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The "B Mark I★" Receiver

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

THIS instrument which was produced during the War for communication in and to trenches is made up in two forms—termed respectively "Forward" and "Rear"—to indicate the relative positions in which they were intended to be used. Both patterns have become available for ordinary experimental or amateur use by the selling up of Government stocks by the Disposal Board, and by various dealers in wireless apparatus.

In general outline both types are similar, the differences between them being necessitated by the position in which they were to be used. The "Rear" pattern was designed to work in conjunction with a small 20 watt spark transmitter connected to an ordinary elevated wire aerial. It was therefore provided with a two-way switch to change over from sending to receiving, and with terminals for connecting it to the transmitting apparatus, in addition to the usual aerial and earth terminals. The "Forward" instrument for use in or near frontline trenches was primarily intended for reception only, and was therefore not provided with any send-receive switch. It could, however, be provided when necessary with a special transmitter, using a small loop aerial attached to a bayonet, and supplied from a small induction coil, but this does not strictly form part of the receiving equipment. The "Forward" instrument was not primarily designed to be used with an ordinary elevated wire aerial, but with two "aerials" in the form of wires stretched out along the ground in opposite or nearly opposite directions, or strung up in dug-outs, etc. Ordinary arrangements of tuned or coupled receiving circuits were therefore not well suited to such a receiver and "aerial" system, and a special arrangement was therefore used.

The two "aerial" terminals of the set were connected inside the instrument to the terminals of a variable condenser, termed an "Antenna Shunt," and across this was joined a tuned circuit consisting of a coil *in series with* a condenser, the grid-circuit of the first or detector valve being joined across the small condenser of this tuned circuit. This condenser consists of two small brass plates mounted on ebonite discs, so that their distance apart can be set by means of three screwed rods and nuts.

The "Rear" pattern of instrument was arranged on similar lines in this respect, except that no "antenna-shunt" condenser was fitted. The antenna shunt condenser in the "Forward" pattern served, of course, to compensate for the varying capacity of different sizes of aerials that could be used with the set. It was, if course, always desirable to keep the capacity of this condenser as small as possible, as increasing it tended to weaken the signal strength.

The normal wavelength to which these sets were tuned was 65 metres, so that in their present form they are not very well suited to ordinary uses. It is, however, comparatively easy to modify them in one or two different ways to render them much more useful.

Both types of set are fitted for two valves, the first being the detector valve, and the second a note magnifier, an iron core intervalve transformer being fitted between them. Terminals are fitted for the connection of a four-volt accumulator battery for the filaments, and there is a multi-point filament regulator switch to control the filaments of both valves together. This switch, after cleaning up if necessary, will be found a very effective regulator, as it gives better contact than many forms of filament rheostat. The adjustment by studs is perhaps somewhat more jerky than the more usual sliding contact, but is generally found quite fine enough for all practical purposes. The studs of this switch are numbered, and so form a convenient means of noting the setting of the regulator for the particular valves that are used.

As arranged in the set, a reaction coil is joined in the anode circuit of the first valve. This is wound on the same former as the grid circuit coil with which it is coupled, both coils consisting of a few turns of fine wire wound on the same ebonite tube, with a space of about one-eighth of an inch between them. The reaction is a fixed one, adjustment of the state of the valve *i.e.*, oscillatory or non-oscillatory—being effected by means of the filament regulator. Brightening up the valves tends to increase the readiness to set up oscillations, so that usually a point will be found on the rheostat at which the set oscillates. This point is indicated by a dull click in the telephones.

As mentioned above, an iron-cored intervalve transformer is fitted into the instrument for coupling the valves together. Another iron-cored transformer (marked "Valve to Phones") is also fitted on the output circuit of the second, or note magnify-

ing valve, for coupling to the telephones. These should be of low resistance, two pairs of sockets being provided on the top of the instrument for plugging in two pairs of telephones. These sockets are joined in parallel.

The transformers, etc., are best suited for "French" valves, although others may be used with the instrument, especially when it is modified for more ordinary purposes.

Both types of instrument are fitted with a self-contained H.T. battery, which is also joined up to two small screw terminals on the top of the instrument. These are marked "H.T. Test," and were provided for testing the state of the H.T. battery by means of a voltmeter.

In the instruments now available, the H.T. batteries are, of course, exhausted. They can either be renewed, or what is usually more convenient, the leads provided for connection to the internal battery can be cut off, and the two "Test" terminals (or two larger and more convenient ones inserted in their place) used for joining in an external H.T. battery.

In the "Rear" type of instrument, the send-receive change-over switch, it may be mentioned, performed an additional function—that of switching on or off the filament circuit of the valves. The filament circuit is connected to the front contacts of the switch on the receive side, so that when the switch blade enters this side it connects the two together and lights up the valves. The filament regulator can thus be left set in the best position when changing over from send to receive. The connections of this instrument are given in Fig. 1. Those of the "Forward" pattern only differ from this diagram, as pointed out above, by the omission of the change-over switch, and their arrangement permanently as "receive," with the addition of an "antenna shunt" variable condenser. A description given for modifying this pattern can, therefore, be applied easily to the other with very little alteration.

It will be noted from this diagram that a leak is joined across the aerial and earth or input terminals. The resistance of this is about 4½ megohms, and it serves to maintain the normal potential of the grid of the first valve, which otherwise would become too highly negative, since with these special connections, there is no tuning coil across the input grid circuit as is usually the case with most receiving circuits.

These instruments can most simply be converted into two valve receiving panels—the first valve being a detector valve, and the second a low frequency amplifier or note magnifier—or into two valve note magnifiers, as preferred. In the latter case, if the "Rear" pattern is used, the send-receive switch can be used to provide a simple means of cutting the note magnifier in or out of circuit—that, is, for joining the input leads to the telephone receivers, either directly, or through the note magnifying valves.

In either case, the 65-metre tuning circuit coil

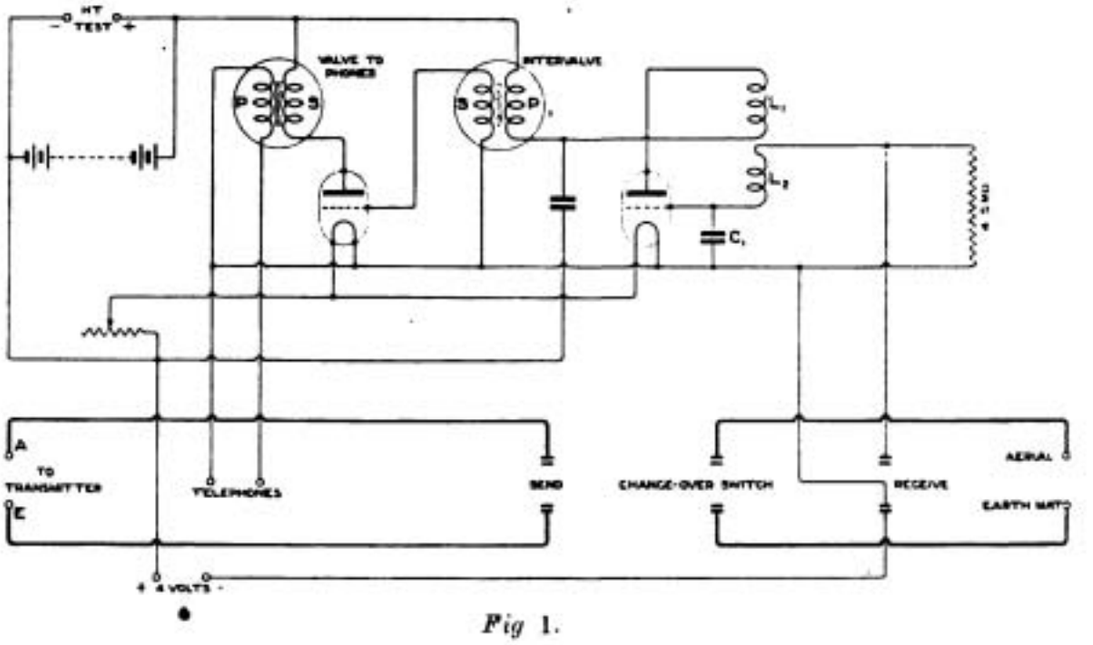


Fig 1.

and reaction coil are not required, so that they should be removed, together with the small condenser in the former circuit. The condenser across the primary of the intervalve transformer should be left in position. The 4½ megohm leak may also be removed, as it is usually of too high a resistance to use in the detecting valve circuit if an ordinary variable coupling reaction coil is used as well.

If it is desired to convert the instrument into a two-valve receiver, with the first valve as a detector, it is advantageous to provide terminals for a reaction coil. Two terminals can easily be inserted in any convenient blank space on the ebonite top panel for this purpose, and connected to the two wires that were originally joined to the reaction coil marked as such in Fig. 1. In the "Rear" pattern of instrument the two terminals provided on the left-hand side for connection to the transmitter (see Fig. 1) can be used for these extra reaction coil terminals if desired. In the "Forward"

pattern two extra terminals must be fitted. The wire from the grid of the first valve should be joined to a small condenser of about 0·0002 microfarad capacity, with a grid leak of 1½ to 2 megohms across it. The lead from the other side of this condenser and leak should be joined to the Aerial (or corresponding input terminal of the "Forward" pattern) of the instrument.

The connections of the instrument when modified in this manner are given in Fig. 2.

A simple way of converting the instrument to a two-valve note magnifier or low frequency amplifier that can be joined on to any existing receiver, is indicated in Fig. 3. This change can be effected by connecting an additional iron-cored transformer between the input terminals of the

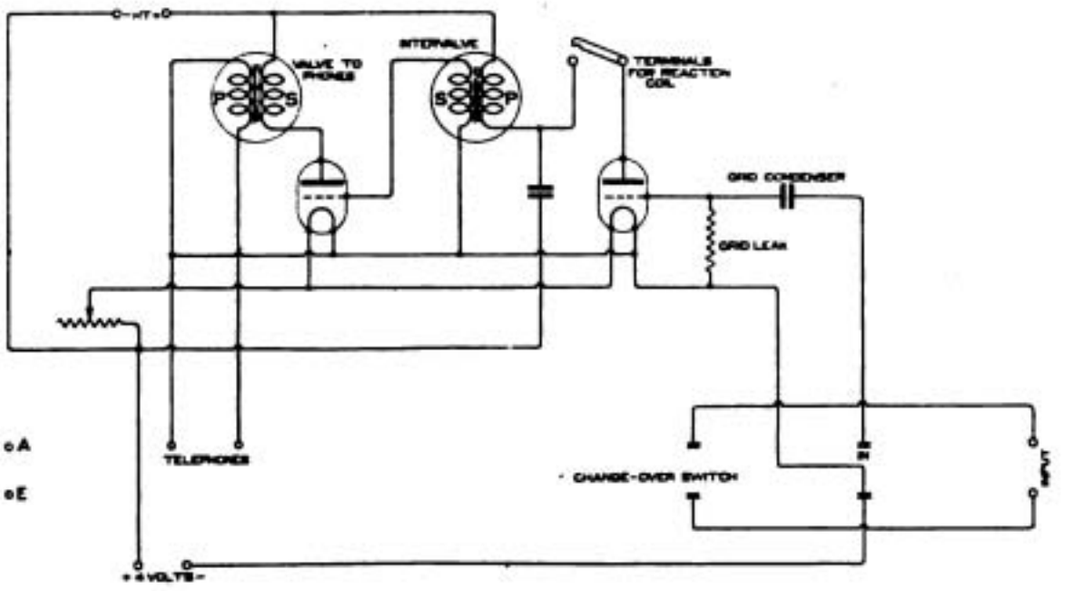


Fig. 2.

Tuning coils, with a variable condenser in parallel, should, of course, be joined across these terminals external to the instrument, *i.e.*, between aerial and earth, in the usual manner.

If a reaction coil is used it should be joined to the above-mentioned terminals provided for it, taking proper precautions in its use so as to avoid undue autodyne radiation on wavelengths where it is liable to cause interference to others.

instrument (the old aerial and earth terminals) and the grid and filament of the first valve, in place of the grid condenser and leak mentioned in connection with the first described method of modification.

If it is desired to join this note magnifier straight on after an existing receiver with detector valve arranged for high resistance telephones, this new extra transformer should be of the "Intervalve"

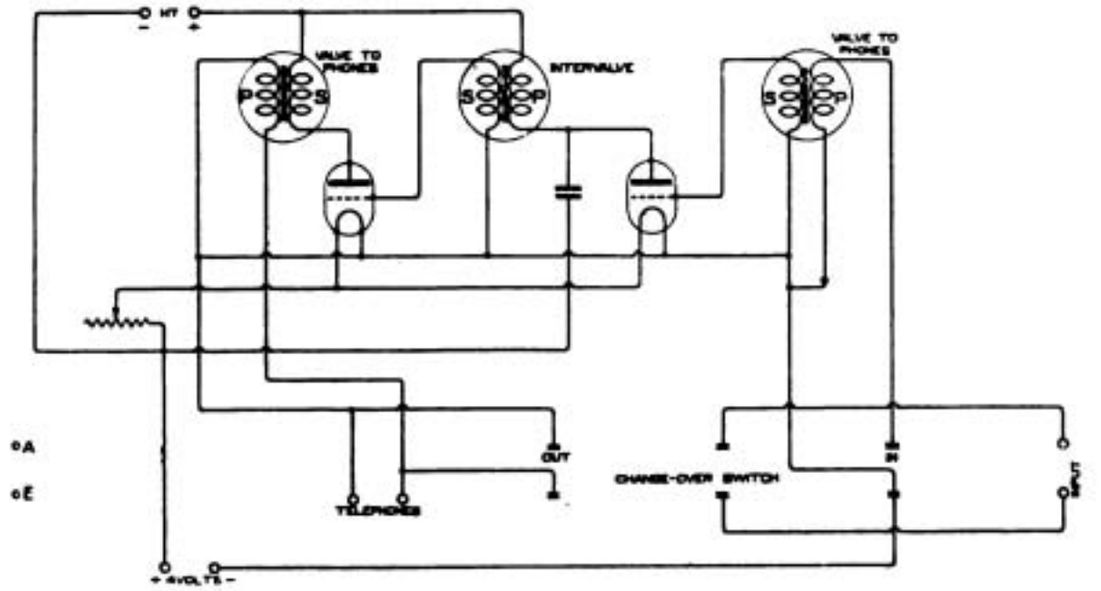


Fig. 3.

type (numbers of which have also been sold by the Disposal Board and others), with its I.P. and O.P. terminals joined to the input (aerial and earth) terminals, and I.S. and O.S. terminals to the grid and filament terminals respectively of the first valve as indicated in Fig. 3.

If, however, the existing valve receiver is already provided with a telephone transformer to enable low resistance telephones to be used, the input transformer of this new instrument should have a low resistance primary winding. A "Valve to Phones," or "Earth to Valve" transformer of similar type to the transformers fitted in the instrument should then be used, with the primary winding (I.P. : O.P.) joined to the input terminals in either case, and the secondary connected to the grid and filament of the first valve When this latter arrangement is adopted use may be made of the change-over switch in the "Rear" type of instrument in the manner already described (see also Fig. 3) for enabling the amplifier to be cut into or out of circuit easily at will.

In any instruments of this kind it is worth while testing the continuity of the windings of all the transformers, and verifying the soundness of all connections before attempting any conversion. Attention to a few details of this sort in the first place may save much trouble at a later stage.

When this conversion is made to a "Rear" pattern, using the change-over switch to cut the amplifier in or out of circuit, the two spare terminals on the left-hand side, marked for connection to the transmitter, can be utilised for the H.T. terminals instead of fitting new terminals in the places of the present "H.T. Test" screws.

Simultaneous High and Low Frequency Amplification

By P. G. A. H. Voigt.

THERE are many circuits in which a valve will amplify both H.F. and L.F. currents simultaneously, thus obtaining with one valve an amplification for which two valves are usually used. This is a great advantage to those who have to fetch and pay for their filament current.

I have tried many of these double amplification circuits, and those given here are among the best. First, I shall explain the single valve double amplification circuit shown in Fig. 1, then I shall go on to the more complicated ones.

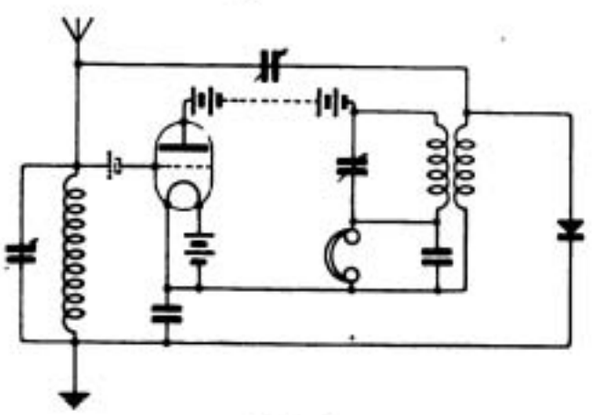


Fig. 1.

The H.F. oscillations are received on the aerial in the usual way by means of a variable inductance (shown fixed for clearness) and a variable condenser in parallel for long waves, and in series for short waves. The H.F. currents flow to the grid and to the filament through the blocking condenser, thus imposing a H.F. oscillation on the plate current. This oscillation produces oscillations in the tuned plate circuit similar to those in the aerial circuit, but amplified. The oscillation here is passed to the crystal detector by means of the secondary winding (which should be very closely coupled to the primary, and wound or connected in the opposite direction, as shown by the arrows on the diagrams).

Since the secondary only carries the crystal and reaction condenser current, it may be wound with very fine wire. This has the advantage of reducing capacity effects. The secondary may have more turns than the primary.

The oscillation, on reaching the crystal, causes it to pass a unidirectional current which will charge the blocking condenser between the filament and earth.

The voltage on this blocking condenser will flow to the grid and filament, and vary the plate current without affecting the H.F. oscillation, thus producing doubly amplified signals in the telephones.

Capacity reaction is used because in this instance it is as efficient as magnetic but is much simpler to construct, as there is no need to make a variable coupling between every set of coils.

The capacity reaction condenser should have a maximum capacity not exceeding 0·0001 microfarad, and may be easily made as follows :—

On a sheet of insulating material a sheet of metal 5 cms. × 5 cms. is laid. This is covered by another sheet of insulating material, (*i.e.*, 10 mil. ebonite or waxed paper), and another sheet of metal 5 cms. × 5 cms. fitted with a flexible lead and a long handle is laid on top so that the overlap can be varied. The minimum capacity must be small, and it should be possible to slide the sheets at least 5 cms. from one another. Better

looking condensers do not give better results, but are more expensive.

The principle of capacity reaction is quite simple. Suppose at a certain instant the wave makes the grid positive, then the plate current increases and makes the plate more negative, if the transformer secondary is connected in opposition to the primary this change of plate current will make

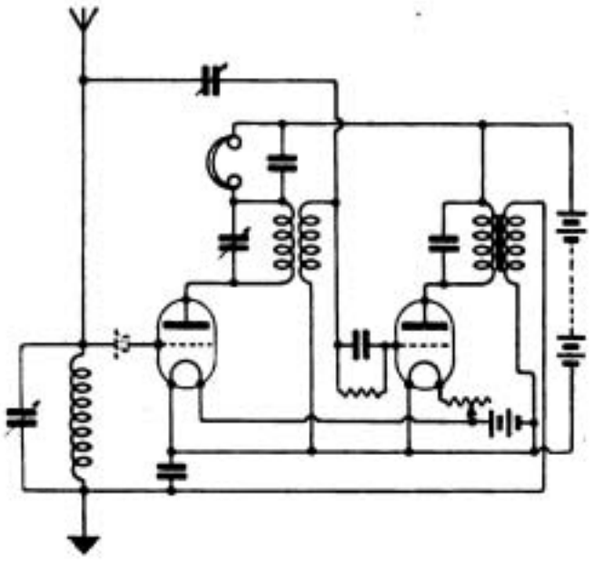


Fig. 2.

the crystal and one side of the reaction condenser positive, the charge on this side of the condenser will attract an equal negative charge into the other side, leaving an equal positive charge free to add itself onto the initial charge, thus increasing it.

In these circuits a crystal not requiring a potentiometer, such as zincite and bornite, or one of the artificial galenas sold as permanite, rectarite, etc., must be used.

With hard valves the grid may be made slightly negative. This reduces the valve damping, and sometimes gives an increase of signal strength.

Fig. 2 shows how a valve detector can be used instead of a crystal, but the second valve is much more useful if used in one of the two valve double amplification circuits shown in Figs. 3, 4 and 5.

In Fig. 3 the second valve is coupled to the first by resistance coupling. The reaction condenser is connected to the plate of the second valve.

This circuit works well even at 600 ms., but like all resistance coupled amplifiers, its efficiency is low with short wavelengths.

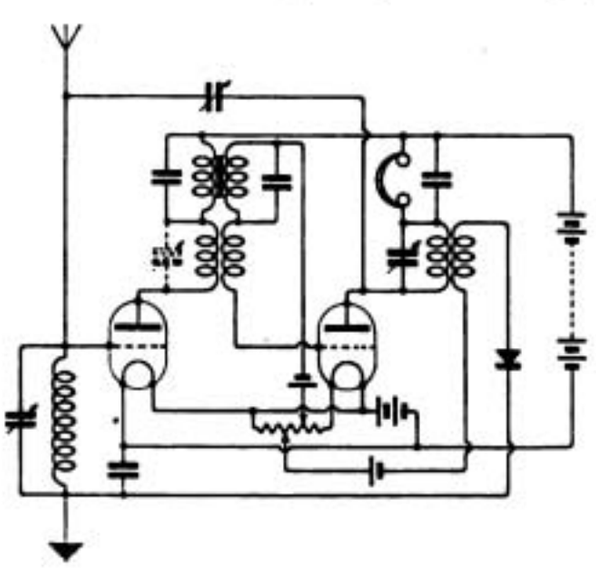


Fig. 3.

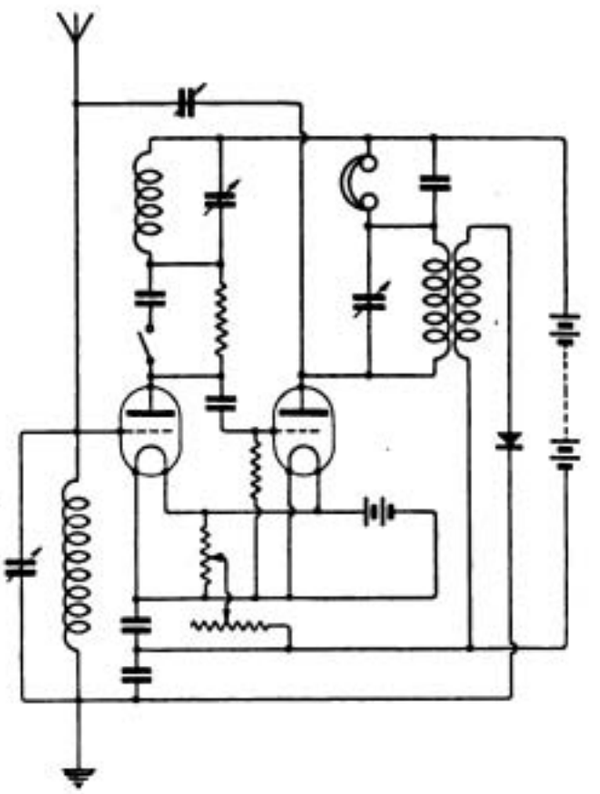


Fig. 4.

The efficiency for wavelengths below 2,000 metres can be considerably increased by shunting the resistance by a small condenser (0·002 microfarad), and putting in series a tuned circuit as shown in Fig. 4. A switch is used to cut out the resistance condenser for "stand by," and the three tuned circuits are used for "receive." This circuit is wonderfully selective.

A further improvement is L.F. reaction, this is also shown in Fig. 4.

By putting a second condenser between filament and earth, and separating the negative of H.T. and L.T. by a variable resistance having a maximum of 5,000 ohms., and making up the voltage drop in this resistance by means of a potentiometer, L.F. reaction can be obtained which doubles or trebles the signal strength.

Suppose the L.F. current made the first grid negative, then the first plate current would decrease and make the second grid positive, and the second plate current would increase to a much greater extent. The resultant through the H.T. and series

resistance would be an increased current. Hence the voltage drop along the resistance would increase

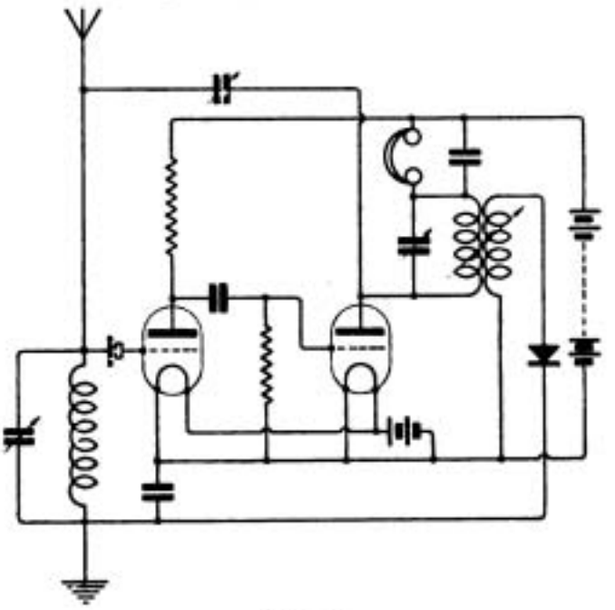


Fig. 5.

and thus producing a higher negative potential on the first grid.

Suitable resistance wire would probably be too fine for a slider, and therefore as many tappings as possible should be used.

For the reaction resistance and the plate resistance I advise one of the fine resistance wires, such as 48 S.S.C. Eureka, which has a resistance of 342 ohms per yard. About 150 to 200 yards would be required for a plate resistance.

When the H.T. is in order and the aerial earthed, the telephones should be absolutely "dead," unless the set is receiving some atmospherics or signals with the aerial earthed.

On long wavelengths this method of amplification is difficult to work with, but for ordinary wavelengths the method is so quiet and sensitive that I can receive the Dutch Concert (250 watts) on a four foot square frame aerial indoors (top floor) with only 17 turns, using the circuit given in Fig. 4 in an open position in London.

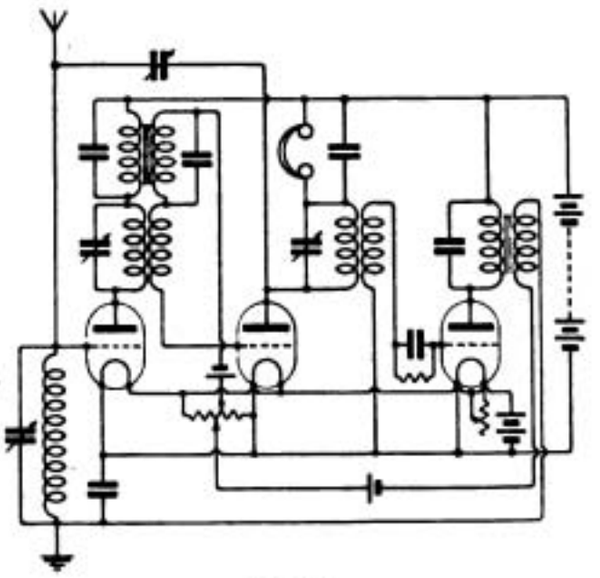


Fig. 6.

Fig. 5 shows how transformers may be used for the inter-valve coupling, the H.F. transformer being tuned for preference.

Fig. 6 shows how a valve detector may be used with the two-valve circuit, the resistance coupling can be used between the valves instead of the coupling shown, but it is not so efficient, although much simpler.

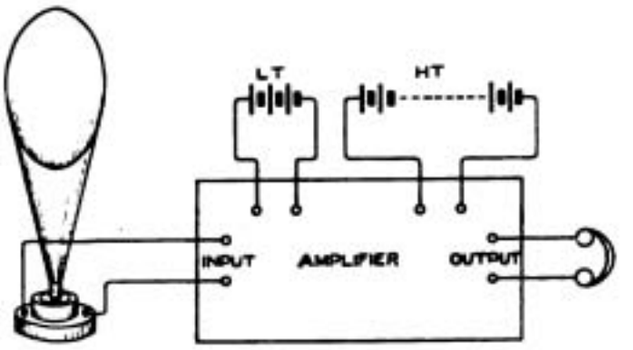
The valve detector set will probably be very difficult to stabilise, and much less time will be wasted in setting the crystal than in fetching the extra current for a valve detector. Besides, the signals are loud enough with the crystal.

An Experiment with a L.F. Amplifier

By J. G. W. Thompson.

An interesting and amusing experiment, well illustrating the amplifying properties of a three-valve low frequency amplifier, can be carried out as follows:—

Across the input terminals (*i.e.*, across the primary of the first transformer) connect a pair of H.R. telephones. Connect up, in the usual manner, another pair of telephones, the L.T. battery and the H.T. battery to the proper terminals. Speak into the earpieces of the first pair, while a friend is listening in the second pair, and watch your friend's face!



The first pair of telephones, of course, is acting as a microphone, and the speech-modulated currents therefrom are magnified up by the amplifier, and are very loudly heard in the second pair.

The writer tried connecting a Brown's loud speaker in place of the first pair of telephones, and the results were still more astounding.

External noises, such as music in other rooms of the building, traffic in the streets, and the cries of children playing in the back gardens, were clearly audible in the telephones, although they could not be heard by the ear alone.

The whole apparatus constitutes an exceedingly sensitive "detectophone."

A sketch of connections is given to make things quite clear.

Selectivity in Wireless Transmission and Reception*

By Maurice Child.

THE problem of selectivity in connection with radio telegraphy and telephony has always presented serious difficulties to the engineer and designer of apparatus.

Most of us will remember that our President, in his address early this year, dealt broadly with this subject, and showed us by means of experiments and diagrams some of the difficulties that are still awaiting solution in connection with this problem.

I propose to deal with one or two practical aspects of the question this evening, and will confine myself mainly to that part of the subject relating to transmitting apparatus and circuits, leaving the receiving apparatus and circuits for others to discuss.

Without wishing to take up too much time, I feel sure that a brief reference to the early forms of transmitting apparatus and the character of the waves emitted by it may be of some practical value, and I will take this opportunity of saying that it is with a view to assisting the very large number of our members, to whom "Wireless" is a hobby, and whose practical and possibly theoretical knowledge of the subject of selectivity is slight, that I have brought some apparatus here in order to demonstrate how selective wave radiation may be produced.

Sir Oliver Lodge, who has kindly associated himself with this Society, was the first to indicate the possibility of making a transmitter to only operate a receiver attuned to it, and showed how, by means of what were called "Syntonic Jars," this result could be attained. Fig. 1 shows the arrangement that Sir Oliver Lodge first used in a famous demonstration which he made somewhere about 1895 or 1896. On the left is

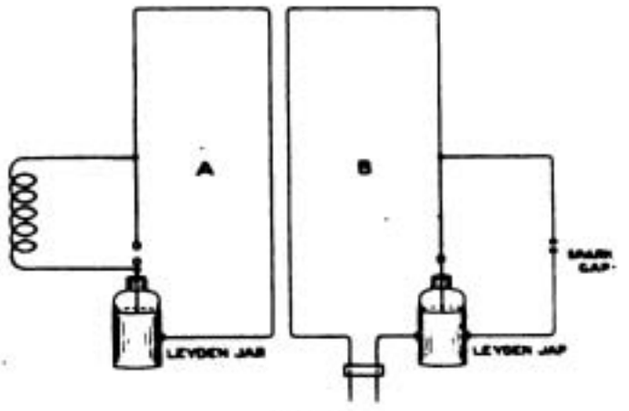


Fig. 1.

a Leyden jar, and across the spark gap, which is immediately associated with the jar, we have a small induction coil. A rather large loop of copper wire or rod is connected to the jar. In the circuit B we have a similar loop, but it is extended slightly at the bottom for a sliding contact to move on the rods which is intended for the purpose of tuning the circuit B to the circuit A. On the right-hand side of the Leyden jar of the circuit B is a small spark gap. There is included a micrometer spark gap which was really the detector for the arrangement.

The limitation of this arrangement for practical wireless telegraphy is fairly obvious.

In the first place circuit A is what is known as a closed circuit, and has practically no radiating properties, whilst circuit B possesses a most insensitive detector, and is of no use for telegraphic purposes.

When Marconi introduced the aerial or radiating circuit Fig. 2, which was essentially an enlarged form of Hertz oscillator, the advantage of the Lodge

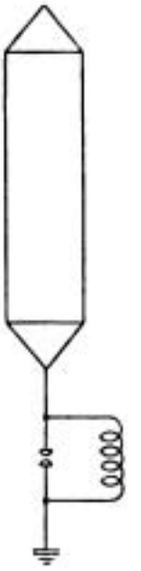


Fig. 2.

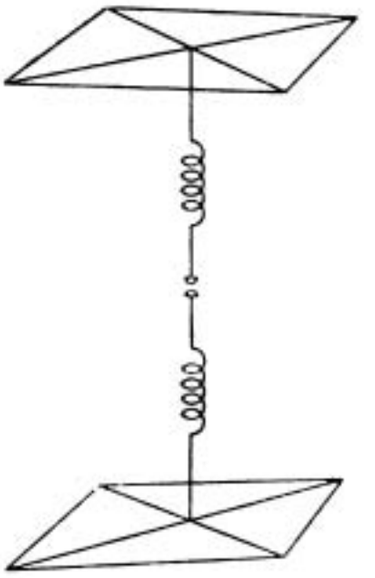


Fig. 3.

syntonic circuit disappeared, since we then had an arrangement whereby the initial energy imparted to the system by the induction coil was so rapidly dissipated in the form of electric waves and heat at the spark gap that only five or six useful oscillations per spark took place. We would say, therefore, that the waves were strongly damped.

The result of this was that any aerial system connected to a detector would respond readily to waves so produced, and we had a condition of affairs similar to that which would obtain, if a piano was struck with a hammer on its case: *i.e.*, every string in the instrument would be caused to vibrate.

Sir O. Lodge compromised between the Marconi aerial and his original closed circuit, in that he employed a large network of wires supported from

* A Paper read before the Wireless Society of London, on Wednesday, October 26th, 1921.

four masts forming the corners of a square, and a similar network two or three feet above, but insulated from the earth. (See Fig. 3.)

It is worthy of note that modern aerial systems differ very little, essentially, from the original Lodge scheme so far as the upper capacity is concerned, but an actual ground connection is more usually employed when the nature of the soil is suitable for giving a low resistance contact with it.

By the use of relatively large capacity aerials as distinct from the one or two vertical wires of Marconi, Lodge was able to put much more energy into the oscillating system without having to employ a long spark gap. This had two advantages. Firstly, it enabled more persistent oscillations, or a longer wave-train, to be generated owing to less spark gap resistance, and secondly, there was less loss of energy due to leakage, a point which only those who had to do with practical wireless telegraphy in its early stages would appreciate.

The introduction of the self-induction coils slowed down the rate of energy dissipation, and was the key to the whole question of selectivity. I might, perhaps, emphasise the fact which is well known to you all, however, that wireless apparatus to-day without inductance or self-induction coils, no matter what particular "brand" they may be, is about as useful as a watch mechanism minus a spring, and for their suggested use, the world will always be indebted to Lodge's genius.

We have now to consider the next important step that was taken to secure what I will call a selective transmitter, *i.e.*, one which causes a succession of feebly damped or alternatively continuous waves to be radiated into space.

The two-circuit transmitter came into being, and, although when used in conjunction with a modern spark gap and proper adjustment, it is still a standard arrangement, there is abundant evidence to show that in its early form, and used with the early receivers, it did not produce the selectivity claimed for it at the time, and I will endeavour to show you a little later experimentally why this was so.

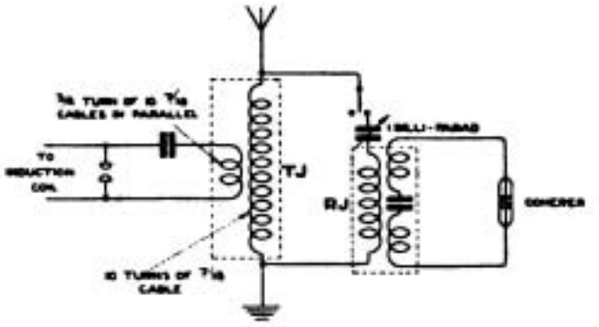


Fig. 4.

The early arrangement used commercially by the Marconi Company is shown in the diagram. (Fig. 4.) Here we have what was known in the early days as a "tune A" arrangement. TJ on the left-hand side is the transmitting jigger, and RJ the receiving jigger. As a matter of interest, I looked up the meaning of the word jigger in the dictionary. Webster gives one definition as a troublesome insect of tropical regions. Certainly the wireless jigger was troublesome, but I have never been able to see any connection between it and an insect.

The jigger was used in the "tune A" system. The primary consisted of $\frac{3}{4}$ of a turn of 7/18 cable, but the cable is a stranded one consisting of 10 strands all bunched together in parallel, and that was placed over the secondary which consisted of 10 turns of the same sort of cable. The size of the former was a 12-inch square.

The object of this arrangement of the transmitter is to give a long train of waves per spark, and also to enable more power to be efficiently used.

In the first place, the condenser connected with the spark-gap circuit can be three or four times the capacity of the aerial, and thus for any given power in the induction coil or transformer, the spark length and resistance associated with the spark itself will be much less than when the "plain aerial" circuit (Fig. 2) is employed. Hence, the oscillations in this closed circuit would tend to be persistent.

Using a closed circuit by itself, *i.e.*, uncoupled to an aerial circuit, and an open spark gap of, say, 5 mm. length, one might obtain as a fair approximation something like 20 to 30 complete oscillations at a frequency of 10^6 cycles per second. Ninety per cent. of the energy would be dissipated in the spark gap, 6 per cent. or 8 per cent. in the condenser dielectric, and 2 per cent. or 4 per cent. in conductor resistance. Those are the approximate figures which were given many years ago for such a circuit.

