The WIRELESS WORLD AND RADIO REVIEW

RADIO TOPICS.

THOSE SIGNALS FROM MARS: ARE WE MISTUNED?

PERIODICALLY the question of the possibility of habitation in Mars is discussed in the press, and public interest is revived. Recently much has been made of the topic on account of the proximity of Mars to the earth, the suggestion being that a particularly favourable opportunity presented itself for observations to be made. The popular belief, whether based on scientific reasoning or otherwise, is that if there is human life on Mars and if civilisation exists we must expect that civilisation to have developed further than our own, because we are told that the Martians have had a considerable start on the human races of our earth. If this is so and we assume that civilisation has proceeded on somewhat similar lines to our own, we would expect that they are far ahead of ourselves in the development of wireless telegraphy as a means of communication. We submit then that those who are listening for the communications of the Martians on wavelengths of the order of 30,000 metres are overlooking the fact that earthly humans have already begun to realise that the use of long waves in wireless telegraphy is to be superseded by the employment of very short wavelengths. We think that those who have the necessary enthusiasm and spare time to listen in, in the hope of receiving signals should at least give the Martians, with their higher civilisation, credit for having developed some short wave super-beam system. Again, we should have been surprised if nothing at all had been heard on receivers tuned to wavelengths of the order of 30,000 metres because it must be remembered that a frequency has then been approached which is within the audible limit, whilst "lower harmonics" of a number of long wave stations can also be heard on receivers tuned to these audible frequencies.

THE TRANSOCEAN AMATEUR TESTS.

IN our last issue we predicted that the Postmaster-General would recognise the annual Trans-ocean tests again officially this year, as this has been the practice in the past. We are glad to announce that information has been received that for the tests this year authority has been obtained for wavelengths between 90 and 200 metres to be used by those who make special application and who enter officially for the tests being conducted by the Transmitter and Relay section of the Radio Society of Great Britain. It is also understood that in certain cases facilities for the use of additional power will be granted.

There is no doubt that the tests this year will far surpass anything which has been done in previous years from the point of view of interest. It must be remembered that this will be the first annual test since two-way communication across the Atlantic on short wavelengths was established by a number of amateurs after the conclusion of last year's Transatlantic tests.

The area to be covered this year includes Mexico, South Africa, India and Australia, in addition to the countries with which more regular communication has already been established. As on previous occasions all those who make application to enter for the tests to the Radio Society of Great Britain will receive complete details of the arrangements. This year it is understood that various trophies are to be competed for. We take this opportunity of calling the attention of readers again to the announcement made by Mr. Marcuse, Hon. Secretary of the Transmitter and Relay Section of the Radio Society which appeared on page 609 of our issue of August 20th.

INTERNATIONAL RADIO WEEK.

FURTHER progress is being made in arrangements for something interesting in the way of International broadcasting during International Radio Week, which it is hoped to organise this year as a development of the Transatlantic broadcast tests which we promoted last year in conjunction with *Radio Broadcast* of America. Cables from America indicate that there is great enthusiasm there and that in the event of the Broadcasting Company undertaking transmissions from this side they can almost certainly guarantee that nearly all of the broadcasting stations of America will close down during the listening periods. It will be remembered that last year our transmissions were not well received in America on account of the fact that there was insufficient co-operation amongst the various Broadcasting interests to obtain the necessary quiet period for listening.

DRY CELLS FOR VALVE FILAMENTS.

WE think it is time that it was realised that although dry cells are being generally used and recommended for filament heating for valves of the 60 milliampere and similar types, yet dry cells of any existing types which are portable are not really applicable for this purpose.

The dry cell is a sound proposition only for intermittent use and not to supply continuous current over prolonged periods as it is required to do when used for filament heating for valves.

