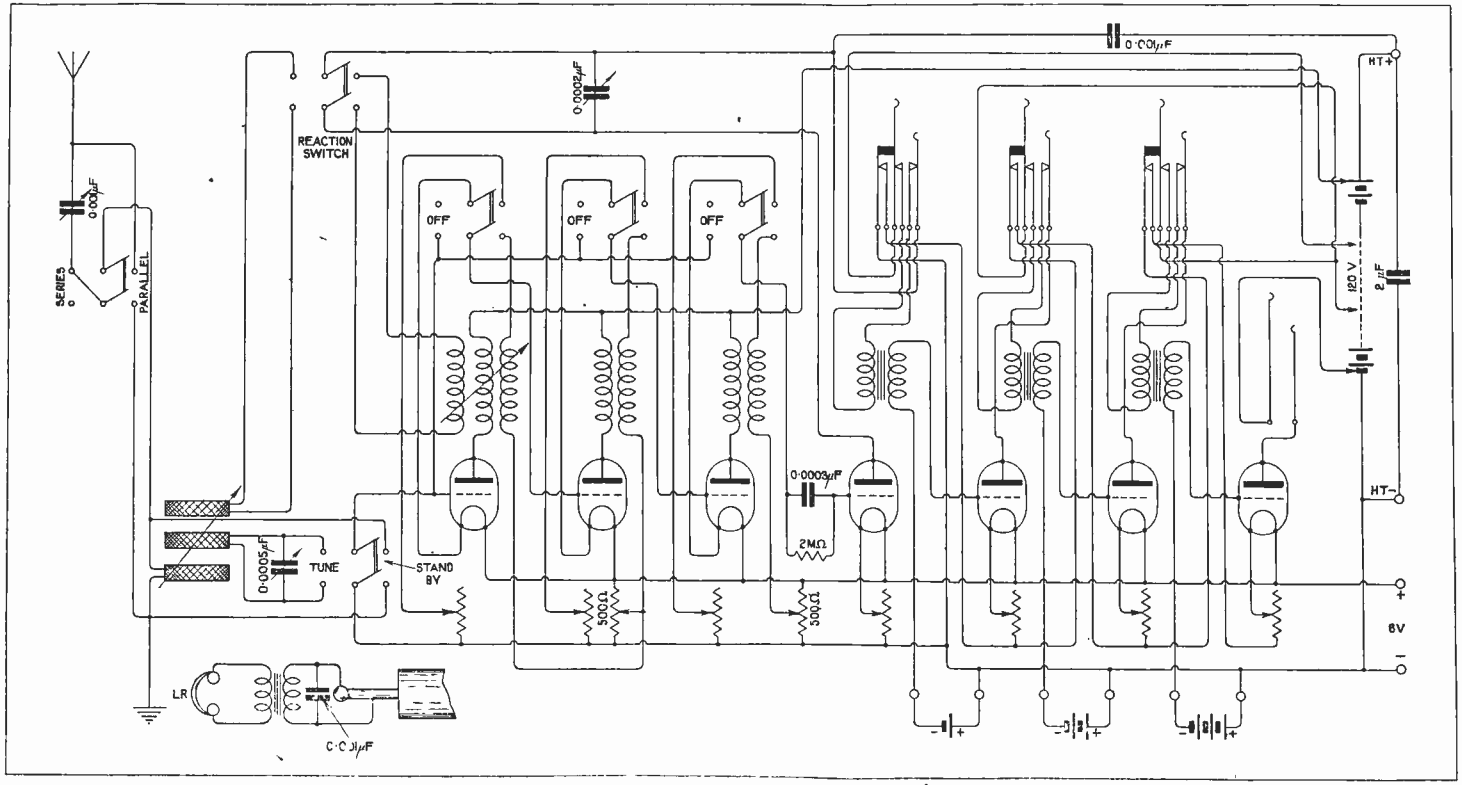
Every Wireless enthusiast should obtain a copy of this Year Book. By so doing he will save much anxious thought and render his experiments all the more interesting by reason of his having to hand reliable information for ready reference.

E. A. G.

* *The Year-Book of Wireless Telegraphy and Telephony*. 6s, nett. The Wireless Press, Ltd., 12-13, Henrietta Street, W.C.2.

† *The Year-Book of Wireless Telegraphy and Telephony*. 15s. nett. The Wireless Press, Ltd., 12-13, Henrietta Street, W.C.2.

CIRCUIT OF A SEVEN-VALVE RECEIVER.



The diagram gives the connections of a seven-valve receiver—three H.F. transformer coupled, detector and three L.F. stages. The aerial circuit has a series-parallel and a stand-by and tune switch to facilitate tuning. The number of H.F. stages in circuit may be varied by the double-pole, throw over switches. The normal grid-potential of these valves is variable with the potentiometer. The detector valve is always in circuit. With certain types of H.F. transformers, the primary windings are tuned with a variable condenser having a maximum value of 0·0002 mfds. The telephones are connected with a telephone transformer to a plug, which may be inserted in any of the jacks connected to the anode circuit of the L.F. valves. The H.T. voltage applied to different portions of the circuit is variable. Cells are connected in the grid circuits of L.F. stages to secure best operation. When valves are cut out by the operation of the switches, the filament circuits are disconnected. By means of the reaction switch, reaction may be obtained by coupling the reaction coil with either the secondary tuner coil, or with a H.F. transformer. The circuit should be of great assistance to those who wish to connect switches and jacks to a receiver. From a study of the diagram it should be an easy matter to provide for one's own particular requirements.

Radio Society of Great Britain.

REPORT OF ANNUAL CONFERENCE HELD ON JAN. 24th, 1923.

The Annual Conference of Wireless Societies affiliated to the Radio Society of Great Britain took place on Wednesday, January 24th, at 2.30 p.m. at the Institute of Electrical Engineers.

Admiral of the Fleet Sir Henry B. Jackson, retiring President, at the commencement of the proceedings took the chair in the absence of the President, Dr. W. H. Eccles, F.R.S., who was unavoidably absent. After the minutes of the last Annual Conference held on January 25th, 1922, had been read and confirmed,

Admiral Sir Henry Jackson, addressing the Conference, said :—

It gives me great pleasure again on behalf of the Radio Society of Great Britain to welcome the delegates from the affiliated societies, and I can only reiterate the views which I expressed last year and hope that the delegates will unhesitatingly give voice to their opinions. In the absence of our President, Dr. Eccles, I am taking the chair, but as I have to leave in less than an hour, I am going to ask our Chairman, Mr. Hope-Jones, to conduct the proceedings.

We have had a busy year, and we in the Society in London have done our best to meet the difficult situation we have been faced with. I hope you will bear in mind that in working for the good of all people interested in wireless, especially the amateur experimenters, the Society has done good and valuable work. and that in all matters we have had the interests of you all in front of us.

I will now ask Mr. Hope-Jones to take the chair and conduct the proceedings of this Conference.

Mr. F. Hope-Jones.

This is the fourth Annual Conference and it has been prepared for in the ordinary manner by circularising the various affiliated societies (of which there are now one hundred and twenty-five), with suggestions for the Agenda to be discussed. From that circular has of course arisen a very considerable mass of correspondence from the various Secretaries. particularly of those societies who either are too far off, or for other causes have been unable to send delegates. I think it is only fair that I should read some part at any rate of their letters, extracts from which will suggest matters for discussion which are not necessarily on the Agenda, and I desire that any subject within the range of our interests may be discussed if time permits.