When, however, such a circuit is coupled, as in the diagram shown, to an aerial or radiating circuit, the rate of energy dissipation from the closed circuit is increased.

It is clear, therefore, that under these conditions the length of time during which the closed circuit will oscillate, will be shorter, or putting it another way, the total number of oscillations of the closed circuit per spark will be fewer.

By an adjustment of the coupling between the primary and secondary of the jigger TJ the number of oscillations in the aerial circuit per spark, and therefore the length of the resulting wave-train can be controlled. In the early Marconi jiggers this adjustment was not provided.

There is, however, a certain optimum coupling which will produce the best results on a given receiver, and this depends on the arrangements of the latter as well as those of the transmitter.

By best results I do not mean *strength* of signals only, but strength combined with the greatest possible selectivity.

Since with modern receiving apparatus employing thermionic valves as detectors together with reaction coupling, which has the effect of eliminating damping almost entirely from such circuits and apparatus associated with them, I shall largely confine myself to the transmitter, as it is mainly here that the degree of selectivity obtainable will depend.

Returning therefore to our diagram, we will

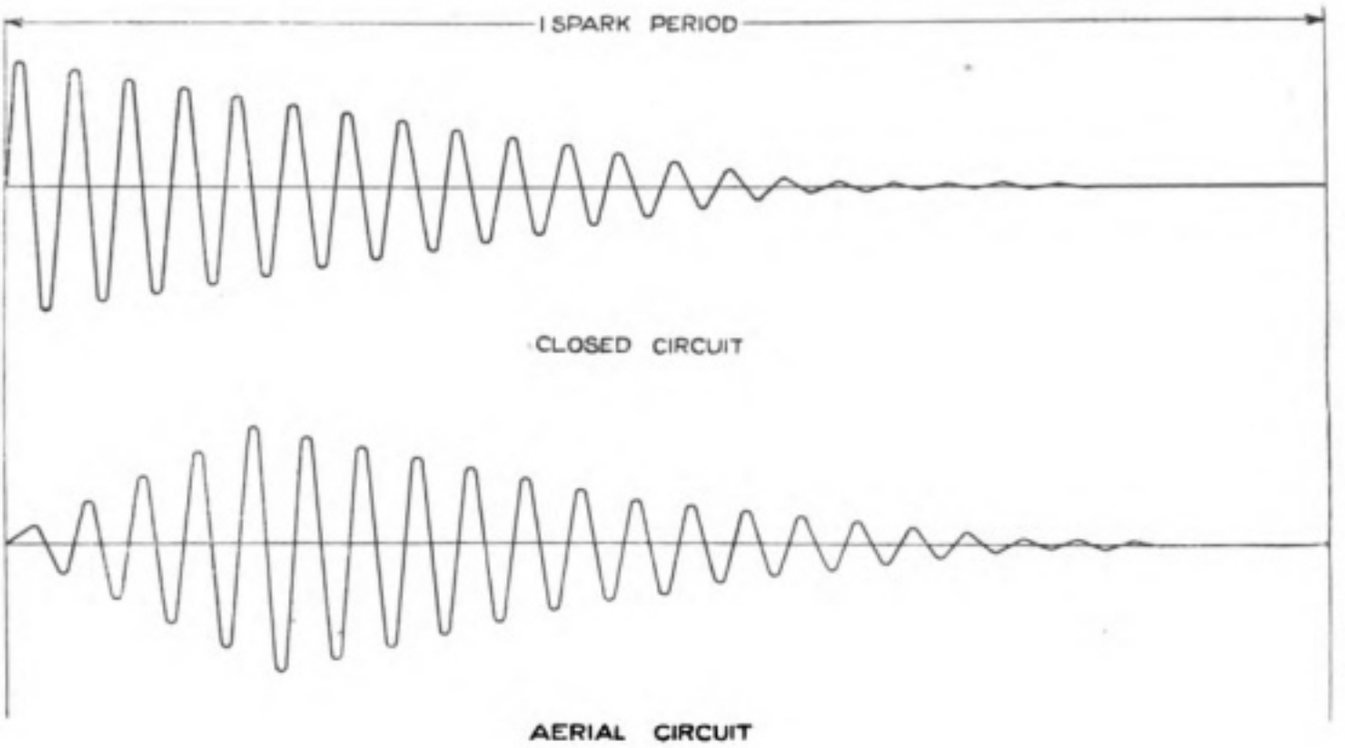


Fig 5.

assume that we have the two circuits, viz., aerial and closed circuits tuned together, and that the coupling between them is very loose.

Under these conditions the effects in the two circuits can be illustrated as in Fig. 5.

We see that the aerial energy is dissipated as fast as it is received, and therefore the total number of oscillations is equal to that of the closed circuit.

(*Two demonstrations were then given with two pendulums suspended from a flexible cord.*

In the first experiment they were well spaced apart, and when one was set in motion its energy was gradually imparted to the other, both coming to rest at practically the same time as illustrated in Fig. 5.

In the second experiment the spacing was very much reduced, and energy was re-transferred from that pendulum which corresponds to the Aerial Circuit, back and forth until it was finally dissipated in the string and air resistance. Fig. 7 *shows graphically what was indicated in the demonstration.*)

This point can be illustrated with pendulums such as those shown diagrammatically in Fig. 6. These pendulums are tuned together. They have the same period, and they are loosely coupled on a string. Now, if A is set oscillating slightly, in the course of a little time the energy will get transferred to B. If we consider A as the closed circuit of the ordinary transmitter and B as the aerial circuit, this illustrates pretty well what happens in the two circuits.

Now, this condition of coupling has to be avoided most carefully, and it is because in the past amateurs did not thoroughly understand what took place when they fixed up their transmitters that they frequently caused considerable interference with other stations; interference which was quite avoidable, and in addition obtained very poor ranges for themselves.

I cannot help thinking that the authorities would have been less stringent as regards present day transmitting licenses, if they had not had some unfortunate pre-war experiences with amateurs and their tightly coupled sets.

Now let us probe into the mysteries of the "troublesome" insect.

If the primary of TJ (Fig. 4) is magnetically closely linked with the secondary, then the closed circuit

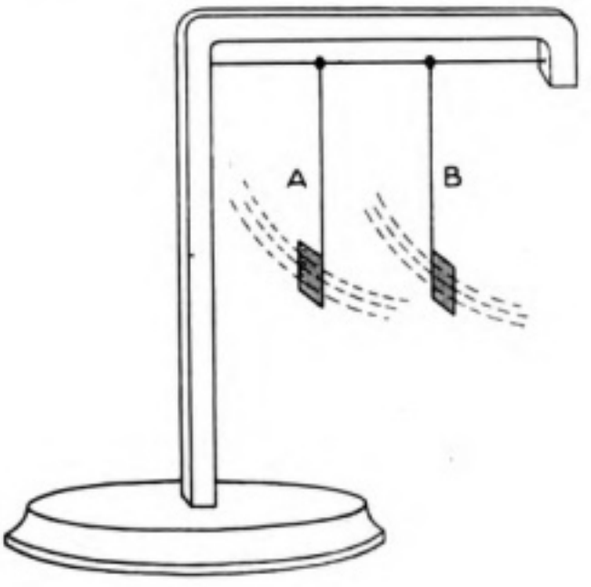


Fig. 6.

will impart its energy very rapidly to the aerial circuit.

The latter circuit, however, especially if it contains much concentrated inductance as in the Lodge circuit, or if it has a large capacity or both, will not radiate the energy in the form of free waves as fast as it receives it, with the result that what was once the secondary now becomes the primary and energy is again put back to the closed circuit, and is wasted in the spark gap.

Not only is the closed circuit highly damped, but the aerial circuit suffers in the same way.

Experience shows that the Lodge circuit is preferable to the tightly coupled two-circuit

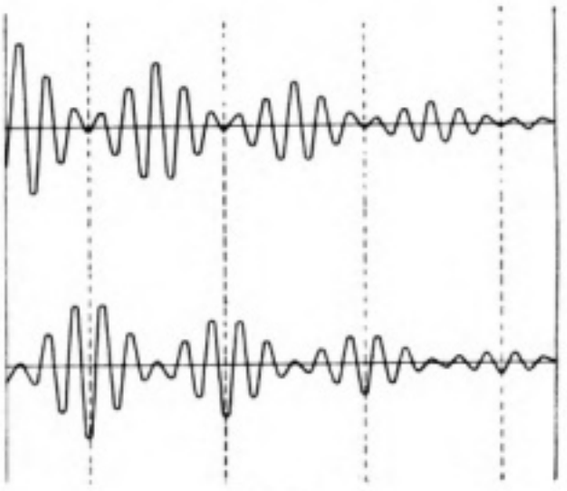


Fig. 7.

transmitter, since in the case of the former the waves radiated are of only one wavelength, whereas in the latter case, waves of two pronounced lengths are radiated, the shorter generally of greater energy than the longer.

The pre-charging of the Lodge aerial to a high potential before the spark takes place is a serious inconvenience to nearby receivers, as the electrostatic field thus created at low frequency is extensive enough to induce currents in any aerial within a mile or so, and such currents can be detected by any standard wireless detector.

For this reason, "plain-aerial" spark transmitters are prohibited.

It is easy to understand the reason for the double wave radiation previously mentioned. Consider the pendulums once again. When a force is applied to one from the other there is a tendency to accelerate the driven one; likewise there is an equal tendency to de-celerate the driver. Hence during the period of energy transfer both pendulums oscillate at different frequencies; one faster and the other slower than their individual natural periods.

As we have seen, that which was once the driver becomes ultimately the driven, and therefore it follows that both of them during different intervals of time move at rates slightly different to their natural rates.

In the same manner tuned electrical oscillation circuits will function.

(*A demonstration was then given with the apparatus shown in the photograph, Fig.* 8.)

I will now come to modern methods of increasing the efficiency of spark transmitters.

You will no doubt appreciate that loose coupling involves enormous wastage of energy in the spark gap of the closed circuit, a wastage which becomes more pronounced if a large inductance is inserted in the aerial for increasing its wavelength, since, as I have already pointed out, such inductance reduces the radiating qualities of the aerial.

This would not be so material if we could insure that after the energy had been transferred from the closed circuit, no re-transfer could take place.

To accomplish this necessitates an automatic opening of the closed circuit at a moment when it has imparted its power to the aerial system.

It is interesting to see at what speed this opening of the circuit must function.

Supposing we adjust the coupling to such a close value that the closed circuit imparts its energy to the aerial in, say, five complete oscillations.

If the wavelength is to be 300 metres, then the time occupied for the transfer is 1/200,000th second. In order that the aerial circuits shall not transfer back again, the incandescent gases of the spark gap must be cleared away or "quenched," in which case the energy can only

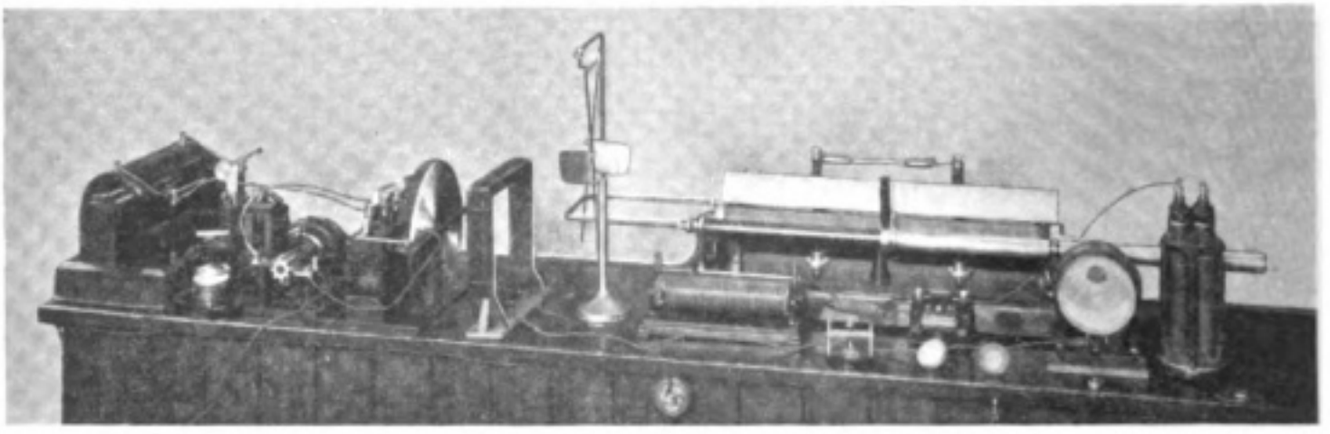


Fig. 8. *The Apparatus used in the Demonstrations.*

be dissipated in radiation of waves and ohmic losses in the earth, etc.

To obtain this quenching, many devices have been used and suggested, but time will not permit me to deal with these in detail.

Out of the many, we have the comparatively simple air blast method, but this has not proved itself efficient except for high power stations employing long waves.

With the use of long wavelengths the frequency comes down, so that if we take the figures I gave just now, but assume a wavelength of 10,000 metres, the period required for quenching becomes 1/6000th second (a more convenient time to deal with).

The principal objection to this method is the extra plant necessary for the compressed air. Pressures to the order of 150 lbs. to 250 lbs. to the square inch being required, a motor of considerable size is necessary, and the cost of running and upkeep is a factor which would appear to have been the principal reason for the non-adoption of the apparatus on a commercial scale.

Another method of quenching, due in the first instance, I believe, to Professor Fessenden, is the rotary spark gap, and this type, either in the synchronous or non-synchronous form, has been very extensively used.

In this gap, we have a drum or disc with projecting teeth or spokes rotated rapidly between two or more pairs of fixed electrodes.

The method of driving may conveniently be done by mounting the drum or disc on the shaft of the alternator supplying power to the closed circuit condenser, or a separate motor may be used, as in the case of the spark gap before you.

With the general use of comparatively high frequency alternators giving from 250 to 500 cycles per second, the number of spokes is usually the same as the number of poles on the machine, and the fixed electrodes are so arranged that a spark takes place once every half cycle, and at a time when the condenser voltage reaches its maximum.

Providing the area of the spokes is maintained small enough, the speed is high, the maximum working voltage low in comparison to a fixed discharger, and the oscillation frequency is relatively low, then what may be called a mechanical quenching will result.

The whole question turns on whether the sparking surfaces can be caused to separate sufficiently rapidly to completely open the circuit directly the energy has been imparted to the aerial.

Further, a design of the electrodes themselves which will create a pressure of air on the gap as they rotate will help matters considerably.

With high power sets, employing large diameter discs, thus giving high peripheral speed, and the use of long wavelengths, good quenching can be obtained, but the reverse is the case with small powers and wavelengths less than 1,000 metres, and I can prove this to you experimentally.

(*An experiment was then conducted with a rotating spark gap.*)

The most interesting and efficient form of quenched spark gap was due to Professor Wien, of Germany, in 1906, and has been most widely used by the Telefunken Company, and Messrs. Siemens Bros., of Woolwich.

That the Marconi Company here have now adopted it—in a slightly modified form—for their standard ship sets—may be considered by some as a further tribute to the genius of the inventor.

In this device, the total energy of the closed circuit is distributed through a number of very short gaps in series, consisting of carefully paralleled surfaces of silver separated from one another by washers of mica 0·2 mm. in thickness.

The energy of each spark is relatively small, and since it is surrounded by a large mass of metal which is capable of readily absorbing heat, the average resistance of the gap, when in a conductive condition is very high.

There is still some difference of opinion as to the precise action of this spark gap.

Leggett, in his recent work on the Quenched Spark System, quotes Fothergill and others as holding the view that the oscillating magnetic field set up reacts on the spark forcing it to the edge, where, owing to a deep groove being cut into the disc, it is extinguished owing to natural elongation.

This explanation would hardly seem to be sufficient of itself.

That a whirling movement of the ionised gases does take place seems probable, and this would be accounted for if we assume the production of eddy currents in the discs themselves.

Nevertheless, the material of which the sparking surface is composed is of considerable importance, silver being that which is used in practice.

Some years ago, I constructed a small quenched gap for myself for experimental transmissions, in which the discs were of an alloy of aluminium known as Fortalium.

I have brought it here for your inspection and interest.

This gap quenched quite satisfactorily when once it was carefully adjusted, but I found the surfaces were liable to fuse together after a time a defect not so noticeable with silver.

The degree of coupling between the aerial and closed circuit affects the quenching enormously, and experience shows that a value of 18 per cent. to 20 per cent. is the best to use. The coupling percentage is reckoned as if an ordinary open spark gap was employed.

If the coupling is too loose good quenching is not obtained, and if too tight, aerial reaction is established with consequent damping to that circuit.

Apart from a wavemeter test it is easy to tell if the coupling is too tight by the breaking up of the steadiness of the spark, and this can be distinctly heard, if one listens carefully.

(*A demonstration of the quenched gap was here given.*)

One advantage of the spark gap you have now seen working is that it makes a low frequency alternating current are almost impossible, and this valuable property was at once taken advantage of by the Telefunken Company, and enabled them to employ high frequency alternators giving 500

or more cycles per second and a spark frequency of 1,000 or more per second.

Those of you who were experimenting in wireless telegraphy some years prior to the war, will probably recall the admiration one felt for that beautiful whistling note of the Nauen and Norddeich stations.

Familiarity with modern notes, twangs, and ear-splitting howls associated with valve reception has rather dimmed our sense of appreciation of the high note spark transmitter.

Another type of quenched spark gap which, however, was somewhat similar to the Telefunken in construction, was due to Dr. Lepel. It is claimed that the action of this gap is different, but as one of our members, Mr. G. G. Blake, has brought one of these, which he made himself, and has used for a very interesting purpose other than wireless telegraphy, I will leave him to tell you about its performance later.

I think now that I cannot do better than to give a few practical hints regarding the setting up of small power spark transmitters.

With our power cut down to 10 watts, measured at the primary terminals of the induction coil or transformer, it is desirable that a high efficiency is obtained between this part of the plant and the aerial. Further, with the common wavelength allowed of 180 metres, corresponding to a frequency of 1,666,666 cycles per second, the losses which can occur are considerable.

The design of an efficient spark gap for such frequencies is still open for experimental research, and I feel sure might form the basis of many interesting experiments and discoveries.

An enormous amount of work has, of course, been done, but I think more with a view to the employment of high power and long waves than in the opposite direction.

It is in this opposite direction that more knowledge is required, and therefore on this account I have directed your attention this evening to the early wireless work which was all more or less associated with very short waves.

Let us consider the aerial circuit of a 180 metre transmitter.

Some eleven years ago I advocated, through the columns of the *Model Engineer and Electrician*, the use of enamelled and stranded aerial wire. At that time no such wire was marketed. I had some 7/22 S.W.G. phosphor bronze wire enamelled by a well-known wire company, and found a very marked improvement in signals of 300 metre wavelength.

Since that time this kind of wire has been employed commercially and in the services.

The earth connection is the most difficult proposition for the average experimenter transmitting with short waves. The bathroom tap earth is practically certain to be bad, and I would suggest that where the apparatus is installed in an upper room of a house, that a large portion of the outside wall be decorated with copper gauze or netting as a better alternative.

I have found it detrimental to efficiency sometimes to use two different or separate house "earths," connected in parallel, and I think the experience of others on this point may be of value.

All these matters affect the radiation efficiency of the aerial circuit, and thus the possibility of selectivity.

(*An experiment was here shown to illustrate the result obtained if the aerial is brought close to iron pipes or other material capable of absorbing electrical energy. A little bundle of iron wires was introduced into a tube, having four turns of thick cable wound over it and included in the secondary circuit. When the bundle of iron wire was inserted it choked down the current enormously, absorbing the energy which should otherwise have been radiated.*)

In conclusion, I would like to make it clear to everyone that there is a vast amount more to be said on this subject, and I trust that some of you with experience of other aspects of it, such as continuous wave transmitters and receiving circuits, will assist us in our quest for knowledge.

The Production of Diathermy Currents*

By G. G. Blake, A.M.I.E.E., A.Inst.P.

Mr. CHILD has asked me to explain to you the application of the quenched spark and hydrogen arc in the production of diathermy currents for medical purposes. The apparatus employed is very similar to that used for wireless telegraphy, and a description may be of interest to those members of this Society who are not familiar with it.

For many years hot air and radiant heat baths have been found to give great relief to pain in cases of arthritis, rheumatism, sciatica, etc., but the difficulty experienced with this form of treatment is, that the external temperature of the patient is raised above that of the internal organs, the heat having drawn the blood towards the skin. This makes the internal organs somewhat anæmic, and the perspiration produced acts as a wet blanket and protects them against an increase of temperature. By the application of diathermy, fever is artificially produced and localised, and its intensity and duration controlled.

When a patient holds two metal handles connected to a diathermy apparatus he first experiences a feeling of warmth, commencing in the wrists and gradually spreading up the arms, the blood is heated as it circulates along them and in a few minutes the whole body becomes heated, and a sensation is experienced similar to entering a hot house. The temperature may be raised to over 103° Fahrenheit.

* A contribution read at the Meeting of the Wireless Society of London.

THE PRODUCTION OF DIATHERMY CURRENTS

The patient's body takes the place of an ordinary heating unit, the heat is experienced in the wrists first, as they are the part having the smallest cross section and are the point of highest resistance.

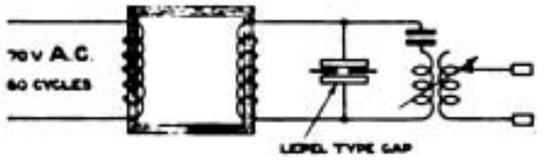
Thermometers introduced into animals, have proved that the increase of temperature is internal and greatest in the path between the electrodes.

Certain organisms which thrive at normal blood-heat are very sensitive to a rise of temperature, and can be destroyed by diathermy. For instance, there is a micro-organism known as gonococus which causes very painful inflammation often in the knee-joint; this is readily destroyed.

Another method of heating the patient instead of connecting him by electrodes directly to the source of diathermy currents, is to give the treatment on a condensation couch, where the patient takes the place of one plate of a condenser and is separated from the other plate by a thin sheet of ebonite or other insulating material.

There is another application of these currents known as cold-cautery, the temperature of the tissues and blood in the neighbourhood of malignant growths is raised until they are coagulated and destroyed *in situ*, and where the application of heat from red-hot cautery instruments would simply burn the parts where contact was made, and the destruction would spread scarcely any distance below the tissues (as they are poor conductors of heat); the tissues conduct the diathermy current so that they become heated through and through and coagulated *en masse* right down to the region where the density of the current is insufficient to produce enough heat; the blood-vessels and lymphatics in the growth are sealed, and the chances of dissemination are greatly lessened. Cold cautery is also employed with success for the removal of warts, moles and other small growths.

The following are the usual connections employed in the construction of diathermy apparatus :—



There are many different types of quenched spark in hydrogen employed by the various makers of diathermy apparatus. In my own set, which I constructed myself, I make use of the Lepel arc, which, as Mr. Child has explained to you, takes place through a sheet of paper which is charred, producing hydrogen gas.

(*Here an experiment was shown with a paper spill to illustrate the production of hydrogen gas with the combustion of paper.*)

The exact amount of capacity and inductance does not seem to be very important so far as the thermal effects are concerned, but it is necessary to have the condenser very large in comparison with the amount of inductance. From my own machine I can obtain an output of 2·5 amps diathermy current.

During the war I carried out some experiments with a view to the sterilisation of fragments of shrapnel or bullets *in situ*. In many instances, as most of you probably know, provided that the foreign body was not septic, the surgeons left it in the patient without any harm resulting. It occurred to me that it should be possible to raise the temperature of a foreign body (or bodies) while still imbedded in the patient and cause it to sterilize itself, by merely placing the patient against an inductance through which C.W. oscillations were surging. I remember seeing a demonstration, I believe by Mr. Campbell Swinton, at the Royal Institution some years ago. He held a sheet of tin foil in this way in front of an inductance, and it just melted.

It will melt equally well if the hand is placed between it and the inductance, and without raising the temperature of the hand. I carried out a number of experiments in this direction, and found that while it was easy to heat a comparatively large piece of metal, it was difficult to get a field of sufficient intensity to heat smaller fragments.

The inductance needs to be wound with large wire so that it can carry sufficient current, and yet it must be wound into the smallest possible space in order to concentrate the lines of force. After many experiments I was able to heat up fragments as small as a pea to past boiling point. I managed this, using a small water-cooled hydrogen arc taking 6 amps. or 220 volts., and by winding my inductance of copper strip ½ in. wide. This, of course, wasted a good deal of the energy, owing to its large self capacity, but it worked.

Full of excitement at the result, I communicated with several surgeons about it, and they thought it would answer quite well, but, and this is what spoilt it, to be of practical use, the shrapnel must be sterilized within an hour or even less of its entry into the patient, and a clumsy apparatus involving hydrogen arcs, etc., was out of the question at the front ; each soldier would have needed one in his waistcoat pocket ready in case of emergency, so ended my dream.

DISCUSSION.

The President (*opening the 'discussion*): As an item of history this little spark gap exhibited by Mr. Blake is previous to the Telefunken quenched gap. I think a good deal was done by Lepel, but his first intention was not to employ it as a spark gap since he first tried to make a receiver with it. He had a polished surface of metal pressing on a very thin piece of rubber against another piece of metal, and with these surfaces closed down very tight he thought it would act as a detector, but it did something more, he got a continuous hissing noise going on. This, then, was not only a detector, but a generator of oscillations. He tried to develop this and got the Lepel gap. There is one point which I have always believed has something to do with the action of this spark gap. When you have two large parallel surfaces with a piece of paper practically enclosed between them, and you make a little spark occur between them, that spark is in a very small space, and therefore heats the surrounding air. The pressure must rise very high round the spark on account of the heat, but it cannot expand because the space is very small. Now we know that a

high air pressure very enormously increases the resistance of a spark, and so tends to quench it: I think that has got a great deal to do with it

Mr. P. R. Coursey: There is one little point that might be interesting. Mr. Childs referred to the loss that might occur when transmitting if two or perhaps more earth connections are used. An experience I had once on a small ship installation rather confirms this. The earth connection in this particular case was made with a lead sheathed V.I.R. cable, and we found that there was practically no aerial current. We could not get any aerial current until we cut away that earth connection and put in an ordinary plain cable without lead-sheathing. I was a little bit puzzled at first, but I came to the conclusion that the principal reason was that the earth connection we had was not only a direct one through the conductor of the cable, but also that there was a very considerable capacity between that conductor and the outer lead sheath which was touching metal work and bulkheads in places. Hence there was not only a direct earth connection, but a pretty good earth connection through the capacity as well, and these two were making a type of rejector circuit, since when we altered the wavelength we got the normal aerial current. Well, it seemed to me that effect might occur when using the earth connections of ordinary type, and it is therefore a point that might be attended to rather carefully.

Mr. N. Faning: May I ask Mr. Child to kindly explain why you get less energy at the low wavelength than you do at the larger one. I do not quite understand that, because it seems that you increase the inductance to get the larger wavelength, and so you would expect to increase the energy at that. Looking at the experiment you got a great deal less.

Mr. C. F. Phillips: I think we ought to thank Mr. Child for giving us a most interesting demonstration. In these days of valves we are rather too prone to forget a lot of the earlier work, and if we forget all the earlier work it is not quite so easy to understand how modern wireless takes effect. It is nearly all based on the old principles, the old spark coil and the first experiments, and they are important and very freely neglected. Those people who go into wireless in these days of valves often never think of an old spark transmitter. They are missing a tremendous lot. The only point I can touch upon, I think, is the question of aerials. Of course losses in aerials of short waves must obviously be very much greater than long waves, but I am talking of the type of aerial that we all use, but the losses which take place with improperly placed aerials on any wave are tremendous. I have been giving one or two demonstrations lately, and in nearly every place where I have been demonstrating I have been told that there is a beautiful aerial very high, very long, perhaps a little too long, but nevertheless a splendid aerial. In every case I find that the down lead is tacked down by the side of the house, or something of that sort is brought in through a wall through a little thin tube. In one case it was carefully tacked along the wall and brought down. Nobody realised how great the losses were. I had an instrument in this case which enabled me to measure the capacity to earth, and I left things as they were in one case and demonstrated very effectively how to reduce the capacity of the aerial by 140 micromicrofarads (0.00014 microfarads). Well it is worth reducing an aerial capacity by that amount. You are able to tune to much shorter waves; and when you come to think of 0.00014 microfarads between aerial and earth it means a tremendous loss of signal strength. I really only got up, Mr. President, to thank Mr. Child for his interesting demonstration.

Mr. H. J. Neill.

I would like to make a suggestion which may seem rather fitting, in reference to what we have just heard, with regard to the cramming of modern experimenters with too much old "spark gap" theory and letting them try to apply it to valve oscillating circuits. Well, it does not usually apply, and frankly it very rarely applies.

The two cases are quite different. Take the case of the spark transmitter; you have, practically speaking, an initial displacement or charge on your condenser; the gap breaks down and you have the system in free oscillation. The forms of the waves and currents depend on the values of constants of the system, as a matter of fact these are expressed by a differential equation to which there are about ten possible forms of solution, about six of these are important.

Well, that is not the case in valve transmission, you have, it is true, two coupled circuits, but the conditions are not expressed by the same differential equation, but by the solution of this differential equation plus the solution of another similar equation giving the steady state. You have displacement effect and free oscillations of the system dying away, but the main effect is a steady state in which the energy of the system is maintained on alternate half waves by an impulse from the valve circuit. In other words it is like a pendulum being fed continuously with a series of unidirectional impulses. The result is sometimes akin to a sine wave.

A similar argument applies to receiving circuit couplings. You have the oscillating system fed all the time by the P.D's. received by the aerial, which may usually be regarded as a periodic function.

Generally speaking I have found these experimenters who went into theory realised this sort of thing, but that they all tried to apply the theory of spark to a valve oscillating circuit, and did not realise the different conditions of producing continuous waves. With spark they produced damped waves, and invariably two damped waves, but you cannot apply this reasoning to C.W. I cannot go into details here of the difference between spark and valve work, but the conditions are not the same.

Mr. Maurice Child (*in reply*): I was very pleased indeed to hear Mr. Coursey's experience with the earth connection on the ship. If that experience of his could happen on a ship installation how much more likely is it that similar effects will occur in installations in buildings, houses and flats, and so on. I am perfectly satisfied myself, from experiments which I have carried out, that the average earth connection in a house, either to a

water or gas pipe, is bad. I do not say that you will not get satisfactory results with it while you are using it for reception purposes, especially for long waves, but for short wave work (anything much below 300 metres), I feel quite certain that with very few exceptions if you are upstairs or above ground level it will be very much better to use a Lodge counter capacity.

A question was asked with regard to the energy of the two waves that we saw set up in the experiment. I did not quite get the meaning. What virtually happens is this: the closed circuit drives the secondary circuit and the frequency of the latter is higher than its natural period. Now, inasmuch as you get the energy from the closed circuit, we should expect to get fairly strong oscillations on the higher frequency. Now, when the secondary circuit is in turn putting energy back into the closed circuit, it is oscillating at a lower frequency, and at the same time the energy is very rapidly damped out because of the absorption of the closed circuit. That is what we noticed on the arrangement of the circuit shown. I cannot see quite how it can be otherwise. Of course you must remember that in this secondary circuit you have got a hot wire ammeter that has a resistance of 7 ohms., so that a good deal of the secondary energy will not get back to the primary closed circuit.

Mr. Phillips mentioned the subject of the aerial I fully endorse his remarks with regard to the tacking of an aerial lead-in to the wall.

Another little point which wants a certain amount of attention is the free end of the aerial. It is not a good practice to bring that free end up to a building. The mast does not very much matter, because its actual capacity is very small unless you have a lot of stay wires up, but generally speaking it is a good plan to leave several feet between the free end of the aerial and its support. I think that is also a point for short-wave work.

As to the question of valves *versus* spark and spark *versus* valves, I was rather hoping that perhaps at some very near date we might have another lecture on this subject dealing with the question of C.W. I certainly do not think the subject is one that the Society ought to drop for some time to come, as it is a most important one, and when I was asked to come and discourse on this subject I felt that at any rate the proper thing to do was to go back a little and start with some of the older work and leave it to others, with more experience perhaps, to unfold their up-to-date knowledge on other matters such as reception and more modern C.W. transmission. I think that is all, and thank you very much for your attention.

Short Wave Signals from America

AS stated in our last issue, the Transatlantic Tests, organised by the American Radio Relay League, have caused great interest in America among members of the League. Their decision to send Mr. Paul F. Godley over here as their representative to ensure that the signals be picked up if it is at all possible to get them, is only further evidence of their determination to make the Tests successful

It is generally believed in America that British amateurs have not suitable equipment for picking up their signals.

In pre-war days when we were limited entirely to short wavelengths, British radio amateurs carried out quite good radio work, but since at the present time we have the licences for 1,000 metres as well as 180 metres, most of us use the longer wavelength. The result of this is in the main that few of us have had much experience in the reception of short wavelength signals, using modern amplifying apparatus. In designing and handling valve circuits, almost as much depends upon working experience as upon the type of equipment used. In this respect the American Amateur is better prepared to receive short wave signals than the average British radio experimenter. Whether or no this receiving equipment will prove better than ours remains to be seen.

Mr. Godley arrived at Southampton in the early hours of Tuesday morning, November 22nd, and after the necessary customs formalities with regard to his wireless gear proceeded to London to discuss the arrangements made for him, and his proposed programme of operations. At the time of writing, he is now engaged upon preliminary tests to investigate receiving conditions on this side of the Atlantic, before finally deciding upon the location to be adopted for his receiving station.

In the main, the equipment that he will use consists of a standard amateur "Regenerative" receiver and amplifier, and an Armstrong Supersonic heterodyne apparatus. While of course the latter has greater amplifying qualities, his great aim is to pick up the signals using as nearly standard American amateur equipment as possible —that is, a regenerative receiver with two or three valves.

A word may be added here as to the differences between the usual American and British equipments used by amateurs. In America, receivers of the "Regenerative" type are the most common, either used as single valve receivers, or in conjunction with one or two stages of low frequency amplification (note magnification). The term "Regenerative" receiver indicates an apparatus in which means are provided for "*regenerating*" the signals, *i.e.*, the incoming signals are amplified by the valve, and the magnified oscillations are fed back again into the grid circuit, so that the valve tends to *generate* continuous oscillations. A similar effect is of course obtained in ordinary reaction valve circuits—or autodyne circuits as commonly used in this country. In the American apparatus the plate circuit of the valve is tuned

to the wavelength of the incoming signals, usually by means of a variometer, the feed-back to the grid circuit occurring generally by reason of the inter-electrode capacity of the valve, and by stray capacities or magnetic couplings between the grid and plate circuits.

Such a tuned plate circuit gives the maximum amplication that it is possible to secure with a single valve, since the plate circuit under these conditions offers a very high effective resistance to currents of the frequency to which it is tuned. Similar effects are, of course, also obtained with ordinary tuned plate circuits in which the tuning is effected by means of a variable condenser across a fixed inductance, but since the effective resistance of a parallel resonance circuit of this type is proportional to the ratio of the inductance to the capacity of the circuit, the effective resistance of a variometer tuned circuit should be somewhat higher than when a variable condenser is used. The amplification given by the valve will, therefore, also be slightly higher, but not much so if the tuning condenser in the other type is kept small.

Control of the oscillating state of the valve in a regenerative receiver is effected mainly by varying the tuning of the plate circuit since the retroactive coupling is constant.

The principles of the Armstrong super-heterodyne circuits have already been described in these columns*, and the reader is referred to that description for further details.

Attention may also be drawn to a speech made by Mr. Godley at the meeting of the Wireless Society of London, held on Wednesday, November 23rd, in which he outlined the work of the American Relay League, and his views about amateur wireless work in this and his own country. A report of the speech will be found on pages 574—576 of this issue. P. R. C.

* See *Wireless World*, November 13th, 1920, pp. 581 583.

Changes in French Time Signals

Since November 15th important changes have taken place in the time signals transmitted by the various French stations. Lyons (YN) now transmits rhythmic scientific signals (beats) at 0800; the international signals from Paris (FL) and beats formerly transmitted at 0955 and 1030 have been advanced by half an hour; the two series of beats transmitted by Paris (FL) at 2110 and at 2300 have been replaced by a single transmission at 2200; the non-musical beats at 2330, the only regular service which was still being sent from the old spark transmitter of the Eiffel Tower, has been suppressed; the French signals from Paris (FL) formerly transmitted at 2345 have been advanced by one hour. The only transmissions remaining unchanged are the French signals from Lyons (YN) at 0900, and from Paris (FL) at 1045, and the beats from Bordeaux (LY) at 2000. The following is a table of these changes:

0800 Lyons	(YN)	15,500	C.W.	Rhythmic scientific signals.
0900 Lyons	(YN)	15,500	C.W.	French time signals.
0925 Paris	(FL)	2,600	spark	International time signals.
1000 Paris	(FL)	2,600	spark	Rhythmic scientific signals.
1045 Paris	(FL)	2,600	spark	French time signals.
2000 Bordeaux	(LY)	23,450	C.W.	Rhythmic scientific signals.
2200 Paris	(FL)	2,600	spark	Rhythmic scientific signals.
2245 Paris	(FL)	2,600	spark	French time signals.

The times of the first and three hundredth beats of the scientific signals are now given in Sidereal Time instead of Greenwich Mean Time.

For each series of beats transmitted by Lyons, Paris or Bordeaux, the times of the first and of the three hundredth beat are sent before the following signals from the same transmitter: the time of the beats from Lyons (YN) at 0800 before its French time signals at 0900. Those of the beats from Paris (FL) at 1000 before its French time signals of 1045. Those of the beats from Paris (FL) at 2200 before its French time signals of 2245. Bordeaux (LY) having only one transmission of time signals a day, the times of its beats of each day are sent before its scientific rhythmic signals of the next day. Other details remain as prior to November 15th.