Manufacturers of batteries have been obliged to do the best that was possible to meet the demand but they are severely handicapped by the materials at their disposal. You cannot make gold coins out of brass neither can you devise a portable dry cell on the principle of the cells at present in use which will be applicable for delivering continuous current over periods of several hours. Especially is the inherent defect in dry cells noticeable where an attempt is made to employ them for filament heating for a multi-valve receiver. In this case it will be found that whilst the receiver is in use, that little by little one has to reduce the resistance in series since the signals will gradually fade. After the cells have had a rest they will probably return to their normal voltage and readjustment of filament controls must be made to bring back the filaments to the correct operating temperature.

PROSECUTION FOR UNLICENSED TRANSMISSION.

ELSEWHERE in this issue we report the first prosecution conducted by the Post Office for the employment of experimental wireless transmitting apparatus without a licence. Although we feel sympathy for the offender who has been the first to be singled out, yet at the same time we congratulate the Post Office on having taken some step to make their authority in the matter of licences for transmitting stations respected.

Unfortunately, we are led to believe that the individual who has been the subject of the first prosecution is only one of a large number of offenders.

What concerns us most of all is that this illegal use of transmitting apparatus brings discredit on amateurs as a whole, and particularly on those who are lawfully licensed to use transmitting apparatus, and are employing it in the interests of experimental and research work.

We sincerely hope that the action taken by the Post Office will serve as a warning to others who hitherto have no doubt felt that the Post Office was apathetic in the matter, and would be unlikely to take steps to curtail the activities of unlicensed transmitters.

Readers will no doubt have observed the all too familiar note appearing in *The Wireless World and Radio Review* from time to time, calling attention to the use of call signs by persons other than those to whom they have been officially allotted. We hope that this prosecution will have the effect of reducing the number of these complaints.

FREQUENCY FILTERS.

The subject of filters is one which is rather neglected by the amateur although filter circuits form a very interesting as well as instructive subject for research. The following article should provide valuable information for the experimenter.

By E. K. Sandeman, B.Sc.

THE word "filter" conveys to the average mind a conception of any one of a number of devices such as those which are commonly employed for drinking water in an ordinary house, or possibly the large outdoor filters which are employed for filtering the water supply of large towns *en route* from the watersheds among the hills where it is collected. A scientist possibly thinks of the various types of light filter which pass only certain rays or colours. A radio or telephone engineer would probably think of some type of electrical filter such as is commonly employed to eliminate ripple from the power supply of a wireless transmitting or receiving set, or telephone exchange system.

The frequency filter is a device which is used for the selection of bands of frequencies, it being so constructed that whatever frequencies are applied to its input, only those frequencies which lie within a predetermined range are delivered at its output.

The type of filter which is described below may really be divided into four classes, of which three only have any direct interest for us. All four classes depend actually on the same fundamental theory for their operation as the light filter and the electric filter (and incidentally, all these types provide for the transmission or suppression of oscillatory waves of certain frequencies travelling through some medium). Two classes have already been described.

The third type is the acoustic filter which provides for the transmission or suppression of certain frequencies travelling in air.

The fourth type is the mechanical filter, or as it has sometimes been termed by engineers of the Western Electric Company, who developed it, the mechanical attenuator, which provides for the transmission or suppression of certain frequencies travelling along a specially constructed mechanical transmission line.

All filters of this type, whether for filtering electrical, acoustical or mechanical energy, depend on the same fundamental principle, the association of certain elements presenting different impedances to the passage of the oscillations.

Impedance is a physical property about which a lot may be said, but for our purpose it will be sufficient to think of it as an opposition to energy flow. That is to say, that in a medium of high impedance the motive force bears a large ratio to the energy transmitted. The two components of impedance with which we are most concerned in making a structure which shall transmit or pass only certain bands of frequencies are what we will term inertance and capacitance. Both these terms express something which is difficult to define and which is best described by an illustration of a case where each occurs.

Inertance is a property possessed alike by a mass and by electrons in an inductance, and by virtue of it acceleration is resisted. Acceleration of a mass is easy to appreciate, and acceleration of an electron is quite a conceivable idea, although in the case of current flow in a conductor, it is probable that increase of current corresponds not merely to an increase in the velocity of individual electrons, but also in an increase in the number of electrons concerned. It is easy to see that either would have the same effect in producing a "back pressure."