You will see the first item on the Agenda is the better organisation of this Annual Conference, supposing it is thought to be desirable. In order to test the views of the Societies on this subject, and to encourage a free expression of opinion, we put forward the following suggestions, the first relating to the organisation of these Conferences as follows :—

1. Organisation of the Conferences :—

(*a*) That a General Committee be formed consisting of delegates from the Affiliated Societies, one delegate from each Society, and one additional delegate for every 50 members beyond the first 50 ; delegates from the Radio Society of Great Britain to attend in the same proportion.

(*b*) That this general Committee hold quarterly meetings alternatively in London and in some Provincial centre ; thus the meetings in one year might be in (1) London ; (2) say, Birmingham ; (3) London ; and (4) say, Leeds.

(*c*) Each meeting to elect its own Chairman and to select the rendezvous for the next alternate meeting.

(*d*) Instead of an Affiliation Fee of a guinea from each Society, it is proposed that each Affiliated Society shall pay in proportion to its membership, viz., 1s. per head.

(*e*) The Secretarial Expenses (hire of hall, etc. for the meetings of the General Committee), to be met by the Radio Society of Great Britain.

The Chairman then read extracts of letters on this subject from the Secretaries of the Societies at Leeds, Hounslow, North Shields, and Willesden, and announced that opinion revealed by this correspondence was practically unanimous against increase of subscription in the form of a *per capita* charge of 1s. per head—vulgarly and popularly spoken of as "a bob a nob."

I think (he continued) a slight increase of affiliated societies' subscriptions would be necessary and it can be done in another form.

The main question for you to consider is : Do you want a more frequent conference than one a year in January, as it has been held in the past ? If so, how many, and where ? And do you wish to endow it with authority and executive ability ? Personally I think the method has worked very well in the past by which you have the Committee of the Radio Society of Great Britain meeting frequently with their ears cocked up to catch the slightest whisper of what is wanted from any part of the country, in order to give effect to those wishes. So far, that to my mind has given us sufficiently close touch, but on the other hand, if it was thought that an executive authority of your own was desired, we are only too anxious to hear what your views are on any of these subjects comprised under the headings of item (1).

The meeting was then thrown open to the delegates.

Mr. H. A. Epton (Hackney and District Radio Society).

My Society has gone into this question, and I wrote a note giving our views, but perhaps I might put one or two before you. The first thing that we considered when we were discussing the question was this: What position will this General Committee, referred to in this item of the agenda, have in the Radio Society of Great Britain ? Will it be a supreme body or will it be only an advisory body ? I notice from the letter heading of the Society that there is a Committee. This is re-elected annually. I should like to know whether

this proposed General Committee is to supersede that Committee now in existence, or whether it can only convey its suggestions to the Committee of the Radio Society of Great Britain. If the General Committee is not the supreme power, our Society consider its purpose cannot be very important, but if it will have the power to carry out the ideas on which it has opinions then I can see that this General Committee will be able to do very useful work. My Committee has requested me to ask this question before any decision is made so that we may know the purpose of this new Committee.

Mr. H. Taylor (Derby Wireless Club).

We are in favour of holding the meeting in London as heretofore.

Mr. A. J. Dixon (North Middlesex Wireless Society).

My Committee thinks that the idea of the Committee being formed as suggested is quite a good one, but I, personally, more or less agree with the first speaker that it would be well to know what is the precise position of that Committee. As regards the meeting in the provinces, this is nearly the same as our suggestion two years ago, but we do not think we need to have four conferences. Probably one in the North or one in the Midlands would do. As regards the capitation fee, we suggest a subscription which is a percentage of the subscription income of the club. Some clubs have a very nominal subscription, of say 5s., and obviously it is unfair for those clubs with 5s. subscriptions to have to pay out of their funds the same as the club which has a half-a-guinea subscription or more. We suggest that you have say a five per cent. subscription on the income of the club. That is to say on the club's net subscription for the year.

Mr. Y. P. Evans (Manchester Wireless Society).

My Committee have asked me to propose, with regard to this item on the Agenda, first paragraph, with reference to the General Committee, that one delegate per society including the Radio Society of Great Britain, should form that Committee. That two meetings be held annually, in addition to the Annual Conference, and at the Annual Conference as many delegates may attend as possible, say one for the first fifty and one for each fifty afterwards.

My Committee agree that the meetings should take place at different towns, to be decided upon by the Committee at its first meeting. They agree with the suggestion that the meeting should elect its own chairman.

Regarding the affiliation fees I am to say that our suggestion is £1 for the first fifty, and £1 for every fifty afterwards. The last item to the effect that Secretarial expenses should be met by the Radio Society of Great Britain was quite agreeable to them.

Mr. Platt (Wanstead Wireless Society).

We have a Society comprising adults and juveniles; the Society is only six months old. Our subscription fees are only 10s. entrance and 5s. annually, and we are on this account prevented from accepting any higher expenses as regards our affiliation to the Society. The information we have received from time to time has been very satisfactory, and we hope to continue to get such information in the future.

With regard to the question of a General Committee. I asked our Secretary if he had any information which suggested why the Radio Society of Great Britain had caused such a minute to be put on the agenda for debate. I really think that your own Committee would do well to give some reasons why these subjects were coming up for discussion to-day, because it is only your present Committee that has had that experience which enables them to say whether it is necessary to extend or increase the activities in this direction. We delegates do not know whether it is necessary or not.

On the question of finance, I really think, if more money is required, an appeal might bear good results. There are men in my own Society who may be able to afford a further amount, but some cannot afford even a shilling.

Mr. Watkins (Maidenhead District Wireless Society).

Is there not some confusion arising out of the term "General Committee." The General Committee is in regard to the Conference of Affiliated Societies, and is quite distinct from the Committee which acts in an advisory capacity to the Radio Society of Great Britain. As far as we in Maidenhead are concerned we are quite anxious that everybody in the Societies in the country should be represented at this Conference, and I take it that the motive of the Radio Society is that there should be better facilities in getting the members together. The delegates here, on that account, do not fully represent the Societies of Great Britain. Some arrangements should be made for meetings in different parts of the country so that the Conference should be fully representative. I should like to ask the Committee to give us some particulars of the financial requirements which necessitate the suggestion of a shilling per head.

Mr. R. H. Parker (Smethwick Wireless Society).

My Society agrees with this proposal in principle, but why is it suggested that they should hold two meetings in London? Why not in the provinces, Cardiff, or Sunderland, so that it would be more convenient for the amateurs extending over the country? We agree with (*c*), but not with (*d*).

Mr. S. Sugden (Birkbeck College Wireless Society).

I just want to put one point in connection with (*d*). In our college, as in many other colleges, the whole of the monies for students' societies are raised from a central fee which is paid with the ordinary tuition fees. It is impossible for us, therefore, and perhaps for a number of other Societies associated with schools and colleges, to define our particular number of members. Every student can belong to all the societies, or he may not do so, but the funds of each individual society of the college or school is not affected by its membership total.

Mr. Watt (Dartford and District Wireless Society).

My Committee are agreed upon the general proposals for the Conference. As regards representation, this might be one for 50, and two for 100.

With reference to (*d*), my Society also wish me to state that an increase in our case would be equal to fifty per cent. of our total, and they think that half that amount should be ample.

Mr. C. T. Atkinson (Leicestershire Radio and Scientific Society).

With regard to this question our Society is generally in favour in principle, but we are not quite sure exactly on the various details which have been raised. We feel that the affiliated societies should have as much power as is possible, and if a number of conferences are necessary, then they must of course be held. We do, however, feel that if the number of conferences can be limited it will be the better for all concerned, providing the work can be expeditiously carried out, and therefore if we can cut the number down by two conferences a year, one to be held in London and one in a place farther north so as to be better as regards attendance for the Societies in the North of England, it would be perhaps the best way.