Our Questions & Answers Section

OUR readers will notice that, with this issue *The Wireless World* adopts a different style of printing from that to which we have hitherto been accustomed. The reason for this reduction in size of type is our inability to do justice to some sections of the Magazine owing to lack of space. The section which has contributed primarily to the necessity for this change is the Question and Answers Section.

Recently we have re-introduced the practice, which was suspended for some time, of including the questions with the answers given. Space again was the factor which necessitated the omission of the questions.

In pointing out these things, we do so with the assurance that any suggestions we make which will simplify our work and tend to speed up the publication of replies to questions, will receive the ready co-operation of our readers.

Our suggestions, then, are as follows:—

(1) That questions that can be answered through elementary wireless text books, which should be in the possession of every wireless experimenter, should not be referred to this section.

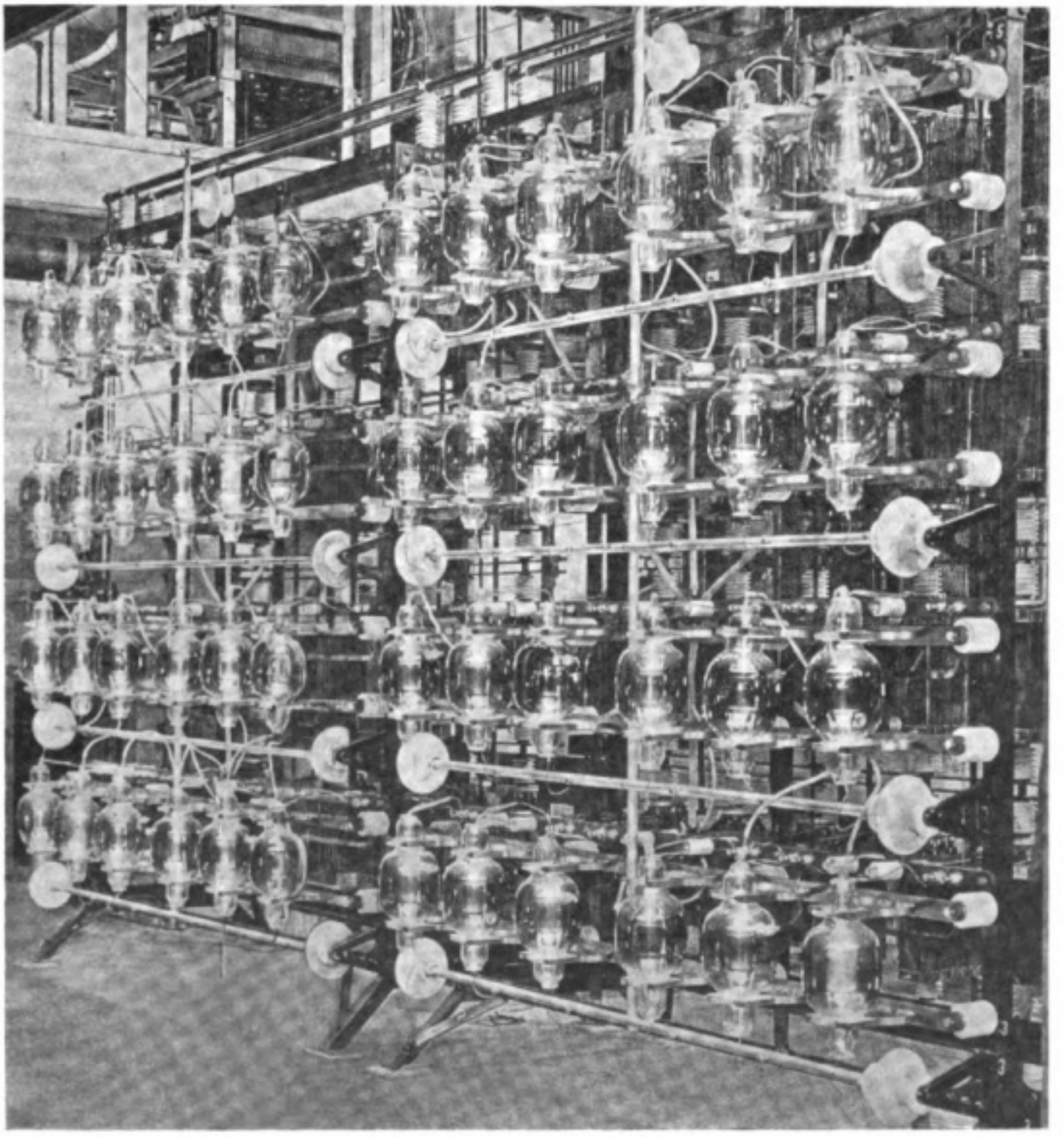
(2) That readers should not take advantage of the offer that four questions will be dealt with at a time, except in cases of necessity. It sometimes appears that a reader wishes to have one serious question answered, and adds to this two or more questions of little importance.

(3) That each separate question should be set out on a separate sheet of paper, and on one side of the paper only.

If readers will give attention to these little points we feel confident that it will be possible to add greatly to the value of this service by dealing more promptly with questions sent in.

Direct Wireless to Australia

A GRATIFYING RESULT WITH VALVE APPARATUS



The Valves employed in the Test.

WIRELESS Test Messages, prepared by an independent expert and transmitted in his presence, were sent direct to Australia on Sunday evening, the 20th November, from the Marconi Station at Carnarvon.

Cablegrams since received by the Marconi Company, announce the reception of the complete messages, on the first transmission, both at Sydney and Melbourne.

The apparatus employed for this demonstration was a Marconi Valve Transmitter, seen in the illustration, composed of 56 valves. Aerial currents up to 350 amperes have been registered and, with certain additions, it is anticipated that an aerial current of 1,000 amperes may be obtained.

This transmitter is the most powerful of its kind in the world.

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 in the exact form in which they are to appear and as concise 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 of unusual or special interest read before Societies.

Wireless Society of London.

The 41st General Meeting of the Society was held on Wednesday, November 23rd, at 6 p.m., at the Institution of Electrical Engineers, the Chairman, Mr. Frank Hope-Jones, in the chair. After the minutes of the previous meeting had been read by the Secretary and confirmed by the meeting, the **Chairman** said :—

Before I call upon the lecturer there is a little business to transact. In the first place, I must apologise on Dr. Erskine Murray's behalf for his absence through ill health, combined with great pressure of official duties. Then I have to announce that there are three Societies who have applied for affiliation and the Committee has granted it in all cases :—The Cowes Wireless Society, Isle of Wight ; The Leeds Wireless Society and the Oldham Lyceum Wireless Society. There is one new member for ballot to-night, whose name you will find upon the seats, and those papers will be collected at the end of the meeting.

I wish to remind you that this is the last meeting before the Annual General Meeting, always held, according to our Constitution, in the month of December. Our meetings, of course, now are uniformly on the fourth Wednesday of each month. The December meeting falls just after Christmas. At that meeting it is our duty to elect officers for the coming year and to elect members to replace those who are compulsorily retired. Now it will be the duty of the Committee to put before you, by post, fully a fortnight before that meeting, in the notice calling that meeting, their proposals for the following vacancies of the Officers of Committee. I wish to remind you that our constitution is a democratic one and that we would like the general body of members themselves to suggest candidates for election on the Committee. It is opportune that I should remind you of this now because any such proposals must be put in writing and handed to the Secretary in good time before that notice comes out, a fortnight before the December meeting. In order to enable you to make some suggestions, I should give you now the Committee's proposals for the personnel of the Society for the coming year.

I think I should announce, first of all, that in place of our President, who has served us so well, we have been fortunate in securing the promise of Admiral Sir Henry Jackson, F.R.S., etc., who will become our President for the following year, for election by you. (*Applause.*) Of course, Dr. Erskine Murray becomes a past President, and as such we retain his services on the Committee as a Vice-President. We have asked Major Basil Binyon, formerly Vice-Chairman, to become Acting Vice-President. He will remain in that capacity with Mr. Klein. The Committee have asked me to remain as Chairman. (*Applause.*) These are only the suggestions of your Committee for you to vary in any way you like, providing your suggestions are put in writing in time for the Secretary to transmit them to other members for their consideration before the Annual General Meeting in December. As Vice-Chairman, the Committee propose in place of Major Basil Binyon, who becomes a Vice-President, Mr. Maurice Child. Mr. Child, I would remind you, is the one member of your Committee who has retired by rotation, and we retain his services by asking him to become Vice-Chairman. Mr. G. P. Mair will remain in the same capacity, and with regard to the Committee, we have two vacancies, one to replace Mr. Maurice Child, as previously explained, and one who neither you or the Committee have filled. There has been a vacancy on the Committee. With respect to these two vacancies on the Committee, your Committee have two to propose, and they are Mr. Phillips and Mr. Rupert Carpenter. These matters are your own affair and it is for you to avail yourselves of your privileges.

I have to inform you that we have a distinguished visitor here to-night, a very welcome one, Mr. P. F. Godley, of the American Radio Relay League, who arrived in this country from the States yesterday. He, as you know, is over here officially, for the well known Society which concerns itself mostly in the organisation of transmissions on the other side of the Atlantic, and he is over here in order to see if he cannot hear his friends across the Atlantic, where we have so far failed to do so. I hope the time will permit of him telling us of the aims and objects of his Society and what he has come to do on this side.

I have nothing more to say now except that as many of us desire to go to the Society of Arts after this meeting, where our former President and our permanent Past President is Chairman this year for Professor Fleming's Lecture, we are anxious to get through our business quickly, so without further words I will call on Mr. Leslie Miller to give us his paper on "Loose Contact Thermal Telephone Receivers." (*Applause*).

(*For full report of this paper and discussion see next issue of* THE WIRELESS WORLD).

At the conclusion of the discussion the Chairman said : I shall be very glad if Mr. P. F. Godley will be good enough to give us a few words on the many subjects which are of mutual interest to us on both sides of the Atlantic. (*Loud and continued applause*).

Mr. P. F. Godley.

I am pleased to be with you this evening, but I want to warn you that you will find that I am by no means a distinguished visitor, although I feel I am quite a welcome one. I want to take advantage of this opportunity to thank the members of the organisation whom I have met for the very kind co-operation that they have offered to me. Perhaps some of you have not heard what my aims are, and may be, that you would be glad to listen to them. Briefly, to begin with, I might outline how this visit has come about. Last year,

as perhaps you will remember, an attempt was made on the part of some American amateurs to communicate with their cousins, as they speak of those in Britain, and as the preparations were hurried, we thought that they did not stand the chance of getting across that we might have stood otherwise. I presume it is rather difficult for British amateurs to realise the great enthusiasm which is displayed in America for amateur radio work. There are at present a quarter of a million people who actually operate some kind of radio equipment, and as a result of that, we have managed with quite a little jockeying to put ourselves in a position where we get almost anything we ask for. If it were not for the fact that some very distinguished members of the Post Office Organisation are present, it might be that I should speak a little more plainly on the subject then I do under the circumstances.

Mr. E. H. Shaughnessy.

I should like you to say exactly what you feel. I should like to warn you that we are very hard-skinned in the Post Office. (*Applause.*)

Mr. P. F. Godley.

I have already been warned.

At least the amateur radio in America is a real wonderful thing, not only from the point of view of education, but from the point that it really knits us closer together than anything else of which we know. At the present time some of the largest organisations, the General Electric Company and the Westinghouse Company, are installing in our principal cities, broadcasting radiophone stations, and at this moment there are daily concerts: about every other day, gramophone concerts and operas, the artists performing before the microphone. Sundays, most anyone within range of one of these stations has the privilege of listening to a sermon from some of our best pastors in the country, together with the music by the choir, and an organ solo: and that thing is only starting. The Radio Corporation is now proposing that a suitable telephone installation be installed in the House of Parliament in Washington, so that the country may listen in to any debates of importance and any speeches by the President, and they will become available to anyone, regardless of their location. It does not seem at all unreasonable to believe that within the next two or three years this may come about, and you can realise what a wonderful impetus it will give to amateur radio work in America.

My visit here at this time is concerned with the Radio League work. The American Radio League numbers about 15,000 men, all of whom have transmitters of some type, spark, C.W., or telephony. These men have banded themselves into a relay organisation. They have laid out in definite form certain traffic routes and branches to the main traffic routes, and messages of a strictly personal nature are broadcasted across the country any time of the night. One can get them at 5 or 6 in the morning, and often hear many people who have been at it all night. Of course, they cannot do it every night in the week, but they do it some nights. These relay routes enable the transmission of personal messages from coast to coast, and from the Canadian border to the Mexican border. The Canadians, too, are taking part in this work, and there are some amateur Canadian stations which operate over very large distances. Another thing which will possibly be of interest and which may be surprising to you, is that the amateur station of 1 kW. and 25 per cent. efficiency between the input and the antenna is in communication every night during the cooler weather with points up to 700 and 800 miles distant without any difficulty, principally all over the land, and it is quite frequent that stations on the Pacific coast communicate directly with stations on the Atlantic coast. The principal difficulty there is the interference. With some 15,000 or 20,000 transmitters, you can imagine what the conditions are like, so that the average distances over which communication is carried on may then more likely be some 300 or 400 miles, and after 10 p.m. at night communication over larger distances takes place. The local communication all takes place prior to 10 p.m., subsequent to 10 p.m. is the time allotted for long distance work.

In the preliminary tests which were carried out last month with a view to selecting those stations best fitted to take part in the Transatlantic experiments, we had one station located in Georgia, using three vacuum tubes, who was reported very loud at a distance of 2,450 miles. We have another station in Chicago, with 1 kW. input, 500 cycles spark, who has been reported as having been got in Bordeaux, France. Another station in a small town (I have forgotten the name of it at the moment) in New Mexico, very close to the Mexican border and east of the Rocky Mountains, for five nights in succession, operated a 4 ohm telegraph sender in my station, which is 15 miles west of New York City, all of this work being done on inputs below 1 kW. Several radio men whom I have met since reaching England have rather been inclined to smile at our optimism in hoping to be able to hear signals on this side: these three estimates which I have given you will give some indication as to why we are optimistic. We should really like to be able to get several stations, and I shall be very glad if we do. Your Honourable Chairman, I fear, impressed you with the fact that we have a feeling that in having sent a man over here we will get signals. We sincerely hope so. We do not think we can show you how to do it, but we want you to get the proper idea. We have admiration for the accomplishments which Englishmen are responsible for and I feel sure that there is no one of us in America who feels that we can tell you anything about how to do it. All we hope is to create an interest in the subject.

As to the attitude of your Post Office Department, it is a deplorable one. I fully appreciate, I believe, their attitude in the matter, and I do not know that I can say I blame them particularly, but I do at least hope that a time will come when amateur radio will be viewed in Europe in the same light as it is now viewed in America.

It has occurred to me, in talking with several of your men, that it would be a great deal better for you if you could be allowed to operate, or rather if you chose to operate, as far as you are now allowed to do, on a shorter wavelength, rather than on those wavelengths in the vicinity now considered useful by your Post Office Department and by the

Navy and by your Air Ministry. If we in America were given our choice between 180 metres and 1,000, without any hesitation we should choose 180 metres, for the reason that when one uses small power one has far greater hopes of being able to travel greater distances on shorter wavelengths than on higher wavelengths.

I happened to be talking the matter over with Mr. Coursey and Mr. Phillips this afternoon, and I pointed out that the efficiency of the antenna of the New Brunswick Station of the Radio Corporation is a little under 4 per cent, whereas the efficiency of many of our amateur antennas as radiated will run as high as 60 to 65 per cent. The radiation at the New Brunswick station at the present time is something like 600 amperes, the antenna resistance is ¼ ohm, you have a total of 180,000 watts in the antenna, but only 4 per cent of that is radiated. We figured it out this afternoon that that would be 7.2 kW. Let us estimate that we have an amateur station with say 6/10ths kW. in the antenna with an efficiency of 60 per cent, you have quite a considerable amount of power radiated, something like 0.36 kW., which is quite comparable with the 7 kW. actually radiated by the 300 kW. Marconi station. We try to keep our antenna efficiency high, and are very pleased to be able to communicate over large distances.

Thank you very kindly. (*Loud and continued applause.*)

The Chairman.

Gentlemen, I have to announce that the candidate for ballot, Mr. Clarence S. Goode, has been duly elected to membership. The meeting is now closed.

The meeting adjourned at 7.20 p.m.

Wireless and Experimental Association.

(*Affiliated with the Wireless Society of London.*)

At the meeting of the Wireless and Experimental Association at Peckham, on November 9th, the Secretary gave a few practical hints on the erection of wireless masts, emphasising the general suitability and availability of straight grained two inch by two inch deal or pine. Nicely planed and with the sharp edges removed and given three coats of good paint, such a pole with proper staying with No. 20 bronze wire would withstand any gale we are likely to get in England, or at least in the neighbourhood of London, and might be thrust 50 feet up into the ether and still look workmanlike.

One of the members reported receiving the new American station at Arlington.

A letter was read from another member, Mr. Sam Middleton, of old telegraph repute, promising a complete set of coils for the Club's installation.

Discussion arose on the question of the provision of battery power for the Club's set, and Messrs. Mitchell, of Rye Lane, offered a loan at any time required at most advantageous terms, and the offer was accepted with a vote of thanks.

Not alone pure wireless matters occupy the attention of the members of the Wireless and Experimental Association, as is indicated by their title, and it was quite in accordance with the fitness of things that they were treated, on October 26th, to a digest of Sir W. A. Tilden's paper on "Chemical Discovery and Invention in the 20th Century."

A member, Mr. Arthur H. Bird, essayed the difficult task of summarising the illustrations original, and he ably acquitted himself of the task.

Mr. Kloots continued his lecture on A.C. transformer design.

At the meeting of the Wireless and Experimental Association at the Central Hall, Peckham, on Wednesday, November 16th, Messrs. Bird and Newson, members, demonstrated the use of the Redwood Viscometer. As use of oil plays a part in air experimental work, the exposition of the apparatus was well received. For the benefit of the elementary members the use of headgear receivers of various resistances as well as telephone transformers was fully explained by the Secretary, who also gave a description, with sketches of the covering of fine wires with silk and cotton. It is hoped to arrange a Saturday visit to a wire insulating works in the near future. The Chairman, Mr. Knight, extended for one week the competition for the best description of a transmitting circuit shown on the board, and Mr. Voigt discoursed on various diagrams of capacity reaction circuits. A short question as to whether, with a three-plate condenser, if the middle plate changed its relative position to the other two the capacity was altered, was also dealt with by Mr. Voigt.

Hon. Secretary, Mr. G. Sutton, A.M.I.E.E. 18, Melford Road, S.E.22.

Sheffield and District Wireless Society.

(*Affiliated with the Wireless Society of London.*)

A meeting of the above Society was held on October 21st, at the Department of Applied Science, The University, George Square, Sheffield. Professor Crapper, the Society's new President, was in the chair. A very interesting and valuable lecture was given by Mr. C. Handford, B.Met., on "Comparative Amplification."

The paper first dealt with the relative advantages of High and Low Frequency Amplification, and then went on to deal with the various circuits employed for H.F. amplification, showing how they were all developed from one fundamental idea, and to what extent this relationship was retained in the evolved circuits.

The lecture was well illustrated by lantern slides showing the circuits' arrangement for obtaining the various results. A lively discussion followed, and a hearty vote of thanks was awarded to Mr. Handford for his careful research work necessary to verify his results.

Leicestershire Radio Society.

(*Affiliated with the Wireless Society of London.*)

A General Meeting of the Society was held on October 10th, at headquarters, the Vaughan College, Mr. C. T. Atkinson, President, in the chair.

Amongst the business items were two admissions and nominations for election of officers for 1922. The President announced that the first of informal meetings arranged two weeks after each general meeting would occur on November 24th.

The lecturer for the evening was E. Masters, Esq., whose lecture, entitled "The Modern Electron Theory," aroused very keen interest. Although this subject was rather technical and deeply involved it proved engrossing, and elicited many questions

which Mr. Masters most ably answered. The lecture was dealt with very straightforwardly, which proved the lecturer's complete grasp of the subject, and many who attended departed enlightened on matters hitherto difficult to fathom.

A very hearty vote of thanks was accorded to Mr. Masters, who suitably replied.

The next meeting was informal, and was passed by experiments and Morse practice.

A General Meeting was held on November 7th, at headquarters, the President being in the chair.

Two further gentlemen were admitted to the Society. The lecturer this evening was Mr. A. E. Ball, whose subject, "Some Experiences with Inductances and Transformers," came rather as an agreeable surprise, because Mr. Ball dealt with the construction of these in several forms as in personal experiments. Many interesting points were raised, and a lengthy discussion followed.

The President afterwards proposed a very hearty vote of thanks to Mr. Ball, and thanking him for the kind description of his own particular apparatus, closed the meeting at 9.30 p.m.

The next informal meeting occurred on November 21st, but as the new year is approaching, those present discussed suggestions to hand regarding lectures to be arranged.

Those interested in the Society should communicate with the Hon. Secretary, Mr. Jos. W. Pallett, 24, Glenfield Road, Leicester.

North Middlesex Wireless Club.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. E. M. Savage, "Nithsdale," Eversley Park Road, Winchmore Hill, N.21.

The 79th meeting was held at Shaftesbury Hall, Bowes Park, on Wednesday, November 16th. The chair was taken by the Secretary, who called attention to the new loading unit made by Mr. W. A. Saville, for the Club. This consists of a number of basket coils enabling the Club's receiving set to be loaded up from 600 to 30,000 metres. Mr. Savage then called on Mr. F. Hilton to give his lecture on "The C.G.S. System of Units."

Mr. Hilton then explained at length how the need arose for having all units used in mathematical calculations co-related, and explained by means of formulæ how the system now in use had been built up. He showed how the fundamental units of length, mass, and the time formed the basis on which all mathematical units rested. He also explained how the electrical units were derived. At the close of his lecture, a vote of thanks was moved by Mr. Dixon, and carried in the usual way.

The new loading coils mentioned above were then connected to the receiving set, and very satisfactory results obtained.

Leeds and District Amateur Wireless Society.

(Affiliated with the Wireless Society of London.)

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

The first Annual General Meeting was held on October 7th, at the Leeds University, Mr. G. P. Kendall, B.Sc., being in the chair. The Chairman called upon the Hon. Treasurer (Mr. R. E. Timms) to read the statement of accounts for the past session. Mr. Timms informed the meeting of the Society's financial position, and stated that the accounts would be available for inspection at the conclusion of the meeting. The Hon. Treasurer's report and balance sheet were accepted unanimously.

The following gentlemen were elected officers for the new session 1921-22. President, Professor R. Whiddington, M.A., D.Sc.; Vice-Presidents, Mr. J. E. Tindall, B.A., B.Sc., Mr. G. P. Kendall, B.Sc., Capt. F. A. Whitaker, R.E., and Mr. A. M. Bage; Hon. Secretary, Mr. S. Kniveton; Hon. Treasurer, Mr. R. E. Timms; Committee, Messrs. Cooper, Hall, Croysdale, Whittle, Holliday, Yardley and Stead.

The Chairman announced that accommodation for the ensuing year had been secured at the Leeds University, Dept. of Geology. Arrangements were drafted out for holding an exhibition of apparatus and demonstration of wireless telephony at an early date. After the enrolment of five new members the proceedings terminated. Attendance was good.

The "Exhibition of Apparatus and Demonstration of Wireless Telephony" was held at the Headquarters, on Saturday, November 5th. The display, etc., was open to the public, the attendance being greatly in excess of that anticipated. The wireless telephone demonstration was conducted by Messrs. Yardley and Whitaker. Mr. Yardley transmitted music, both chin and instrumental, from his originally designed two-valve transmitter 2LB on 1,000 metres at 10 watts. The speech, etc., was received at the exhibition on a temporary aerial, and rendered audible to the audience by apparatus assembled by Mr. Whitaker, which included a four-valve set, comprising three H.F. transformer coupled amplifying valves and one rectifier—ES 4 valves being used—with numerous pairs of Brown's telephones in parallel. Taking into consideration the interference due to A.C. mains, tramways static, and the usual hubbub of an exhibition, the demonstration was highly successful, and Messrs. Yardley and Whitaker are to be congratulated for having done some really wonderful work, under extreme disadvantages. The exhibitors of apparatus were Messrs. Bage, Kendall, Holliday, Whitaker, Yardley, Hall, The British Wireless Supply Co., The North Eastern Instrument Co., and Pettigrew. The apparatus displayed was for the main part entirely home made, and together with the manufactured gear, formed such a large collection of apparatus, that it would be entirely impossible to give an adequate description in this limited space.

A General Meeting was held on November 11th, G. P. Kendall, Esq., being in the chair. The resignations of Mr. J. E. Tindall (Vice-President) and Mr. S. Kniveton (Hon. Secretary) having been tendered recently, on account of pressure of work, were brought before the meeting. The resignations were accepted with regret. Mr. D. E. Pettigrew was elected Hon. Secretary. Fifteen new members were enrolled, bringing the membership of the Society close upon seventy. The meeting then broke up into two sections, a paper on "The Electron Theory" being read to the primary section by the Hon. Secretary, and Mr. Bage spoke on

Radio topics in general to the secondary section. The meeting terminated at 9.30 p.m.

In future Morse classes are to be held at each meeting, under the supervision of Messrs. Fryer, Cockroft and O'Donohue. Names of members desiring to join these classes should be given to any of the above instructors, or to the Hon. Secretary. The Society meets at the Headquarters on the second and fourth Fridays of the month at 7 p.m. As a result of a Committee meeting, the membership has been extended to ladies (British subjects), and all persons desirous of joining the Society, or requiring information concerning the Society, are requested to communicate with the Hon. Secretary.

The Radio Society of South Africa.

(Affiliated with the Wireless Society of London.)

Cape Provincial Branch.

On Friday, September 30th, Professor A. Ogg presided over the Annual Meeting of the above Society in the engineering lecture room University Buildings, Cape Town, at which there was a good attendance of members. The financial statement showed a credit balance of about £24.

The attendance at the regular monthly meeting averages forty. In addition to practical work and the exhibition of some interesting films, the following lectures were delivered :—"Wireless Telephony and Telegraphy," by Messrs. Bridge and Rogers; "The Postmaster-Generals," by Mr. H. E. Penrose; "The Measurement of Extremely Small Distances," by Prof. L. Simons; "Construction of Amateur Apparatus," by Messrs. H. E. Penrose, J. S. Streeter and L. B. Bridge; "How Radio Signals are Propagated and Received," by Mr. H. E. Penrose; "The Thermionic Valve," and "Wireless Aircraft," by Mr. Poyntz; "Elementary Principles of Wave Motion," by Prof. A. Ogg.

The membership roll now stands at 87, and that of the Durban Branch, over 40.

A hearty vote of thanks was accorded Mr. H. E. Penrose for the yeoman work he had done for the Society since its inception. The election of officers for the ensuing year resulted as follows :—Chairman, Prof. A. Ogg; Vice-Chairman, Messrs. W. H. Perrow and H. P. Trainor; Treasurer, Mr. G. W. Heugh; Secretary, Mr. G. H. J. Sadler; Committee, Messrs. A. Copenhagen, A. Freeman, G. H. Grey, J. Levyns, J. Milne, A. Speight and J. S. Streeter.

All communications in connection with the Radio Society of South Africa should be addressed to the Secretary, P.O. Box 43, Simon's Town.

The Radio Scientific Society.

(Affiliated with the Wireless Society of London.)

At a meeting held at the Society's Rooms, November 2nd, 1921, Mr. Boullen took the chair.

After the transaction of the usual business, Mr. Halliwell was called upon to give his paper on "The Mushroom Valve."

In the course of his remarks he pointed out the special features of this new valve.

After an interesting discussion on the various points put forward by the lecturer, a valve was shown in operation, and was responsible for much expression of surprise by those present on its extraordinary properties.

A very pleasant evening closed with a hearty vote of thanks to the lecturer for his paper.

An Ordinary Meeting of this Society was held on Wednesday, November 16th, 1921, at 61, High Street, Manchester, Mr. G. G. Boullen in the chair.

After the usual business, a new member was elected, and a paper read, and experiments carried out by Mr. E. Grocott on "Relays for Wireless Purposes."

The lecturer explained in detail the following relays :—Post Office "B" type, Gulstadt, Gulstadt as modified by the Post Office, Weston Moving-coil, Bow type, and Brown telephone relay.

He discussed the common difficulty in using relays to work other apparatus in conjunction with a wireless receiver and amplifier due to the certain steady current produced by a valve whether affected by signals or not, and offered as one solution the Gulstadt relay.

In this relay the tongue is continuously vibrated by extra electro-magnetic means, and so prevented from taking up one bias or the other and remaining there.

An arranged letter in the Baudôt code was then received from an experimental station about 20 miles away, and made visible by means of the Gulstadt relay, at the same time and connected to the same receiving apparatus was a pair of telephones, but no indication of the agreed signal was heard.

Of course special apparatus was in use at the transmitting station.

Proof was given that it may be possible shortly to operate at the same time and on the same wavelength as ordinary Morse signals are being sent, the Baudôt and other mutiplex printing systems without mutual interference.

The lecture closed with a hearty vote of thanks to Mr. Grocott for his paper.

Attention is called to the Hon. Secretary's address, viz., 16, Todd Street, Manchester.

Bradford Wireless Society.

(Affiliated with the Wireless Society of London.)

A meeting was held on November 4th, at 7.45 p.m. The chair was taken by Mr. Ramshaw.

The minutes of the previous meeting were read and accepted as correct.

The Chairman then called upon Mr. N. Whiteley to deliver his lecture entitled, "Wireless and the Mercantile Marine." An exceedingly interesting lecture it proved to be, Mr. Whitely began at the beginning of wireless in the Service, and explained by means of splendidly made diagrams and lantern slides the various differences and advantages or otherwise of the different systems now in use.

A hearty vote of thanks was passed. The lecturer is much to be thanked for the care and pains he has taken with preparing slides.

Two new members were elected at the close of the meeting.

A meeting was held in the Club-room at 7.45 p.m., on Friday, November 18th, with Mr. A Bever in the chair. After the minutes of the previous meeting had been read and passed, the Chairman called upon Mr. A. Liardet to give his lecture on

"Alternating Current." The lecturer dealt in an exceedingly able manner with this difficult subject, and illustrated his remarks with the requisite formulæ, etc., which he explained very simply. At the conclusion a hearty vote of thanks was passed to the lecturer.

SPECIAL NOTE.—Arrangements are proceeding satisfactorily for the Exhibition which is to be held on January 27th and 28th next, at the Bradford Technical College, and it is hoped that all members will do their best to make it a success. Entry forms will be forwarded in due course.

The Organising Secretary, Mr. N. Whiteley, 8, Warrels Terrace, Bramley, Leeds, would be glad to hear from any apparatus manufacturers interested, and to supply the necessary particulars.

Sussex Wireless Research Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. Edward Hughes, B.Sc., A.M.I.E.E., The Technical College, Brighton.

At a meeting of the above Society held at Cottesmore School, Hove, on November 16th, a lecture was given by the President, Capt. Hoghton, F.P.S.L., on "The Valve as a Generator of Oscillations." The lecturer lucidly explained why and under what conditions a valve is capable of producing self-oscillation, and furthermore, why the oscillations are sustained. The applications of an oscillating valve for reception work was then dealt with, and various electro-magnetic and capacity methods of reaction were reviewed, both single and multi-valve circuits being considered. The question of re-radiation was touched upon, and the most effective methods for reducing it were discussed. At the end of the lecture, Capt. Hoghton discussed a number of questions raised by various members.

This Society is particularly fortunate in having as its President such a capable exponent of wireless matters as Capt. Hoghton, and the members are extremely appreciative of the very free manner in which he imparts a knowledge gained from a long and studied experience of the problems of radiotelegraphy and telephony.

The Stockport Wireless Society.

(Affiliated with the Wireless Society of London.)

Since our last report the Society has made good progress, meeting regularly every Wednesday and Friday evening.

The course of lectures arranged for the winter months is being proceeded with, on November 9th, Mr. McLachlan giving a very able lecture on the induction coil, explaining in a manner clear to all, the methods of winding, etc., and also demonstrating different spark discharges, their effect through vacuum tubes, etc., by means of apparatus of his own construction.

On November 16th, another very active member, Mr. F. Gorton, delivered a very fine lecture on condensers, first explaining the theory, and by means of a very good analogy the charging and discharging of a condenser, afterwards explaining the functions of a condenser in wireless circuits.

The meetings on Friday evenings are mainly for the purpose of Morse practice, in which the members are becoming quite efficient.

Several members of the Society recently gave a very successful wireless demonstration at a function of one of the Sunday Schools of the town.

The Society has been very unfortunate in losing the services of a very able and hard-working member in Mr. R. H. Jackson, the late Hon. Secretary, he having gone as an operator at sea.

The Hon. Secretary is now Mr. F. Joule, of Mersey Chambers, King Street East, Stockport, from whom particulars may be had.

Croydon Wireless and Physical Society.

(Affiliated with the Wireless Society of London.)

A meeting of the above Society was held at the Croydon Polytechnic, Croydon, on Saturday, November 5th, 1921, at which Dr. H. A. Eccles gave a most interesting lecture on "The History of X-Rays," accompanied by some excellent lantern slides, clearly demonstrating the progress of X-Rays during the past few years.

The next meeting, which will be a General Annual Meeting, will take place at the Croydon Polytechnic, when the officers for the ensuing year will be elected. The lecture on this date will be a wireless subject, and all members, and intending members, are especially requested to attend. The Secretary Mr. B. Clapp, Meadmoor, Brighton Road, Purley, will be pleased to receive applications for membership.

Cardiff and South Wales Wireless Society.

(Affiliated with the Wireless Society of London.)

The first General Meeting of the Winter Session was held at the new headquarters of the Society on Thursday, November 10th, 1921, when a goodly number of members were in attendance, Mr. A. Lawrence occupying the chair.

The minutes of the previous meeting having been read and duly confirmed, the Chairman called upon Messrs. Moon and Proger to report the result of their interview with Commander J. R. Schofield, M.B.E., R.N.V.R. (C), with reference to the generous invitation extended by him to the Society to make the South Wales Training College headquarters.

Commander J. R. Schofield has kindly consented to act as President for the coming year, and has unreservedly placed at the disposal of the Society the modern and extensive equipment of the College, comprising Marconi Quenched Spark and Valve Apparatus.

Mr. J. G. Proger moved that the Society's appreciation of the President's very generous offer be placed on record, which proposal was heartily acclaimed by all present.

Mr. W. E. Gorves then proposed that the Society make application to the P.M.G. for a transmitting permit (the intention being subject to the powers that be) to broadcast music and items of purely local and Society (S.W.W.) interest periodically for the benefit and encouragement of district amateurs, of whom there are a considerable number. Capt. W. Harwood Moon seconded this proposal, and it was carried unanimously.

At the next meeting at the South Wales and West of England Wireless Training College, Ltd., Market Buildings, St. Mary Street, Cardiff, there

will be an exhibition of members' apparatus, to which all are cordially invited.

Hon. Secretary, Mr. P. O'Sullivan, 16, Adamsdown Square, Cardiff, who will be pleased to receive enquiries from amateurs desirous of joining the Society, and will forward full particulars of membership on request.

Brighton Radio Society.

(Affiliated with the Wireless Society of London.)

A meeting of this Society was held on November 10th, Mr. W. E. Dingle being in the chair. There was a very good attendance indeed. The question of applying to the P.M.G. for a transmitting licence was discussed at some length, and it was decided that the Secretary be instructed to write for the necessary forms of application forthwith.

A buzzer practice class has been definitely fixed for Tuesdays and Fridays, at 7.30 p.m. until 8.30 p.m. Any members desiring practice upon these evenings are invited to attend.

At the conclusion of the usual business a most interesting paper was read by Mr. W. Rogers, entitled "A Home Made Short and Long Wave Single Valve Receiver."

It is desired that any gentlemen interested in the science should become members, and any prospective members are invited to visit the Club-room upon any meeting night. Meetings are held fortnightly on Thursdays, at 8 p.m.

Any gentlemen interested are invited to communicate with the Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue, Brighton, who will be pleased to furnish full particulars regarding membership, etc.

Borough of Tynemouth Y.M.C.A. Amateur Wireless Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. L. L. Sims, "Eynesbury," Cleveland Road, North Shields.

At a well attended meeting held on Monday, October 17th, in the Y.M.C.A., North Shields, Mr. Geo. Littlefield lectured upon "The Theory of the Thermionic Valve."

The Chairman, Dr. J. A. Hislop, accorded a hearty welcome to the new members present.

Mr. Littlefield then proceeded with his lecture, which proved to be a great help to all those present.

At the end of the lecture a very lengthy discussion took place. A hearty vote of thanks was given to the lecturer.

At the last meeting of the Society, held on Monday, October 24th, a good evening was spent, when Mr. R. Willis, of Armstrong College, Newcastle, gave a paper upon "Accumulators."

The chair was taken by the President of the Society, Mr. J. E. Burnett, there being an excellent attendance.

During the course of his paper, Mr. Willis dealt with the different parts of the accumulator, chemical action, etc., and finished by dealing very lucidly with their care and maintenance.

A very hearty vote of thanks was accorded to the speaker by Dr. Hislop.

Mr. Willis has kindly promised to give another paper later on in the session upon "Generators," which is being eagerly looked forward to.

The Burton-on-Trent Wireless Club.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. R. Rose, Belvedere Road, Burton-on-Trent.

The Third Annual General Meeting was held at the *Burton Daily Mail* offices on November 3rd, 1921, when Mr. A. Chapman presided. The Secretary submitted the balance sheet, which showed that the Club had a substantial balance in hand. The following officers were elected:—President, Colonel J. Gretton, M.P.; Vice-Presidents, Dr. A. L. Sternand, Mr. A. Chapman; Committee, Messrs. T. W. Parkin, W. L. Butt, F. V. A. Smith, A. J. Selby, L. G. A. Sims; Hon. Librarian, Mr. W. L. Butt. Mr. Rose intimated his desire to retire from the post of Secretary owing to other engagements. Mr. A. J. Selby was elected in Mr. Rose's place.