Capacitance is a property possessed by a spring and also by a condenser. The capacitance of a spring is proportional to the reciprocal of its elastic strength.

Now, strangely enough, it will prove simplest to explain first the action of an electrical filter, and to follow this up with an explanation of the action of a mechanical filter and finally by an explanation of the acoustic filter.

Electric Filters.

In Fig. 1 are shown a variety of forms of Campbell wave filter, which evidently consist of a series of sections of shunt and series impedance elements.

In the case of the high pass filter, if alternating voltages of complex wave form are applied across the two terminals "A," the only frequencies which will arrive at "B" without appreciable attenuation will be those above a certain frequency, termed the cut-off, and indicated in the figure by *fc*. For the low pass filter only those frequencies below its cut-off are passed. The behaviour of both these filters might have been predicted to a certain extent from an examination of their construction, *e.g.*, for the high pass filter it is evident that the series elements will decrease in impedance with frequency, while the shunt elements will increase in impedance with frequency so that high frequencies will evidently be passed with less attenuation than low ones. The existence of a sharp "cut-off," such as is indicated in the figure on the right, could, however, only have been determined by experiment, or by mathematical analysis. In practice the sharpness of this cut-off is limited by the value to which it is possible to reduce the resistance of the inductances.

Types of Campbell Filter.

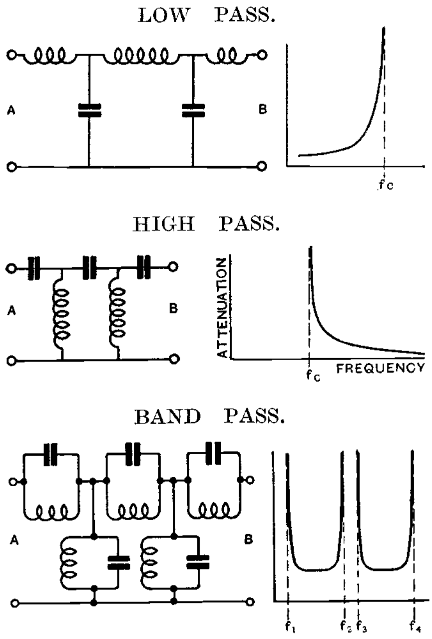


Fig. 1.

In the case of the band pass filter the region passed consists fundamentally of two bands of frequencies limited by the four cut-off frequencies f_1, f_2, f_3 and f_4. Since in practice only one band is generally required, it is usually convenient to design the filter elements so that either f_1 and f_2 tend to zero, or f_3 and f_4 tend to infinity; the same result may be obtained by designing the filter so that $f_2 = f_3$. Actually a high pass or low pass filter is a special case of a band filter.

A filter may consist of any number of sections, the more sections that are employed the sharper the cut-off and the more completely the undesired frequencies are suppressed.

There are various other types of electrical filters, notably those employed by Siemens and Halske, consisting of a number of inductively coupled, or capacity coupled, tuned circuits, but the above types serve to illustrate the general idea, and since these types lend themselves more readily to the drawing of an analogy between the electrical and the mechanical case they have been chosen for portrayal here.

Mechanical Filters.

It would seem from the above that if it were possible to arrange in the mechanical case a linkwork of mechanical impedances, the equivalent of any of the networks shown in Fig. 1, then the system might be expected to behave in an analogous manner and to transmit only those frequencies lying within a certain region in the frequency spectrum. Such is actually the case, and in Fig. 2 are shown a number of such arrangements. Mechanical vibration may be longitudinal, transverse or rotary, accordingly there are three possible equivalent mechanical arrangements which will give the equivalent of any of the filters shown in Fig. 1. In Fig. 2 we have shown some of the simpler ones, the others become so complicated that they are scarcely to be considered as fair instances of what we are trying to demonstrate.