With regard to (*c*), this is satisfactory.

As regards (*d*), like most of the other Societies, we object to the amount suggested, not knowing exactly what money would be required. We have not fixed any amount to bring before you, but we do feel that it is very essential that the amount should be the absolute minimum necessary, and below the amount figuring in the agenda. We have endeavoured to keep our funds as low as possible because of the large number of people we have in our Society who have not too much of this world's goods. A payment of (in our case) twenty per cent. of the annual subscription to the Radio Society of Great Britain would be excessive. On this account item (*e*) has been well received.

Mr. J. H. Reeves (Kensington Wireless Society).

On the subject of the number and powers of the Conference General Committee. We have certainly thought that the Committee members of the Radio Society of Great Britain, as we know them, are very much overworked. They have a tremendous amount to do, and the general idea seems to be that while the Radio Society of Great Britain is going to take care of the amateurs in bulk, this Conference of all the Societies has for its primary object the direct personal concerns of the Societies and of the individual. If one may argue from an analogy—some years ago, in the motoring world, the Royal Automobile Club found there was a very large group of provincial bodies, and it became very necessary to arrange some local conferences so that they could act in closer touch all over the country.

Now this organisation will probably develop very largely on the same lines. I think there is a good deal to be done which is particularly suitable for a general conference of all the societies of the Kingdom. For that reason I fall in with the suggestion, and so does my Society of Kensington—that this Conference be held rather more frequently. The meetings should be, say alternately in London and the provinces. If four are too many, I think we could have three at any rate. The success of the Radio Show in the autumn of last year is going to be repeated. It is going to be bigger in the future, and I think it will attract people all over the country. It would be no hardship for every Radio Society in England to find a member who would be very glad to have the excuse to come to London and attend the Conference, and also the exhibition. I think as a start there might be three conferences, one during the Exhibition in London, the Annual Conference in January, and one meeting in the provinces during the summer months.

There could never be what one might call a clash of powers. If a point is not voted unanimously it is hardly ever voted at all. These conferences meet together to discuss and to advise the Radio Society of Great Britain on important matters, on the same lines as the various motoring societies meet together monthly in order to advise the Royal Automobile Club, and between them they come to unanimous decisions.

Mr. H. A. Epton (Hackney and District Radio Society).

I had expected that my earlier question would have been answered so that the matter might be clear to us. No answer was given to it then, and there was a suggestion of closing the discussion.

Mr. Reeves seems to speak with an air of authority. I think he has had experience of meetings which we are not all in the position of having had. In a businesslike body like ours, we should know exactly what we are going to do. The question of power must come up. At present, as far as I understand it, the affiliated societies have no definite standing. Now, if this General Committee has no power beyond that of an advisory Committee, I cannot see how we are going to have any control over the running of this Society. If we have to pay an annual fee, surely we ought to have some representation either on the original Committee or else our new Committee must have full power.

As regards the representation by delegates, my Society maintains this figure is too high (the figure of fifty); it should be reduced to twenty-five. I do not think there are many societies in this country who have one hundred members or more. Fifty to seventy-five is the average. The great majority of societies would only have one delegate and a very few indeed two delegates.

(*Here the Chairman interrupted, as Mr. Reeves had not completed his remarks.*)

Mr. J. H. Reeves, after emphasising that he was not speaking with authority, continued:

I happen to know the members very well, and I am sure they do an enormous amount of work, and put in an enormous amount of time, and if there is much more to be done, that Committee must, it seems, be enlarged or else we, the Societies who want these things done, have got to do more to assist in the work ourselves. I think the Radio Society of Great Britain have done a very wise thing in bringing this matter forward. As regards the power which the conferences will have, let us think what is going to happen if the one hundred and twenty-five Radio Societies are unanimous on something which the Radio Society of Great Britain does not agree with? Surely either the Radio Society goes out, or the result of such a strong expression of opinion will convince the Committee of the Radio Society of Great Britain. Personally I am only suggesting that. I feel there is no possibility of a clash of voting. It would certainly be well to define the powers of the proposed Committee.

(*To be concluded*)

The British Wireless Relay League.

THE announcements which have appeared in this Journal in connection with the British Wireless Relay League have stimulated a very considerable interest in the matter. A large number of applications for membership have been received, and there is every indication that it fills a gap which should do much to bring into closer association the amateurs, and particularly those holding experimental licences, of this country. The work of the League should go farther, for it is intended that it shall co-operate as far as possible with similar organisations abroad.

In a recent letter received from Mr. Lêon Deloy, so well known as one of the leading amateurs in France, mention is made of the fact that at the last meeting of the Comité de la Société des Amis de la T.S.F. Mr. Deloy brought up the subject of the handling of such traffic by amateurs in France, and states that Général Ferrié expressed approval of the proposals outlined. Dr. Pierre Corret, President of the Comité Français des Essais Transatlantiques was asked to request his committee to get in touch with the postal authorities on the matter. Let us hope that the near future will bring good news of the result of their negotiations.

There is little need here to refer to the work of the American Radio Relay League since their activities are already so well known to British amateurs, and already the British Wireless Relay League is assured of their hearty support and co-operation in any experimental transmissions or other work to be undertaken.

The British League cannot, of course, ever aspire to the same membership as the American League, but nevertheless, if all those who have an interest in the work will come in, a very efficient organisation should result. Below are published the provisional rules of the British Wireless Relay League for the information of readers of this Journal :

BRITISH WIRELESS RELAY LEAGUE.

NAME.

The League shall be named the " British Wireless Relay League."

OBJECTS.

Intercommunication between members with a view to improving existing transmitting circuits.

Relaying of messages through stations owned by members, at times to be regulated by headquarters, the object of which will be the efficient organisation of all amateur transmitting stations, whereby a service of excellent utility will be maintained. All messages shall be confined to the business of the League.

Strict observance of all laws and regulations applicable to wireless telegraphy and telephony.

Co-operation with wireless leagues of other countries.

The advancement of wireless science generally.

RULES.

1. The League shall consist of members and associate members, and shall be governed by a central committee consisting of the officers and four committee members, assisted by a local committee elected by members.

2. Members shall possess an Experimental Transmitting Licence.

3. Associate members shall possess an Experimental Receiving Licence, and may transfer to full membership on compliance with rule 2.

4. Members and associate members shall be eligible for any office of the League and shall receive all circulars and printed matter concerning the League.

5. Prospective members shall apply to the Hon. Secretary for the necessary application form, and after completing and returning same, with remittance, shall receive a certificate of Membership.

SUBSCRIPTIONS.

6. An entrance fee of five shillings shall be paid by each member on election, and the annual subscription shall be ten shillings, payable in advance, and due on the 1st January each year.

7. Associate members shall pay an entrance fee of five shillings on election, and the annual subscription shall be five shillings payable as in rule 6.

8. Any member whose subscription is one month in arrears shall be notified by the Hon. Treasurer. Should his subscription not be paid at the expiration of one month from the date of such notice, the committee shall have power to erase his name from the list of members.

9. The committee shall have power to reprimand any member who, in the opinion of one or more members, has wilfully acted in contravention of the rules of the League, or the laws and regulations governing wireless telegraphy, after such an act has been investigated.