A letter was read from the Halifax Wireless Club, stating that the American Government had announced that it would broadcast news by wireless telephony. A British Commission had also been appointed with Mr. Churchill as Secretary. The Halifax Club asked, was it not possible to make a joint application to the Commission asking for the inauguration of a similar news service in England. Stations have been erected at Croydon, Didsbury, and Renfrew, which could be utilised for that purpose.

It was decided to support the proposal, and suggest that the Halifax Club get into touch with the London Wireless Society, in order that more weight might be given such an application.

A letter was read from Mr. M. H. B. Mash, the Burton Librarian, intimating that quite a number of books dealing with wireless, were available at the library, and that privilege tickets would be issued, which would prove beneficial. Thanks were accorded Mr. Mash, and the members decided to make full use of the facilities thus afforded them.

A meeting of the above Club was held on November 17th, at the Club's headquarters, *Burton Daily Mail* office, Mr. T. W. Parkin, B.Sc., presiding.

A letter was read from the Wireless Society of London asking for suggestions which could be reasonably carried out, and which would add to the usefulness of the Affiliation Scheme of Wireless Societies. There are now about 50 clubs and societies affiliated with the London Wireless Society, including the Burton Wireless Club. It was proposed that the Burton Wireless Club make the suggestion that a lecturer from the Wireless Society of London be sent down once a year to each club affiliated.

The Wireless Society of London also wrote that the matter of special weekly transmissions of telephony on fixed wavelengths for the benefit of amateurs and experimenters had been engaging the close attention of the committee, and the matter had been fully discussed between the G.P.O., Messrs. Marconi, Ltd. (who kindly agreed to undertake the transmissions), and the committee of the Society, and it was expected that an announcement would shortly be made which would be satisfactory.

A lecture was given by Mr. A. J. Selby, on "Coils and Coil-winding." He described the construction of many different types of tuning coils for wireless experiments, showing by actual demonstration the method of winding the coils.

At the end of the lecture questions were asked and a general discussion followed.

Mr. F. V. A. Smith proposed a vote of thanks to Mr. A. J. Selby for his very interesting and instructive lecture. This was seconded by Mr. L. G. A. Sims, and carried unanimously.

At the next meeting of the Club Mr. L. G. A. Sims will lecture on "Gas and Petrol Engines."

The West London Wireless and Experimental Association.

Hon. Secretary, Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

A very interesting meeting with a very good attendance, was held on November 3rd. "Buzzer" practice was taken by a large number of the members present. Mr. C. Hirst read a paper entitled "Inductances in Various Forms and their Mode of Construction." Members were able to clear up many small queries by putting questions to the lecturer.

At the meeting held on November 10th, "listening in" was indulged in, and the junior members are becoming very interested in the mysteries of wireless. "Buzzer" practice was also taken advantage of, and Mr. F. E. Studt read a very interesting continuation of his previous paper. A ballot was taken for the most interesting paper read during October, and the result was in favour of Mr. R. Cole's paper, "Spark Transmitters." The President of the Association, Mr. G. Oxford, then handed the prize to the successful member.

At the meeting held on November 17th, the Committee decided that in the interests of the Association and its members that they would endeavour to arrange a syllabus for the session following the Annual General Meeting, and it is hoped to get out a very attractive programme.

This will, of course, depend upon the members, and the Committee will be pleased to receive through the Hon. Secretary any suggestions they desire to put forward.

The Secretary will be pleased to answer any queries as to qualification for membership, etc., etc.

Nottingham and District Radio Experimental Association.

An Extraordinary General Meeting of the Nottingham and District Wireless Society took place on Thursday, November 10th, at the Mechanic's Hall. The object of the meeting was the reorganisation of the Society, which had fallen very flat during the summer season. All offices falling vacant, the following were elected :- Vice-Presidents, Mr. Lancelot Allen, Mr. F. Robinson; Chairman, Mr. J. H. Gill; Vice-Chairmen, Messrs. A. N. Ley and J. Thornton; Hon. Secretary, Mr. H. R. Carter (re-elected); Asst. Secretary, Mr. D. F. Robinson; Treasurer, Mr. M. Allan. It was decided that this should constitute the working Committee, which should hold its meetings between the weekly meetings of the Association, to arrange lectures, and any other business within their power.

The first resolution passed was that the Society should be re-named, and termed The Radio Experimental Association (Nottingham and District).

Room No. 75 was booked at the Mechanic's Hall every Thursday, the meetings commencing at 7.30 prompt, buzzer practice taking place until about 8 o'clock, and then a lecture or demonstration, and to terminate with a discussion and questions for the consideration of the Committee.

It was evident that success depended largely upon new members.

It is sincerely hoped that all interested will give their support to an association that will further their interest in wireless matters.

The last meeting had been advertised in the local papers for November 17th, and in consequence, about twelve prospective members came, making a total attendance of about twenty.

The meeting opened with 30 minutes buzzer practice. Mr. J. Thornton was then called upon to give his lecture on "The History of Wireless." Although this subject is a very difficult one to make interesting, without giving a string of dates or going deeply into the theory, Mr. Thornton struck the happy medium, and gave a very interesting and instructive lecture.

A vote of thanks was proposed both to Mr. Thornton and the Chairman, Mr. J. H. Gill, which was heartily accorded, all those present appreciating the efforts made by the two gentlemen to make the first meeting of the re-organised Association a success.

All persons interested are asked to apply to the Hon. Secretary, Mr. H. R. Cater, 22, Cranmer Street, Nottingham, when all information will be willingly supplied.

Kensington Wireless Society.

Headquarters, 2, Penywern Road, Earl's Court, S.W.5.

Hon. Secretary and Treasurer, J. H. Reeves, M.B.E.

Meeting, November 3rd.—Lecture and demonstration, "Wireless Reception," by Capt. W. R. Tingey. Starting from an elementary reception circuit the lecturer showed how this could be developed into a very sensitive and selective one. Throughout, each point raised was illustrated by actual reception of external signals, all of which "came off" exceptionally well, ending with loud signals from YN on a small frame aerial.

Meeting, November 15th.—Lecture and demonstration, "Recording by Means of a Dictaphone," by Mr. J. H. Reeves. The lecturer first showed the methods of reproduction, illustrating by records taken previously of Paris, Poldhu, Leafield, and high speed automatic. At 21.30 Poldhu was recorded and reproduced through a two-valve note amplifier and a loud speaker.

Further meetings :—December 1st, Exhibition of home-made apparatus; December 20th, "The Measurement of Aerial Constants," by Mr. L. G. Bolton. Measurements will be made of the Society's aerial chief constants.

Plymouth Wireless and Scientific Society.

An Ordinary Meeting of the above Society was held on Wednesday, October 26th. Several members brought apparatus with which a four-valve set was fixed up. With a home-made loud speaker signals were audible all over the room.

The first Annual General Meeting was held on Wednesday, November 2nd. The suggestions of the Committee for the rules were brought before the members, and after one or two amendments and additions had been made, were passed. The appointment of the temporary Committee, which had been made a fortnight before, was confirmed. It was decided to fix the fees of the Society at 7s. 6d. per year. The rules of the Society are to be printed, and every member is to be supplied with a copy.

It is felt that there are still some amateurs in Plymouth and district who are still "unattached." A copy of the rules and any other information will be gladly furnished to them by the Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

At the meeting held on November 9th, a very interesting and instructive lecture was given by Mr. L. J. Voss on the subject of "Hard and Soft Valves." Having dealt with the essential points of difference between the two classes, the lecturer devoted most of his time to a consideration of the soft valve. The Fleming, the Round C, the R 2a and the R.M.R. valves were described. The lecturer had been fortunate enough to have been able, during the war, to experiment with the Round valve, and made those present rather envious by relating some of its remarkable characteristics. He has also experimented recently with the R 2a type, and has accomplished with it some noteworthy achievements The lecture concluded with a most useful description of the general characteristic curves of the "hard" and "soft" types, and several highly interesting circuits.

Full particulars of the Society may be obtained from the Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Devonport.

Working Men's College Wireless Club.

On Founders' day we held our first demonstration in public. Mr. W. R. H. Tingey kindly arranged to have music sent from his works at Hammersmith, and personally superintended its reception at the College on his own instruments. The music was received quite distinctly, but was at times somewhat marred by the interpolation of loud Morse signals from an unfriendly naval station. After the demonstration, Mr. Tingey kindly consented to become a Vice-President of the Club.

A collection of transmitting and receiving apparatus was also on view in the Club-room, many of them being the work of members.

An X-ray exhibition, another of our "stunts," proved a great attraction, the room being thronged with visitors during the whole of the evening. X-ray photographs were taken, and various articles inspected with the aid of the screen, including the heart, the action of which could be seen quite clearly.

Attention is drawn to the fact that Mr. Philip R. Coursey, B.Sc., A.M.I.E.E., is giving two lectures at the College on December 1st and 8th, the subjects being "Continuous Wave Telegraphy" and "Wireless Telephony" respectively. These lectures are open to the public, and all will be welcome.

Hon. Secretary, Mr. W. F. Matt, c/o Working Men's College, London, N.W.1.

The South London Wireless and Scientific Club.

The above Society has now been formed, and is receiving very good support from South London amateurs. Meetings are held on Mondays and Wednesdays at 7.30 p.m. at St. John's Institute Larcom Street, Walworth Road, S.E.17.

Intending members should apply there at stated times, or to the Hon. Secretary, René Stowe, 178, Walworth Road, S.E.17., who will be pleased to give the necessary particulars.

Merchant Taylors' School Wireless and Scientific Society.

Secretary, Mr. A. R. Ogston, Merchant Taylors' School, Charterhouse Square, E.C.1.

On November 1st the Secretary gave a very interesting lantern lecture on "The History and Developments of Wireless Telegraphy." Many lantern slides were very kindly lent by Messrs. Marconi Wireless Telegraph Co., Ltd.

The lecturer at first pointed out that there was really no *discoverer* of Wireless Telegraphy: Prof. Hertz, it is true, proved the existence of the waves to which his name is given, but it was Senator Guglielmo Marconi who was the *inventor* of practical Wireless Telegraphy. The lecturer then described, with the help of numerous slides, the first methods of producing ether waves and their detection by means of the coherer or crystal. Slide diagrams of Hertzian waves to scale with heat, light and X-rays were shown and their similarities pointed out.

The lecturer went on to describe Marconi's first successful attempts to transmit wireless signals across the Atlantic and his apparatus. A series of slides then followed dealing with ship sets, together with a very interesting photograph of a North Atlantic communication chart, which was duly explained.

The lecture was concluded by showing several slides of the Marconi High Power Stations; the huge control switch board at Carnarvon being particularly interesting. A vote of thanks was accorded the lecturer, and the proceedings ended.

Cambridge and District Wireless Society.

Hon. Secretary, Camden House, Park Terrace, Cambridge.

A meeting of the above Society was held on Wednesday, November 9th, at 7.30 p.m., at the Lecture Room of the Photographic Society, Ram Yard. Mr. Farren was in the chair.

At the beginning of the meeting the Secretary made some announcements which concerned wireless telegraphy in general, *i.e.*, that the Dutch telephony station had been blown down, and that there is to be no further Thursday Dutch Concert, etc. The Chairman then called upon Mr. Hanley (C.U.W.S.) to deliver a paper on "Interference." Mr. Hanley complied, and dealt in a very able

fashion with interférence, both from atmospherics and from jamming by other stations. He described 16 circuits for the elimination of interference which cannot here be inserted. At the close of the lecture Mr. Butterfield proposed a hearty vote of thanks to the lecturer, and this was carried in the usual manner.

The subject was next declared open for discussion, and the lecturer answered the many questions that were fired upon him.

The meeting was next declared informal. A set was then rigged up with instruments supplied by members of the Club who have promised to supply these instruments for every meeting, thus a set is to be maintained for every meeting.

Redhill.

As there appear to be a number of wireless amateurs in and around this town, a proposal has been put forward to form a Club. Will any gentleman interested communicate with the undersigned: Mr. F. Howell, c/o the Secretary, Redhill Y.M.C.A.

Blackburn (Y.M.C.A.) Wireless Club.

On Friday, October 7th, the Club held their first annual meeting, when officers for the coming year were appointed.

A good number of new members have made their presence felt by falling in with the older members in their eagerness to get some knowledge of Radio work.

Classes for Morse have been arranged for Monday and Wednesday, and already the members are making good progress. It was decided to have a small weekly subscription to defray expenses. The meeting then closed with tea and cakes provided by the Secretary.

On Friday, October 14th, the Club had a most interesting night with Mr. Whiteside and his short-wave tuner, used in conjunction with the experimental valve panel described in the September 17th *Wireless World*. Signals were boosted up on the Club's three-valve L.F. amplifier.

Ships came in very clearly, also telephony.

The meeting broke up after all had partaken of supper, and a vote of thanks was passed to Mr. Whiteside for the way in which he explained his tuner and its uses.

The weekly meeting takes place in the Y.M.C.A. every Friday evening at 7.30.

Hon. Secretary, Mr. J. Whittaker, Y.M.C.A., Blackburn.

The East London Radio Society.

The third meeting of the Society was held on October 8th at the King George's Hall, East India Dock Road, Poplar, E.14, the Society's headquarters.

The Rev. W. H. Lax has very kindly offered us one of the numerous rooms in this building in addition to a substantial sum of money to enable the Society to get going.

Mr. J. Horace Bowden, M.I.E.E., M.I.Mech.E., has expressed his willingness to act as President, while the Rev. W. H. Lax has accepted the office of Vice-President.

Under the able direction of the Assistant Secretary, Mr. J. F. Haines, the aerial was erected just prior to the meeting, and this enabled a demonstration to be given with a five-valve set.

The results obtained were of a highly satisfactory nature, and altogether an interesting afternoon was spent by the members. Meetings have been arranged to take place twice weekly, Thursdays 7 p.m., and Saturdays, 3 p.m.

Residents in Poplar and the neighbouring boroughs interested in wireless are heartily welcomed, and should communicate with the Hon. Secretary, Mr. W. G. Claxton, 29, Zetland Street, St. Leonard's Road, Poplar, E.14.

Wireless Society for Middlesbrough.

It is proposed to form a Wireless Society in Middlesbrough. A meeting room has been secured and permission to erect an aerial.

As there must be a number of wireless enthusiasts in this district, will those interested in the matter in the formation of a new Society please write or call.

Mr. H. M. Mayfield, 141, Albert Road, Middlesbrough, or Cleveland Hood, Nunthorpe, S.O., Yorks.

Dewsbury and District.

Mr. S. S. Davies, 36, Crackenedge Lane, Dewsbury, will be pleased to hear from any amateurs in the district who are interested in the formation of an amateur Wireless Club.

Newbury.
(New Society Formed.)

At a meeting of wireless amateurs on October 17th, a Society was formed for Newbury and District, and a Committee elected. As amateurs in this town have for a long time past felt the need of a Society, it is expected that there will shortly be quite a large list of members.

Will all those interested kindly communicate with the Hon. Secretary, Mr. F. G. Leader, Bank House Chambers, Newbury, Berks.

The Wireless Society of London.

The Committee of this Society recently asked all affiliated societies—now over 50 in number—to offer suggestions on the present affiliation scheme. A number of Societies and Clubs have responded, and many useful suggestions have been brought forward. The Committee of the Wireless Society of London have appointed a Sub-Committee to go carefully into the suggestions with a view to giving effect to them where practicable, and also to arrange the programme of the forthcoming Conference of Affiliated Wireless Societies. Arrangements will be communicated to those concerned in due course. It is expected that the Conference will take place in London in January.

Further Prizes for Transatlantic Tests.

H.P.R. Wireless, Ltd., give the following details of their Prize offer: An H.P.R. Universal Tuner, 400–30,000 metres, value £25. Prize conditional on some piece of their apparatus being used by the Winner.

The International Electrical Trading Combine, offer a Concertone Magnephone to the winner. This prize is to be awarded at the discretion of the judges and carries no other conditions.

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 only. (2) Queries should be clear and concise. (3) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. **(4) The Editor cannot undertake to reply to queries by post.** *(5) All queries must be accompanied by the full name and address of the sender, which is for reference, not for publication. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* **(6) Readers desirous of knowing the conditions of service, etc., for wireless operators will save time by writing direct to the various firms employing operators.** *(7) Four questions is the maximum which will be accepted at a time.*

M.F.C.W. (Malvern) *asks (1) Which is the better of two given circuits. (2) If vulcanised fibre is as good an insulator as ebonite. (3) If a variometer in the grid circuit is an improvement. (4) How to change quickly from one circuit of (1) above to the other.*

(1) and (4) (*a*) Is good for searching, and (*b*) for continuous reception after the station is heard. A switching arrangement is given in Fig. 1.

(2) It depends on the relative qualities, but it is probably quite good for receivers.

(3) No, we do not think so.

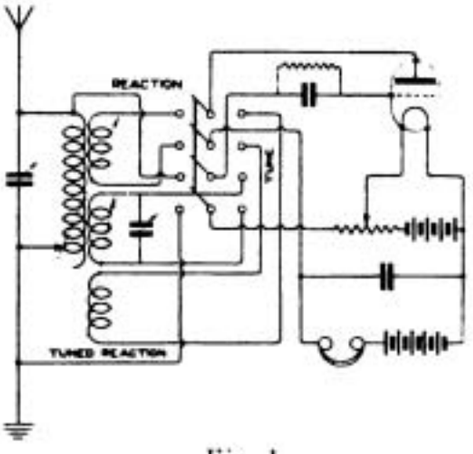


Fig. 1.

E.W.C. (Lincoln).—Connect A to earth, B to the aerial, C to D, E to F, and G to A.

B.C.G. (Woolwich) *submits certain conclusions which appear to follow from the article on self capacities in the June 11th issue for our comment.*

The article in question is based on some assumptions, and whilst the actual results quoted are not very wide of the mark, this appears partly due to the fact that the writer has refrained from applying his methods to any but a few specially related cases.

(1) The self capacity of a single layer coil is not inversely proportional to its turns.

(2) and (3) The capacity of a multilayer coil of few layers (or part of a coil of many layers) is often greater than the capacity of the whole coil.

(4) The whole subject is very complex and needs very difficult mathematics for even an approximate treatment. The greater part of the known facts are of experimental origin.

A.S.O.M. (Bowes Park) *asks (1) The best single valve circuit for general purposes. (2) If a circuit (Fig. 2) is suitable. (3) If the Hague could be got on this set. (4) For a diagram of a 3-valve L.F. amplifier for use with above.*

(1) and (2) The circuit sketched is not bad as it stands, but would be improved by the use of a telephone transformer—placed on the plate side

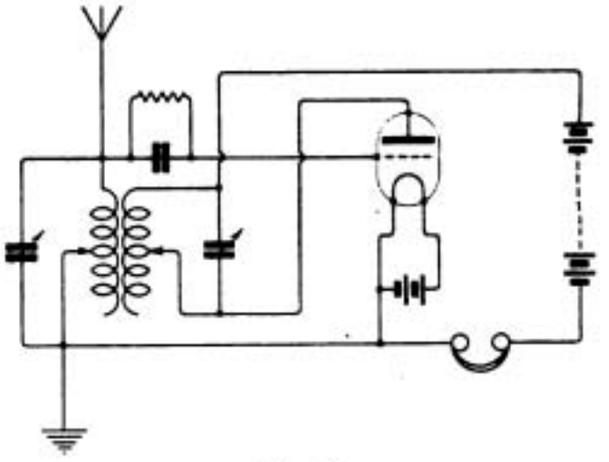


Fig. 2.

of the H.T. battery, the telephones as shown. 6,000 ohms—if a transformer is used, 120 ohms. The set would be more manageable if the condenser across the reaction were omitted. A blocking condenser is required across the telephones or transformer primary.

(3) Possible with very careful adjustment.

(4) See Fig. 1, page 851 of the March 5th issue. We do not recommend more than two stages of L.F. amplification, but you can try a third, connected in the same way as the others, if you wish to.

C.F.L. (Streatham Hill).—(1) Effects of this nature are common, but generally hard to explain accurately. The effect is due to a capacity introduced between the coil and the telephones, but it is not easy to explain how it works.

(2) This is unusual, and may be due to insufficient voltage of the anode battery.

(3) WLY is s.s. *Suwanee*.

F.W.M. (Deptford) *asks two questions relative to R.A.F. wireless operators.*

The possession of a P.M.G. certificate and the training given by most colleges will no doubt be very useful, but as most of the R.A.F. sets are now of valve type it is probable that the R.A.F. gives special training to all its operators. Write and ask the appropriate authorities.

J.M. MCB. (Worcester) *wishes to make a valve set, and asks re the single valve long range set recently*

* See note regarding this section, page 572.

given (1) *Conditions for an extension of permit for the use of valves.* (2) *If 60 volts H.T. can be obtained by using a 50 volt 30 watt lamp in series on 100 volts mains, D.C., and if this supply would be suitable.* (3) *If 8,000 ohms telephones would be suitable.* (4) *If the set would radiate badly.*

(1) Furnish a diagram for approval, and request necessary revision of license.

(2) Valve will probably be O.K. on 100 volts especially if the grid potential is slightly adjusted to suit. The lamp will not drop voltage to 60 owing to the small current taken by the anode of the valve. The supply will be O.K. if the commutator ripples are not too bad. It will probably be improved by a large condenser across the mains and a choke in each lead.

(3) Yes.

(4) Not very badly.

W.B. (Northiam) *asks* (1) *If a circuit sketched is suitable for a given range of wavelengths.* (2) *The inductance of certain coils.* (3) *If slab inductances could be used instead of single layers for two of these coils.* (4) *Which would give best results for the A.T.I., a coil with a slider, or one with tappings.*

(1) Quite.

(2) Approximately as follows :—A, 15,000 mhys ; B, 8,000 mhys ; and C, 1,300 mhys.

(3) Yes, but for such a set we prefer the solenoids.

(4) Immaterial.

E.O. (Penarth) *asks* (1) *The gauge of two samples of wire.* (2) *What they can be used for.* (3) *An issue describing the construction of a variometer.*

(1) Nos. 30 and 32.

(2) Suitable for secondary circuit coils or reactances.

(3) The first issue for April, 1920.

G.C P. (Brighton) *asks how to arrange certain apparatus as a set, and if anything further is needed.*

We doubt if you will find a water potentiometer of much use, so show one of normal type in the diagram (Fig. 3). The connections of the water type if used will be on exactly the same lines.

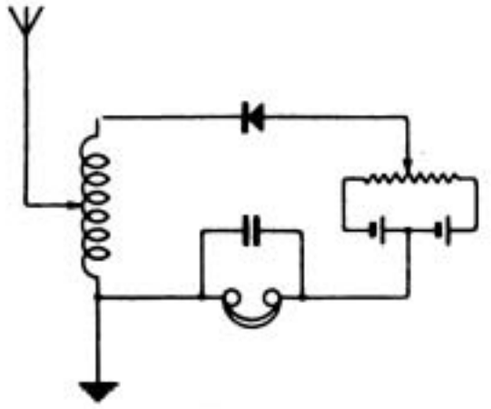


Fig. 3.

G.V. (Whitby).—The Skinderviken microphone is simply a microphone, and not an amplifier in the sense that a valve is. We do not think you will be able to do any good by trying to embody one or more in an amplifier. Their purpose is analogous to the transmitter of a telephone. The current they are constructed to handle will probably be of the order of a few milliamps.

H.C. (Bromley) *sends a list of apparatus which he proposes to buy, and asks* (1) *For our opinion of it.* (2) *Whether he could do better for the money.* (3) *The range of the set.* (4) *If satisfactory for C.W. and telephony.*

(1) and (2) The suggested components are quite good, and we do not think you could improve on them greatly. Other possible combinations would be just about as good. We do not recommend the purchase of a second-hand accumulator, however, unless you have a good deal of experience of them, as it is rather difficult for anyone without experience to tell the difference between a good one and one which is nearly "played out" and just "done up" for sale.

(3) This will depend on the capacity of the condensers. The makers of the receiver will quote you suitable values and the corresponding ranges.

(4) Yes.

R.W.B. (Bromley) *describes his crystal set and asks* (1) *If the connections are right.* (2) *What are the best instruments for an amateur to use.* (3) *What instruments are required to receive concerts, etc.* (4) *Whether batteries are necessary with silicon or galena.*

(1) No, connect as in the diagram, Fig. 4.

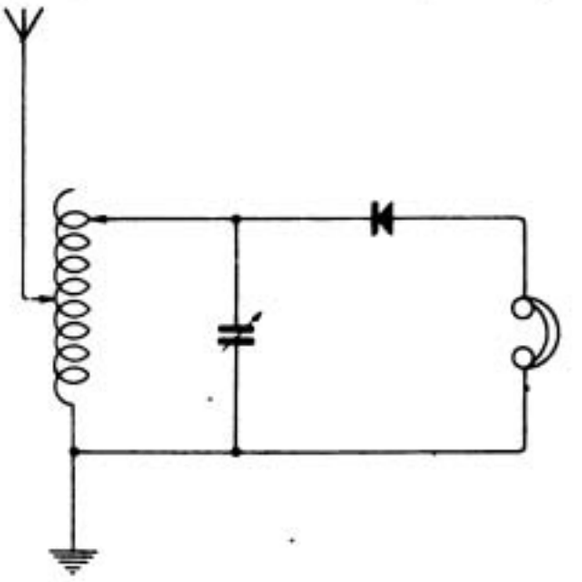


*Fig.*4.

(2) This depends on such a variety of factors, such as the skill of the amateur and the length of his purse, that we really cannot say. The gear you propose to use is capable of giving useful results and is suitable for the beginner.

(3) The above arrangement is suitable as it stands, but will not be very sensitive. For better results you will have to use a valve set.

(4) Not necessary, but will probably improve results.

R.E.R. (Brighton) *wishes to construct a receiver and asks* (1) *Dimensions for an A.T.I.* (2) *The best simple detector to make.* (3) *If an A.T.I. is essential.* (4) *The minimum height for an aerial.*

(1) Try 10" × 6", wound with No. 22.

(2) A carborundum crystal; you will have to buy the crystal.

(3) Not essential, but it improves results.

(4) There is no rigid limit. For a crystal set it should be not less than 30-40 ft.

J.A.C. (Newcastle) *sends a diagram of a 2-valve receiver, and asks* (1) *For criticism, and* (2) *Whether it will be of any use with a frame aerial.*

(1) O.K., but we should prefer a telephone transformer with a set of this type.

(2) Results will only be very poor with a frame, as you are not using H.F. amplification. Honeycomb coils can be used if desired, but the size will depend on the wavelength required which you do not specify.

E.E.A.R. (Reading) *sends a sketch and asks* (1) *If correct.* (2) *Winding for reactance.* (3) *Capacity of condensers.* (4) *Winding for an anode impedance coil.*

(1) No. The telephones should be in series with the reaction coil, and not in parallel with it.

(2) This depends on the wavelength range, and dimensions of the A.T.I., neither of which you state.

(3) Grid condenser 0·0001 mfds. Blocking condenser 0·002 mfds.

(4) This coil should preferably be just a high resistance, of the order of 50,000 ohms. You may possibly get some results with a choke similar in type to the H.R. winding of a telephone transformer, but they are not likely to be as good.

"DOUBTFULS" (St. Anne's). The position of the A.T.C. shown in your Fig. 1 is quite wrong for at least two reasons, which we will leave you to argue further over. That shown in Fig. 2 is correct. The inductance arrangement of Fig. 1 is best, particularly for short wavelengths. That of Fig. 2 is not bad for long wavelengths, but is never as good as 1.

R.T.N. (Petersfield) *sends a sketch of a proposed recording arrangement, and asks* (1) *Whether it will work.* (2) *If we can suggest a better.* (3) *What sort of relay will be required.* (4) *How many valves will be required.*

(1) (Sketch to be reproduced). This arrangement will be O.K. if you have a sufficiently sensitive relay.

(2) See report of a recent meeting of the Wireless Society of London which appeared recently in the magazine. Several methods of recording are described.

(3) The most sensitive electromagnetic relay available—say a P.O. relay wound to 10,000 ohms, or a Weston relay.

(4) Two or three stages of L.F. amplification after rectification of fairly strong signals.

G.H. (Rawtenstall) *has a 3-valve receiver which will not receive telephony, although O.K. on C.W. He asks for advice.*

There does not appear to be anything the matter with the set. This result is almost certainly due to your trying to receive the telephony with the set oscillating. If you weaken the reaction coupling until you lose the heterodyne note the set will be properly adjusted for telephony.

"VALVES" (Leacombe) *asks* (1) *How to add a H.F. amplifier to a given set.* (2) *If it will be possible to get the Dutch concerts in the North of England with this three-valve set.* (3) *If there is any advantage in adding a variable condenser across the primaries of the transformers.*

(1) See Fig. 2 page 396, Sept. 17th issue.

(2) Possible, but not very likely.

(3) This depends on the type of transformer, etc. It will not be necessary in the circuit given except in the place shown.

A.B. (Walthamstow) *is troubled with a howl in an L.F. amplifier. He asks for advice.*

The symptoms are rather curious, and we are not very sure what is causing the howl. Try altering the position of the transformers with regard to each other, and if this does not improve matters, try enclosing them in iron boxes, with the smallest possible holes left for the introduction of the leads. Separate H.T. batteries should not be necessary with only two stages of amplification.

J.C.M. (Wallasey) *has a crystal set which will give signals on 600 metres on the "stand-bi" side and none on the tune side. He asks* (1) *Why.* (2) *Range of set.* (3) *If he should get FL.* (4) *How to use the closed circuit coil as a reactance.*

(1) We can see no reason, unless the tuning condenser is quite unsuitable: capacity should be about 0·0005 mfds. Probably there are no very strong signals to hear except on 600 ms.

(2) About 2,000 metres.

(3) No, increase the diameters of the coils to about twice the given values with the same number of turns.

(4) This cannot be done on a crystal set. For connections with a valve set see various diagrams in these columns.

C.L.B. (Bradford) *asks* (1) *Whether he should get PCGG on a two-valve circuit* (1 *detector*, 1 *L.F. amplifying*). (2) *If not, why not.* (3) *Why certain telephone results are better on a house flex aerial than on an aerial of No.* 12 *wire.* (4) *If the efficiency of the No.* 12 *wire would be increased by binding workshop flex or rope round it.*

(1) and (2) No, unlikely at the distance without two or three stages of H.F. amplification.

(3) Probably due to the considerable H.F. resistance of the unstranded wire. But if you can get the carrier wave you should get the speech by weakening the reactance.

(4) No.

J.N. (London) *sends a description of a single valve reaction set, and asks* (1) *For criticism.* (2) *For wavelength range.* (3) *If an iron tube sunk* 5 *or* 6 *feet in the ground will do for the earth, instead of burying a plate.* (4) *If he will get* PCGG.

(1) All O.K. except that with only simple reel insulators for the aerial the insulation will not be very good in wet weather.

(2) Probably 250 to 10,000 metres; impossible to say accurately without details of the coils.

(3) Possible, but not so good as the plate.

(4) Possible, but not likely with so small an aerial.

"KUMA" (Oxford) *sends particulars of a single valve set from which he expects better results than he is getting, and asks for advice, and* (2) *Asks how to make a* 1/1 *transformer for use with H.R. telephones.*

(1) There does not appear to be anything the matter with your set. The condenser between the filament battery and earth would be much better placed across the telephones. The value you find best for the grid condenser appears unusually high. The results obtained are quite good. The only reason why you do not get speech is that you let the set oscillate all the time. Weaken the reaction till you lose the carrier wave, you will then get the speech.

(2) No. 36 wire will be too thick for the purpose. You would get satisfactory results with about 2 ozs. of No. 44 for each winding.

"CODE" (Blackpool) *asks* (1) *For dimensions for the foils for 0·002 mfds. condenser, with mica dielectric.* (2) *Ditto for 0·005 mfds.* (3) *Ditto for a 1 mfd. condenser with photo plates as dielectric.*

(1) With an area of 10 cms. of overlap for each plate, four copper foils in all.

(2). 9.

(3) Assuming a thickness of 1 mm. for the glass and 100 sq. cms. overlap for each plate, you would require nearly 3,000 plates. For such a high capacity you should use a thinner dielectric.

J.H.I. (Bloomsbury) *asks* (1) *If he could get the Hague on a frame aerial, crystal and three-valve resistance amplifier.* (2) *What wire to use to wind a pair of telephones to 5 ohms. resistance.* (3) *If honeycomb coils can be used for a crystal set.* (4) *If he could get Lyons or New Brunswick on the above set.*

(1) With careful work you should be able to do so, using the crystal to rectify after three stages of H.F. amplification.

(2) Probably No. 34 or 36, but the results would not be very satisfactory.

(3) Yes, but for crystal wavelengths they have no advantages and certain definite disadvantages.

(4) Lyons, yes; New Brunswick, yes, with careful tuning.

"AUSSIE" (Colombo) *asks if it is normal for a V24 valve to work best with a grid leak and only* 12 *volts on the plate.* (2) *And queries the recommended ¼ and 1½ ozs. of No.* 44 *wire for the construction of intervalve transformers on the ground of low resistance.*

(1) Very unusual, probably your condenser is *very* leaky.

(2) The suggested winding, though on the low side, gives satisfactory results. The resistance usually comes out above the 2,000 ohms. you suggest. You can increase the windings up to about double the suggested amounts if you like without ill effects.

C.J.W. (Scalloway) *asks about a toy set he is making.* (1) *If an ⅛" spark coil will suit.* (2) *The voltage to apply to it.* (3) *If a crystal detector and telephone will give him a reception range of* 20 *yards.* (4) *What will be the maximum range.*

(1) Yes.

(2) We cannot say without a knowledge of the windings, three large size dry cells of a total voltage of about 4½ should be ample.

(3) The suggested receiver is not at all good, though you might possibly get this range all right. We should prefer a coherer for a set of this type.

(4) Very difficult to say. Probably less than 100 yards.

J.N.C. (Muswell Hill) *has a set with an electrolytic detector which will not work; he asks* (1) *If the circuit is correct.* (2) *If the same circuit would work with a crystal.* (3) *Why signals are faint.* (4) *If it is a matter of tuning.*

(1) and (2) Circuit would not be correct in either case. Connect the detector in series with the potentiometer and the telephones, all across the variable condenser.

(3) Because the circuit is incorrect.

(4) No.

N.J. (Liverpool) *asks* (1) *For a diagram of a variometer receiver.* (2) *If there is a wireless club in Liverpool.* (3) *If the Hague concerts can be heard so far North.*

(1) A variometer can be used with almost any receiver where a variation of inductance in a circuit is required. It is useless for us to give you a diagram without further knowledge of your requirements.

(2) Liverpool Wireless Society, 98, Ampthill Road, Liverpool.

(3) Yes, but a very good set would be required, with at least three stages of H.F. amplification.

J.B. (Whetstone) *asks* (1) *Which is the best for an A.T.I., a coil of large or one of small diameter.* (2) *Whether the wavelength of a coil is directly proportional to the number of turns.*

(1) It is almost immaterial, provided that neither the length is many times the breadth, or the breadth many times the length. Either of these extreme cases is bad.

(2) No; provided that no other dimensions are altered, to double the wavelength to which a coil will tune any circuit, it is necessary to put rather more than four times as many turns of wire on the coil.

H.C. (Bury).—Use the valve which is at present detecting as an amplifier; you can do this without altering the connections. Put another valve in the circuit with its filament in parallel with the old valve. Put the primary of the intervalve transformer in the plate circuit of the old valve on the earth side of the reaction coil. Put the other winding to the grid of the added valve. Then connect up the plate circuit of the added valve exactly as the plate circuit of the old valve was arranged, to the same H.T. battery, but of course omitting a reaction coil.

H.F. (Birmingham) *asks if it is possible to take current from the house lighting system for a wireless set instead of making use of accumulators, of course realising the necessity of cutting down the voltage.*

This depends chiefly on whether the supply is D.C. or A.C. If the latter, very little good can be done with it, in spite of various freak circuits which are published from time to time purporting to do so. If D.C., it can generally be used, but sometimes gives trouble from parasitic noises when the generators are badly designed or maintained. See various notes and articles on the subject which have appeared from time to time.

F.C.L. (Sutton) *has a set in which the run from the lead in to the instruments is about* 90 *ft. of stranded 7/22 wire. Results are very poor on short wavelengths. He asks for advice.*

We are not surprised that the results are poor;

if possible move the instruments. But if not, the only things that you can do are to keep the lead in as far as possible from the return to the earth, from lengths of metal, such as gas or water pipes, or from any bad dielectric such as damp wood. Also use much finer stranded wire than No. 22. High tension flex as you suggest will be all right, with the precautions given above.

S.R. (Barcelona) *asks various questions about a frame aerial.*

The frame will be suitable for use with a three or more valve amplifier. It receives most strongly from directions in its plane, and not at all directions at right angles to it. Connect as in Fig. 5.

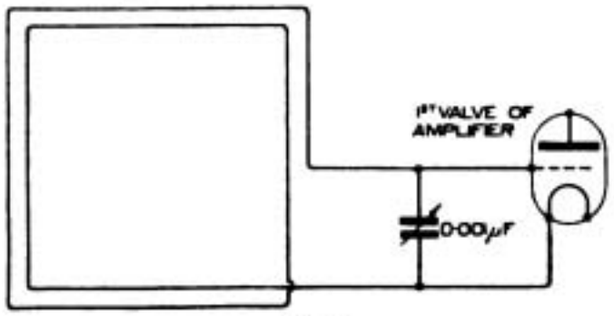


Fig. 5.

Your frame will tune to about 6,000 ms. Put the tappings at the 10th, 20th and 40th turns.

E.E.H. (Croydon) *asks the relative efficiencies of aerial of (a) No. 18 wire, after reasonable atmospheric oxidation (b) No. 18 enamelled (c) 12/22 cable, each strand enamelled. (2) Percentage efficiencies of (a) a single wire aerial, and (b) aerial of same length and height with two wires spaced 6 ft. (3) With stranded enamelled wire should the outer ends be soldered together or left insulated. (4) Why.*

No figures are available; the values would vary considerably with different conditions. Our personal preference would suggest about the following, but the figures are in no ways guaranteed as accurate.