It will be noticed that in the case of the transverse motion filter a point of "fixed potential" or "no movement" is required. This could be avoided if we made the "axis" of the filter supply the restoring force, as would be the case with a number of weights strung on a stretched piece of elastic for instance, and as is actually the case in the rotary filter.

The two transverse filters present a very good analogy to the case of a loaded earth return telegraph circuit, while the two arrangements shown in Fig. 3 are also mutually analogous.

A comparison of Fig. 3 with the transverse filters shown in Fig. 2 affords a very good picture of the difference between an earth return and a double metallic circuit, as used, for instance, for telegraphy or telephony.

The importance of the principles underlying the action of the mechanical filter in any piece of apparatus designed to handle sound vibrations will be readily appreciated. The Western Electric Company holds several basic patents covering the application of these principles.

Perhaps it will serve to make things a little clearer if we examine the disposition of the elements in one or two of the filters shown in Fig. 2, and find out why any particular element may justifiably be said to be the equivalent of a shunt or series element in an electrical filter.

Looking at the transverse and the longitudinal filters, it is evident that if the springs have small stiffness or elastic strength, so that they present a small impedance to motion, then only comparatively small amounts of energy will be transmitted, although the impedance to movement at any point in the arrangement will be low. Looking at the electrical filter at the top of Fig. 2, it is evident that if the condenser elements are of large capacity (*i.e.*, small elasticity), then only small amounts of energy will be transmitted, although the impedance at any point in the arrangement will be low. The reverse is true for the masses and for the inductances. It is evidently, therefore, quite in conformity with the general convention to consider the spring units as being in shunt and the mass units in series.

In the case of the rotary filter, things are perhaps not quite so evident, but it will be quite clear when we realise that elasticity is provided by the lengths of rod between the masses, while the velocity of movement instead of being transverse or longitudinal, is rotational, being generally spoken of as angular velocity. The inertia effect presented to an angular acceleration is then dependent on the shape of the mass, and is most easily presented to the mind by an equivalent point mass which may easily be calculated—acting at some convenient radius.

Mechanical Filters.

(For Electrical Equivalents see Fig. 1.)

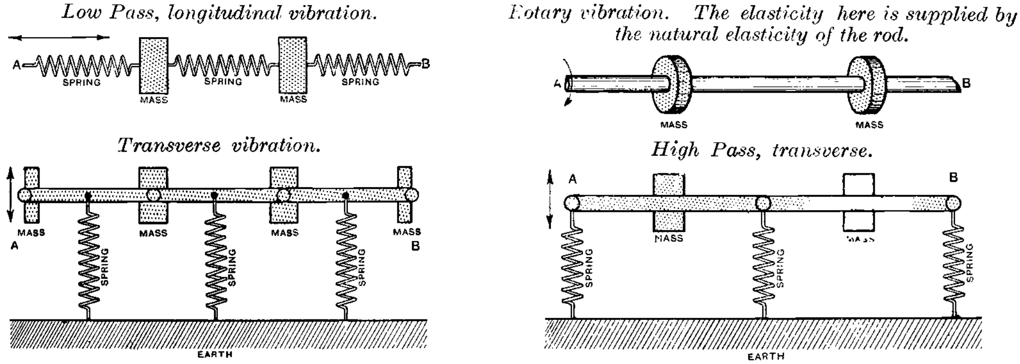


Fig. 2.

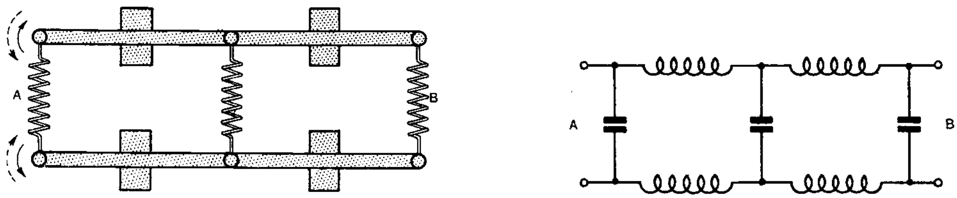


Fig. 3.