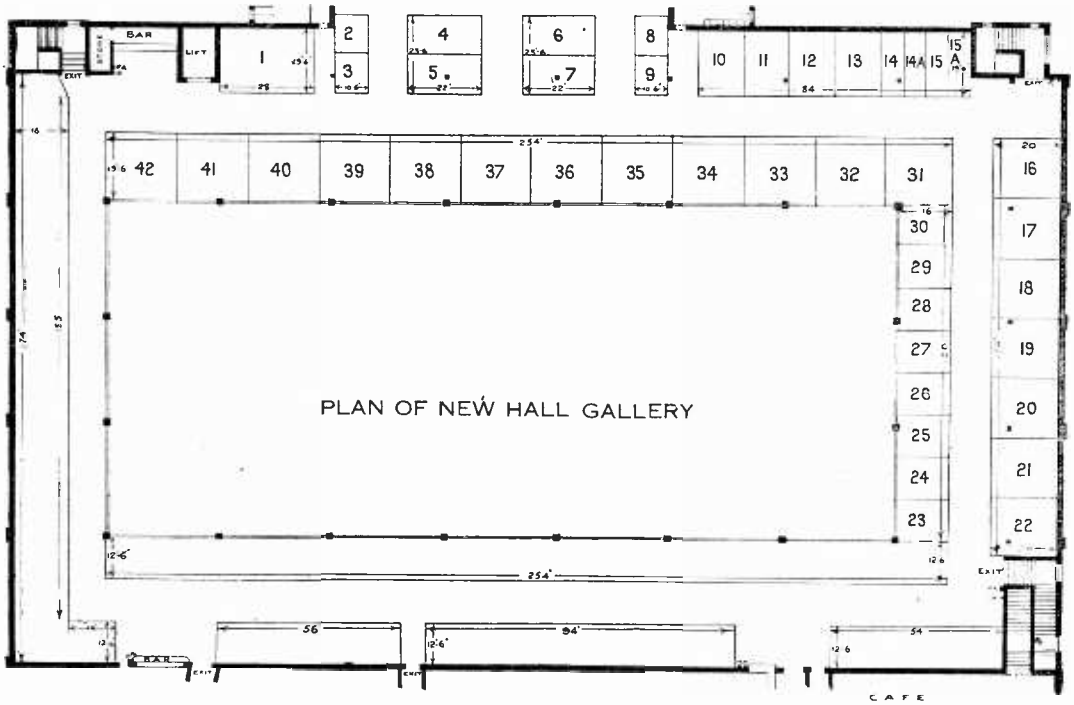
10. Should any member wilfully break these rules or regulations a second time the committee shall have power to expel him from the League.

11. Until other rules are drawn up for the management of the League, the above provisional rules shall be considered binding.

12. In these rules the word member includes associate members unless otherwise stated or where the context does not so admit.

Applications for membership or associate membership should be made to the Hon. Secretary, The British Wireless Relay League, care of this Journal, 12-13, Henrietta Street, London, W.C.2.

Ideal Home Exhibition.



The *Daily Mail* Ideal Home Exhibition, which will be open at Olympia on March 1st to 24th, will include as an important feature a Wireless Section situated in the New Hall Gallery. The following are the firms exhibiting in this section with the numbers of their Stands:—

1. Burndept, Ltd.
2. H. Stanley Prince & Co.
3. Electric Appliances Co., Ltd.
4. Amalgamated Press, Ltd.
5. Radio Press, Ltd.
6. Cassell & Co., Ltd.
7. Wireless Press, Ltd.
8. Tingey Wireless, Ltd.
9. Igranic Electric Co., Ltd.
10. Wates Brothers.
11. Gambrell Brothers, Ltd.
12. Perophone, Ltd.
13. Rogers Foster & Howell, Ltd.
14. ———
14A A. H. Hunt, Ltd.
15. ———
15A Abbey Industries, Ltd.
16. General Radio Company.
17. L. McMichael, Ltd.
18. Telephone Mfg. Co., Ltd.
19. A. W. Gamage, Ltd.
20. Radio Society of Great Britain.
21. ———
22. Peto & Radford.
23. Beaver Electric Company.
24. Alfred Graham & Co.
25. J. A. Coomes & Co., Ltd.
26. Siemens Brothers & Co., Ltd.
27. Tomlinson, London, Ltd.
28. Fellows Magneto Co., Ltd.
29. Dubilier Condenser Co. (1921), Ltd.
30. Radiophones, Ltd.
31. Sterling Telephone & Electric Co., Ltd.
32. Automatic Telephone Mfg. Co., Ltd.
33. British Thomson-Houston Co., Ltd.
34. Western Electric Co., Ltd.
35. General Electric Co., Ltd.
36. Marconi Scientific Instrument Co., Ltd.
37. Marconi's Wireless Telegraph Co., Ltd.
38. Metropolitan-Vickers Electrical Co., Ltd.
39. C. F. Elwell, Ltd.
40. Radio Communication Co., Ltd.
41. Radio Instruments, Ltd.
42. S. G. Brown, Ltd.

Calendar of Current Events

Thursday, February 22nd.

INSTITUTION OF ELECTRICAL ENGINEERS.
At 6 p.m. At Savoy Place, Victoria Embankment, W.C.2 Lecture on Transoceanic Wireless Telephony, by Dr. H. W. Nichols.

Friday, February 23rd.

MANCHESTER WIRELESS SOCIETY.
At 7.30 p.m. In Council Chamber, Houldsworth Hall. Discussion.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture on "Receivers and Loud Speakers." By Mr. A. M. Bage (President).

BIRMINGHAM EXPERIMENTAL WIRELESS CLUB.
At 7.45 p.m. Lecture by Mr. Abbott.

HULL AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At the Memorial Institute Schoolroom, Dewsbury Street. Smoking Concert.

Saturday, February 24th.

MOUNT PLEASANT RADIO SOCIETY.
At 7 p.m. At Lecture Hall, 21A, John Street, Theobald's Road, W.C.1. Lecture on "A Beginner's Difficulties in Receiving anything but Broadcasting." By Mr. A. Hinderlich, M.A.

Sunday, February 25th.

At 3.5 p.m. Concert from PCGG, The Hague, on 1,050 metres.

Monday, February 26th.

9.20 to 10.20 p.m. Dutch Concert from PCGG, The Hague, on 1,050 metres.

Tuesday, February 27th.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.
At St. Margaret's Institute, Alexandra Road, Lowestoft. Lecture by Mr. L. Burcham.

THE EAST LONDON RADIO SOCIETY.
Lecture on "Charging Accumulators on the House Lighting Mains." By Mr. J. Keens.

Wednesday, February 28th.

ROYAL SOCIETY OF ARTS.
At 8 p.m. At John Street, Adelphi, W.C. Lecture on "Heat Resisting Glasses." By Professor W. E. S. Turner.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.
Lecture by Lieut. H. E. H. Burbury.

EDINBURGH AND DISTRICT RADIO SOCIETY.
At 8 p.m. At R.S.S.A. Hall. Lecture on "Detection and Measurement of Minute Electric Currents." By Dr. H. Dryerre, M.R.C.S., L.R.C.P.

Thursday, March 1st.

Daily Mail Ideal Home Exhibition, with Radio Section, Opening Day (March 1st-24th inclusive).

At 9.20 to 10.20 p.m. Dutch Concert from PCGG, The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.
At 8 p.m. At Hitchin Road Boys' School. Practical Work and Demonstration.

STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.
Lecture: "Half-an-hour with a Technical Dictionary." By F. Bew.

THAMES VALLEY RADIO AND PHYSICAL ASSOCIATION.
At 8 p.m. Film on Radio Transmission and Reception.

Friday, March 2nd.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Lecture on "The Progress of Telephony and its Bearing on Modern Life." By Mr. W. Davies.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture on "The Evolution of Receiving Valve Amplifiers." By Mr. H. H. T. Burbury.

Saturday, March 3rd.