(1) (*a*) 50, (*b*) 55, and (*c*) 100.
(2) (*a*) 50, (*b*) 75.
(3) Left insulated.
(4) To minimise the risk of losses by local currents between the wires.

F.R.W.S. (Dovercourt) *asks (1) dimensions for a grid condenser. (2) Method of making a grid leak. (3) Dimensions for a single slide coil to tune to 3,000 metres. (4) Dimensions for reaction coil.*

(1) Try dielectric of glass, 1 millimetre thick. One foil on each side, area of overlapping portion about 10 square cms.

(2) Rub in pencil lead between 2 terminals on an ebonite block until the best results are obtained.

(3) 10″ × 7″, of No. 22.

(4) 6″ × 4″, of No. 26 or 28.

R.H.A. (High Hauxley) *has a three-valve amplifier which gave good signals till a fortnight ago, and now gives spark, no C.W., and very poor telephony. He asks (1) Why. (2) If H.R. telephones can be damaged if connections are known to be correct. (3) Approximate life of E.S. 2 valves. (4) If life is shortened by using higher plate voltages than those recommended by the makers.*

(1) Difficult to say without examination. The windings seem O.K. Result is very likely due to damp, *e.g.*, on the coil formers. Dry these. Also clean valve holders and as you have a megger try the I.R. between the contacts. Also try increasing the reaction coupling. Or get another valve and replace each of the old ones in turn, in case one may have deteriorated.

(2) Coils may be burnt out or shorted. Try the resistance and the I.R. to the case.

(3) Varies considerably. Average probably about 1,500 hours burning.

(4) Yes, but as a rule not seriously unless the voltage is more than twice the rated value.

"NEW READER" (Hove) *asks (1) For diagrams of a two-valve receiver. (2) Method of winding and calculating basket coils. (3) If the set described in Sept. 3rd issue is suitable for telephony, or (4) Whether basket coils would be more efficient.*

(1) In the Sept. 3rd issue, Q. and A. column, there are three two-valve receiver diagrams, the best for telephony being that of Fig. 4, page 366.

(2) Too long to answer here. See articles in issues for Oct. 16th and June 12th, 1920, which you can get from the publishers.

(3) Yes.

(4) Single layer coils are the most efficient for short waves, on which most telephony is received.

D.H.C. (Wolverhampton) *asks for a diagram of a three-valve set for telephony.*

You will get better results with telephony if the amplifier is used for H.F. instead of L.F. amplification. A good circuit is shown on page 369, Sept. 3rd issue. This diagram shows a condenser for capacity reaction. If desired this can be omitted, and a magnetic reaction coil substituted. The fine wire coil of the loose coupler can be used for the reaction. Connect the grid and filament across the A.T.I. and primary of the loose coupler.

"NOVICE" (Bristol) *has a Mark III. tuner and a Mark I. aircraft receiver, and wishes to increase the wavelength ranges considerably.*

An article in the March 5th and 19th issues showed how to increase the range of a Mark III. tuner. These sets cannot be made into useful 20,000 metre sets. The best thing to do is to dismantle them and use the parts for making up a good set.

SHARE MARKET REPORT.

Prices as we go to press, December 1st, are :—

Marconi Ordinary	£1	10	0
,, Preference	£1	10	0
,, Inter. Marine		16	9
,, Canadian		4	0

Radio Corporation of America :—

Preference		9	9
Ordinary		10	0

The WIRELESS WORLD

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VOL. IX. No. 46. DECEMBER 24TH, 1921 FORTNIGHTLY

The "B Mark I★" Receiver

METHODS OF CONVERSION—II.

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

IN the last issue of *The Wireless World*, some indication was given of the ways in which the B Mark I* receiver could be converted into an instrument more useful for general amateur experimental work than it is in its original form. Of these the second in particular makes a quite useful instrument, especially when the "Rear" pattern of instrument with the send-receive change-over switch is used. In Fig. 3, on page 559, a suggested circuit diagram is given for this modification, using the send-receive change-over switch for cutting the two-valve note magnifier in or out of circuit—*i.e.*, as a means for transferring the (low-resistance) telephones from the output of the detector valve, which must be used in front of this instrument, to the output terminals of the amplifier. This is a very convenient change-over arrangement, since the change-over switch also cuts off the valve filaments when the amplifier is cut out of circuit. In the diagram as there given, it will be noted that when the amplifier is cut out in this way (*i.e.*, when the change-over switch is on the left-hand contacts, marked "OUT" in the diagram), the telephones are shunted by the P winding of the second "valve-to-phone" transformer. This, of course, will cause a slight loss of signal strength, so that the following change may, with advantage, be made in the arrangement there described, so as to avoid this loss. Disconnect the wire joining the "Earth Mat" terminal to the lower switchblade (lower as drawn in Figs. 1 to 3 on pp. 558 and 559 in last issue), and also the connection between the primary and secondary windings of the new "valve-to-phone" transformer, shown in Fig. 3 of the article referred to above. Disconnect the leads (cased in thick rubber tube) running between the left-hand contacts of the switch and the terminals on the left-hand side of the instrument marked for connection to the transmitter. Connect the "Earth Mat" terminal to the lower left-hand contact of the change-over switch, and also to the OP terminal of the new "valve-to-phone" transformer shown on the right-hand side of Fig. 3 in the first part of this article.

A wire will also be found in the instrument connecting the "IS" terminal of the intervalve transformer to one of the telephone plug sockets. This wire is usually cased in green insulating sleeving. A connection (also covered in green) will also be found between this "IS" terminal of the intervalve transformer and the "IP" terminal of the existing "valve-to-phone" transformer. This latter connection should be left in place, but the former should be removed from the "IS" terminal and joined instead to the lower switch blade of the change-over switch, to take the place of the wire previously removed from that switch. The other connections then remain as in Fig. 3 in last issue of *The Wireless World*—*i.e.*, the changes to be made in the instrument to effect this modification are the above connection changes, the removal of the 65 metre coils, of the double disc tuning condenser, of the grid leak, and of sundry connection screws, the connection of the top left-hand contact of the change-over switch to the telephone plug sockets which are connected to the "OP" terminal of the existing "valve-to-phone" transformer, and the mounting of the new "valve-to-phone" transformer in the space cleared by the removal of the above mentioned parts. The "IS" winding of this new transformer should be connected to the "— 4 volts" terminal, and the "OS" terminal to the grid of the first valve. Convenient terminal plates with connection screws will be found for making this last connection.

The connections of the instrument when rearranged in this way are shown in Fig. 1. The change-over switch is by this means made very convenient to use, since when it is on the left-hand side, the telephones (low resistance) plugged into the sockets on the instrument are joined straight through to the input terminals (the old Aerial and Earth Mat terminals), so that the amplifier is entirely cut out of circuit. When the switch is moved over to the right-hand contacts the telephones are removed from the input circuit and are joined to the output telephone transformer of the instrument. The circuit of the input transformer is simultaneously closed, and the valves lit up by the same operation, the one movement of the switch effecting all the changes necessary to cutting the two-valve amplifier into or out of circuit.

While originally designed for use with French valves using 4 volts on their filaments and about 35 on their plates, the apparatus functions quite well with ordinary R type valves, with a higher plate voltage. Very good, if not the best, results are, however, obtained when using V24 valves, in suited for a high resistance circuit, instead of a low resistance one.

In the above arrangement it will be noted that the high resistance winding of the "Valve-to-Phone" transformer is used to feed the grid circuit of the first valve. This winding is, however,

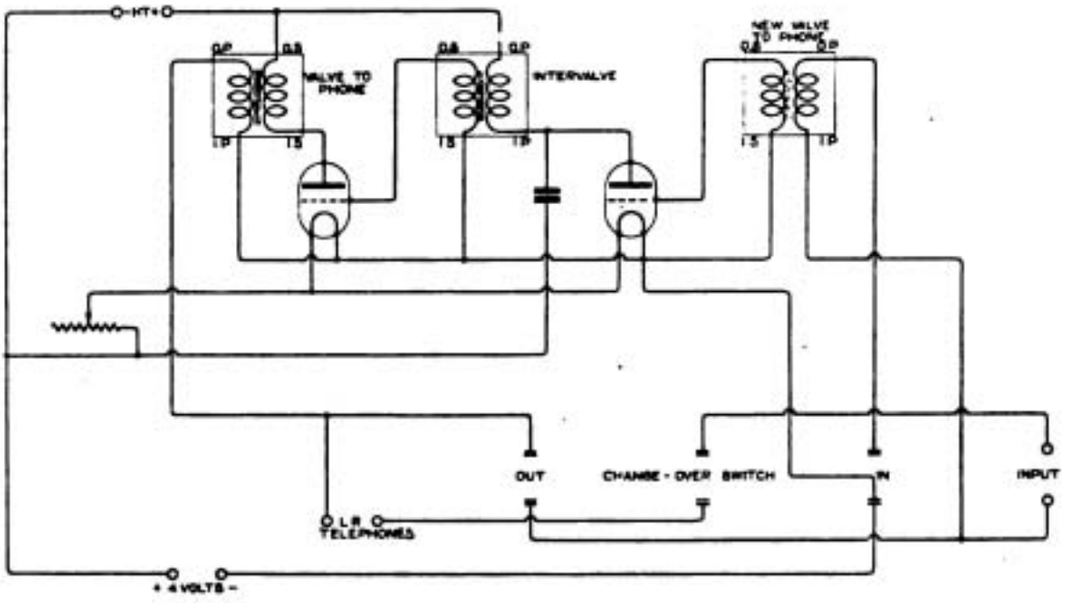


Fig 1.

conjunction with suitable adaptors for enabling them to be connected in the R type sockets. These valves require a 6 volt battery for their filaments and give very good results with 30 volts H.T. The latter may, however, be increased up to about 50 to 60 volts with slightly improved results.

A similar type of change-over switching arrangement to that described above can be fitted when it is desired that the input to the instrument be primarily designed for connection in the anode circuit of a valve, so that the efficiency of this method of connection is not quite so good as is obtainable if a proper intervalve transformer can be employed in the input circuit. Details of such an alternative method of conversion will be given in a later article, but it may here be pointed out that if high resistance telephones can be used with the set, a very simple method of conversion can be

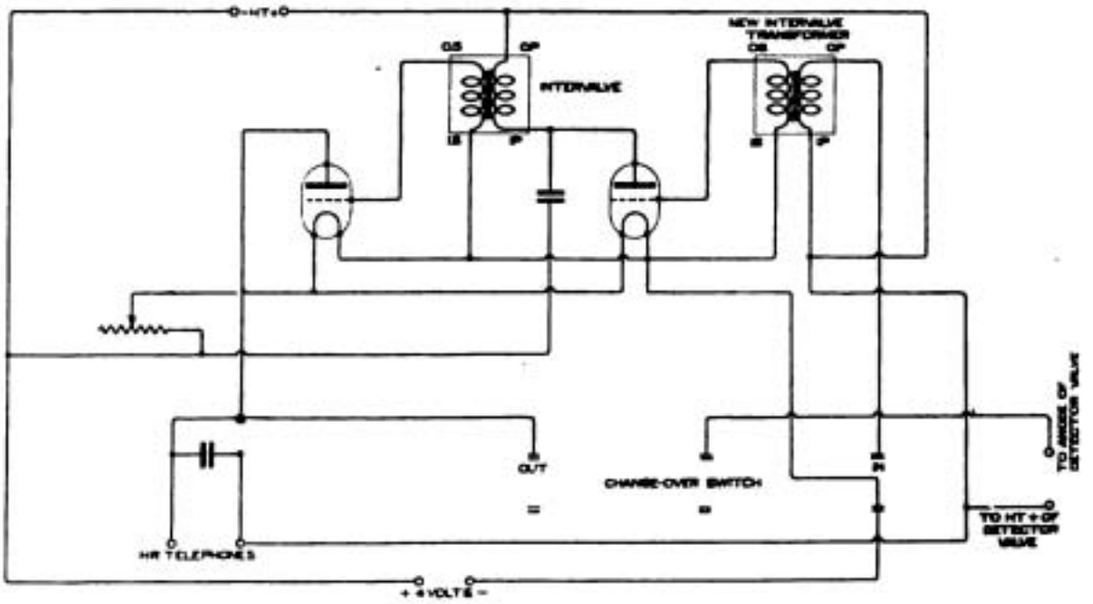


Fig. 2.

adopted, using an "Intervalve" transformer for the input instead of a "Valve-to-Phone" transformer, as described above. For this purpose the existing "Valve-to-Phone" transformer, connected in the circuit of the second valve, can be removed, together with the other parts that are not required, *i.e.*, the grid leak, tuning coils, etc., (as described above), and a new "Intervalve" transformer fitted in the space created by the removal of the 65 metre tuning condenser. The change-over switch can with this method also be used for transferring the telephones, and for joining up the input transformer, as well as for switching on the valve filaments, so that the complete change over of the amplifier into or out of circuit with the detector valve of the existing receiver can be effected merely by moving over the change-over switch, and without disturbing the setting of the filament regulator switch or altering any of the connections.

An additional blocking condenser of about 0·005 microfarad capacity may be fitted across the telephone sockets with this arrangement, as indicated in Fig. 2. In this case the old "Aerial" terminal should be joined direct to the anode of the detector valve, and the "Earth Mat" terminal to the positive terminal of the H.T. battery used with the detector valve. As may be seen from Fig. 2, the lower switch arm of the change-over switch is now used only for closing the circuit of the valve filaments when it is on the right-hand side and the amplifier is joined in circuit. Where the same H.T. battery is used for feeding the amplifier as is employed with the detector valve with which the instrument is to be used, the connection of the old "Earth Mat" terminal to the H.T. + of the detector valve is not necessary, as the connection would be effected inside the instrument. When using common filament batteries as well, care must be taken in joining them up in all cases, since it must be remembered that in these instruments as here described, the negative terminal of the H.T. battery is joined to the positive terminal of the L.T. battery, not to the negative L.T. as is commonly done for detector valve panels. This point should be watched when making the connections, or a short-circuit may be set up.

In both the above described methods of converting this Trench set, as well as for the methods described in the last issue of *The Wireless World*, it is necessary to remove the wood partition dividing off the space previously occupied by the H.T. battery unit, as this space is required for the extra transformer, or grid leak, etc., as the case may be. An external H.T. battery should therefore be used with the converted instrument, by utilising the spare terminals on the left-hand side for this purpose as was described in the first article dealing with this instrument (see p. 560 of last issue of *The Wireless World*). It is evidently desirable in any of these arrangements described to re-mark the terminals by appropriate engraving or labels. Alternatively a key diagram of circuits and terminal marking can be pasted in the lid of the instrument.

When these two-valve note magnifiers are arranged in the manner last described above, it is possible to cascade two or more of them efficiently, by connecting the input terminals of the second instrument, marked "To Anode" and "To H.T. +" in Fig. 2, to the "Phone" terminals of the previous instrument, taking care that the "To Anode" terminal is joined to the telephone plug socket that is connected to the valve anode, *i.e.*, the right-hand telephone plug socket shown in Fig. 2. If these connections are reversed, part of the circuits would be short-circuited, and the apparatus would not function properly.

The Transatlantic Tests

SUCCESSFUL RECEPTION OF THE SHORT-WAVE SIGNALS.

AS we go to press with this issue the joyful news is beginning to come through—the amateur transatlantic signals have been received on this side, not only by the representative of the American amateurs who is over here, but also by members of our own particular fraternity of this country.

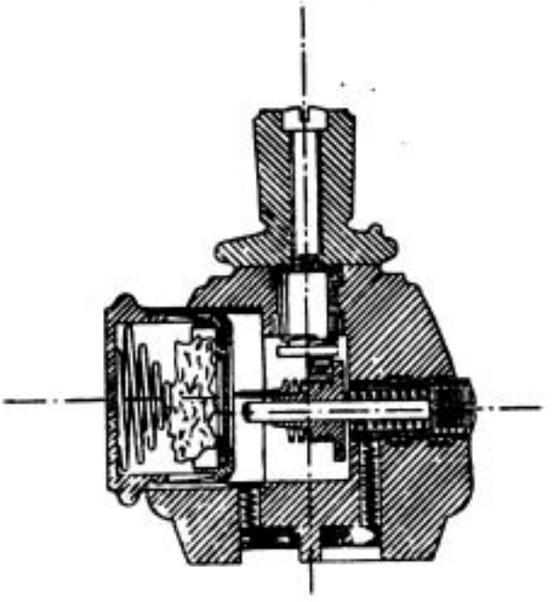
Mr. Paul F. Godley has erected his station at Ardrossan, near Glasgow, as this locality had been specially recommended to him for strong transatlantic signals. Mr. Godley made arrangements with the Marconi Company for the results of his watch to be broadcasted by the Carnarvon station daily for the benefit of those on the other side who must have waited in eager expectation to know if their particular stations had been heard by him. The first reports from Mr. Godley were received before it was possible to verify the reception by any British amateurs. Naturally, we have not yet received from any British amateurs their complete logs, and only a few have sent in preliminary reports at the time of writing. When the full logs are received we look for great things from them. The success of Mr. Godley is truly remarkable, complete messages having been copied in some cases, though one or two of the stations received well by him are probably using greater power, and are not included in those transmitting stations actually taking part in the competition. Perhaps a word to the British amateurs regarding the station erected by Mr. Godley is only fair in view of the fact that the aerials of the amateurs in this country are restricted by the Postmaster General; Mr. Godley is employing a special type of aerial full details of which will be published in a later issue, but for the present it suffices to say that the total length is 850 feet, and it is reasonable to suppose that this may be an important factor contributing to his success. Our congratulations to Mr. Godley and to the British amateurs whose energies and patience have been so well rewarded.

In order to adhere to the conditions of the competition it is not possible to notify any competitor of the result of his efforts until all the logs have been checked by the judges.

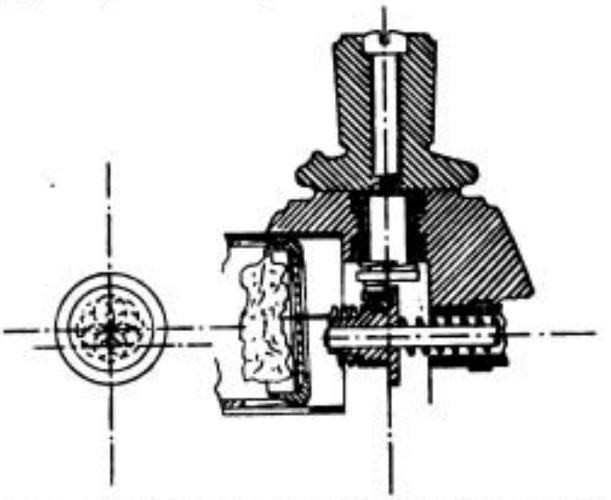
Competitors may rest assured that the judges will do their utmost to supply full details of the results at the earliest possible moment, and you are asked not to expect anything like a full report in the next issue of the WIRELESS WORLD, owing to the fact that the Christmas holidays necessitate that the Magazine should be made up several days earlier than usual.

Crystal Detectors and a Novelty

ALTHOUGH technical literature in general, and maker's catalogues in particular, would lead the wireless beginner to imagine that the crystal detector is rather a "back number," it must not be forgotten that thousands of wireless amateurs in all parts of the world still use this convenient rectifier. Properly used and adjusted, with a suitable form of tuner, a good crystal is capable of surprising feats—feats which would astonish many valve enthusiasts who have known no other detector than the magic bulb. Thus, for example, using the well-known Mark Three Star Tuner with its perikon detector and a pair of Brown Telephones (4,000 ohm), the writer of this note has received in one evening, on an aerial of a maximum height of 20 feet, with twin wires sixty feet long, the following stations:— North Foreland, Niton, Land's End, Cullercoats, Parkeston, Boulogne, Havre, Ostende, Norddeich, Ushant, St. Maries de la Mer, Cadiz, not to mention Eiffel Tower and Poldhu on long wave adjustments obtained with additional coils. Ships, of course, particularly those in the Channel and the North Sea, are very easily read.



Surprisingly little attention has been given to the design of crystal detectors since the armistice, probably because of the lure and fascination of the valve. France, however, has recently produced a remarkably convenient and efficient detector, shown in cross-section in our illustrations, possessing a number of points of interest and utility. Primarily it consists of a small cup, in the rim of which is held a ring. This ring carries a piece of silk gauze, beneath which the crystal is held. Good electrical contact with the crystal is made by means of a spiral brass spring in the base of the cup. When fitted in place for use, this cup is held in the side of a composition box, which forms a dustproof case. Projecting from the opposite side of the box is a thin wire coiled in a spiral, save at the end, which projects against the crystal face.



The particular point of originality in the device consists in the arrangements for "searching" the crystal and finding the most sensitive point. On the top of the container is placed a small knurled knob, by turning which the interior wire is automatically made to vary its pressure upon the crystal, pressure being given exactly at right angles to the crystal face, so as to avoid slipping and scratching. By means of an ingenious eccentric arrangement, when the wire has been moved right back from the crystal and is no longer in contact with it, the back moves round a few degrees and the wire is once more brought forward to bear upon the crystal. Continued turning of the knob therefore presses the wire upon the crystal, withdraws it, turns it through a few degrees of a circle, brings it forward once again and then repeats the cycle of motions described. In this way a search can be made of many points on the crystal face, and when all of these points have been explored, a turn may be given to the cup and the process repeated. All this is done without touching any part other than the exterior knobs.

The device is well-made mechanically and sells in this country for about half a guinea. In our own tests we used a piece of galena, with which the results were remarkably good. Silicon should work just as well if properly selected, and has the advantage of being easily obtainable in good quality in this country.

P.W.H.

Loose-Contact Thermal Telephone Receivers*

By Leslie Miller, A.M.I.E.E.

ANOTHER name for my paper would have been Microphone Receivers; a third, perhaps the best of all, Coherer Telephones.

About 43 years ago, I was a young amateur student of electricity, experimenting with the newly-discovered microphones of Professor David Hughes. I then noticed, when using two of them in series, with a strong battery in circuit, that one reproduced faintly, but clearly, words spoken into the other. Because of the unusually strong current, I ascribed the effect to heat. I must have written to Prof. Hughes, for among other correspondence with him, which I have kept out of respect for the memory of a great, and kind, man, there is the following letter:—

"I have received yours of to-day relative to receiving microphone, and from the good results you have obtained I should be anxious to see it, except that it requires 2 Grove's cells, that which would very much destroy any practical value. The one I have you can hear with 3 small Daniell's feebly—not so strong as Bell's, but quite sufficient to demonstrate the fact.

I am suffering from a severe cold, and also my presence is required here each day, so could not very well visit you, but whenever you think that you can make your microphone speak well with 3 small Daniell's (I have no stronger battery, as it is all I need) by writing me a word a day in advance you can visit me any day except Saturday, from 2 to 4 p.m., and bring your microphone and try it against the one I have.

You could publish it in *English Mechanic* if you desire publicity at present, and if it contains something new, but if you get a really valuable receiver it would be best for you to patent your form before publishing it."

Later on, others noticed the same thing; but, so far as loose contacts are concerned, heat, as the operating cause for the reproduction of speech, seems to have been allowed to go into oblivion. On June 7th, 1920, however, a paper by Mlle. P. Collet appeared in *Comptes Rendus*, an abstract of which was printed in the *Journal of The Franklin Institute*, and copied in the *Electrical Review* of May 20th, 1921, entitled "Reproduction of Speech by Galena and Undamped Waves."

In her experiments, the authoress, Mlle. P. Collet used a primary circuit in which undamped waves were set up and a secondary circuit, entirely separate from the primary, and tuned to it by means of a variable condenser. From the terminals of this run off two line wires several metres long, at the end of one of which was a crystal of sensitive galena, while a platinum point at the extremity of the other, touched the galena, thus forming a circuit shunting the condenser. The point was fixed to the centre of a phonograph diaphragm mounted on the horn of the instrument, and when the secondary circuit was tuned to the primary, and the latter interrupted by a tuning-fork, then the phonograph emitted a note of the same pitch as the fork. When a carbon microphone was joined in the secondary circuit, the sounds of a voice speaking in front of it were reproduced in an adjacent room with great intensity and with remarkably good quality. The singing voice was likewise admirably rendered in all detail. The phenomenon was attributed to thermal effects, being kindred to the Trevelyan rocker, made well known in America by Professor Tyndall half a century ago.

This recalled my early experiments, and caused me to start work again on the subject about the middle of this year. Since then I have taken out several Provisional Patents, the contents of which are more or less embodied in the description which follows.

Briefly stated, a loose-contact microphone, consisting of two contacts, one mounted in the centre of a suitable diaphragm, acting as a sounding-board, and the other pressing very lightly against it, will reproduce speech of fine quality with the greatest ease, provided always there is a direct current of a certain strength, suited to the material and size of the contacts, passing through them. Otherwise the effect is very much less, if noticeable. Their pressure against one another, also, must be nicely adjusted, if great sensitiveness is required. The result does not seem to depend, at bottom, on the material employed for the contacts. Anything that will act microphonically will answer, and I am of opinion that carbon is the most practical substance for most purposes. All the rectifying crystals formerly used for wireless telegraphy answer, more or less, but most of them are a source of annoyance, because they are only good in parts.

For ordinary telephonic purposes, as well as for wireless, fused iron sulphide (marcasite) is reliable in its action. It can be filed to a point with an ordinary file. Galena in the crystalline form is very sensitive for experimental use where a low resistance is needed, but it is soft and easily spoilt. The granular variety is suitable for high resistance uses. By low resistance 15 to 50 ohms is meant; by high, 5,000 to 10,000 ohms. This is with an average working pressure between a point and a flat surface only. The most sensitive form for the contacts to take, theoretically, is one knife edge at right angles to another, i.e., two masses joined by a very small, narrow bridge. The possible forms are endless.

The current necessary to render the points sensitive must be found by experiment. It is, of course, independent of whatever may be necessary for the transmitter. For example, in a simple circuit, with a R.A.F. wireless telephone transmitter, a lead, or iron, sulphide thermophone will need 20 to 40 milliamperes for good speech. If the transmitter is in the primary circuit of a transformer and the thermophone in the secondary, less than a quarter of this current in the secondary will suffice. This will be the case also when a condenser is in the line, as in the Government public telephone system. It then becomes necessary to shunt the thermophone with a local circuit containing a battery; with choking coils in addition, to prevent the alternating (speech) current passing passing through the battery.

Numerous other forms have been tried, but the best I have found consists of a diaphragm, at the centre of which is a small piece of marcasite.

* A Paper read before the Wireless Society of London on Wednesday, November 23rd, 1921.

Pressing lightly against it is another piece of marcasite. One or the other should be pointed, and it is essential that the one connected to the

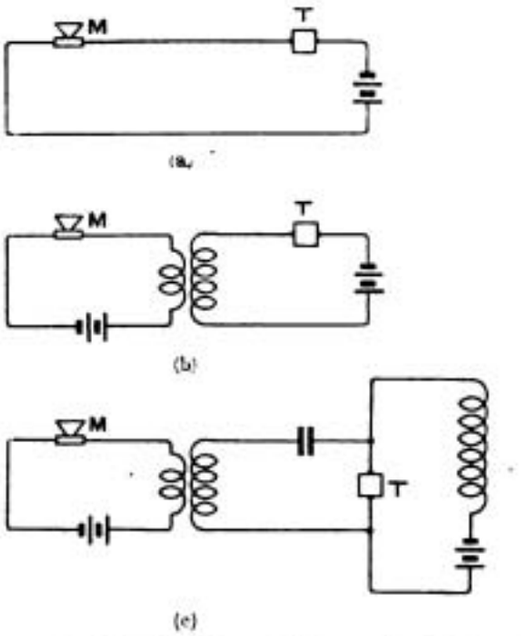


Diagram showing the three ordinary circuits in which the Thermophone can be used.

(a) *Simple circuit with Microphone, Thermophone and Battery, all in series.*

(b) *Microphone in the primary circuit of a transformer, and Thermophone in the secondary with a battery also in the secondary.*

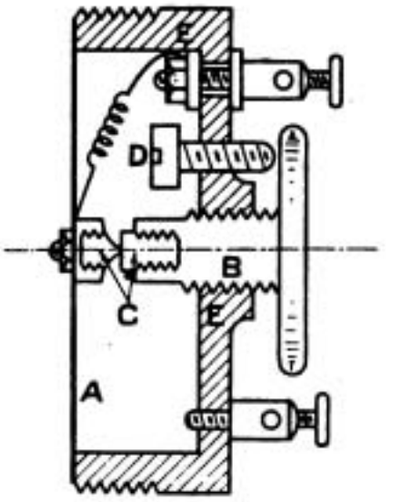
(c) *Primary circuit as in* (b), *but there is a condenser in the secondary. The Thermophone should be shunted with an inductance and battery.*

back should be rigidly fixed in some way, or have considerable inertia. For ordinary speaking purposes, instead of the crystals, I recommend two blocks of carbon separated by ½ a millimetre and a small carbon ball 2 mm. in diameter in between. There should be some means of adjustment, both of pressure and current.

It would seem as if identical thermophones might as well be used for sending and receiving. They can be, but a granular transmitter is better for sending, although practically useless for receiving, when it contains the ordinary large number of granules in parallel; but if a carbon granule happens to become jammed between the plate and the carbon cup, it answers quite well. I have received both good speech and wireless signals with a faulty granular carbon transmitter used as receiver.

As regards sensitiveness to small changes of applied voltage, in its present state of development the thermophone is not equal to a very ordinary Bell telephone. It is not, however, easy to judge the sensitivity, because current through the contacts and pressure have both to be adjusted. It is difficult to see how a thermophone receiver can be otherwise than very sensitive, seeing that it can reproduce speech as perfectly as it does. The naturalness of reproduction is, of course, modified adversely by any twang due to the diaphragm at either end, but is very clear. Such a sentence as "she sells sea shells" can be heard quite plainly with a good transmitter, just as though the speaker and listener were face to face. This, no doubt, is mostly due to the practical absence of all self induction or capacity to distort the waves, in the case of a simple circuit.

It is hard to define the exact way in which the transformation from varying current to varying sound is effected in the receiver. Most of the thermophones give a click when the circuit through them is made, and a somewhat louder click when it is broken; but others give scarcely any sound at the make. With each wave, or each train of waves, the narrow bridge between the contacts must expand, and then contract during the time the current is broken. For this action to take place strongly, and very rapidly, the resistance should be at the actual contact, not in the bulk; but, none the more, the action goes on just the same when the whole is quite hot. It is evident there must be a definite time that is best, during which expansion or contraction can take place in the bridge, and the facility with which the receivers can be heterodyned proves this. A heterodyner is, in fact, necessary for wireless, though spark signals can be received without one, and an ordinary buzzer



A. *Phonograph diaphragm (mica).*

B. *Back adjusting screw, with its end fitted with back contact.*

C. *Acting contacts, of marcasite, galena, or other material, screwed or cast into brass sockets.*

D. *Screw to prevent accidental overpressure on contacts.*

E. *Ordinary telephone metal case, shown without the cap.*

NOTE.—*The diaphragm may be of very thin carbon, and the back contact of carbon also, with the surface slightly hollowed out to receive a carbon shot, about 2 mm. in diameter, which is gently pressed against the diaphragm by the back screw. This must pass through a hard insulating bush, or through a metal bush insulated by mica from the case.*

employed for tuning. In this connection it should be mentioned that tuning is very puzzling. When a thermophone is joined in series with a condenser across a regulating inductance, to tune in a longer wave sent out from the wave meter, the turns of the inductance have to be diminished (not increased) in some inductances; and increased, as usual, in others. When the thermophone is inserted in the earth circuit, tuning can always be effected as with a Bell telephone and a crystal rectifier. The only explanation I can offer is, that the self capacity is, in some coils, cut out faster than the inductance is added.

In wireless, there is much room for experimental work. The first necessity is to clear the mind from all ideas derived from long use of the Bell type. The thermophone is entirely different in its action, and it is a strange coincidence that circuits intended for a Bell receiver should act, even fairly well, with one so different. The heat effect is independent of the direction of the current, and it must accumulate while a train of very rapid waves is flowing. With a thermophone there is no need to make the current unidirectional, although this may be needed for charging condensers.

As to results, both spark and C.W. signals and telephony can be received by means of an ordinary heterodyning amplifier, with two or three valves. I have never heard signals on my small aerial without valves, though, as I can tune in with my small buzzer up to 18 inches off, they must be on the point of being audible. On the aerial over the General Post Office, signals from America could be heard on the only occasion I was present, but they were almost drowned by a kind of sizzle quite new in my experience. The instruments are now in the Research Department of the G.P.O.

In general, there is a pleasing absence of unwanted noises when listening to wireless with a thermophone, and there is without question some strong limiting action at work which wipes out atmospherics, at any rate with high resistance galena points. This is doubtless mostly due to the very flat curve of current-sound. At first, with a point pressing very slightly on a plate, signals and atmospherics can be heard together; but as the pressure is increased with the adjusting back screw, the ordinary atmospherics are cut out faster than the signals. As X's can very seldom be heard at all on my small aerial, I have not personally investigated the matter thoroughly. Trials should be made with various materials in contacts, as their action as X-stoppers may vary widely.

Although extra current in the thermophone circuit is not absolutely necessary for receiving wireless in the case of some contacts, it adds greatly to the loudness. The chief merit of the thermophones is, however, their clearness of reproduction, not the loudness. At the house of a friend (Mr. F. R. Weatherstone), who has an amateur station, I have heard Horsea readably, about a yard off the thermophone, with the receiver (sharp-pointed marcasite, pressing on a marcasite flat surface fixed on a mica diaphragm) and a home-made three-valve amplifier. An ordinary aerial, about 30 feet high, was in use. The latest forms of receiver, if not as sensitive as point-and-plate, are on the lines of the ordinary P.O. telephone transmitters, and will stand rough usage. But for amateur use, to begin with, a very sharp point on a small plate is recommended with a micrometer screw to adjust the pressure, and a potentiometer to obtain the right sensitising current. Extreme cleanliness is absolutely necessary. Hours may be wasted by using a dirty file. A knife is best to give the final surface.

There is another use of the instrument that may be mentioned. It is well known that a microphone can be employed to produce alternating current, and therefore beats. Consequently it looks as though a thermophone might be made self heterodyning.

It is not clear what the action of the sensitising current really is. It amplifies, but how? In my opinion it is the equivalent of the permanent magnets in an ordinary telephone.

After forty-five years the Bell telephone is still being improved by Mr. S. G. Brown and others. Therefore I do not claim that the thermophones are perfect, after putting three months' work into them, under difficulties. But, even as they are, it is certain there could have been an efficient telephone service in the world if Bell had never invented his receiver, although, of course, this led to the microphone of Hughes. It seems strange to think such a good and very cheap tool as a microphone receiver can have been lying, neglected, under the hands of all of us so many years. It is a case similar to the revival of Elisha Gray's instrument so successfully by the two Danish engineers, Johnsen and Rahbek. Their receiver needs extra applied voltage, the thermophones require extra current.

In the thermophones there is practically no self induction or capacity, and the action takes place exactly at the centre of the diaphragm. In the discussion, I should like to know if these are not the ideal conditions for faithful reproduction of sound by electrical means. Also, I should wish to hear if there is any theoretical reason why heat should not reproduce sound waves even better than electro-magnetism. If the theory is correct it is well worth while for members of this Society to make experiments for themselves. It seems to me we have all been hypnotised by the great merits of the Bell telephone; and there is a reasonable probability of an improved type of receiver being developed by trials with simple and cheap appliances.

Speech cannot be reproduced in thermophones loudly enough for an audience to hear; but the Chairman will listen to one, and members can, singly, form their own opinion as to what the instruments are capable of when properly made and developed. They can also hear some wireless signals.

DISCUSSION.

The Chairman (*after listening to speech in the instrument*).

I do hope it will be possible for all of us to hear. The speech is absolutely magnificent, and is entirely different from what one gets in an electro-magnetic receiver.

I ought to say with regard to the aerial erected

in this building that our thanks are due to our Secretary, Mr. McMichael, who has loaned the material, and to Mr. Burnham for the labour to fix it. This aerial, I may say, is only temporary. We hope to have a permanent aerial here. I also happen to know it is the intention to have apparatus here, and that is of interest to us because by kind permission of the Institution of Electrical Engineers it may be available to all members. I propose, with Mr. Leslie Miller's permission, to open the discussion as soon as possible. We have several here to-night who are very competent to discuss this subject, and I hope there will be no shyness in getting on your feet, and that I shall not have to call on members of the Society to take part in it. I have my eye on many.

Professor G. W. O. Howe.

I am afraid I am not at all competent to discuss this subject, I know practically nothing about it, but it is very interesting, and at the moment I am rather mystified by the phenomenon and can think of no explanation. I wish that the author would make a diagram of connections on the board so that we can see more clearly how he uses the apparatus.* If he would indicate the magnitude of the voltages and currents used and the action, so that we may attempt to get to the bottom of the phenomenon. So far as I understand it we have a small permanent steady current flowing between these two contacts, and the speech current, I presume, is superimposed upon the steady current and gives a mechanical movement between the electrodes. If that is so it looks as if there must either be a thin film between the contacts which is altering its thickness, or else the actual material at the contacts is undergoing some alteration. I notice that the author refers to the phenomenon throughout as the thermo effect and calls it thermo apparatus, but I understood him also to express some doubt as to whether it was a thermo phenomenon. Of course, there has been a discussion spread over the last 12 years, or perhaps 15 years, as to whether the various forms of rectifiers that were employed in wireless telegraphy depended on thermo effects or not and that discussion is still going on. I have read two or three papers within the last year, including one or two of the German periodicals, on the subject, some proving conclusively that the phenomena are thermo and the others proving just as conclusively that they are not. I am afraid that at the present moment I have an absolutely open mind on the subject, and I hope that the author will give us a little more detailed information so that we may be in a better position to try and get to the true explanation of this very interesting phenomenon. This paper and the paper by Messrs. Rahbek and Johnsen that we heard a little time ago shows that there are great possibilities yet in the way of inventing devices for reproducing speech, and anything that is going to improve the ordinary telephone, which we know reproduces speech very badly, is to be welcomed. (*Applause.*)

The Chairman.