(To be concluded).

AN EASILY BUILT TWO-VALVE RECEIVER.

The description of a two-valve receiver given here is one which should make an appeal to those who are more interested in reception of distant stations than in getting maximum signal strength from the local Broadcast station only. A wide choice of components is possible without departing from the design given.

ALTHOUGH many people when they build a set may prefer one which will give strong signals for loud speaker reproduction, yet there are a good many more who like to have a receiver which will give good telephone signals over long distances.

Such a receiver should be so designed that it can be used for reception on any wavelength and so that an amplifier can be added to it if it is specially required to operate a loud speaker or obtain great signal strength.

For all ordinary reception it is seldom that more than one stage of high frequency amplification is needed, whilst the addition of more than one stage makes tuning very difficult; or if a type of high frequency coupling is used where tuning is simplified as in semi-tuned systems, more than two stages will usually be required before much advantage is obtained over one properly tuned high frequency stage.

The best circuit using one stage of high frequency amplification is almost undoubtedly that which has come to be known generally as "tuned anode." This circuit therefore is used in the simple receiver about to be described, the second valve serving as detector. The circuit diagram is shown theoretically in Fig. 1, and it will be seen that this is the usual arrangement. It will be noticed that two terminals are provided for the aerial connection, one of which is marked "aerial," and the other "X." When reception on fairly long wavelengths is desired, the aerial connection should be made to the top terminal and connection made by means of a strap between terminals "X" and "earth." In this way the tuning condenser is in parallel across the aerial tuning inductance. If shorter wavelength reception is required, the strap should be opened, and the aerial joined to the terminal "X," when the condenser will be brought in series with the aerial and tuning coil.

All components of the receiver, with the exception of the tuning coils and coil holder, are mounted on the front panel of ebonite and the bracket at the back on which the valve holders are supported.

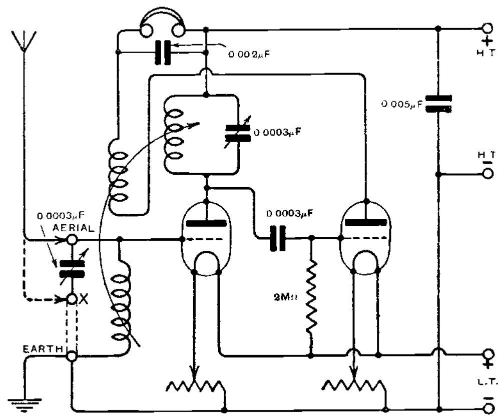
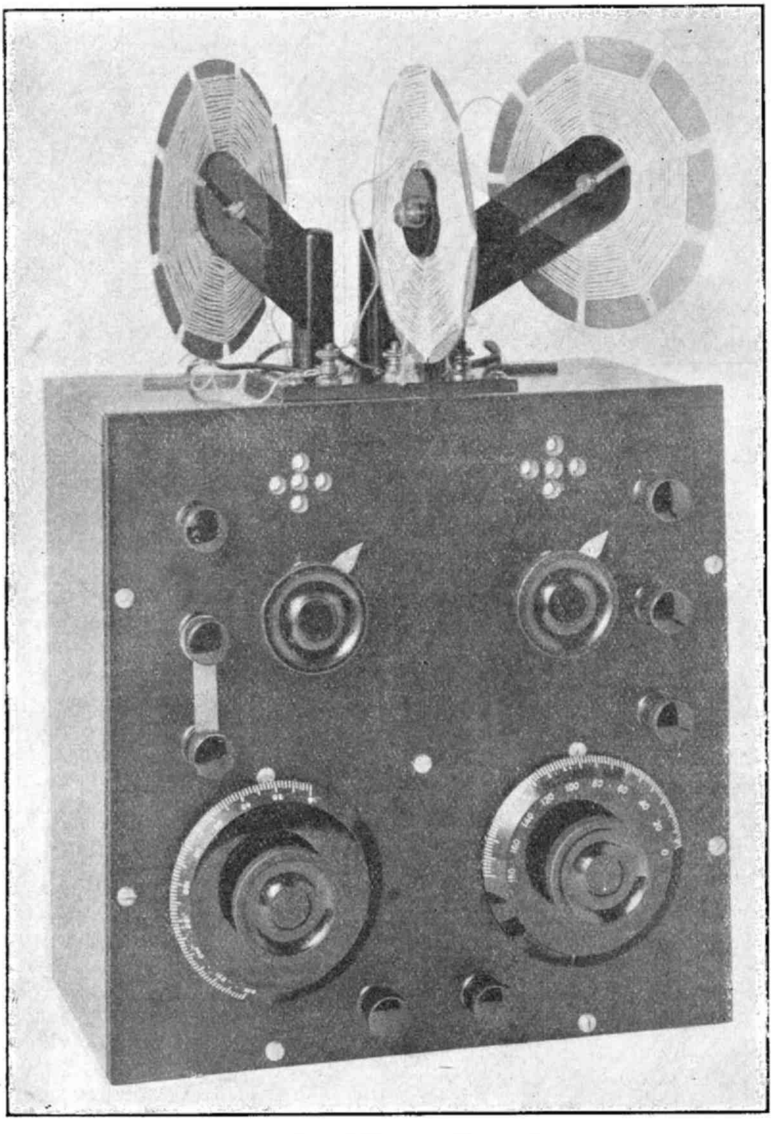