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. A. Southgate, A.M.I.E.E.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company :—

London	2LO	369 metres.
Birmingham	5IT	420 ,,
Manchester	2ZY	385 ,,
Newcastle	5NO	400 ,,
Cardiff	5WA	395 ,,

Glasgow Broadcasting Station (5 SC) is expected to be in operation on March 19th.

Correspondence.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—As I have been experimenting with chemical rectifiers for some considerable time I read with interest Mr. Rushton's investigations on the well-known Tungar Rectifier.

Although the article sets forth with considerable aptitude the scientific side of the subject, there are several points which need consideration from the practical or commercial point of view. These are :—

1. The cost of valve replacements.
2. Only one wave of the supply current is "rectified," the other wave being repressed.
3. The low overall efficiency.

I understand that the cost of replacing the valve or bulb is over £4, and that such bulbs are guaranteed only for a maximum of 600 hours.

Taking this at the 5 ampere rate for a 6-volt cell of 50 ampere hours capacity, the cost per charge is 1s. 6d. for the bulb alone, to which must be added a certain amount towards the first cost of the apparatus, and then the cost of the current consumed from the mains at 29 per cent. efficiency, that is, rather over 100 watts input.

In comparison with chemical and other rectifiers this does not appear to me to be sufficiently good, but doubtless improvements will be effected in course of time. MORTIMER A. CODD.

Questions and Answers

NOTE.—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) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *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.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"G.T." (Leeds) *asks for a diagram of a telephony and C.W. transmitter for short wave work. It is proposed to use about 5 watts of H.T.*

The diagram is given in Fig. 1. The aerial inductance will be determined from the constants of your aerial, but will generally be 6" in diameter and 6" long, of No. 16 D.C.C. The closed circuit coil may be 8" in diameter and 6" long, of No. 18 D.C.C., the wire in each case being spaced. The grid circuit coil should be a winding 5" in diameter and 3" long, of No. 20 D.C.C. The air choke coil in the anode circuit of the first valve may be a winding 2" in diameter and 3" long of No. 28 S.S.C. The key is connected to join the grid leak across the grid condenser. When it is required to use the transmitter for telephony, the key is screwed down, and the switch is thrown over to the right-hand side. 200 volts anode potential would be suitable. Some experimental work will be necessary before the best values for the components are obtained.

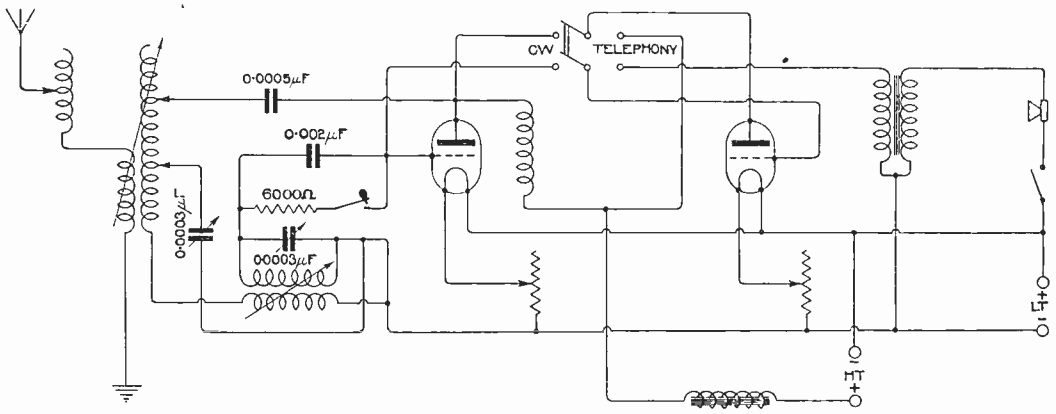


Fig. 1.

"SIGIL" (Cheshire) *asks* (1) *For diagram of a three valve circuit capable of later extension.* (2) *Where detailed instructions for making such components as are desired may be obtained.*

(1) We would refer you to Fig. 5, page 356, December 9th, issue. The diagram is a very good one, and may be thoroughly recommended. (2) We do not know of any text-book which deals with the construction of such components as you would require, in a suitable manner. We suggest you obtain the last volume of *The Wireless World and Radio Review*, where you will find a number of constructional articles, and in particular articles dealing with "Experimental Station Design," which appeared in every other issue.

"PUZZLED" (Pendleton) *asks* (1) *What type of Dewar switch would perform the same functions as a double pole throw-over switch.* (2) *Could the three-valve receiver illustrated in the issue of October 28th, 1922, be converted into a cabinet set.*

(1) A Dewar switch, which has six contacts,

comprising two moving contacts and four fixed, may be used in place of the double pole throw-over switch. The Dewar switch would be such that with the springs in one position contact is made in a similar manner to when the double pole throw-over switch is thrown over into one of its contact positions. (2) The three-valve receiver referred to may of course be assembled to form a cabinet receiver, provided the components are suitably mounted. Any receiver may of course be mounted in a cabinet in this manner.

"W.B." (Bristol) *is interested in telephony transmission, and asks* (1) *Where he can find information.* (2) *Where to obtain microphones.* (3) *For criticism of diagram submitted.* (4) *What power is required to transmit ten miles, the receiver to be a one-valve receiver.*

(1) We suggest you look through back numbers of *The Wireless World and Radio Review*, where you will find a considerable amount of useful information. In particular we would refer you to the issue of December 23rd, where you will find, under the heading of "Experimental Station Design," a constructional article dealing with a small telephone and C.W. transmitter. (2) We suggest you communicate with the Automatic Telephone Manufacturing Company of Liverpool. (3) The diagram submitted is quite suitable for a beginner, although the arrangement is very inefficient, and it cannot be expected that one would be able to transmit for any great distances with such a transmitter. In addition, the tuning adjustments are shown. (4) If you use 10 watts of high tension, your transmissions should be heard over a ten miles radius.

"RESISTA" (Mont) *asks* (1) *Whether the licence purchased from the General Post Office, London, is an experimental or a broadcast licence.* (2) *Is he allowed to use a receiver purchased some time ago, and may he add to it; and will he be called upon to pay the British Broadcasting Company's fees.* (3) *Is he allowed to give demonstrations, say in the local village.* (4) *May a power valve be used in the last note magnifier panel.*

(1) We think the licence which was sent to you is an experimental licence. (2) If you hold an experimenter's licence, you are of course able to experiment with apparatus just as you desire, provided the conditions under which the licence is granted are borne in mind. You will not be called upon to pay any fees to the British Broadcasting Company. (3) You will probably have to gain the permission of the Post Office before you are able to give wireless concerts. We suggest you write to the Secretary of the Post Office, London. (4) The power valve is connected in the circuit in the same manner as an ordinary receiving valve, but the anode is supplied with a higher potential, which is tapped off the H.T. battery. This is the only alteration required. The aerial may, as you suggest, be either 60′ long and 40′ high, or it could be 60′ long, two wires, and 40′ high.

"ULTRA FIXED" (Rugby) *asks* (1) *For suitable values of components to use in the circuit wired according to the diagram submitted.* (2) *Whether a certain book has been published.* (3) *How can a reactance coil be made so that it is reasonably efficient, and tuned by taps only.*

(1) and (3) The A.T.I. may be a winding 4″ in diameter and 3″ long, of No. 22 D.C.C., with six tappings. The A.T.C. should have a maximum value of 0·001 mfds. The tuned anode winding may be 4″ in diameter and 5″ long, of No. 26 D.C.C., and the tuning condenser should have a maximum value of 0·0002 mfds. The reaction coil may be a winding 3″ in diameter and 3″ long of No. 26 D.C.C. with three tappings. The grid leak and condenser have values of 0·0003 mfds. and 2 megohms. (2) The volume referred to has not yet been published.