Did I hear Mr. Leslie Miller say that these instruments are undergoing examination in the Research Department of the Post Office. We have our Vice-President, Mr. Shaughnessy, with us to-night, I wonder if he can tell us anything.

Mr. E. H. Shaughnessy.

I am very interested in the paper, but, like Professor Howe, I miss diagrams and some little pictures of what is inside these instruments here.* I think that before the paper is printed in the Proceedings of the Society, Mr. Miller might supply these details. I should like to have heard, perhaps I shall have an opportunity of hearing, the telephone speech on that instrument. I understand that it is very clear, and I also understand from Mr. Leslie Miller that it has great volume when you get sufficient of it, and of course one would have to consider what is the quantity of energy you might get at the receiving end in order to work these instruments so as to give speech before one could get any idea of comparison with the existing type of telephone receiver; and we know what amount of energy is required in this case. With regard to the tests by the Post Office Research Department, I must plead entire ignorance in this case. I am not connected with the Research Department. We have our own wireless research in the Post Office which is not a part of the ordinary Research Department; that department deals with all telephone and telegraph problems and mechanical problems, but as soon as ever they have carried out any tests of this apparatus we get a copy of their report, and we see whether there is anything of interest to us in it. We shall, of course, watch for this report, and if it looks promising on the telephone side, we shall naturally see whether we can make any use of it in wireless telegraphy. When Mr. Miller was giving us the description of this combination, it struck me that it was somewhat similar, it may be a little drawn in my imagination, to the Duddel Arc, in which you have a continuous current flowing through the arc which produces oscillating current and good speech out of the arc. I do not know whether there is any similarity, but, as Professor Howe pointed out, you have, between the contacts of this thermophone, films through which you do apparently maintain a steady and critical continuous current. I very much enjoyed coming here and hearing this paper to-night. (*Applause.*)

Mr. W. H. Shortt.

Would it be possible for Mr. Miller to give us that diagram now.*

Mr. Leslie Miller.

I should be pleased, but there is simply no diagram wanted. There is an R.A.F. microphone transmitter with 4 or 6 volts, I do not remember exactly, in series with one of these receivers which consists of a thin carbon diaphragm, at the back of which, half a millimetre away, is another block of carbon fixed in the back. In the back, let in, there is a small hollow with a single carbon shot. The back part of the shot is resting in the hollow, and the front part of it rests against the diaphragm. That is the whole thing. You simply use the thermophone exactly in the same way as you use a Bell receiver. The circuits do not differ in any way. In the case where the microphone is in the

* See paper for diagrams. These were not shown at the Meeting.

primary of the transformer and the receiver is in the secondary circuit, naturally you have D.C current in the primary circuit, but not D.C. current in the secondary circuit. You hear a little noise in the receiver when the primary circuit is traversed by speech currents, but as soon as you put a couple of dry cells in the secondary circuit you get speech. A similar arrangement is necessary when you are working with a condenser in the primary circuit. In ordinary Post Office telephones there is a condenser in the circuit, and I find then that the condenser prevents the flow of any D.C. through the receiver, so that I then shunt the receiver with a battery in series with a choking coil so that the battery current can flow through the thermophone but the A.C. cannot get through the battery. The speech is then heard clearly again. The same thing applies in wireless, as you can either have the thermophone in the plate circuit of the valve receiver if the thermophone has a suitable high resistance, or it can be joined in the secondary circuit of a transformer. In the former circumstances, about $1\frac{1}{2}$ milliamperes of direct current flows through the crystal points, but its value is fixed by the other constants of the circuit. Therefore it is more convenient to put the thermophone in series with the secondary of a transformer. I always find that the more current you put through the receiver the better—as the current is increased the sound gets louder and louder until you get a fizzling sound.

Professor G. W. O. Howe.

If you use the receiver without the polarising current on a pure musical note, does the receiver give that note or an octave of it? It looks to me as if it is a pure thermal phenomenon, the heat causing the slight expansions of the carbon.

Mr. Leslie Miller.

I think there is no doubt about that.

Professor G. W. O. Howe.

If you call the steady current A and the superimposed alternating current B, you get $(A + B)^2$ when they assist one another, and when the two currents are in opposition we would get $(A - B)^2$, *i.e.*, in one case $A^2 + B^2 + 2AB$, and in the other $A^2 + B^2 - 2AB$. The difference which gives you the sound is four times $A\ B$, and is thus strictly proportional to the polarising current, and so will increase up to the point where the current burns the contacts. If that is the correct explanation it shows that the A.C. should give you the octave above the note which you are listening to, because each half wave will cause the same action of heating, and you will get two impulses due to the two expansions of the point.

Mr. Leslie Miller.

I should say that, as far as I understand, the action takes place past the point of microphonic action. If you place two things near together they act as though there were films of water between them. As they approach nearer and nearer with a steady applied voltage, the currents get stronger and stronger, with increasing rapidity until actual cohesion occurs. After this has occurred, then the coherer action comes into play, and replaces the microphonic action, and then these instruments begin to act.

Mr. Maurice Child.

There are one or two little questions I should like to ask. One I think has a little bearing on what Professor Howe suggested just now. Has Mr. Miller ever tested the effect of a change of direction of the polarising battery. Does it make any difference whether the battery is placed to the crystal material or to the carbon as the case may be. That would be an interesting point to ascertain. I would like to ask Mr. Miller about the reliability of these contacts, the actual life he gets out of telephone of this description, how long it will retain its sensitiveness in actual working, and when the contacts are prepared and the instruments made up, whether it is sensitive for say a period of several months. That of course is the most important thing when one is comparing this type of telephone of Mr. Leslie Miller's with the standard magnet type. I should like to ask Mr. Miller whether he had tried peroxide of lead pellets in connection with this. Some years ago Mr. S. G. Brown used what were called peroxide detectors for wireless telegraph purposes. The pellet was not in connection with the diaphragm of the telephone, but it struck me it might be worth trying that form of detector in the telephone case itself. I was particularly interested in Mr. Miller's remarks with regard to the effect of atmospherics, and if there is any real benefit to be obtained by the reduction of atmospheric noises I think we all have to be very much indebted to Mr. Leslie Miller for making such a thing known, because at the present time the atmospheric disturbances that one gets with valve amplifiers are most distressing for practical work. (*Applause.*)

Mr. P. R. Coursey.

There are just one or two little points I would like to mention. With regard to the real action underlying such receivers it occurred to me just now that their mode of operation is probably very similar to a phenomenon described, I think, by Dr. Eccles at the Physical Society some years ago on the setting up of A.C. by a galena detector—a phenomenon similar to the Trevelyan rocker. I think he described some such phenomenon at the Physical Society, and if I remember rightly, it was there attributed to heat at the point of contact. I had the privilege of glancing through Mr. Miller's paper before it was read, and I think I am partly responsible for suggesting its title. In the paper Mr. Miller used the term "thermophone," but this term has also other meanings, and its use in this case might cause some confusion with the de Lange thermophone, and also with the transmission of intelligence over distances by heat rays the apparatus for which has also been known by the term of thermophone.

It seems to me that the action may also be similar to that occurring in the old microphonic detectors often termed auto-decohering receivers—those very early coherers of a microphonic nature which cohered and decohered themselves automatically as the signals came in without the use of a decoherer. In such coherers there must be some mechanical action, and probably some similar mechanical movements may be set up in a receiver of this kind. Although there is a steady current flowing through the receiver, the highest

resistance is in all probability at the point of contact and the largest potential drop will therefore be across the contact, producing some electrostatic action tending to pull or release the pressure between the two points of contact, the electrostatic forces acting between the two masses of material.

I was not quite clear with regard to the tuning phenomenon that Mr. Leslie Miller mentioned, when he said something about the change in wavelength and the relative changes in inductance and capacity. A diagram of what he was doing then would be of great help.

Mr. C. F. Phillips.

It occurred to me that most of us would like to try an experiment on the same lines as Mr. Leslie Miller has indicated, and if I have understood his apparatus it would be simple to do so. I understand that one form of the apparatus consists of a thin carbon diaphragm with a carbon point close to it and a shot of carbon fixed in the back case. Practically the same form of apparatus is repeated by the ordinary Post Office microphone so that what it really comes to is that this device is a microphone. One should be able to test the device in wireless apparatus by taking any ordinary microphone which one can adjust, and use an ordinary receiving set with an output transformer. We could all test this for ourselves. I listened to the apparatus before the lecture, and the reproduction was good and clear, although rather faint. It is certainly well worth trying.

Mr. F. J. Chambers.

In connection with the Duddel arc mentioned by Mr. Shaughnessy, it seems to me one could hardly expect an arc to be formed under the conditions existing with this instrument as there would not be quite sufficient voltage across the contact. Mr. Leslie Miller mentioned that atmospherics, or perhaps they were noises which were not atmospherics, were actually reduced. Rather a curious thing happens if you put a carborundum crystal in series with the telephone in the plate circuit of your receiver—you get rid of noises to a very great extent.

The Chairman.

Mr. Leslie Miller tells me there is no need to reply further now, and that being so, and as we are all anxious to get on, Mr. Miller will arrange for his experiments, and as I feel sure that a large number of you would like to listen, I ask you to restrict yourselves to five or ten seconds each. I would like you to hear the purity of the speech. I think that, as that would close the lecture proper, I cannot do better than voice the feelings which I am quite sure you all possess, of thanks to Mr. Miller for his lecture. I offer the thanks of the meeting to you, Mr. Leslie Miller, for your lecture. (*Loud and continued applause.*)

Mr. Leslie Miller (*communicated*).

In reply to a point raised by Mr. Shaughnessy, about the energy required to work one of the thermophones; under favourable conditions it is possible to hear the tick of a watch with about 0·0005 of a watt in the thermophone. This is probably much more than when one of them is used for receiving wireless waves from a small buzzer, but in any case far more is needed than for a Bell telephone.

The same energy must be required to produce the same sound by moving the same kind of ferrotype plate backward and forward, no matter whether it is done by electromagnetic means, or an expansion engine, like the thermophone; but which of the two is the more efficient in theory, I am unable to say. As to the possibility of a thermophone working as a short arc, I think there is no doubt this does happen sometimes, for such oscillations can be heard, but if they occur the instrument is not much good afterwards, till the contacts are re-scraped.

The direction of the direct current to which Mr. Child referred, makes no difference when the contacts are of the same material and shape. As to the life of the thermophones, when a point is used it can be easily burnt by excess of direct current, and will need sharpening before being sensitive again, but I am beginning to employ a small ball, or a few loose fragments in a cavity, instead of a point. The point, however, is the more sensitive. Mr. Coursey asks if there is an electro-static effect. The answer to this depends on whether there is actual cohesion or not. Before cohesion occurs, there must be some trace, at least, of electro-static action, but as soon as there is a real conducting bridge of resistance material, equivalent to a short piece of fine high-resistance wire, joining one electrode with the other, it must cease. This is the proper working condition.

Quite a distinct sound can, however, be heard when one wire from a thermophone is touched on one side of a working buzzer, and a weaker sound when it is touched on the other. This needs further investigation.

The Wireless Society of London.

Announcement of Meeting.

The next ORDINARY GENERAL MEETING of the Society will be held at the Institution of Electrical Engineers, Victoria Embankment, W.C.2., on Wednesday, December 28th, at 6 p.m. A paper will be read by Mr. P. W. Harris on:—"The Reception of C.W. without Valves."

Tea will be served at 5.30 p.m.

The ANNUAL GENERAL MEETING will follow the above Ordinary General Meeting. The business will include the election of Officers and Committee for the year 1922.

The Hon. Treasurer will also present his report for the past year.

THE ANNUAL CONFERENCE OF AFFILIATED WIRELESS SOCIETIES will be held on Wednesday, January 25th, at 2.30 p.m. Invitation tickets will be issued later.

The Halifax Wireless Club.

The above Club wishes to correct any mistaken impression regarding their activities which may have arisen from the wording of a certain Club report which appeared in THE WIRELESS WORLD recently.

The Halifax Wireless Club has been in close touch with the Wireless Society of London throughout the negotiations which the former Club has been conducting for the organisation of a regular Wireless Telephone transmission. The whole question is now being proceeded with by the Wireless Society of London.

Wireless Direction Finding Stations: British Isles, France, Germany and Italy*

BRITISH ISLES.

1.—**Stations:**—

Station.	Call Signal.	Latitude.	Longitude.	Wave-length (in metres).	Remarks.
Berwick - -	BVG	55°41'46"N.	1°53'43"W.	450	—
Carnsore - -	BVZ	52°11'51"N.	6°21'00"W.	450	—
Croydon - -	GED	51°21'10"N.	0°07'40"W.	900	Aircraft only.
Flamborough -	BVN	54°06'49"N.	0°04'56"W.	450	210°, 310 yards from Flamborough Head Lighthouse.
Lizard - -	BVY	49°59'07"N.	5°12'24"W.	450	—
Pulham - -	GEP	52°24'15"N.	1°14'25"E.	900	Aircraft only.

N.B.—

Aircraft, when within an area northward of the parallel of latitude 51°10'00"N., and westward of the meridian of longitude 8°30'00"W., should not ask for bearings from *Carnsore*, as such bearings from it to aircraft in the above area will probably be unreliable on account of the effect of the coastline, the night error in particular being of considerable magnitude.

2.—**Procedure :**—

(*a*) If bearings are required for more than one station (*e.g.*, *Lizard* and *Carnsore*), they should be called up together and the bearings taken in one operation.

(*b*) The following abbreviations are to be used :—

Signal.	*Meaning.*
QTE? - -	"What is my true bearing from you (or from .....)?"
QTE - -	"Your true bearing from me (or from .....) was ..... degree."

(*c*) The aircraft calls the station or stations on the appropriate wave, making "QTE ?" in conjunction, if necessary, with the call signals of the stations from which bearings are required. The aircraft then awaits instructions.

The station or stations called, when ready, answer in alphabetical order of their call signals (if more than one was originally called), and make "K" (go on).

(*d*) An aircraft, whose call sign is GEXYZ, requires a bearing from *Lizard* and *Carnsore* (BVY and BVZ).

The aircraft makes on 450 metres :—

$\overline{CT}$ BVY BVY BVZ de GEXYZ GEXYZ QTE ? $\overline{AR}$

On receiving "K," the aircraft makes her own call signal for 45 seconds, and awaits the result.

The stations reply (in alphabetical order) either asking the aircraft to repeat ($\overline{UD}$) or giving the result. The result is given by the signal QTE, followed, as necessary, by the call signal and by a group of three figures (000 to 359) indicating the true bearing from 0° to 359° of the aircraft from the station, reckoning clockwise from North (North = 000°, West = 270°). The time of handing in is always expressed in Greenwich mean time for all messages giving bearings to aircraft.

The result would be given in the form :—

$\overline{CT}$ GEXYZ GEXYZ de BVY BVY 1945 M (time) = QTE 92 $\overline{AR}$ followed by :—

$\overline{CT}$ XYZ XYZ de BVZ BVZ 1945 M (time) = QTE 125 $\overline{AR}$

The aircraft, on receiving the result, acknowledges receipt in the ordinary way, and makes $\overline{VA}$ ("end of work" sign). This sign is then repeated by the stations concerned. It is important that the "end of work" sign should not be omitted, since it not only indicates that the operation is finished, but it also shows that all concerned are about to resume normal watch.

(*e*) The procedure to be employed for obtaining a bearing by radio telephone is as follows :

Example :—

Aircraft GEALU is uncertain of its whereabouts and course. It calls *Croydon* as follows :—

"Hullo, Croydon, Hullo, Croydon, GEALU calling, GEALU calling, bearing required, bearing required, GEALU changing over."

* Air Ministry Notice to Airmen.

Croydon replies: "Hullo GEALU, Hullo GEALU, Croydon answering, Croydon answering, bearing 110 degrees, bearing 110 degrees, Croydon changing over."

The aeroplane replies: "Hullo Croydon, Hullo Croydon, GEALU got bearing 110 degrees, GEALU got bearing 110 degrees, changing over."

Croydon replies: "Hullo GEALU, Hullo GEALU, Croydon answering, Croydon answering, bearing correct, bearing correct, Croydon switching off."

FRANCE.

3.—**Stations**:—

Station.	Call Signal.	Latitude.	Longitude.	Range in Miles.	Wavelength.		Remarks.
					Receiving.	Transmitting.	
Barre de l'Adour	FEU	43°31'40"N.	1°31'20"W.	150	600	300, **450**, 600, 700	——
Ben Negro (Tunis)	FUA FUB	37°15'00"N.	9°53'30"E.	300	800	800	Will be replaced later by Bizerte.
Bernieres -	FEB	49°20'00"N.	0°25'00"W.	120	600	**450**, 600, 800	——
Berre - -	FED	43°28'55"N.	5°20'45"E.	—	—	—	Not yet erected.
Bizerte (Tunis)	FEQ	37°15'42"N.	9°50'03"E.	—	—	—	Not yet erected.
Brest-Moulin du Seigneur	FEI	48°19'36"N.	4°33'14"W.	300	600	**450**, 600, 800	Answers *via* Brest-Mengam FUE.
Casablanca D.F (Morocco)	CNP	33°35'21"N.	7°34'10"W.	300	800	800	——
Cherbourg -	FUC	49°36'32"N.	1°36'00"W.	200	600	**450**, 600, 800, 1100, 1350	The D.F. station works in conjunction with the ordinary W/T traffic station.
Djidjelli (Algeria)	FEJ	36°49'10"N.	5°46'12"E.	120	600	**450**, 600, 800	——
Gris-Nez -	FEN	50°52'18"N.	1°35'18"E.	120	600	**450**, 600, 800	——
Guipavas -	FEG	48°27'00"N.	4°26'00"W.	—	—	—	Not yet erected.
Kenitra (Morocco)	CNK	34°18'49"N.	6°35'40"W.	—	—	300, **450**, 600	Not yet erected.
L'orient -	FUN	47°44'00"N.	3°21'00"W.	300	600	**450**, 600, 800, 1100	——
Ouessant -	FEO	48°26'27"N.	5°05'37"W.	120	600	**450**, 600, 800	Answers *via* Ouessant W/T FEO.
Penmarch -	FEP	47°48'30"N.	4°21'01"W.	120	600	**450**, 600, 800, 1100	——
Point du Raz	FER	48°02'23"N.	4°43'54"W.	120	600	**450**, 600, 800	——

WIRELESS DIRECTION FINDING STATIONS

FRANCE—*continued.*

3.—Stations :—

Station.	Call Signal.	Latitude.	Longitude.	Range in Miles.	Wavelength.		Remarks.
					Receiving.	Transmitting.	
St. Nazaire -	FEZ	47°15′24″N.	2°13′49″W.	120	600	**450**, 600	——
Sfax (Tunis)-	FUS	34°45′05″N.	10°46′21″E.	—	—	—	Not yet erected.
Soubise -	FES	45°56′00″N.	0°58′40″W.	150	600	300, **450**, 600, 800	——
Toulon-Liberte	FUT	43°06′35″N.	5°54′38″E.	—	600	800	——
Treguier -	FET	48°50′13″N.	3°13′56″W.	120	600	**450**, 600, 800	——

N.B.—

I. French D.F. Stations normally use the wavelength of 450 metres, shown in heavy type above; they also take bearings on 800 metres, and in exceptional cases on 600 metres, but the use of this latter wave will shortly be discontinued.

The stations keep watch and answer calls on the 600 metres wave, but transmit bearings on 450 metres, with the exception of Toulon, Ben Negro and Casablanca, all of which transmit bearings on 800 metres.

II. The method to be followed by the aircraft depends on various circumstances, but it should be observed that—

(*a*) Bearings can be taken simultaneously by several D.F. stations on the normal wave of 450 metres.

(*b*) If the D.F. stations are not keeping watch on the same wave, each station should be called separately.

(*c*) If several D.F. stations are specially connected by land telegraph line, one station only need be called (*i.e.*, the nearest transmitting station). The results are sent by this station, each bearing following immediately after the call signal of the station making the observation. *Such connection does not, however, yet exist.*

4.—Procedure :—

The procedure for French D.F. Stations is in general similar to that for British stations.

The abbreviations to be used are :—

QTE ? .... "What is my true bearing from you (or from ——) ?"

QTE .... "Your true bearings from me (or from ——) is —— "

The bearings are indicated by a group of three figures from 000 to 359, reckoning clockwise from North (North = 000°, West = 270°).

The procedure is as follows :—

(*a*) The aircraft calls the station or stations on the wavelength indicated, and transmits the signal : QTE ? followed by the call signals of all the stations it requires to take observations, giving the wavelength to be used. The aircraft then awaits instructions.

(*b*) The stations called prepare to take the bearings and, when ready, reply in alphabetical order of their call signals direct to the aircraft by the signal K (go on), followed by a figure giving the strength of the signal.

(*c*) On receiving the signal K, the aircraft having adjusted the transmitting gear, sends her own call signal for 45 seconds and awaits instructions.

(*d*) The stations then reply in the alphabetical order of their call signals, either asking for the aircraft signal to be repeated, or giving the results of their observations, by the signal QTE, followed by a group of three figures indicating the bearing.

Example:

An aircraft GEXYZ requires bearings from Moulin du Seigneur (FEI) and Ouessant—Pen ar Roch (FEO), which both keep watch on 600 metres. She will make use of the normal wave of 450 metres.

GEXYZ calls on 600 metres :—

CT FEI FEI FEO FEO de GEXYZ QTE FEI FEO ? 450

FEI replies on 600 metres :—
CT GEXYZ de FEI K6
FEO replies on 600 metres :—
CT GEXYZ de FEO K7
GEXYZ adjusts her wavelength to 450 metres and signals :—
CT FEI FEO de GEXYZ GEXYZ GEXYZ (for 45 seconds).
Both Ground stations, having made their observations, arrive at the following results .—
FEI 330° and FEO 010°
FEI thereupon signals on 450 metres :—
GEXYZ de FEI 1 1945 = QTE 330 FEI
FEO signals on 450 metres :—
GEXYZ de FEO 3 1945 = QTE 010 FEO

Having received the result of the observations, the aircraft acknowledges the receipt of the message and follows the usual procedure by making VA ("end of work" sign), which is repeated by the Ground stations, and all resume their ordinary service.

Note :—With reference to the figures 1 1945 and 3 1945, 1 and 3 represent the number of the record on the station register; 1945 refers to the civil mean time of the meridian of Greenwich.

If one of the stations (FEO for example) desires to repeat the message, the observation having been made incorrectly, it will make the signal :
CT GEXYZ de FEO UD.
The aircraft again repeats the signal for 45 seconds.
The remainder of the operation is as described above.

GERMANY.

5.—Stations :—

Station.	Call Signal.	Latitude.	Longitude.	Wave-length.	Remarks.
Borkum -	KBO	53°34'50"N.	6°41'42"E.	600	—
List - - -	KAO	55°00'12"N.	8°23'12"E.	600	—
Nordholz - -	KBQ	53°47'06"N.	8°38'30"E.	600	—
Wilhelmshaven -	KAN	53°31'16"N.	8°09'33"E	600	Control Station.

6. Procedure :—

The stations belong to the State Marine, and are available for public use only when not in use by the Navy.

An aircraft requiring bearings could call Wilhelmshaven W/T station on a damped wave of 600 metres. That station makes the necessary arrangements with the D.F. stations, and communicates the position ascertained in latitude and longitude to the aircraft concerned (full details are given below). The D/F stations in the Heligoland bight, or, as the case may be, the W/T stations with which they are linked, correspond with aircraft of other countries only through Wilhelmshaven station.

(*a*) If an aircraft (call sign GEXYZ) requires a bearing from each of the three stations, the following procedure is to be employed :—

CT KAN KAN KAN de GEXYZ AR
CT GEXYZ GEXYZ GEXYZ de KAN AR K
CT KAN de GEXYZ BT QTE AR
CT GEXYZ de KAN VE AS
CT KBO KBO KBO KBQ KBQ KBQ
KAO KAO KAO de KAN BT PEILUNG (Bearing)
600 m—WELLE GEXYZ (metric wave).
CT GEXYZ de KAN BT BITTE VV GEBEN AR
(Please send V's)
CT KAN de GEXYZ BT V's. . . . . GEXYZ AR
CT KBO KBQ KAO de KAN AR K
CT KAN de KBO BT PEILUNG GEXYZ
(Bearing)

GRAD KBO 1018 AR
(Degrees)

Similarly KBQ and KAO pass their bearings to KAN.

CT KBO KBQ KAO de KAN VE
CT GEXYZ de KAN BT PEILUNG 1018 ? AR K
(Have you received Bearing)
CT KAN de GEXYZ VE VE AR VA
CT GEXYZ de KAN VE VA
CT KBO KBQ KAO de KAN VA

(*b*) An aircraft (call sign GEXYZ) requiring her position to be obtained by means of bearings from the three stations, the following procedure is to be employed :—

With the exception that QTF is substituted for QTE, the procedure is as in (*a*) above until the three stations have passed the bearings to KAN.

KAN then makes to GEXYZ :—

CT GEXYZ de KAN BT IHR STANDORT NACH
(your position by means of
FUNK PEILUNG UM 1018 IST..... GRAD
bearings at.....is.....degrees
.....MIN.....SEK NORD-BREITE
.....minutes.....seconds north latitude
.....GRAD.....MIN.....SEK OST-LANGE
.....degrees.....minutes.....seconds east longitude)
AR K

The procedure is then as is in the last three lines of (*a*) above.

Note.—Mid-European time is used, the hours and minutes being expressed in four figures from 0001 to 2359.

ITALY.

7.—Stations :—

Station.	Call Signal.	Latitude.	Longitude.	Wave-length.	Remarks.
Murano - -	IRM	45°27'40"N.	12°21'22"E.	600	...

N.B.—Bearings from this station are to be obtained by calling *Carbonera* ICZ on 600 metres, and ar transmitted for *Murano* by *Carbonera*.

8.—Procedure :—

The procedure is as follows :

An aircraft whose call signal is GEXYZ wishes a bearing.

On a wave of 600 metres she will signal :

CT ICZ ICZ de GEXYZ QTE ?

Carbonera will answer :

CT GEXYZ de ICZ AS

Carbonera then wires *Murano* ; when ready, *Carbonera* replies :—

CT GEXYZ de ICZ K

GEXYZ after 30 seconds signals :—

CT ICZ de GEXYZ GEXYZ GEXYZ, etc., for 45 seconds.

If dissatisfied with the bearing, *Murano* through *Carbonera* will ask the aircraft to repeat.

Carbonera signals :—

CT GEXYZ de ICZ UD

GEXYZ repeats the signal as given above.

When satisfied with the bearing, which is assumed to be 170°, at 9.45, *Murano* will transmit it by telegraph to *Carbonera*, whence it is passed to the aircraft as follows :

CT GEXYZ de ICZ de IRM 9.45 M BT QTE 170 AR ICZ

GEXYZ acknowledges receipt :—

CT ICZ de GEXYZ R VA

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 in the exact form in which they are to appear and as concise 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 of unusual or special interest read before Societies.

Manchester Wireless Society.

(Affiliated with the Wireless Society of London.)

Thursday, November 17th.—Annual General Meeting, held at the Albion Hotel, Piccadilly, Manchester. Mr. McKernan in the chair.

The minutes of the last General Meeting having been passed the Chairman asked the Hon. Secretary to read his report for the past year. Mr. Evans outlined the work of the Society for this period and gave the membership to date as 107, adding that splendid progress was being made and that the future of the Society was assured.

The Hon. Treasurer, Mr. Lamb, then presented the financial report, in which he stated that the total receipts for the year amounted to £124 13s. 10d. The total expenditure was £112 16s. 7d., leaving a balance in hand of £11 17s. 3d. Considering the fact that the annual subscriptions were due on January 1st, and that the year under review had called for heavy expenditure, Mr. Lamb expressed his satisfaction and assured the members that the Society was in a moderately good financial position.

Following the two reports, the Chairman called for remarks on the administration of the Society during the past year, after which the resignation of all officials was announced.

Mr. Maguire then proposed a hearty vote of thanks to the retiring officers, and stated that he also had much pleasure in moving that Mr. McKernan be re-elected as Chairman for the next 12 months. This was seconded by Mr. Hanstock and carried unanimously with generous applause.

Mr. McKernan immediately resumed office and thanked the members for their confidence, after which the election of officials took place, the result of which was as follows:—President, Mr. J. Hollingworth, M.A., B.Sc., Eng.; Vice-Presidents, * E. Blake, A.M.I.E.E., * A. Parkinson, J. C. A. Reid, J. C. Wrigley; Chairman, * J. McKernan; Vice-Chairman, T. Maguire; Hon. Treasurer, * W. H. Lamb; Hon. Secretary, * Y. W. P. Evans; Committee members, * W. R. Burne, A. Cash, * A. G. Gregory, H. L. Holt, W. H. Hanstock, H. G. Jenkinson, E. Jones, * L. Mansfield, A. Milner, A. Rowlands, * E. Samuels, LL.B., H. E. Thomas.

Following the elections, the Chairman continued with the agenda, which dealt with the amendment of rules. Six rules were amended and one deleted. Three new rules were put forward, two of which were adopted. These read as follows:—

(1) Junior members, from the age of 18 to 21, shall be accepted at a reduced fee of 10s., and shall be entitled to the privileges of full membership.

(2) In order to further the objects of the Society, the Committee are empowered, out of the Society's funds, to expend such sums as they may consider desirable, to encourage scientific or technical research and contributions.

(* Re-elected.)

The Hon. Secretary then read a letter which it was proposed to circularise among the wireless societies in the North of England, with a view to forming a Northern Wireless League.

This concluded the business of the meeting, whereupon, Mr. Maguire proposed a hearty vote of thanks to the Chairman for the able and efficient way in which he had conducted the meeting. After this had been seconded, the members showed their appreciation in the usual manner.

The Chairman then declared the meeting closed.

Hon. Secretary's address, 7, Clitheroe Road, Longsight, Manchester.

Bradford Wireless Society.

(Affiliated with the Wireless Society of London.)

A meeting was held in the Club-room on Friday, December 2nd, at 7.45 p.m., with Mr. W. C. Ramshaw in the chair. The minutes of the previous meeting were read by the Hon. Secretary and passed, following which, three new members were elected.

Mr. H. T. Sayer, late of the R.A.F., who was to have given us a paper, being unavoidably absent, the Chairman then called upon Mr. Whiteley to read the paper entitled "The Calculation of Inductances" (single layer coils), which Mr. Sayer had forwarded to him. This paper was very much appreciated by those present, and as an illustration of the method described the inductance value of one of the Society's coils was worked out on the blackboard.

At the conclusion of the paper a hearty vote of thanks was passed, and the Hon. Secretary was instructed to write to Mr. Sayer, thanking him for the trouble he had taken in the preparation of the paper.

Exhibition entry forms are now ready and will be in the hands of members within a few days. Please note the closing date for entries—December 31st.

The Radio Scientific Society.

(Affiliated with the Wireless Society of London.)

An ordinary meeting of the above Society was held on Wednesday, November 30th, 1921, at the Society's rooms, 61, High Street, Manchester, Mr. G. G. Boullen in the chair. One new member was elected.

The meeting intentionally took the form of open discussion under the guidance of the Chairman, and was quite a success both in attendance and questions and replies.

The Wireless Society of Hull and District

(Affiliated with the Wireless Society of London.)

This Society continues to make slow but steady progress, both as regards strength of membership and general usefulness of the discussions which

take place at the meetings. Through the kindness of Capt. W. E. Dennis, R.E., one of the Vice-Presidents, these meetings are now held in a very suitable lecture hall, placed at our disposal at the headquarters of the local Signal Corps (Territorials) situated in Park Street, where a very good outside aerial is always available for testing and experiments. The Society meets there on alternate Monday evenings at 7.30 p.m.

Recent papers which have been read and have proved most interesting and instructive, include "Modern Practice in Receiving Instruments Applicable to Wireless," by Mr. F. J. Southwell, who treated the members to a comprehensive description of the method of reception by the modern Creed machines. Capt. W. E. Dennis, R.E., who is the O.C. of the Local Signal Corps, gave an excellent account of "Wireless Direction Finding during the War," in which he took an important part in France. Then, for the benefit of would-be wireless enthusiasts, Mr. J. Nicholson, A.M.I.E.E., gave what he termed a talk with chalk on his own experiences of building up a complete receiving station, thoroughly explaining by diagrams on the blackboard the various pieces of apparatus from the aerial and masts down to the telephones. This proved one of the most interesting and at the same time very instructive papers yet given.

Recently a Questions and Answers evening was held, from which some very instructive discussions arose. To enable members to increase their speed of reception in Morse, about half an hour is devoted to practice on the buzzer after the conclusion of the lectures or discussions.

A feature of the Society is the mutual aid which exists amongst the members. The Hon. Secretary has prepared a list of members who are specialists in certain parts of wireless work, and who are willing to give their assistance to other members, especially those just commencing, in such things as mast erecting, testing apparatus, drilling and turning, wiring and general electric work, etc., etc.

To encourage persons interested in wireless who reside outside of the city to become members of the Society, it has been decided to admit such persons at a reduced subscription of 6s. per annum.

New members are now being elected at every meeting, and the Hon. Secretary, Mr. H. Nightscales, 16, Portobello Street, Holderness Road, who is very desirous of further increasing the membership, will be only too pleased to forward full particulars on receipt of a postcard from any person so interested.

Woolwich Radio Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.

The usual monthly general meeting of the above Society took place at Woolwich Polytechnic, on Friday evening, November 25th, at 8 p.m. We were pleased to welcome a large audience—about 80 ladies and gentlemen being present.

Mr. W. L. McPherson, B.Sc., one of our Vice-Presidents, took the chair, and welcomed the speaker for the evening Col. Cousins, C.M.G., R.E., our respected President.

Col. Cousins, in opening his lecture on "Wireless Telephony," pointed out that wireless telephony had been tried first in the old days when spark systems were the only ones; but this had not been successful to any great extent. Now that valve and arc transmissions were extensively used, telephony was not only possible but was successful to such an extent that speech had been clearly transmitted across the Atlantic. By means of many lucid diagrams he showed the chief characteristics of the several forms of telephony transmission in use. Modulation of the intensity of the emitted wave to follow the modulations of the voice could be effected either by microphone or magnetic control. If the microphone was coupled directly to the primary inductance or capacity it was found to affect to a slight extent the wavelength of the emitted wave; this was highly undesirable in the interests of sharp tuning. It was far preferable to use the microphone to control the potential of the grid of the valve; either the transmitting valve directly, or, better still, that of a control valve whose plate circuit was connected to the grid of the transmitting valve. One circuit the Colonel showed was of great interest as being that which was first used to speak to aeroplanes while in flight; a noteworthy achievement considering the difficulties to be surmounted.

At the conclusion of the lecture a demonstration was given. First of music, which was being sent out from the S.E.E. for our benefit. Although the weather and electrical conditions were most unkind some splendid music was heard clearly by all the audience. Afterwards an exhibition of high speed sending and receiving was given. A message was sent out from the S.E.E., first slowly and then the speed was increased up to 150 words a minute. This was faithfully recorded on the printer, kindly loaned by our President. Specimens of the tape were handed round to the audience to read.

At the conclusion of the demonstration a very hearty vote of thanks was given to our President for his most interesting lecture and demonstration.

On Saturday, November 26th, at 3 p.m., many of our members were allowed to visit the Signals Experimental Establishment Wireless Station, Woolwich Common, by the kind courtesy of Col. Cousins, the head of this establishment. We were conducted round by the Colonel himself and Captain Hughes. The wonderful apparatus and achievements of this most truly marvellous station surprised all of us. But as this is a private Government station, no details of what we saw there may be published. Sufficient it is to say that we all came away both amazed and delighted.

Southport Wireless Society.

(Affiliated with the Wireless Society of London.)

The second Annual Meeting of the above Society was held at the new Club-room, Queen's Hotel, on Tuesday, December 6th, 1921.

In presenting the annual report the Secretary referred to the enlarged scope of the Club now that better accommodation had been obtained, and the satisfactory growth of the apparatus installed therein, including a transmitting set and receiving set with a 4-valve amplifier.

The summer months had been spent in painting and fitting out the new premises, erecting the aerial and installing the Club set. The outstanding feature had been the willingness of the members to give their spare time to this necessary work.

The membership now stood at 18, in spite of several resignations, due to removal from the town.

The Treasurer's statement showed:—Income, £41 18s. 10d.; expenditure, £41 15s. 6d.

The election of officers for the ensuing year was as follows:—President, Councillor H. Taylor; Vice-President, Colonel A. D. Lomas; Chairman, Mr. A. Stock; Secretary and Treasurer, Mr. E. Field; Committee, Messrs. Stock, Field, Hanley, Brown and Wilde; Librarian, Mr. A. E. Fielding.

A hearty vote of thanks was passed to the retiring office bearers, and to those members who had contributed gifts of apparatus and money, and also to the anonymous donor of a cheque for £15 to the Club funds.

Hon. Secretary, Mr. E. R. W. Field, 26, Hartwood Road, Southport.

Blackpool and Fylde Wireless Society.

(Affiliated with the Wireless Society of London.)

The first Annual General Meeting was held on November 24th, at the Society's headquarters, "The Cafe Waldorf," Church Street, Blackpool.

In the absence of the President, Colonel P. Warren, C.M.G., C.B.E. (Postmaster of Blackpool), Mr. Thomas Sharples, Chairman of the Executive Committee, presided, and opened the meeting by calling upon Mr. C. Sheffield Doeg to read the notification sent out convening the meeting: the Hon. Secretary followed on by reading the minutes of the previous General Meeting, which was held on November 25th, 1921, three weeks after the Society was founded.