Fig. 1. The circuit used in the receiver.

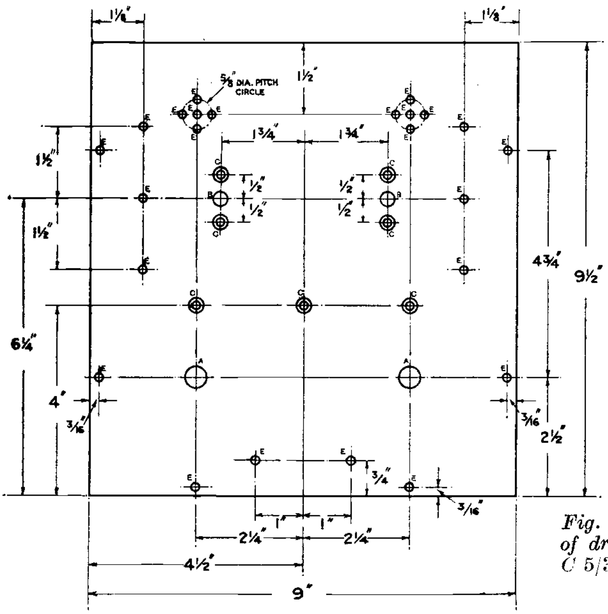
The size of the front ebonite panel is 9 ins. × 9½ ins. whilst the bracket measures 8 ins. × 3 ins. Both of these panels are ¼ in. in thickness. Fig. 2 shows fixing holes with position for drilling, and since these give all necessary measurements, no difficulty should be experienced in drilling them ready for mounting the components. The two variable condensers and the filament resistances used in this set were by Ormond's and the drilling holes are marked out for these components. Other components may, of course, be used instead if desired, but it will then be necessary to measure up everything carefully to see that there is sufficient space allowed for mounting. Two Athol porcelain valve holders are used as these are convenient to fix and to wire.

The holes marked "C" on the front panel are for screws to fix the bracket in place. Those who have taps will experience no difficulty in drilling 5/32 in. and tapping out threads in the edge of the bracket to take the fixing screws. Where taps are not available, if the holes are drilled a size smaller than the screws, the screws themselves will cut their own thread in ebonite quite satisfactorily if screwed in with care.