"B.H.H." (E. Yorks.) *proposes to use a frame aerial, and asks* (1) *For a diagram showing how to connect two high frequency, one detector, and one L.F.* (2) *Is there any serious objection to the use of a frame aerial.*

(1) A suitable diagram is given in Fig. 2, page 72, in the issue of October 14th, 1922. (2) As your open aerial is rather poor, you will probably find no very great decrease in signal strength with the use of a frame aerial, it being borne in mind that one can take advantage of the directional properties of the frame.

"G.R.B." (Essex) *refers to the diagram given on page 418 of December 23rd issue and asks* (1) *What would be suitable dimensions for the anode and reaction coil.* (2) *Which valves give best results in a circuit of this description.*

(1) The anode and reaction coils may be plug-in coils if desired, in which case a two-coil holder is very useful. For the reception of broadcast transmissions two small single layer coils may be used, but the anode coil should be 3″ in diameter and 3″ long of No. 28 D.C.C., and the reaction coil could be 2″ in diameter and 3″ long of No. 28 D.C.C. Ten and three tappings should be taken from the coils. (2) "R" valves are quite suitable for use in a circuit of this description.

"MARRIED QUARTERS" (Halesowen) *submits particulars of his proposed aerial arrangement and asks* (1) *Are the results from the arrangement likely to be as good as from an outdoor aerial, 30 yds. long and 25′ high.* (2) *With condenser plates of the size given, and the distance between the plates 1/16″, what is the capacity.* (3) *Is the proposed layout satisfactory.* (4) *What capacity is considered desirable, if at any time the set is used on a 250-volt D.C. main.*

(1) We think stronger signals will be obtained with the outdoor aerial. (2) The capacity of the condenser would be of the order of 0·00005 mfds. (3) The lay-out is not very satisfactory, and it is not safe to use air dielectric condensers for work of this description. (4) We suggest you use mica dielectric condensers with a capacity of the order of 0·0005 mfds.

"W.J.T." (Surrey) *asks* (1) *Can we say why when listening-in to French and Dutch amateur transmissions, the signals appear to fade occasionally.* (2) *What power is put into the aerial at Ongar,* **GLO.**

(1) When listening in to short wave transmissions it is often noticed that the signals appear to fade away at times. This is due to absorption, which is very pronounced at short wavelengths. (2) This station is operated by a private company, and we have no definite information of the power employed.

"P.L.B." (Bucks) *submits a sketch of his receiver and asks* (1) *Whether the circuit is suitable*

for general purposes. (2) *How to add two L.F. connected valves.*

(1) The circuit submitted is quite suitable for short wave telephony, although it would be better to couple the reaction coil with the secondary of the intervalve transformer instead of the aerial tuning inductance. (2) The method of connecting L.F. valves is given in all issues. In particular we would refer you to Fig. 4, page 386. December 16th issue.

"E.W.C." (Birmingham) *asks* (1) *For an explanation of the tuned anode method of H.F. amplification.* (2) *For particulars of the construction of an anode coil suitable for a wide range of wavelengths.*

(1) The tuned anode method of H.F. amplification works on very similar principles to the resistance method, but in the former case the high impedance is brought about by tuning the anode winding to the frequency of the signal it is desired to amplify. When the frequency of the winding and the frequency of the signal coincide the tuned circuit offers very high impedance to the signal, and consequently there are large voltage variations across it. These are transferred to the grid of the next valve through a small condenser. (2) We suggest that you wind a cylindrical coil 3" in diameter and 6" long full of No. 36 S.S.C. wire and take twelve tappings. The winding should be tuned with a variable condenser having a maximum value of 0·0003 mfds.

"A.H." (Purley) (1) *Wishes to construct a two-valve high frequency panel to add to a single valve unit which he has by him, and* (2) *Asks for a diagram of connections, using certain components.*

(1) and (2) See Fig. 2. Suitable values are indicated in the sketch.

"F.G." (Scarborough) *asks* (1) *Whether a crystal may be used in place of a detecting valve.* (2) *Whether any alteration of the wiring will be necessary if the reaction coil is made to swing over the plug-in transformers.* (3) *What would be a suitable basket coil winding for the reaction coil suitable for use over a wavelength range of 400 to 5,000 metres.*

(1) A crystal may be used in place of the detecting valve, but we do not recommend it. The advantage of having a detector valve is the stable adjustment. This cannot be claimed for a crystal. (2) No wiring changes will be necessary. The reaction coil will simply be moved and the reaction leads will be taken to the foot of the stand on which the sliding reaction coil is mounted. (3) A suitable reaction coil would be one consisting of 60 turns of No. 32 S.S.C. wire with a mean diameter of 3". For the higher wavelengths we suggest a coil having 120 turns of No. 36 S.S.C. wire with a mean diameter of 3½".

"TYLER" (Huddersfield) *asks* (1) *For diagram of a three-valve receiver, comprising one high frequency, one detector, and one L.F. valve* (2) *For criticism of the receiver, particulars of which are submitted.* (3) *May honeycomb coils be used in place of a loose coupler.* (4) *What honeycomb coil should be used to receive* WJZ.

(1) We would refer you to Fig. 5, page 147, of the issue of October 28th. Suitable values are indicated in the diagram. (2) and (3) We suggest you secure the single-wire aerial from the house chimney to the post. Honeycomb coils may, of course, be used in place of the loose coupler. Basket coils work equally as well as honeycomb, but are a little more difficult to mount. (4) The wavelength of WJZ is 360 metres, and you will use the first set of honeycomb coils mentioned. We would point out that the reception of the transmissions from this station is in the nature of a freak; that is, the transmissions cannot be received except under the most favourable conditions.

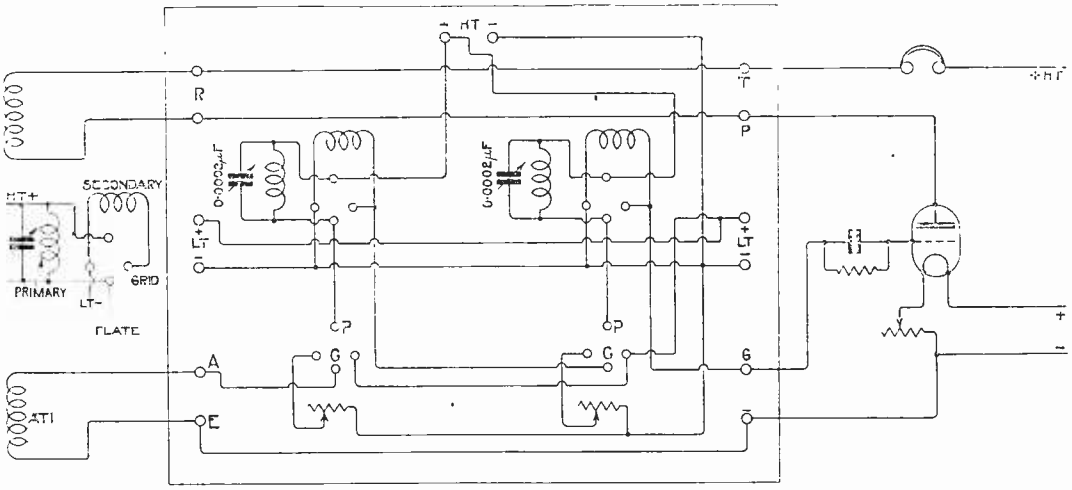


Fig. 2.