After a few remarks from the Chairman, the Hon. Secretary continued on with the correspondence which included a letter from the Manchester Wireless Society with reference to the proposed Northern Wireless League, and which was received with great enthusiasm by the members present.

After the correspondence the reports from the Hon. Secretary and the Hon. Treasurer were read and confirmed.

The Chairman stated that the most important item on the agenda was the election of President, Vice-President, Hon. Secretary, Hon. Treasurer and Executive Committee for the coming year.

The meeting thereupon unanimously passed a vote of confidence to the retiring officers and committee by re-electing them en-block, with the addition of one new member.

The nine rules which had sufficed for the closing year, owing to the steady growth of the Society, were found to be totally inadequate to cope with the present requirements.

A Sub-Committee was therefore drawn up consisting of independent members with the Chairman, Hon. Secretary and the Hon. Treasurer as *ex-officio* members, and were endowed with wide discretionary powers to revise the rules and add or delete as they thought fit.

The meeting was then thrown open for propositions, suggestions and general discussion, and the accounts laid out for inspection.

Afterwards, Mr. L. H. Franceys, one of the Society's Vice-Presidents and also President of the Blackpool Literary and Scientific Society, asked members to attend a lecture to be given to the latter Society by Mr. R. D. Ball, the former Society's late Hon. Treasurer.

The meeting was then closed, the Chairman making a few appropriate remarks anent the general future welfare of the Society.

Mr. C. Sheffield Doeg, Hon. Secretary, "The Poplars," 6, Seventh Avenue, South Shore, Blackpool, to whom all communications should be sent.

Wireless and Experimental Association.

(Affiliated with the Wireless Society of London.)

At the meeting of the Wireless and Experimental Association at the Central Hall, on Wednesday, November 23rd, the competition introduced by Mr. Knight, the Chairman, for the best description of a wireless telephone transmitting circuit, was decided.

Members Voigt and Kloots had written papers showing such a grasp of the subject and lucid exposition of the means whereby the results were obtained, that it was found impossible to prefer one before the other, and the prize was divided.

Mr. E. Smith proposed and Mr. Bird seconded a hearty vote of thanks to Mr. Knight for instituting the interesting competition.

At the meeting on Wednesday, December 7th, a treatise upon secondary cells, written by Mr. R. G. De Wardt, A.M.I.E.E., was read to the members.

Only one half of the paper could be read at this meeting, but it is hoped to continue its reading at our next meeting after which a discussion on the points raised will be opened.

Members laughed at a reported incident of a chauffeur who praised up his accumulator battery because he could melt hairpins on it, but the reading of the paper showed that there were other things which one might ignorantly do which were only slightly less risky.

None of our members will, after this, buy a nice new accumulator at the local ironmongers, and call in at the oilshop on his way home for sulphuric acid, mixing it later on with water guaranteed by the Metropolitan Water Board not to contain an undue amount of living matter, and then put it on a County of London Company's lighting circuit to charge.

He will more probably seek an electrical dealer of repute and state his needs and be largely guided by his advice, checking what he is told in the light of what he has learned at our meetings.

Hon. Secretary, Mr. Geo. Sutton, A.M.I.E.E., 18, Melford Road, S.E.22.

The Leeds and District Amateur Wireless Society.

(Affiliated with the Wireless Society of London.)

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

A general meeting was held at the Leeds University on November 25th, at 7 p.m. At 7.15 a Morse instruction class was initiated, and until 8 p.m. Mr. P. Cochroft kept the members desiring instruction fully occupied. At 8 p.m. Mr. A. M. Bage, Vice-President, took the chair, and called upon the

Hon. Secretary and Hon. Treasurer to discharge certain business. The Hon. Secretary announced that as a result of a decision arrived at by the Committee, ladies were now eligible for membership in the Society. The Hon. Treasurer announced that the annual subscriptions for 1921-22 session were now due. The Chairman then called upon Mr. G. P. Kendall, B.Sc., to deliver his lecture on "Tuning Coils for Long Wavelengths." Prior to delivering his paper, the lecturer spoke for a few moments on the subject of autodyne receivers. He laid emphasis on the fact that unless very carefully handled, these receivers were going to be more nuisance than they are worth, and he urged all members to see that they used utmost care not to radiate unintentionally, especially during the coming Transatlantic tests.

Mr. Kendall concluded his paper, by exhibiting and explaining a coil of his own design, wherein every turn is spaced, but having much greater rigidity than the majority of multilayer coils. The Chairman opened a discussion on the paper, which was heartily joined in by the members. The Hon. Secretary mentioned the fact that he had carried out some very successful receiving results, usual multilayer coils of enamelled wire in the duolateral form. Sizes of wires were discussed, values of self capacity, etc., by the meeting, at the close of which a very hearty vote of thanks was accorded to Mr. Kendall, and duly carried out in the usual manner.

The subject of an annual dinner and Presidential address was discussed, and after enrolling four new members the proceedings terminated towards 9.30 p.m.

The Willesden Wireless Society.

(Affiliated with the Wireless Society of London.)

A meeting of the above Society was held on November 1st, and Mr. Wyatt gave us a lecture on "X-ray Tubes and Allied Phenomena," followed by a demonstration. The Society's induction coil and other apparatus was used by Mr. Wyatt, who succeeded in reproducing some well-known and interesting effects.

At an informal meeting on the following Tuesday, an attempt was made to get the Society's receiver into working order. Owing to the fact that German valves were in use, with which most of our members are unfamiliar, results were not entirely successful. However, at an informal meeting on the following Thursday, we achieved success. We are still greatly hampered by our temporary aerial's limitation, and the local tramways cause a lot of interference until 10 p.m. each evening, when things seem to get quiet again. It is hoped to erect a permanent and more efficient aerial in the near future.

As an experiment the usual Tuesday meeting has been replaced by meetings each Thursday and Saturday, alternate evenings in each week being given over to an informal meeting, when the Society set can be demonstrated and elementary questions asked and answered.

To resume our report upon past events, on Saturday, November 19th, Mr. Carsham, our Chairman, gave a lecture and illustration of a 7-valve low frequency amplifier, which he has constructed. He gave several hints as to the elimination of the howling and noises which one might reasonably expect.

Particulars as to membership can be obtained from the Hon. Secretary, Mr. F. A. Tuck, 87, Mayo Road, N.W.10.

Edinburgh and District Radio Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary and Treasurer, Mr. W. Winkler, 9, Ettrick Road, Edinburgh. Headquarters, 8, Forth Street, Edinburgh.

Mr. R. Ogilvie Crombie delivered his lecture on "Telecontrol" before a large meeting of the Society.

He opened his discourse by enumerating the various methods which might be used to convey energy or signals over varying distances, by using water, air or aether as a medium.

He then showed the relationship between the various aether waves from X-rays to electric or wireless waves, explaining where each particular group possessed advantages and failings.

Having decided on the transmitter and receiver suitable to the purpose required he introduced his audience to the next difficulties to be met with in attempting to control a piece of mechanism by this means, where several difficult controls were required, such as starting, steering, stopping and revising a model boat, etc.

This device might be operated by wireless waves and coherer, or any of the devices mentioned above. Mr. Crombie mentioned that he intended to use heat or infra red waves to demonstrate this at the exhibition next month.

He concluded his lecture with these remarks and an apology to the effect that the apparatus which he had prepared for this evening being operated by heat waves had been reduced to inaction by the temperature of the room and the excess of infra red rays emitted by the large number of members present.

The Chairman then proposed a very hearty vote of thanks, which was carried in the usual manner. A letter from "L.P." was read, giving their telephony transmission times as follows:

2,500 ms. 0700 0725 G.M.T. } Reduced
2,500 ms. 1030 1055 G.M.T. } power.
4,000 ms. odd times, experimental, full power.

Sussex Wireless Research Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. Edward Hughes, B.Sc., A.M.I.E.E., The Technical College, Brighton.

On November 30th, the members of the above Society were invited to the physical laboratories of the Brighton College, where they were entertained to a series of very interesting experiments by Mr. W. Bennett, B.Sc., A.R.C.S., the Science Master of this well-known Institution. Mr. Bennett dealt with the theory of the oscillating circuit, and explained how a buzzer circuit can be regarded as a circuit containing resistance, inductance and capacity. The subject of coupling between two circuits was explained and strikingly demonstrated by oscillating weights, the coefficient of coupling of which was calculated from their periodic time, and the time of transference of

energy from one weight to the other and back again. A number of methods for the measurement of inductance and capacity were described and demonstrated, the important feature of most of the methods being their extreme simplicity and the accurate results obtainable. Some high-frequency experiments were shown and also the effect of different intensities of illumination upon the resistance of a selenium cell.

The spacious workshops and laboratories of the College were open for inspection by the members of the Society.

Croydon Wireless and Physical Society.

(Affiliated with the Wireless Society of London.)

A meeting of the Croydon Wireless and Physical Society was held at the Croydon Polytechnic on Saturday, December 3rd, 1921. This being the Annual General Meeting the Society proceeded with the election of officers and council for the ensuing year. The following gentlemen were duly elected—President, W. Thompson, Esq., M.A., B.Sc.; Vice-Presidents, H. T. P. Gee, A.I.E.E., C. Harrison, J. Erskine Murray (Major), D.Sc., F.R.S.E., F.Inst.R.E., D. M. Kerley, K.C., LL.B., M.A., C. W. Rafferty, F.R.A.S., Sir Allan-Smith, K.B.E., M.A., LL.B., M.P., J. E. Taylor, M.I.E.E.; Secretary, Mr. B. Clapp; Treasurer and Assistant Secretary, Mr. E. E. Hart; Members of Council, Messrs. J. C. Aves, A. Bennett, R. E. H. Carpenter, H. A. Eccles, H. T. P. Gee, C. Nutter and F. C. Reynolds.

The Chairman then gave a short resumé on the year's work.

It was announced that the gentleman who had promised to lecture had failed at the last moment. Messrs. F. O. Read & Co., Ltd., at very short notice, kindly lent the Society some of their apparatus, including a tuning panel, H.F. valve panel, etc. The Society was also indebted to Messrs. S. G. Brown, Ltd., for the loan of a loud-speaker. Mr. Carpenter greatly added to the interest of the meeting by delivering a short talk on the advantages to be gained by using a separate heterodyne. The meeting then terminated with a hearty vote of thanks to Mr. Carpenter.

The next meeting of the Society will be held on January 7th, notice of which will be duly sent to members. The Secretary, Mr. B. Clapp, Meadmoor, Brighton Road, Purley, will be pleased to receive applications from intending members.

Dartford and District Wireless Society.

(Affiliated with the Wireless Society of London.)

Hon. Secretary and Treasurer, Mr. E. C. Deavin, 84, Hawley Road, Wilmington, Dartford.

The usual fortnightly meeting of the Society was held on Friday, December 2nd, 1921, at the Society's headquarters, Dartford Grammar School, Mr. J. R. Smith, A.M.I.E.E., Vice President, in the chair.

This meeting was exceptionally well attended and proved one of the most interesting held for some time. Efforts had been made to obtain the services of a lecturer for the evening, but, unfortunately, were not successful. The Secretary therefore requested each member to bring along any apparatus or instruments for demonstration, which request was most admirably complied with, and a most excellent array of apparatus was on show. Some very good signals were received on some of the instruments, and it was to be regretted that more time was not available, as there was more apparatus, amateur and professional, for demonstration than time would permit.

Arrangements are now being made with regard to fixing up a definite programme for the new year, and all persons interested in wireless or allied subjects are invited to communicate with the Hon. Secretary, at the address given above.

North Middlesex Wireless Club.

(Affiliated with the Wireless Society of London.)

Hon. Secretary, Mr. E. M. Savage, "Nithsdale," Eversley Park Road, Winchmore Hill, N.21.

The 79th meeting of the Club was held on Wednesday, November 30th, with the Hon. Secretary in the chair. After half-an-hour's Morse code practice Mr. Savage announced that he had received a letter from the member who was to lecture that evening, regretting his inability to be present that evening. He therefore suggested that some time be devoted to questions and answers by members. He also announced that the booklets giving details of the Club and the names of the officers and members were now to hand, and be distributed a copy to each member present.

Mr. Dixon started the questions by asking why it was that he found that when using a certain amplifier he got better results without a grid condenser and leak, while, according to the text books this should not be the case. Mr. Holton then got up and explained by means of diagrams that this result could be caused by altering the H.T. voltage. Other members contributed to the discussion by relating their experiences.

Before the meeting closed, a sub-committee was elected with Mr. Dixon as Hon. Secretary for the purpose of organising the social evening, to be held in February. It is hoped to make this even better than the last one, which was voted a great success.

Bolton Wireless Society.

A 3-valve set has been installed for some weeks at the headquarters of the above Society, and splendid signals are being obtained by means of it. Many members have now purchased or made their own sets—one member being fortunate enough to obtain a Marconi 7-valve set.

Owing to several members being unable to attend meetings every Friday night, every alternate meeting will be held on some other week-night. Full details of these alterations may be obtained from the Secretary.

A series of lectures has been arranged for the winter session; two of these having been given already. The first one was, "Elementary Principles," by Mr. H. Chadwick: the second one was "Wireless Telephony in the R.A.F.," by Mr. McLeod. Both lectures were well attended and much appreciated by the members of the Society.

All interested in wireless in Bolton and district are asked to communicate with the Secretary, Mr. O. Stott, 11, Oxford Street, Bolton.

Sheffield and District Wireless Society.

On Friday, 4th ult., Mr. W. Burnet gave a lecture on an "Ideal Receiving Set," illustrated as usual by carefully prepared lantern slides. The lecturer

pointed out that actually there is no such thing as an ideal receiving set, and that the main purpose of his paper was to bring out the various ideas of the members of the Society.

The lecturer set out to give the amateur wireless experimenter much valuable information which had only been gained by personal experiment and trial, both as a maker of wireless apparatus and as a wireless experimenter.

A very full discussion followed, and opportunity was given to the members present to examine a receiving set made on the lines of the lecturer's experience.

On the 16th ult., by the kindness of Messrs. Marconi Wireless Telegraph Co., Ltd., a lecture was given on "Modern Wireless Telegraphy and Telephony," to which the general public were admitted by cards obtainable from the Committee and members of the Society. The lecture was given in the "Mappin Hall," Department of Applied Science, George Square, and the seating accommodation was taxed to its utmost capacity between 300 and 400 being present.

The lecture was popularly treated, being very interesting throughout, and there were numerous lantern slides and cinematograph films to illustrate the subject. Good strong telegraph signals were received on the demonstration set from distant coast stations. A very hearty vote of thanks to the lecturer terminated the proceedings.

On the 2nd inst. a practical demonstration on wireless reception was given on the Society's new permanent aerial, which has recently been completed, and much useful work is expected to be done on this during the coming winter months.

Liverpool Wireless Association.

At a recent meeting Mr. F. H. Haynes, of R.M. Radio, Ltd., gave a lecture on the R.M.R. system of wireless. The lecturer first dealt with the theory of the valve, and pointed out certain qualities which it was desirable a valve should possess for thoroughly efficient operation and the difficulties which had been experienced in designing a valve which should combine as many of the desirable features as possible whilst avoiding at the same time the more obvious disadvantages.

The R.M.R. valve was then exhibited, and its special properties explained. The lecturer then mentioned the new field which had been opened out by the results obtained by the magnetic control of the electronic movement, which, properly investigated, might prove to be fruitful in results. Mr. Haynes then described various methods of recording signals, and, after considering the merits of each, proceeded to explain the Bridge method of actuating a relay. As this device has been described in a recent issue of *The Wireless World* it is not necessary to go over its points again, but, needless to say, this description of the system by its inventor was much appreciated by the members present. During the evening Mr. Henderson and other members produced for inspection samples of Morse tape with recorded signals, showing that their apparatus must be in a very efficient condition. A vote of thanks to the lecturer closed the proceedings.

At a later meeting various members contributed lecturettes on subjects of general interest. Mr. N. D. B. Hyde compared the results to be obtained from various types of valves, and stated their individual characteristics. He also exhibited a potentiometer and multiple switch of novel and ingenious design. Mr. Wainwright gave a description of an improved type of coil holder for use with honeycomb and basket coils. Mr. Grindon exhibited a detecting and amplifying set, and was congratulated on its design, finish and compactness. Two members who have done considerable work on high-tension batteries, Messrs. Watkin and Henderson, gave a summary of the results of their research work on this, to the amateur, rather perplexing subject.

Hon. Secretary, Mr. J. Coulton, 98, Ampthill Road, Liverpool.

Guildford and District Wireless Society.

On Thursday, November 10th, a meeting of those interested in Wireless was held at 4, Market Street, Guildford, kindly lent for the occasion by Mr. W. H. Cole.

The chair was taken by Ald. W. T. Patrick, J.P.

It was decided to form the "Guildford and District Wireless Society," the following officers and Committee being elected:—Hon. Secretary, Mr. F. A. Love; Hon. Treasurer, Mr. L. G. Cosh; Committee, Mr. R. W. Buttemer, M.I.A.E., F.C.S., Mr. W. H. Cole, Major E. C. Harris, A.M.I.E.E., Mr. J. H. Haynes, Mr. J. C. Nicholls, Ald. H. Fentum Phillips.

Mr. L. McMichael, M.Inst. Radio Engineers, kindly attended, and explained the methods and procedure of the Wireless Society of London, of which he is Hon. Secretary, and to which it is hoped to be affiliated.

A circular letter will be despatched shortly to all wireless amateurs in the district, giving particulars of the Society, and in the meantime, any enquiries are invited by the Hon. Secretary, at "Ivy Dene," Guildford Park Road, or any member of the Committee.

Plymouth Wireless and Scientific Society.

At the meeting held on Wednesday, November 16th, a demonstration was given by the Secretary of his 2-valve portable set. Good signals were obtained when connected to the College aerial.

On Wednesday, November 23rd, we were favoured by the presence of Mr. Hinks, a representative of the Western Counties Electrical and Engineering Company, of Yeovil, who gave us a demonstration with Messrs. Burnham's Ultra III Receiver. Remarkably good signals were obtained, showing the efficiency of the apparatus. The excellent workmanship and neat design of the set were greatly admired. A hearty vote of thanks was accorded to Mr. Hinks for his kindness.

Prospective members can obtain a copy of the rules and proposal form from the Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

Ipswich and District Wireless Society.

Hon. Secretary, F. T. G. Townsend, 46, Grove Lane, Ipswich.

The first Annual General Meeting of the above Society was held in the Society's large Club-room

on Hyde Park Corner on November 5th, at 7.45 p.m. In the unavoidable absence of Mr. F. Mellor through indisposition, Mr. F. A. Townsend presided. A set of rules were discussed and agreed to, and the Secretary gave some interesting details of the Society's position. A programme was also drawn up for every evening of the week with a Committeeman in charge each night. On Monday, Thursday and Saturday the seven-valve set will be working by the kindness of Mr. Parsons. Tuesday is set apart for elementary instruction on theory, Wednesday buzzer practice, and Friday for constructional work under the able guidance of Mr. Keeble. Although only possessing at present an indoor aerial at headquarters, remarkable results are obtained on a single valve, and members should take advantage of this to test new gear, etc.

DUTCH CONCERTS.

The following additional contributions to the Dutch Concerts Fund are acknowledged :—

	£	s.	d.
Carried forward - -	43	13	0
Newcastle and District Amateur Wireless Association - - - -	2	2	0
Western Counties Electrical and Engineering Company - - -	2	2	0
Mr. C. Buckley - - - - -	1	1	0
Mr. R. D. Spence - - - -	1	1	0
Universal Electric Supply Co., Manchester - - - - - -	1	1	0
Mr. J. E. Wilkes - - - -	1	1	0
Mr. H. F. Brand - - - -	0	10	6
R. C. - - - - - -	0	10	6
Mr. S. Williams - - - -	0	10	0
Mr. R. J. Whittingham - - -	0	10	0
Rev. W. P. Rigby - - - -	0	5	0
Total - - -	£54	7	0

Correspondence

To the Editor of *The Wireless World*.

Sir,—Nearly every evening I listen in on a three-valve L.F. set and get a great deal of enjoyment from the concerts and conversations of numerous amateurs in the London area. The common fault one finds is, that they rarely give their call letters and when they do so the result is so indistinct that it is impossible to differentiate between 2AD, 2AV, 2AB, etc. There is a very good concert sent out on Fridays, at 8 p.m. by ABC (whoever that may be), who occasionally talks to XYZ (another mystery). They gave a demonstration of sending 150 words a minute a fortnight ago which deserves praise. I would gladly send a postcard to anyone who might like to know that his transmitting is well received forty miles away.

I would like to suggest that Ack, Don, Vic, etc., be substituted for A, D, V, etc., in all call letters.

F. HARPER-SHOVE (Capt.).

Westcliff-on-Sea.

To the Editor of *The Wireless World*.

Sir,—In your issue of October 15th, an extract from *Engineering* (on reconditioning dry cells) is given. I don't think we need to go to Berlin or Vienna to learn about this matter. In either the *Electrical Review* or *Electrician** several months ago was a note on reconditioning porous pots of Leclanché cells, as practised extensively on the L.S.W.R., where large numbers of these cells are used for signalling purposes. The pots are allowed to soak in clean water for a day or so, then in dilute hydrochloric acid (after draining out excess water). This is followed by further washing and draining, all the soaking being done in the glass jar of the cell; the zinc, of course, being removed. I have treated a large number of cells, including the "sack" form (both wet and dry varieties), and found the method adds considerably to the useful life of a battery. Hydrochloric acid would seem preferable to sulphuric, as (i) chlorides generally are much more soluble than sulphates; (ii) HCl is not nearly so corrosive as H_2SO_4, and would not weaken the fabric of the bags so much.

Regarding the correspondence on Mr. Burbury's removable transformer system, has either of your correspondents tried connecting the condenser from anode of one valve to grid of next? This would increase the coupling as well as have some tuning effect. Care must be taken to connect the windings in the right direction, or one coupling will tend to neutralise the other. The correct

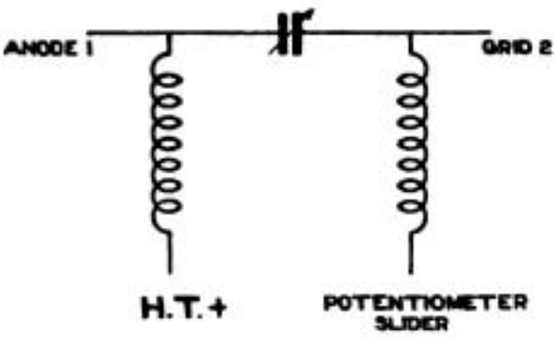


Fig. 1.

direction is best shown by diagram Fig. 1, the coils being understood to be closely coupled in any of the ways mentioned.

LEONARD J. VOSS.

Note.—In this method the need of good insulation is more than ever apparent.

To the Editor of THE WIRELESS WORLD.

SIR,—In reference to "Experimenter's" letter in your issue of the 26th inst., has he made quite certain that the "lower harmonics" he hears are not due to one of his own higher harmonics heterodyning the fundamental frequency of the distant station? For instance, if the receiver is oscillating

*Regret a more exact reference is not available. —L.J.V.

at a frequency of $\frac{N}{3}$, (N = fundamental frequency of station heard), then the receiver's second harmonic will have a frequency N, which will heterodyne the sender's fundamental. The act of tightening the reaction would, by forcing the limits of oscillation round the bends in the oscillation curve, increase the amplitude of the receiver's harmonics and so give louder signals. I suggest this as a possible explanation of the effect, rather than one involving the supposition of lower harmonics.

R. C. CLINKER.

Bilton, *November 27th*, 1921.

To the Editor of THE WIRELESS WORLD.

SIR,—With regard to the article on pages 530-533 of the current issue (Nov. 26) of THE WIRELESS WORLD, I should like to warn amateurs not to be too sanguine about the life of such a battery. I tried the idea a long time ago and gave it a fairly exhaustive test. I found that the chief trouble arose from the very unequal behaviour of the carbon elements. Some indeed stood up for quite six months, but after the first two months or so each week would see a few cells quite out of action, and this, although I started with perfectly new complete elements. The makers themselves stated that it was impossible to make up the carbon elements so that they would all behave similarly, but perhaps other makers may be more experienced. They were very interested in the idea, and themselves made up a battery for testing purposes, but I presume they "turned it down" for they never reported results to me as promised. Mr. Codd's constructional details are quite ingenious, but he omitted to state that the zincs should be amalgamated; this is most important.

A cheap and efficient container can easily be made for each cell by wrapping a piece of paper, dipped in wax, round a rod of correct size. The cylinders of paper are subsequently stood upon a strip of wood and a little melted wax poured in to make a bottom.

Perhaps Mr. Codd has been more successful than I; I should much like to see a report from him on the battery after it has been in use for about six months.

E. W. KITCHIN.

To the Editor of THE WIRELESS WORLD.

SIR.—I am writing to you, to relate my experiences as an amateur in the tropics, and the only one in this colony at that.

My set consists of a crystal detector, two De Forest Honeycombs, and two variable condensers for short wave work. 600—1,200 m. and a single valve receiver employing pancake coils for a range of 1,500—15,000 metres. Atmospherics out here at night are so bad that it is always possible to draw a ½" spark off the aerial. My aerial is 120 feet long, supported at the free end by a mast 58 feet high and at the down lead by a 75 feet palm. My earth is the water system. I can get Key West, Jamaica, Trinidad, and Punta Arenas, OK without interferences.

One of the great troubles out here is insulation. Ebonite deteriorates and warps terribly, also insects get into condensers and short terminals. There is a very large naval station about 500 yards away from me, and when it works I have to shut down. It is impossible to calibrate a valve set here because of the variation in capacities that takes place between night and day. I get your excellent magazine, THE WIRELESS WORLD, every month, *i.e.*, two copies, and look forward to it very much.

I miss the telephony out here very much after hearing Croydon and the Hague concerts last year in England.

I may mention that I construct all my apparatus.

Hoping this will be of interest to your readers.

H. E. JOHNSTONE SMITH (Lieut.).

Georgetown, Demerara,
October 21st, 1921.

To the Editor of THE WIRELESS WORLD.

SIR,—I shall be glad if any of your readers can tell me who 2KQ is. I cannot find this call in any of the lists published hitherto in your paper, but on November 6th, about 9 p.m., I heard him working on 1,000 metres calling "NOKES de 2KQ I hope you are getting this all right." As it is comparatively rarely that one hears an amateur up here, I should be much interested if anyone can enlighten me.

R. D. SPENCE.
(2JZ).

Aberdeenshire, *November 12th*, 1921.

To the Editor of THE WIRELESS WORLD.

SIR,—On behalf of over one hundred wireless enthusiasts in Birmingham and district, I am asked to say a word in support of the suggestions recently made in your columns by other societies, with regard to the transmission of music and speech by a British high-power station.

That it should be necessary for British amateurs to rely upon a Dutch firm for their only reliable source of regular music and telephony is a disgrace to a country which has always prided itself on being in the forefront in scientific matters. It is evident that other countries are getting ahead of us in the matter of news transmission, and particularly in the use of the radiotelephone for this purpose. The Governments of other powers are rapidly appreciating the possibilities of radiotelephony for propaganda purposes, and it is not to be supposed that the Government of the United States, for example, would have embarked on their great scheme for the dissemination of news by this means, unless it were to their advantage, directly or indirectly, to do so.

In this connection I should like to draw the attention of wireless amateurs to the petition which is being promoted by the Halifax Wireless Club,* with the support of many other societies, urging the adoption of a regular wireless telephone news service by a British station. I should be pleased to hear from Midland gentlemen who wish to associate themselves with this petition.

FRANK S. ADAMS,
Hon. Secretary.
Birmingham Experimental Wireless Club.

**Readers are directed to a note appearing on p. 598.— ED.*

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 only. (2) Queries should be clear and concise. (3) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. **(4) The Editor cannot undertake to reply to queries by post.** *(5) All queries must be accompanied by the full name and address of the sender, which is for reference, not for publication. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* **(6) Readers desirous of knowing the conditions of service, etc., for wireless operators will save time by writing direct to the various firms employing operators.** *(7) Four questions is the maximum which will be accepted at a time.*

N.X. (York) *asks (1) If 44 D.W.S. is suitable for rewinding L.R. telephones and how much to use. (2) The difference between a telephone transformer and a telephone induction coil.*

(1) Yes, about ⅛ oz. will be required. Wind each bobbin full.

(2) An induction coil has a make and break contact, which is not required in a telephone transformer.

D.E.W. (Halifax) *asks for a three-valve diagram for telephony, to comply with certain requirements.*

A suitable circuit is shown on page 396 of the Sept. 17th issue, the first transformer shown in this diagram should have an iron core, and the condenser across the anode windings shown variable may be 0·002 mfds. fixed.

E.V.H. (Mill Hill) *asks for information re the conversion of the Mark III. tuner to a longer wavelength.*

See article in the March 5th and 19th issues. In practice if may be more convenient to dismantle the set and use the parts for building another one.

G.R.F. (Scarborough) *asks (1) Whether a crystal set is correctly connected. (2) If a telephone transformer would improve it. (3) Whether to use a single or double aerial, maximum length in either case. (4) If the Dutch concerts could be heard with such a set.*

(1) Quite.

(2) Yes. H.R. side 3 ozs. of No. 44. L.R. side, 6 ozs. of No. 32.

(3) We rather prefer the single wire.

(4) Doubtful.

L.E.I. (Kennington) *asks (1) For a non-radiating single valve circuit. (2) Whether the circuit shown in Fig. 4, page 399, of the September 17th issue, is suitable for 300 to 3,000 ms.*

(1) A good circuit to meet this requirement is given on page 458 of the October 15th issue.

(2) Resistance coupled amplifiers are not very efficient at such low wavelengths as 300 ms. It should work well above 600 ms.

E.G.A. (Goodmayes) *asks for particulars of an inductance for a single valve set.*

For 2,000 ms. maximum wavelength make a 4" diameter former 8" long, and wind it full of No. 24 wire. For a reaction coil wind 5" of No. 28 on a 3" former. 1,000 ms. will be found with about 1/3 of inductance in the circuit. Connect a 0·001 fixed condenser across the primary of the telephone transformer.

C.A.H. (Bedford) *has a single valve set and asks (1) For the value of the fixed condenser across the A.T.I. (2) If a telephone transformer is necessary. (3) If the circuit is suitable.*

(1) and (2) It is not advisable to use a fixed condenser across the A.T.I. but connect a 0·001 mfd. condenser across the telephones. The circuit will be made more useful if a reaction coil coupling into the A.T.I. is connected between the plate and the positive H.T.

(2) As the telephones are neither high nor low resistance, and the anode voltage only 30, a telephone transformer is not necessary.

L.W.H. (Mitcham) *has a complicated-looking crystal circuit, and asks (1) If certain condensers are necessary. (2) For the gauge of the wire for the inductance.*

(1) Rearrange the circuit as in Fig. 1.

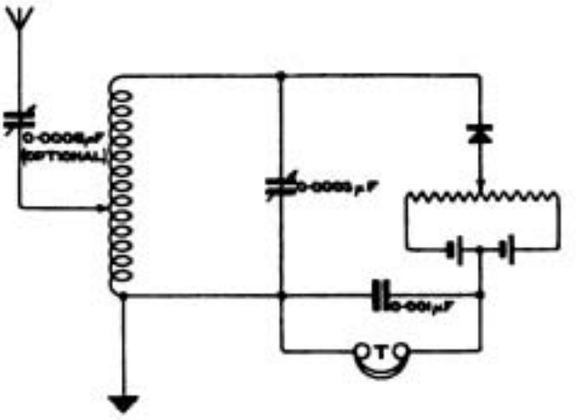


Fig. 1.

(2) A 6" former 12" long wound full of No. 2 enamelled wire will tune to 3,000 ms.

G.F.S. (Birkenhead) *asks (1) For a circuit to receive the Hague concerts. (2) The size of the aerial.*

(1) For good speech it will be necessary to use three valves at your distance. A diagram of a suitable amplifier is shown on page 369 of the issue for September 3rd. Connect the input terminals across the A.T.I.

(2) The maximum aerial allowed is 100' single wire, or 140' total length of the twin aerial. Make yours as large as possible.

J.S. (Peterborough) *asks for a diagram to add a note magnifier to a single valve receiver.*

The diagram of Fig. 5, page 387 of the September 3rd issue shows how this may be done.

D.P.K. (Cheltenham) *wishes to add a H.F. magnifier to his crystal set and a L.F. amplifier.*

The best method will be to connect up as shown in Fig. 3, page 432 of the October 1st issue, in which a grid condenser and leak is used for rectification instead of a crystal. This is a better arrangement than the one submitted, and should enable you to hear the Dutch concert.

QUESTIONS AND ANSWERS

H.P.H. (Elstree) *sends an unconventional crystal circuit, and asks* (1) *If it will be suitable for all-round work.* (2) *If the condensers are suitable.* (3) *If certain inductances will be suitable.* (4) *If the set will receive signals without an aerial.*

(1) No; this is a bad circuit altogether.

(2) The condensers are the correct capacity for a proper circuit.

(3) Inductances wound in layers as you suggest are useless. Make a single layer coil about 5" diameter, 12" long, and wind full of No. 24 D.W.S. Connect up as shown in the Fig. 5, page 400, of the September 17th issue.

(4) The set as described will not receive signals with an aerial, much less without one.

A.W. (Bothwell) *asks questions relative to using variometer in place of condensers for tuning.*

The subject of the advantages and disadvantages of variometers is too long to deal with in this column. Variometers, unless carefully devised, are only suited for tuning round a limited wavelength. In the circuit shown in your diagram the only capacity in the circuit is that due to the self-capacity of the variometer and the leads to the valve which means that the variometer must be large to tune to any reasonable wavelength. The American book Practical Amateur Stations, deals a little with this subject. It would not be easy to adapt a four-electrode valve to this circuit.

A.W.W. (South Merstham) *asks* (1) *For a circuit diagram for a two-valve set suitable for telephony, and* (2) *For suitable dimensions for the parts.*

(1) The circuit of Fig. 5, page 367, September 3rd issue should be satisfactory.

(2) Use the present A.T.I. and condenser for the closed circuit. New A.T.I. to be 10" × 7" of No. 22. Reaction, 5" × 4" of No. 26, all coils with tappings. Other dimensions are those usually given in these columns.

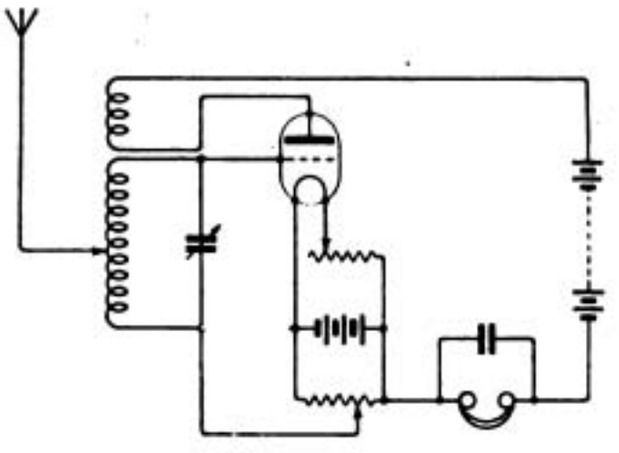


Fig. 2.

W.L.B. (Bristol) *sends a sketch of his set, and asks* (1) *How to apply a valve to it.* (2) *Whether to use a hard or soft valve.* (3) *A question about his aerial.* (4) *If four three-strand guy wires insulated from the ground will affect signals.*

(1) We wonder what results you get with your present set, as the connections are quite wrong. Connect as in Fig. 2.

(2) Hard.

(3) No, provided that the spreader itself is adequately insulated from earth.

(4) Probably not to any extent.

A.W. (Sunderland) *asks for a diagram of the Marconi 127 tuner.*

We are sorry that we have been unable to obtain this diagram.

W.M. (Glasgow) *can only use a frame or very small aerial, and wishes to receive* PCGG. *He asks* (1) *If the set of page 105, May 14th issue, would be O.K.* (2) *If not, for a diagram to suit.* (3) *For a book dealing with the construction of such a set.* (4) *For a sound non-mathematical book on valves.*

(1) Possible, but not very likely, without more H.F. amplification.

(2) We should prefer not to offer a set for this purpose, as the problem of reception of PCGG at such a distance as yours with a very poor aerial and the local jamming you are likely to get makes it very doubtful if you would get results with any set without some previous experience with valves.

(3) We know of no suitable book. We should advise a careful study of the constructional articles in this magazine.

(4) Bangay's "Oscillation Valve" is suitable, also Scott-Taggart's book recently published.

W.J.O. (Whitstable) *is having trouble in converting his crystal set into a valve set and asks for advice.*

Any of your circuits should work, although the two using reaction should have a small blocking condenser across the telephones. We cannot judge of the suitability of your variable condenser as you do not state the nature of, or the thickness of, the dielectric. If this is thin sheet mica, the capacity will be considerably too great. The telephones should be on the earth side of the H.T. battery. We are afraid we cannot suggest much else, as you tell us so little that might suggest any trouble.

"SPARKS" (Hetton) *asks* (1) *for a circuit to fulfil certain requirements.* (2) *Wavelength range.* (3) *How to introduce a separate reactance.*

(1) See Fig. 4, page 399, September 17th, for a circuit showing general principles. You can easily alter this to suit your own aerial circuit arrangements.

(2) 5,500 metres with condenser in series, and about 10,000 metres with it in parallel.

(3) We do not quite understand this. The coil shown is a separate reactance. If you mean as a separate heterodyne a complete new oscillator will be required.

C.D.M. (Ilkley) *asks* (1) *If an "R" valve will be as good as a "V24" for the long range single valve receiver recently described.* (2) *The meaning of D.W.S. and S.W.S.* (3) *A question about his aerial.*

(1) An R valve will be quite O.K. for this circuit.

(2) Double and single wound silk respectively.

(3) Not likely to. If the switches are introduced in the lead-in, there is no need to use two switches at all.