D

"W.A." (Windermere) *asks* (1) *Why, when anyone touches the headphones, the tuning is altered.* (2) *Is it possible to put a milliammeter in series with the telephones and + H.T. to indicate when the receiver is on the point of oscillation.* (3) *What is the maximum number of telephones which may be connected in series in the anode circuit of the last valve.*

(1) The reason why tuning is altered when the telephones are touched may be because the telephones have low insulation, and because they are connected directly in the anode circuit. A telephone transformer should be used if possible, and the receivers should be tested for low insulation. The loud-speaker circuit is correct because a telephone transformer is used. (2) We do not think much would be gained by inserting a milliammeter in series with the telephones as suggested. (3) Three or four pairs of telephones may be connected in the anode circuit of the last valve without any great loss of signal strength.

"E.C.H." (Doncaster) *asks* (1) *The capacity of a 33 plate condenser built up from plates of the dimensions of the samples submitted.* (2) *The capacity of an 11 plate condenser.* (3) *The dimensions of a suitable anode coil.*

(1) The 33 plate condenser will have a maximum value of 0·0005 mfds. (2) The 11 plate condenser has a maximum value of 0·00016 mfds. (3) The anode coil may consist of a winding 4" in diameter and 6" long of No. 30 S.S.C. wire, 18 tappings being taken.

"N.G.C." (S.E.) *asks* (1) *Whether the diagram submitted is correct.* (2) *Whether good results will be obtainable, it being desired to receive signals other than the broadcast transmissions.* (3) *Is a reaction coil tuning condenser and a high frequency transformer tuning condenser necessary.*

(1) The diagram submitted is quite correct, and it is a standard circuit. (2) Good results will be possible over all wavelengths, provided suitable tuning coils are used. (3) The reaction condenser may have a value of 0·0002 mfds., and the high frequency transformer primary should also be tuned with a small condenser, one having a maximum value of 0·0002 mfds. being suitable.

"PIPACAC" (Harpenden) *submits a diagram of connections and asks* (1) *Would it be useful to include a switch so that the tuned anode or the high frequency transformer may be used as desired.* (2) *What connections are necessary so that a Dewar switch may be connected for throwing the high frequency valve out of circuit when not required.*

(1) If desired, a switching arrangement may be included for the purpose of using the high frequency transformer or the tuned anode method of amplification as desired. A suitable diagram is given in Fig. 1, page 129 of October 28th issue. (2) The method of switching valves with a circuit of the description submitted is given in most issues of this journal.

"SPARKS" (Yorks) *asks* (1) *For criticism of the circuit submitted.* (2) *What is the reason for the distortion of speech which is received from a broadcasting station.* (3) *With reference to the diagram of aerial submitted, is it to be expected that interference will result, due to telephone and tram wires.* (4) *Are any additional tuning arrangements suggested.*

(1) and (4) The diagram of connections is correct, except that a wire is connected across the reaction coil, which is presumably an error. The tuning arrangements are quite correct, and with the high frequency transformer in use, it is not desirable to connect a small tuning condenser across the primary winding. It would probably be better if the secondary coil were connected between the grid and filament negative instead of filament +. (2) The distortion may be caused by a number of reasons, and you should find for yourself the best values of anode voltage and filament current. One or two small cells may be connected in the grid circuit of the last valve, for the purpose of giving the grid a small negative potential. Distortion may be caused through allowing grid current to flow through the grid becoming too positive. The normal grid potential may not be correct, resulting in the operating point on the characteristic not being central. The filament temperature may be too low. (3) It is very likely that some interference will be caused by the telephone wires running close to the aerial, and if possible we suggest the aerial be removed round a little, so as to form an angle with the telephone wires, which at the present time are running practically parallel.

"H.F.W." (Leeds) *submits a diagram of his receiver with particulars of the components used, and asks for criticism.*

The diagram of connections submitted is quite correct, although it is sometimes an advantage to tune the primary of the high frequency transformer with a two-plate condenser. The high frequency transformer has suitable dimensions, but the L.F. transformer has rather a high ratio to be efficient. The tuning coils are of suitable dimensions, but it is difficult to see why such peculiar results are obtained when the aerial tuning condenser is in series with the A.T.I. If care is taken that the right tuning coil is used, the results may be accounted for by your aerial lead being rather long, and perhaps the aerial has a large capacity.

"D.G.B." (S.W.15) *asks* (1) *What is the meaning of the expressions "R4," "R5," etc.* (2) *With reference to the diagram submitted, how many turns of wire, using No. 20 enamelled, would be required on the aerial coil to tune between 200 and 300 metres, the former to be 6" in diameter.*

(1) The terms "R4," "R5," etc., mean that signals of a certain strength are being received. In the military service only the odd numbers were used, and the following meanings are attached: R9, Signals clear and strong; R7, signals strong; R5, signals readable; R3, Signals weak; R1, signals heard but not readable. (2) We suggest you wind 40 turns of No. 20 enamelled wire upon the 6" diameter former. The wire should be spaced slightly, a suitable spacing being the thickness of the wire itself. With the arrangement suggested, it is only possible to modulate a small amount of power without the microphone being heated.

"**G.F.H.**" **(Epsom)** *submits a diagram of connections and asks* (1) *Are the connections correct and suitable for the reception of telephony.* (2) *Is it necessary to have a filament rheostat connected with each valve.* (3) *Is it better to connect the grid leak across the grid condenser or across the grid and L.T.*

(1) The proposed arrangement is quite suitable, although instead of coupling part of the high frequency transformer with the aerial coil, it would be better if a reaction coil were used. The reaction coil should be connected in series with the low frequency transformer connected in the anode circuit of the detector valve. (2) It is better to have a filament resistance to control the temperature of each filament, because each valve will have slightly different characteristics, and it is desirable to be able to adjust the filament temperature of each valve separately. (3) It is generally better to connect the grid leak between the grid and plus or minus L.T. The correct connection depends upon the valve in use, and one should try whether best results are obtained with the leak connected to + or — L.T.

"**WELSHMAN**" **(Woking)** *asks* (1) *Whether he may expect to receive the London broadcast transmissions, using a frame aerial and the single valve receiver.* (2) *What are suitable dimensions for a frame aerial.* (3) *Which type of frame aerial is the better.* (4) *Is it necessary to obtain an experimental licence before one may use a receiver built up from parts.*

(1) We do not think you could expect to receive the London broadcast transmissions using a frame aerial and a one-valve receiver. We suggest you use an outdoor aerial, or if you cannot fix an outdoor aerial, use a three-valve receiver in conjunction with the frame aerial. (2) The frame aerial may be 4′ square, wound with eight turns of No. 20 D.C.C., the turns being spaced a ¼″ apart. (3) The form suggested in your sketch B is preferred. (4) An experimental licence is necessary.

"**TELEPHONY**" **(Scotland)** *asks* (1) *Are the two diagrams submitted suitable for the reception of wireless telephony.* (2) *Would "R" type valves be suitable for use with the receivers referred to.* (3) *Would a C Mark II or A Mark IV low frequency amplifier be suitable as a note magnifier with this combination.* (4) *What size of wire and how many turns are required for the construction of the A.T.I. and closed circuits.*

(1) As the receivers give excellent reception of spark signals, we think you should certainly hear telephony transmissions. (2) "R" type valves may be used with a receiver wired according to the diagram submitted. (3) As suggested, a low frequency amplifier may be added to the receiver, but it should be borne in mind that the purpose of a high frequency connected valve is to amplify very weak signals before applying them to the detector. The low frequency amplifier is to magnify the rectified currents. The high frequency amplifier enables one to obtain a greater range, while the low frequency gives stronger signals. We suggest you use the first valve as a high frequency connected valve, the crystal detector, and a two or three-valve low frequency amplifier. (4) The aerial circuit may be a winding 4″ in diameter and 4″ long of No. 20 D.C.C. The anode winding may be 3″ in diameter and 4″ long of No. 30 S.S.C. with 12 tappings in each winding.

"**O.W.M.**" **(Brighton)** *asks who are the stations with call signs* **GGB, GGC,** *and* **FNB.**

The first two calls have probably been allotted for special experimental or test purposes. We have no record of them being in permanent or regular use. **FNB** is the call sign of the ship station "Aviateur Roland Garros."

"**ZULU**" **(Catford)** *submits a lay-out of a three-valve receiver and asks* (1) *Whether the wiring is correct.* (2) *Whether double-pole throwover switches will do what is required.* (3) *Could a diagram of connections showing the correct values of the components, which would be suitable for the arrangement proposed in* (1), *be given.* (4) *Which method is recommended to safeguard the H.T. and L.T. batteries from short circuits.*

(1) The lay-out is quite suitable from the point of view of ease of wiring and arrangement of apparatus. We do not recommend the wiring of a Dewar type switch for the purpose of connecting or disconnecting coils in the aerial and closed circuits. When it is desired to receive short wave telephony, we suggest you use a three-coil holder, but use coils having a small inductance. The complication and the loss of signal strength occasioned by the inclusion of switches in the aerial and closed circuits is not accompanied by any great gain. (2) Suitable diagrams are given in many recent issues, together with suitable values for the condensers. (3) If desired, a small flash lamp may be used in series with the H.T. battery. The dry cells should be well insulated at all times, and they should not be kept in a damp place. It is as well to disconnect the various units when they are not in use. In the event of a short circuit the flash lamp will burn out, and this will to some extent protect the battery. If you wish to protect the accumulators from short circuits, we suggest you use a small fuse. Suitable fuses may be purchased from several of the manufacturers who advertise in this journal.

"**RADIO**" **(Stourbridge)** *refers to the diagram Fig. 2, page 780, September 16th issue, and asks* (1) *Is the high frequency intervalve transformer properly connected when it is desired to use a plug-in type transformer.* (2) *May a variable 0·005 mfd. condenser be used in place of the 0·001 mfd. fixed condenser shown in the diagram.* (3) *May the reaction coil have the same number of turns as the aerial coil, or will the results be poor if the number of turns is a little different.* (4) *Is a Vernier condenser suitable for use across the primary of the high frequency transformer.*

(1) As the high frequency transformer is of the plug-in type, the L.T. should be connected with the plate; I.P. with + H.T.; I.S. with grid; and O.S. to — L.T. (2) A 0·0005 mfd. variable condenser may be used in place of the fixed condenser if desired. (3) The reaction coil need not have the same number of turns as the aerial coil. In some cases it will require more turns, and in others less. The coil could be provided with two or three tappings for this purpose. (4) A Vernier condenser may be used in place of the 0·0001 mfd. condenser shown in the diagram if desired.

"ZODIACAL" (London) *asks* (1) *How to add a high frequency connected valve before the crystal detector.* (2) *How to prevent the noises which are heard in the receivers.*

(1) We suggest you connect the high frequency valve as shown in Fig. 3. Suitable valves are indicated in the diagram. The anode coil may be a winding 4" in diameter and 6" long of No. 30 S.S.C. wire with 18 tappings. The reaction coil

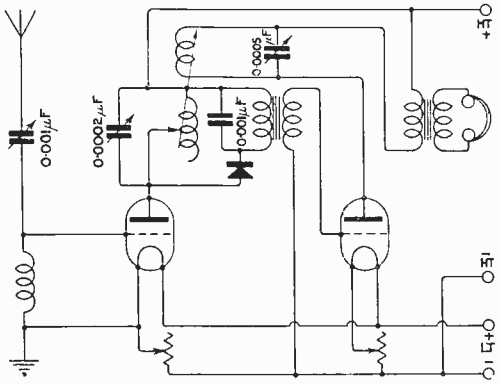


Fig. 3.

may be 3" in diameter and 4" long of No. 30 S.S.C. wire with six tappings. The remainder of the apparatus is connected up as shown in the diagram submitted. (2) We suggest you connect the 3 mfd. condenser across the H.T. battery, and a 0·001 mfd. condenser across the telephone transformer, and another 0·001 mfd. condenser across the low frequency transformer which is in circuit with the crystal detector.

"L.B.B." (Weston-super-Mare) *asks whether we can tell him which transmitting station he heard transmitting music and speech in French, while listening-in a short time ago. The wavelength was 440 metres.*

Without a knowledge of the call sign, we cannot identify this station. We would point out that several British experimenters appear to have been transmitting music and speech in French recently, and of course there are a number of French amateurs who are engaged in telephone transmissions.

"T.C.P." (Treorchy) *submits a diagram of connections and asks* (1) *Is the diagram correct; if not, kindly point out the fault.* (2) *Is the aerial quite suitable.*

(1) The diagram of connections is quite correct, but you are not making use of reaction. We suggest you use a 6-volt L.T. battery, and put the aerial tuning condenser marked B in your diagram in series with the A.T.I. The grid condenser and leak should have values of 0·0003 mfds. and 2 megohms. If the tuning arrangement, which is the condenser and plug-in coil, will tune to the wavelength of the signals you wish to receive, you should certainly hear signals. (2) The aerial is quite large enough, but we suggest you take the lead-in from the end nearest the house instead of from the mast end. The lead-in will then drop straight down from the aerial to the lead-in insulator fastened to the house. Great care should be taken with the earth connection, which should be as short as possible and go directly to an earth. A waterpipe may be used if there is one convenient, and the connection with the waterpipe should preferably be soldered. If an earth clip is used, the waterpipe must be thoroughly cleaned and the earth clip securely fastened, otherwise a high resistance earth will result. If the waterpipe is not conveniently situated, we suggest you construct an earth by burying a sheet of galvanised iron of as large an area as possible, two or three feet in the earth. A heavy wire such as 7/22 should be soldered with the earth plate and brought to the instrument.

"H.W." (Birmingham) *refers to the diagram on page* 128, *October* 28*th issue, and asks whether the wiring is correct.*

The diagram referred to has a small error. The leads to the negative terminals of the high frequency and the detector valves should be interchanged, when it will be found that the wiring is correct. The operation of the circuit is best seen from the previous figure, which is a theoretical diagram.

"W.R.C." (St. Margarets) *asks whether we have any particulars of multiple microphones.*

We would refer you to the article by Mr. Deloraine, page 156, in November 4th issue. We regret we are unable to give you much information concerning the construction of this type of microphone.

"ROBIN HOOD" (Staffs) *submits a diagram of his receiver and asks* (1) *Whether the anode coil may be used as a reaction coil, or should a second coil be used for reaction.* (2) *Are the tuning arrangements correct.* (3) *How many tappings should be taken off the coils.*

(1) The proposed arrangement is quite suitable, and the anode coil may be used as the reaction coil as desired. It would be better to connect a fixed condenser with a capacity of 0·001 mfds. across the telephone terminals. The tuning arrangements are correct, and you should be able to tune to just beyond 4,000 metres. It would be better, of course, if the aerial circuit were wound with No. 22 D.C.C., the closed circuit with No. 26, and the anode coil with No. 32, but no great loss in signal strength will be noticed, due to the use of a little finer wires. (3) We suggest you take 16 equally spaced tappings from the aerial coil, 8 tappings from the closed circuit coil, and 16 from the anode coil.

SHARE MARKET REPORT

Prices as we go to press on February 16th, are:—

Marconi Ordinary	£2	12	0
,, Preference	2	5	6
,, Debentures ..	108	0	0
,, Inter. Marine ..	1	8	3
,, Canadian		11	0
Radio Corporation of America :—			
Ordinary		15	4
Preference		13	3