"S.O.S." (Rugby) *asks three questions about a single valve and crystal receiver, and* (4) *Whether either iron bars across his window or a drain pipe*

which does not reach the ground can be used for his earth. (5) *Whether an earth is essential.*

(1) For C.W. it will be necessary to couple the coils, but the coupling should only be very loose.

(2) Coil "a" is necessary.

(3) Condenser 1 should be about 0·004 mfds., but is not essential. 2 is essential and should be about 0·0005 mfds.

(4) Neither of the "earths" you suggest is of the least use.

(5) An earth is essential for this set. See article on page 519, Nov. 12th issue.

H.S. (Clapham Common) *asks* (1) *Why his set will not receive* PCGG, *although he gets such stations as Lympne all right.* (2) *The capacity of a certain condenser.*

(1) Crystal reception followed by L.F. amplification is quite unsuitable for the purpose. You only get the Air Force stations because of their greater power and proximity. You will require about two stages of initial H.F. amplification, with reaction, in order to get PCGG well.

(2) We do not know the exact value of this condenser; probably about 0·002 mfds.

E.C.S.O. (Shepperton) *asks* (1) *If it is possible to get useful results on* 600—10,000 *metres with a single valve set.* (2) *For the proportions for the coils.* (3) *If the reaction coil should be variable for such a range.* (4) *If a certain circuit sketched is the best for the purpose.*

(1) and (4) Quite good results can be got with the circuit you suggest if skilfully used. It is one of the best possible, but the telephones should be on the negative side of the H.T. battery to minimise capacity effects. It would be better to use a transformer, which should be on the positive side.

(2) A.T.I. should be about 60,000 mhys., with a parallel condenser of 0·001 mfds. Reaction coil can be about 20,000 mhys.

(3) For such a large wavelength range the reaction coil should have three or four tappings.

D.D.R. (Edinburgh) *asks* (1) *For particulars of two valves described.* (2) *Where he can get information about honeycomb coils, and whether we recommend them more than basket coils.* (3) *If reconditioned Brown H.R. telephones are likely to be satisfactory.*

(1) The A.E.G. valve works on 2·2 volts. L.T., and 100 volts. H.T. The characteristic is very poor, and the valve is not likely to be good except for L.F. amplification. The other valve appears to be by Siemens and Halske, and has most probably similar characteristics.

(2) Information is rather scattered. See issue for July 23rd. Except for their portability, we prefer the basket coils if in single units.

(3) If reconditioned by the makers these will be O.K. If not, there will be a certain element of risk, but they will probably be satisfactory.

G.R. (Huddersfield) *asks* (1) *If an additional* 10*s. has to be paid more than for the crystal license to enable a valve to be used.* (2) *What wire to use for an earth lead.* (3) *If a sketched circuit is a good one.* (4) *For a good cheap book on valves.*

(1) No.

(2) 7/22 would be very good, but you may use No. 16 or 18 if you prefer it without much loss of efficiency.

(2) Yes; we should not give it so frequently if it were not.

(4) Bangay's "The Oscillation Valve" is very good for this purpose.

C.P.V. (Holloway) *asks* (1) *Which is the better of two suggested aerial arrangements.* (2) *A question about the windings of a telephone transformer.* (3) *Which is the better for telephony, a single valve, or a valve and crystal set.*

(1) That of Fig. 2.

(2) The rule that the resistance should be that of the telephones is approximate only. The value you suggest, though not the most efficient, will probably give quite good results.

(3) Valve and crystal.

A.R.P. (Malborough) *asks* (1) *What type of variable condenser we recommend for a capacity reaction* (2) *Windings for a transformer for* 4,000 *ohms telephones.* (3) *For any suggested improvements to his set.* (4) *What is the call signal of the "Quest."*

(1) Any type which will give small capacities with the power to vary them at will is quite satisfactory. Either the vane or the tube type is quite good.

(2) Make the windings about 10,000/4,000 ohms, with about No. 46 wire.

(3) A potentiometer to the first grid, and also to the outer grids when using the transformers, would improve the set.

(4) Regret have no information.

G.R.E.C. (Coulsdon) *asks* (1) *How to wind a certain pair of formers for a reaction coupler for long wavelengths.* (2) *If it is advantageous to have separate filament resistances to each valve in an amplifier.* (3) *The best way of charging accumulators from an A.C. supply.*

(1) The former will be too small for the reaction for such long wavelengths. You might try winding as much No. 26 on the big coil and 30 on the smaller as you can, both windings to be pile. The result will probably not be very satisfactory.

(2) Improvements so obtained are so small as to be hardly worth the trouble and expense.

(3) By means of a rectifier, as for instance of the B.T.H. "Tungar" type.

"BEGINNER" (Coventry).—(1) The result of the test does not prove that there are no more breaks in the coil. In fact we should think it was more probable that there were.

(2) and (3) This piece of apparatus appears to be a shunted condenser for use in conjunction with a Brown telephone relay. It is of no use in connection with a normal receiving circuit.

A.D.H. (Havering) *asks for windings for H.F. transformers for a range of* 300—25,000 *ms.*

Read the present series of articles on this subject, and also refer to the June 25th issue, in which a report is given of the Wireless Society of London meeting at which Mr. Campbell Swinton read a Paper.

D.H. (Sutton) *asks* (1) *If* BYC *should be readable on a three-valve set at* 3,500 *miles on a large aerial.* (2) *Whether a self or a separate heterodyne is more suitable.* (3) *If Burndept coils would be suitable.* (4) *For a four-electrode valve circuit for* 300—24,000 *ms.*

(1) Yes, provided the receiving circuit was well designed and used.

(2) A separate heterodyne will give best results.

(3) Yes, if carefully selected.

(4) We regret that we cannot obtain the required circuit at present.

"SPREADER" (Newcastle) *asks* (1) *If the telephone transformer described on page 693 of December 25th issue is suitable for 150 telephones.* (2) *What alteration to make a frame aerial tuning panel on page 595, 1920, to use an outside aerial.* (3) *Windings for a coil.*

(1) Yes.

(2) No alteration is necessary. Put the switch to long wave position and join aerial to A and earth to B.

(3) No. 22 will make the coil more than 3½" outside diameter. Wind with No. 26 to the full diameter of 3½". Traverse the wire across the coil about three times for each revolution.

A.L.B. (Boxmoor) *has an H.F. amplifier which apparently he cannot stop oscillating. He asks why.*

Your test with the reaction coil should show you that a coil of 70 to 100 turns is the most suitable one for the circuit. To obtain control of the oscillation connect a 200 ohm potentiometer across the 6-volt battery and its slider to all the grids, instead of your present connection. By this means you will be able to introduce grid current which will have a damping effect on the oscillations.

"WORRIED" (Aberdeen) *has a valve transmitter with a pair of telephones shunted by a condenser in the earth lead. He asks* (1) *Value for the telephone condenser and for the grid leak.* (2) *If a 20 henry smoothing choke is sufficient.* (3) *If a microphone transformer described is O.K.* (4) *If the circuit is correct.*

(1) Grid condenser and leak depends on the type of valve used. Try 0·001—0·002 mfds., and adjust the leak till best results are obtained. Placing the telephones in the aerial circuit is thoroughly bad. If the condenser breaks down the full machine voltage will come across the telephones and your head, with serious results to both.

(2) This should be suitable.

(3) Yes.

(4) Yes. An additional condenser across the smoothing chokes to the negative H.T. will improve the smoothing arrangements.

S.F.B. (Oundle) *asks* (1) *If external reaction is necessary in his three-valve resistance amplifier.* (3) *If the transformer coupling is preferable on a fairly wide range of wavelengths.* (3) *If it is possible to arrange a set of four resistances for a resistance amplifier for a range of* 180—10,000 *ms.* (4) *For criticism of set.*

(1) A capacity reaction or electromagnetic reaction will be a great improvement.

(2) For a very wide range of wavelengths above 1,000 metres, the resistance coupling will give better results than transformers; but for a single wavelength a suitable transformer can be made to give better results.

(3) For wavelengths above 1,000 metres it is only necessary to use one set of resistances. There is no advantage in having four. Intervalve condenser should be about 0·001 mfds. Up to 1,000 metres transformers properly designed will give good results.

(4) The circuit is quite good.

H.F.J. (Oxford) *asks* (1) *Why telephony is not received on his two-valve set.* (2) *How to add another valve.* (3) *Capacity of a given condenser.* (4) *For particulars of a telephone transformer.*

(1) Croydon telephones on 900 metres, and should be heard on your set if properly adjusted. Disconnect the condenser across the A.T.I., and carefully adjust the reaction almost, but not quite, to the point of oscillation. There is no telephony from aviation stations except during the daytime and under favourable flying conditions.

(2) Add another L.F. magnifier, coupling it to No. 2 valve by an intervalve transformer.

(3) Approximately 0·00002 mfds—very small owing to thick spacing washers used.

(4) See December 23rd, 1920, issue, page 693.

W.W. (Airdrie) *asks, with regard to Capt. Hobbs' article, page 212, June 25th issue.* (1) *Diameter and length of A.T.I. former.* (2) *Details of telephone condenser.*

(1) The diameter of the former in the Mark III tuner is approximately 3½", and the length about 4".

(2) For a 0·003 condenser use 0·002" mica between the foils, and four foils with an overlap of 10 square cms. To obtain this capacity the condenser must be clamped very tight.

(3) The dates of issue of the pages you give are October 30th and December 11th, 1920.

H.P. (Cogham) *describes a single valve set, and asks* (1) *If the ordinary telephones are suitable.* (2) *If suitable for telephony.* (3) *For inductances for 4,000 metres with a condenser which is only partly described.*

(1) H.R. telephones, 1,500 ohms. or more, can be used directly in the anode circuit, or L.R., 120 ohms with a transformer as described in the December 23rd, 1920 issue, page 693.

(2) Yes, if a reaction coil is added to the circuit between the anode and the positive of the H.T. battery, and coupling into the A.T.I.

(3) We cannot calculate the capacity of the condenser, but suggest the following former:—5" diameter wound with 12" of No. 24.

A.S. (Wakefield) *describes a crystal set, and asks* (1) *If suitable for* PCGG. (2) *For additional apparatus.* (3) *For a diagram of a suitable circuit.* (4) *If telephony comes under the same permit as telegraphy.*

(1) No, although the set is very fair as a crystal set.

(2) and (3) Try a two-valve resistance set, as shown in the issue for September 17th, page 399, Fig. 4.

(4) Yes, but not unless your license states so.

C.C.G. (Lowestoft) *asks* (1) *For a criticism of a crystal circuit.* (2) *Where to add a valve.* (3) *The gauge of wire for a loading coil.*

(1) Circuit is not quite correct. Crystal and telephones should be connected in series across the variable condenser, block condenser should be across the telephones.

(2) A V24 or an R valve could be adapted to this circuit in many ways, but we think you will

do well to make up a single valve reaction set which has been described as shown in these columns many times recently.

(3) For an aerial loading coil use No. 24 wire.

R.C. (Dundee) *asks* (1) *For a winding on a 5" former for 600—3,500 ms.* (2) *For a 4" diameter secondary (but omits to state the size of the condenser).* (3) *Where to obtain crystals.*

(1) Wind for 12" with No. 26.

(2) Assuming a 0·0005 mfds. condenser, wind with 8" of No. 26.

(3) From any of the dealers in wireless apparatus advertising in this magazine.

G.S. (Carlsbrooke) *wishes to have a diagram of a crystal circuit.*

The simplest crystal circuit is shown on page 302, August 6th issue. A better circuit is shown on page 400, September 17th issue.

"SUBSCRIBER" (Handsworth) *asks if* H.F. *amplification is the most efficient for receiving telephony.*

This is undoubtedly the most efficient method because the small changes in the H.F. potential are amplified, with greatly increased efficiency of rectification. Rectification of most detectors is very poor for weak signals.

E.A.D. (Amsterdam) *has a Mark I aircraft tuner, and asks for information regarding range, valves, etc.*

We have no definite information regarding this set. It probably required R valves, and has only a short wavelength range. The best course to adopt is to dismantle the set and use the parts to make a new one. We cannot say what modifications are required for frame aerial reception with this set.

J.R.S. (Walworth) *asks* (1) *If weakening the coupling on a single valve set should strengthen the signals.* (2) *Why a telephone transformer does not increase the signal strength.*

(1) This result may be due to the reaction coupling being the wrong way round, in which case you will probably be unable to get C.W.; or else it is the result of your coupling being considerably too tight. If this is so, the remedy is obvious, *i.e.*, to work at looser values of the coupling.

(2) Signals with L.R. telephones and transformer should be as strong as with H.R. telephones. Either the transformer is defective, or it is incorrectly connected up. Connect L.R. winding to the telephones.

Q.S.B. (Pangbourne) *asks if it is possible to do without the reaction coil on a two-valve set.*

Yes; use a capacity reactance. Connect a small variable condenser, 0·0001 mfds, between the anode of the second valve and the grid of the first.

"BUZ BUZ" (Streatham) *asks* (1) *If the reaction coil must be wound in the opposite direction to the A.T.I.* (2) *Can the reaction slide in and out of the A.T.I.* (3) *Suitable dimensions for a reaction coil for a 4" × 10" A.T.I. wound with No. 22.* (4) *If a circuit sketched is suitable.*

(1) No.

(2) Yes.

(3) Diameter 3", wound with 4" of No. 28.

(4) Yes.

A.H.M. (Carbis Bay) *asks* (1) *Whether a certain coil will be suitable for a reaction coil.* (2) *If a transformer is necessary to couple a resistance amplifier to a detecting valve.* (3) *How to do it* (4) *The range of his set.*

(1) Yes.

(2) and (3) A transformer is not necessary. The simplest method is to connect on to the final valve in exactly the same way as the last valve of the amplifier is connected. A resistance amplifier rectifies as well as amplifying.

(4) About 5,500 metres.

H.S.W. (Anerley) *asks* (1) *For dimensions for grid condenser and leak for a two-valve receiver.* (2) *Dimensions for a telephone condenser.*

(1) It is impossible to predict accurate dimensions for either the condenser or the leak without a full knowledge of the set and the valves to be employed. You might try a mica condenser, with two sheets of mica for the dielectric, and with one pair of plates, overlapping about 2 or 3 square cms. grid leak, a strip of ebonite 3" long and ¼" wide, with pencil lead rubbed in till the best results are obtained.

(2) As above, but with an area of overlap of about 25 square cms.

"OHM, SWEET OHM" (Hampstead) *asks* (1) *Which is better, magnetic or capacity reaction.* (2) *For diagrams of two two-valve amplifiers.* (3) *Ratio of inductance of A.T.I. and reaction coils.* (4) *If he could receive Annopolis and Arlington on a two-valve resistance amplifier.*

(1) Magnetic is usually more easy to manage, otherwise very little to choose between them.

(2) (*a*) See Fig. 5, page 527, November 12th issue. (*b*) As above, but with the reaction coil omitted and the condenser inserted between the grid of the first valve and the plate of the second.

(3) This is impossible to state, as it depends on various constants of the circuits employed, about which we know nothing.

(4) With a good set, capable of reaching the wavelengths, and skilfully handled, you might get results under favourable conditions.

"LIMESDALE" (Old Hill).—The coils you suggest are too small for the purpose. We should recommend the A.T.I. to be about 5" × 4", wound with No. 22 wire, and the reaction coil to be 4" × 3", wound with No. 26 or 28. It is, however, safer not to couple the reaction coil into the A.T.I., but to use a coupled circuit and couple into that.

J.A.V. (Reading) *asks* (1) *The capacity of a certain condenser.* (2) *For a diagram of a single valve set, with full details of working dimensions.* (3) *If a single wire aerial 75' long and 30' high will be suitable for the above.* (4) *If a circuit sketched is correct.*

(1) We cannot say, as you do not give the thickness of the dielectric. Probably of the order of 0·001 mfds.

(2) The type of set desirable will depend on the work which you wish to do, about which you say nothing. The single valve receiver described with full instructions in Nos. 23-26 of Vol. 8 should meet with your requirements.

(3) Yes.

(4) Quite correct.

S.H.H. (Reading) *sends a sketch of a circuit,*

and asks (1) *Whether it would be suitable for* PCGG. (2) *Dimensions for the coils.* (3) *If a loose coupler would be satisfactory.*

(1) The circuit might give fairly good results if very carefully used, but a 2 or 3 stage amplifier would be much preferable.

(2) See reply to "**LIMESDALE,**" above.

(3) Yes.

H.G.P. (Putney) *asks for a diagram of a set as that given on page* 199, *June 25th issue, but using only one H.F., one Rectifier, and one L.F. valve.*

We think that if you have any knowledge of the principles of working of the set referred to, it should be quite easy for you to make such an alteration to the diagram yourself. An attempt to do so would be far more beneficial to you than merely getting the result from us. However, we add the diagram as requested. See Fig. 3.

"**ANXIOUS**" **(Dublin)** *asks* (1) *What resistance the telephones of a valve receiver should have.* (2) *What gauge of wire should be used.* (3) *What current flows through the telephones.*

(1) If used directly in the anode circuit the resistance should be as high as possible, say 4,000 ohms. for each earpiece.

(2) Wire should be about No. 47.

(3) About $\frac{1}{1000}$ of an ampere.

J.W.S. (London) *asks* (1) *The capacity of a given condenser.* (2) *Winding for an A.T.I. for* 6,000 *ms.* (3) *How to space* 28 *tappings on it.* (4) *Suitable dimensions for a reaction coil.*

(1) About 0·00015 mfds.

(2) 6" - 12", wound with No. 26. No. 32 is too fine for an A.T.I.

(3) Arrange the spacing so that the intervals increase steadily along the coil, the intervals at the end being about three times those at the commencement.

(4) Try about 4" × 3" of No. 26.

"**AMATEUR**" **(Northumberland)** *asks whether converting a* 60′ *twin aerial to a* 100′ *single wire, the height and direction remaining approximately the same, will improve the results given by his set.*

It may do so a little, but is not likely to make very much difference.

W.A.P. (Porthcurno) *asks how to arrange buzzer and crystal circuits for transmission and reception on a wavelength of one metre.*

We regret that we have no experience of sets working on such a wavelength. We are afraid you will find the problem by no means easy of solution, owing to the difficulty of getting any appreciable radiation at the transmitter or absorption at the receiver, with circuits possessing sufficiently low capacity and inductance to tune to such a wavelength. You will have to dispense with earth leads altogether. For such a wavelength your aerial systems will probably have to be just single wires about a couple of feet long.

W.B. (Birmingham) *asks* (1) *How to convert the times given in the August* 6*th issue for various transmissions to ordinary time.* (2) *What the mean time there referred to means.* (3) *Information as to the wavelength of Northfield station.* (4) *If there is any objection to using a valve with the plate outside the glass.*

(1) The first two figures give the hour, reckoning

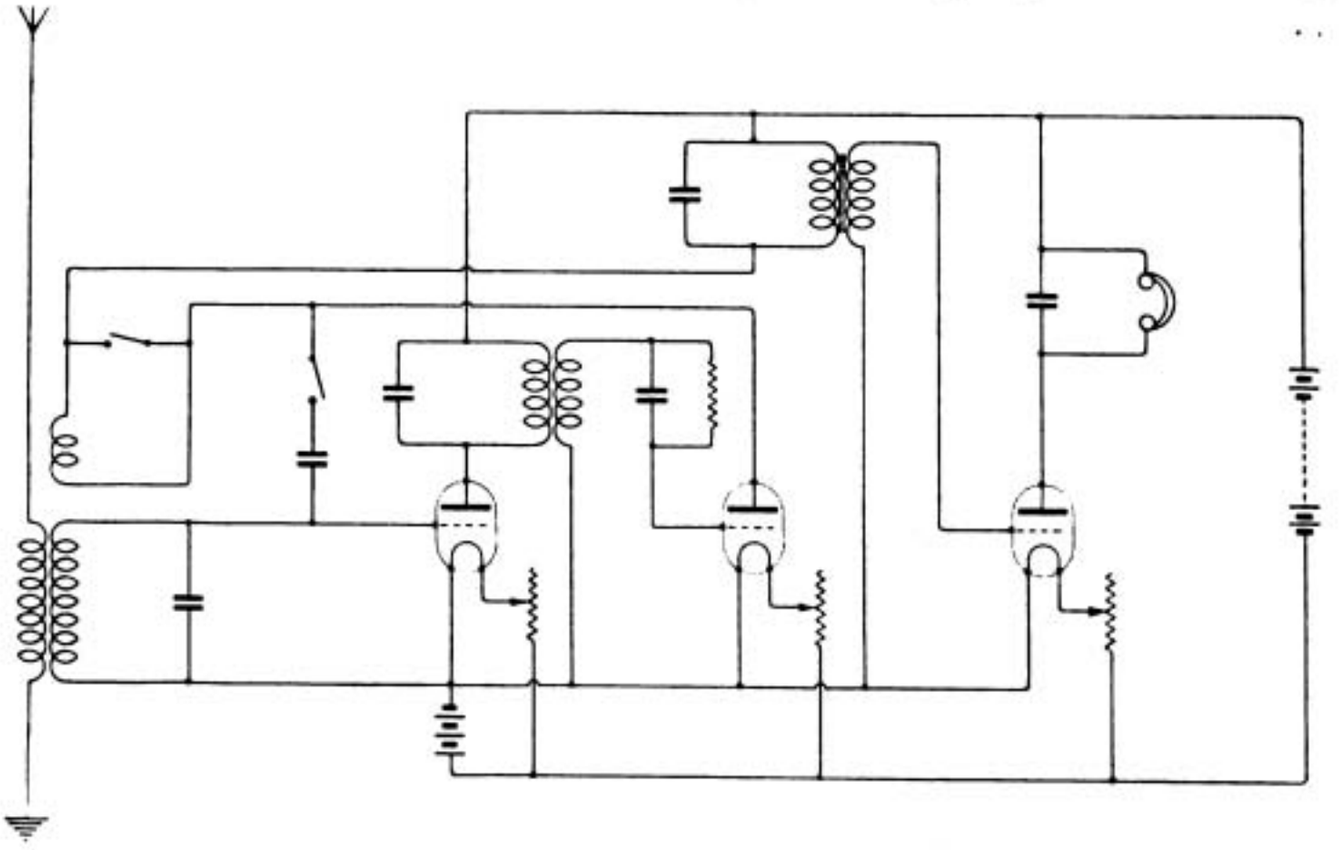


Fig. 3.

from midnight to midnight, *i.e.*, 24 hours in all. The second two figures give the minutes after the hours.

(2) Greenwich mean time corresponds to the standard time used at this part of the year. During the period in which summer time is in force the equivalent summer time is one hour later than the corresponding mean time, *e.g.*, 2 p.m. G.M.T. is equivalent to 3 p.m. summer time.

(3) Regret no information.

(4) Some results may be obtained with valves of this type, but they are not so good as the normal type.

"HONEYSLAB" (Coventry) *asks* (1) *Which give better results on any wavelength, slab or honeycomb coils.* (2) *Whether a certain list of coils would be suitable for a range of* 300-12,000 *metres.* (3) *For suggestions for winding the coils.* (4) *What objection there is to winding two big coils and tapping them to get shorter wavelengths.*

(1) There is very little to choose between them. The honeycomb type is somewhat more compact and quicker to make for long wavelengths.

(2) You might omit the 500 and the 4,000 metre coils, which are hardly required. Otherwise O.K.

(3) See the issue for October 30th, 1920.

(4) A considerable loss of efficiency may arise from currents induced in the parts of the wire which are not being used, but which are not entirely disconnected from the circuit.

R.O.E. (Birmingham) *asks* (1) *For criticism of his single valve set.* (2) *What wavelengths it should tune to.* (3) *If the coils should be closely coupled for the set to oscillate.* (4) *What is meant by the set oscillating.*

(1) The set appears O.K., except that you show only one end of the A.T.I. connected into the aerial circuit. It should be connected either in series or in parallel with the A.T.C., and if in series, it should be placed on the earth side of the condenser.

(2) Impossible to say, as you only give the weight of wire on the coils, and say nothing about their dimensions. You also say nothing about the A.T.C.

(3) Fairly tightly.

(4) A set oscillates when it generates currents of high frequency, or oscillations, independently of any such currents received from any distant source.

H.S. (Cricklewood) *asks* (1) *Which will give best results for transmission for* 25 *miles to a crystal receiver on* 10 *watts* (*a*) *a spark coil,* (*b*) *a power buzzer, or* (*c*) *tonic train, using a spark coil for the H.T. for the valve.* (2) *How much the addition of a L.F. valve to the single valve receiver is likely to improve results.*

(1) On the whole we prefer (*b*) in this case. (*c*) Would also be good if efficiently carried out, but the difficulties, and the possibilities of very poor efficiency are considerable. We doubt if you will get very good results at this distance on this power without valve reception.

(2) Probably 200-350 per cent. for average strength signals.

G.S. (Brighton).—It is difficult to advise you how to add a further two valves to your set without some knowledge of how your present set is connected up. You will find typical three-valve sets on page 369, September 3rd issue, and on page 396, September 17th issue. There are also many others in recent issues.

E.W. (Port Talbot) *asks* (1) *What telephones to use with a Mark III tuner or with a two-valve amplifier.* (2) *If* 750 *ohm. telephones are used, what ratio transformer to use.* (3) *For a diagram of a "Mark I* 20 *watt rear* 65 *metre two-valve panel.*

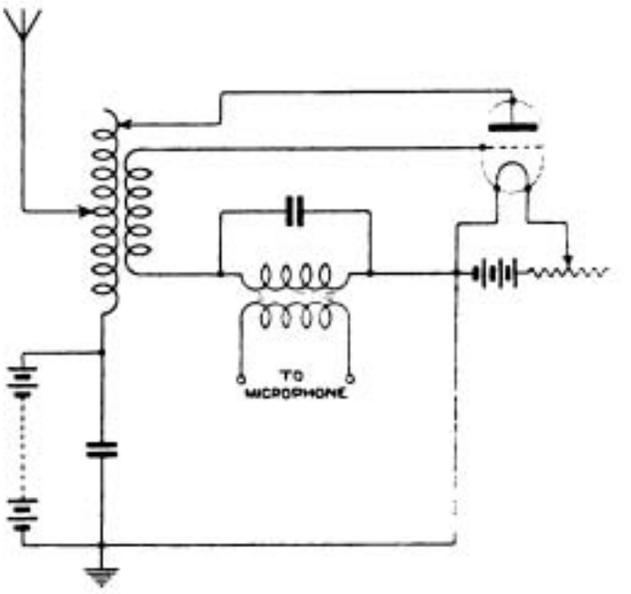
(1) The Mark III tuner has no telephone transformer. 8,000 ohms. telephones may be used, or low resistance 150 ohms. with a transformer will give equally good results. For valve sets it is preferable to use L.R. with a transformer.

(2) Use a transformer with a ratio of about 4 to 1.

(3) See last and this issue for an article on this set.

B.R. (Peckham) *asks how a Mark III three-valve amplifier can be made suitable for telephony.*

This set is a low frequency amplifier, and only magnifies signals after rectification. It should be connected to the receiver in place of the telephones through a 1 to 1 transformer. For C.W. reception a valve oscillating set must be used, or else the connection to the first valve be altered so that it can be made the detector and reaction valve.



STRAYS (Northampton) *asks* (1) *The name of the station sending* QI *for long periods.* (2) *The meaning of* pse *at the beginning of a message.* (3) *The call of Leafield station.* (4) *The meaning of groups of figures sent by* MPD *after weather reports.*

(1) Probably the new P.O. station, at Leafield.

(2) This is the unofficial abbreviation for please.

(3) GBL.

(4) This is an Admiralty message.

R.H. (Tufnell Park) *asks* (1) *Can a Morse inker be used with one valve.* (2) *Can a Weston relay be used in conjunction with a Morse inker.* (3) *If good results will be obtained by using* 200 *volts A.C. mains for lighting a receiving valve filament through a transformer.*

(1) No; one valve does not give sufficient current change.

(2) Yes, but it is hardly robust enough for heavy duty of this sort.

(3) It will probably be much better to stick to accumulators if you already use them. See a recent article on the subject.

H.S. (Oldham) *asks* (1) *For instructions for converting the Mark III tuner to a longer wavelength.* (2) *How many valves would be required for telephony.* (3) *For a conversion diagram.*

(1) See articles on the subject in issues for March 5th and 19th, 1921.

(2) and (3) The addition of a valve is not essential for telephony, though it would certainly lead to improved results. The more valves you add the better will be the results. So many circuits are possible that we cannot do better than refer you to the many valve circuits recently published in these columns. Preferably choose one with magnetic reaction, and if more than one valve is used, employ at least one stage of H.F. amplification.

W.B.V. (Hulme) *asks for a criticism of a circuit.*

If you add a condenser across the primary of the telephone transformer the circuit will be the one that we sketch very frequently in these columns as about the best possible single-tuned single valve receiver. The arrangement of the panel appears to be in accordance with the theoretical diagram.

L.H. (Liverpool) *asks* (1) *For a circuit to make use of certain items of gear.* (2) *Whether it will enable him to receive American stations.* (3) *Particulars with regard to Seaforth* (GLV) *station.* (4) *The cause of whistling when receiving signals.*

(1) The circuit of Fig. 4, page 526, November 12th, should meet your requirements, but you will be able to use two tuned circuits in the ordinary way instead of the single circuit there shown if you prefer it.

(2) Under favourable conditions you may do so if the set is well designed and built.

(3) We believe a 1½ kW. spark set, operating nominally on 600 metres.

(4) Interference between two sources of C.W., either both outside the set, or one outside the set, and the other arising in it.

H.B. (Lincoln) *asks* (1) *What size of former to use for the secondary of a loose coupler, the primary being* 6″ × 12″, *wound with No.* 22. (2) *Dimensions for a potentiometer.*

(1) 7″ × 5″, wound with No. 28.

(2) About 60′ of No. 36 eureka or similar wire, wound on a bar of slate so that consecutive turns are insulated from each other, will be satisfactory.

H.E.W.D. (Cheltenham) *asks for criticism of a circuit.* (2) *What size to make certain coils.* (3) *What wire to use for a filament resistance.*

(1) The type of circuit suggested is quite good, but condenser D has about four times too much capacity. Also a diameter of 2½″ is very inefficient for an A.T.I., except for very short wavelengths.

(2) It is difficult to give figures since you give us no information as to the wavelength that you desire to reach. The circuit you have chosen is suitable for quite long wavelengths if you wish. Consult replies of this nature frequently given, and choose the sizes that best meet with your requirements.

(3) Two yards of No. 22 eureka will be sufficient.

"BILLI" (Gosport) *asks for the best method of constructing a variable grid leak for use with a special type of valve.*

We have no practical experience of such a device, but think that the most satisfactory type would be a solution of cadmium iodide in amyl alcohol, with electrodes (of cadmium) whose distance apart could be varied. If a fine tube of liquid is used, a resistance of many megohms can be obtained in this way. See an article by N. W. McLachlan in the *Radio Review* for June, 1920.

G.V.P. (Harrow).—(1) The wavelength of the set will be about 4,000 ms.

(2) The addition of this coil will probably raise the wavelength about 500 ms.

(3) You will be able to hear ships in the North Sea and the Channel, and the larger Continental spark stations, if your set is fairly efficient.

"SKYRO" (Highbury) *asks* (1) *For criticism of a set.* (2) *Wavelength ranges.* (3) *For winding for a H.F. transformer.* (4) *Whether hard wood well shellaced may be used for the former of the transformer.*

(1) Quite O.K.

(2) Aerial circuit about 4,500 ms. Secondary circuit, 6,000 ms.

(3) See the constructional articles now appearing.

(4) This could possibly be used if nothing better were available, but results with a good dielectric such as ebonite would be very much superior.

J.B. (Gainsborough) *asks for a diagram of a four-valve amplifier for use on telephony.*

We should recommend a circuit of the type shown in Fig. 2, page 396, September 17th issue, an additional H.F. valve added. The connections between the second valve shown and this additional valve will be exactly the same as the connections between the first and second valves shown, except that no second reaction coil will be necessary.

TELEFUNKEN (Camden Town) *asks* (1) *For a diagram of wavemeter with variometer, fixed condenser, lamp, etc.* (2) *For a diagram of a Mark I combined C.W. transmitter and receiver.*

(1) The Townshend wavemeter is the one required in this case. The diagram will be given in a forthcoming issue of *The Wireless World*.

(2) Unfortunately we have not a copy of this diagram at the present time.

HAROLD (Biddulph Park) *submits a circuit diagram, and asks* (1) *For criticism.* (2) *For connections to add to another valve.* (3) *If wire netting laid on grass is a good earth.*

(1) We do not think this circuit will work, and suggest that shown in Fig. 1 of the October 15th issue (Question and Answer column) instead.

(2) To add another valve the simplest way is to use it as a L.F. magnifier, connections for which have been shown in several recent numbers.

(3) Fairly good, but it is generally better to bury it in damp earth.

D.F.V. (Reading) *asks* (1) *What are the advantages of honeycomb coils.* (2) *The ratio of capacity to inductance in a closed circuit.* (3) *If circuits can be tuned by means of a variometer instead of a variable condenser.* (4) *The inductive effect of placing two coils at right angles.*

(1) Honeycomb coils give coils of large inductance with fairly small self capacity, in a comparatively small space.

(2) On a circuit for use with a potentially operated detector, the capacity should be as small as possible so that the inductance may be a maximum to give the biggest possible potential changes for the detector.

(3) It can be done, but only for limited ranges with a given variometer. The variometers require careful designing.

(4) The inductance of two coils placed at right angles is equal to the sum of the two inductances, if there is no mutual inductance between them. There may be a small mutual inductance, and if so it adds to or subtracts from the inductance according to the direction of the windings.

J.M. (Birmingham).—(1) and (3) The circuit is wrongly connected. Wire up as shown in the figure, which shows a double slide inductance in use. If only using a single slide inductance, connect the crystal to the A.T.I. slider as shown.

(2) 7/22 would be more suitable for the aerial, but it is expensive. Try a single No. 16 wire. Use 120 ohm telephones with a transformer.

PHONEZ (Plymouth) *asks* (1) *If Weston relays are sensitive enough to work in conjunction with one valve.* (2) *For a circuit.* (3) *For the issue of "The Wireless World" in which a set employing slab inductances is described.*

(1) and (2) Only with very strong signals. You would get better results with two or more valves. The circuit may be of any ordinary type; possibly a condenser rectifier with reaction would be about the best.

(3) There is no particular article dealing with a set of this nature. We suggest that you try a single valve reaction circuit given many times in these columns. Place a big coil in the aerial and the next big one in the anode circuit as a reaction coil, and adjust until signals are received. From this you will be able to pick out suitable combinations of coils to give a continuous range.

(4) We have not tried gramophone records as a dielectric, but think they should be suitable.

W.O.B. (Forest Hill) *refers to a single valve set, and asks* (1) *If No. 2 unit coil can be honeycomb wound with* 10,000 *and* 20,000 *mhy. coils.* (2) *If No. 26 wire will be suitable.*

(1) Yes, it will be quite satisfactory.

(2) No. 26 wire will do. Wind on a 2" former 2" wide for 10,000 mhys., 20 layers will be required and 30 for the 20,000 mhy. coil with 30 turns per layer.

F.M. (Oldham) *has a two-valve set with an indoor aerial on which signals are "hoarse and elusive," and asks* (1) *If the circuit is correct.* (2) *If slab inductances will be suitable.* (3) *What type of aerial most suitable for his set.* (4) *Reactance to work with A.T.I.*

(1) Use only a single slider, and connect the grid and negative filament across the portion of the A.T.I. in use; otherwise O.K.

(2) Yes.

(3) We do not particularly favour indoor aerials, but suggest that you sling several wires in parallel under the roof.

(4) Use a 2½" diameter former wound with 6" of No. 26 enamelled wire.

H.G.V. (Shrewsbury) *has a single valve set which will not work.*

The grid circuit is broken, as there is no connection from the 6-volt negative to earth. Also there should be a 0·001 condenser across the telephone transformer primary. We have no detailed information of the coils referred to, so cannot say if they are satisfactory. Try all possible combinations of coils for fixed and rotating coils, changing over the connections of the rotating coil each time to get the proper direction of the winding for oscillation.

J.M. (St. Helens) *describes a three-valve German H.F. amplifier, and asks* (1) *If suitable for the Hague and Kœnigswusterhausen telephony.* (2) *Any suggested improvements.* (3) *Why the reaction coils of a recent L.W. set are made to rotate through* 180.

(1) Yes, results should be very good.

(2) As a standard set the design can hardly be improved, except perhaps that the 0·002 condenser between the anode and grid might be of higher capacity for long wavelengths.

(3) For no particular reason, except that it is simpler for those who do not understand the necessity of the reaction being in a certain direction for oscillation.

CORRECTIONS.

In the article by Mr. Voigt in the last issue, Figs. 3 and 5 on pages 561 and 562 respectively have unfortunately become interchanged.

In the advertisement of Messrs. The Mullard Radio Valve Co., Ltd., appearing on page xvii of the November 26th issue, the filament voltage of the "ORA" valves was shown as "36 to 40 volts" instead of "3·6 to 4·0 volts."

Mr. F. W. Higgs, who contributed the description of two practical sets appearing on Page 533 of the November 26th issue, asks us to mention that the sets are mainly designed by a cousin, Mr. J. S. Hobbs. The stations are located in Wolverhampton.

SHARE MARKET REPORT.

Prices as we go to press, December 16th, are :—

Marconi Ordinary	£1	14	0
„ Preference	£1	14	0
„ Inter. Marine		19	6
„ Canadian		5	3
Radio Corporation of America :—			
Ordinary		10	0
Preference		9	3

The Directors of the Marconi International Marine Communication Company, Ltd., announce an Interim Dividend of 5 per cent., less Income Tax, payable on the 19th December, 1921, to the Shareholders registered on the books of the Company on the 1st December, 1921, and to holders of Share Warrants to Bearer, and that the Transfer Books be closed from the 2nd December, 1921, to the 8th December, 1921, inclusive.