Front view of the two-valve receiver.

The purpose of these screws is merely to hold the bracket in place, but not to take any strain. On this account it will be noticed that in Fig. 3 provision has been made in the wooden case for grooves into



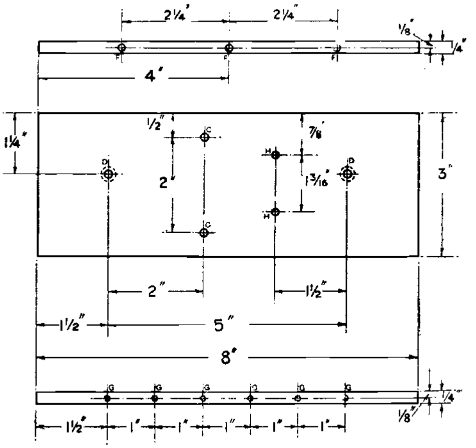


Fig. 2. Drilling diagram for the panels. The size of drills should be as follows:—A 7/16", B 5/16", C 5/32", and countersunk for No. 4 B.A. screws; D 5/32", E 5/32"; F 4 B.A. screw thread.

which the bracket slides when the panel is put in place. These strips of wood on either side of the panel serve to take the strain when the valves are taken out or replaced. The back edge of the bracket

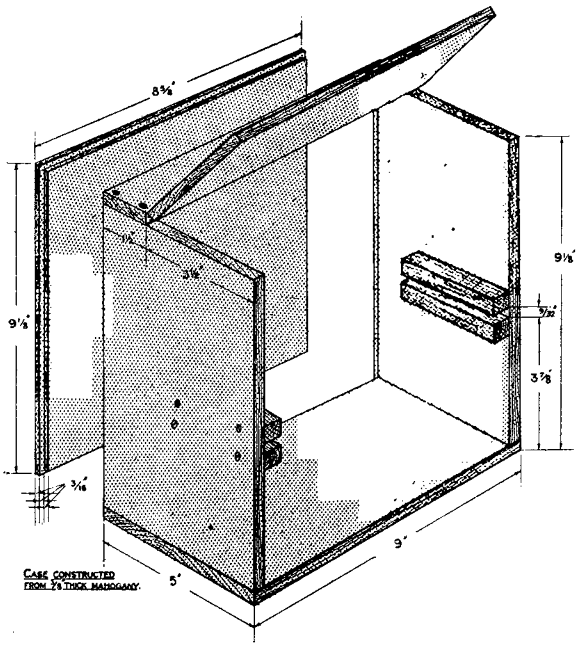


Fig. 3. Dimensions of the case containing the receiver.

panel shown on the right of Fig. 2 has six holes drilled to take brass screws or pins. Again, if taps are available, threads may be cut to take small brass screws, but otherwise brass pins or pegs can be tapped in with a light hammer into slightly smaller holes, leaving enough of the pins projecting to allow leads to be soldered to them.

Fig. 4, which shows the positions of the various components and the wiring, also indicates the six terminal pins or screws, which are marked "A" to "F." All the wiring shown in Fig. 4 is done with stiff bare wire and may be No. 16 or No. 18 S.W.G. All leads going to the three inductance coils are terminated at the points "A" to "F" and soldered. Six flexible insulated leads are also soldered to these points and are taken through six holes in the back of the top of the wooden case and to the terminals of the three coil holder which is mounted on the hinged part of the top of the case as is shown in the photograph. Any type of coil holder and plug-in coils may be used. The coil holder shown in this particular instrument carries pancake coils wound on cardboard formers of the familiar type which are now so cheap to purchase that the time required to make them is scarcely justified. The coils of this type can be had wound ready for use for different wavelengths; or other types such as Igranic, Burndept, Rimar, etc., may be coil should be approximately the same as for the aerial coil. With cards (if these are used and coils wound) where the mean diameter of the space occupied by the wire is 3 inches, the number of turns in order to cover the

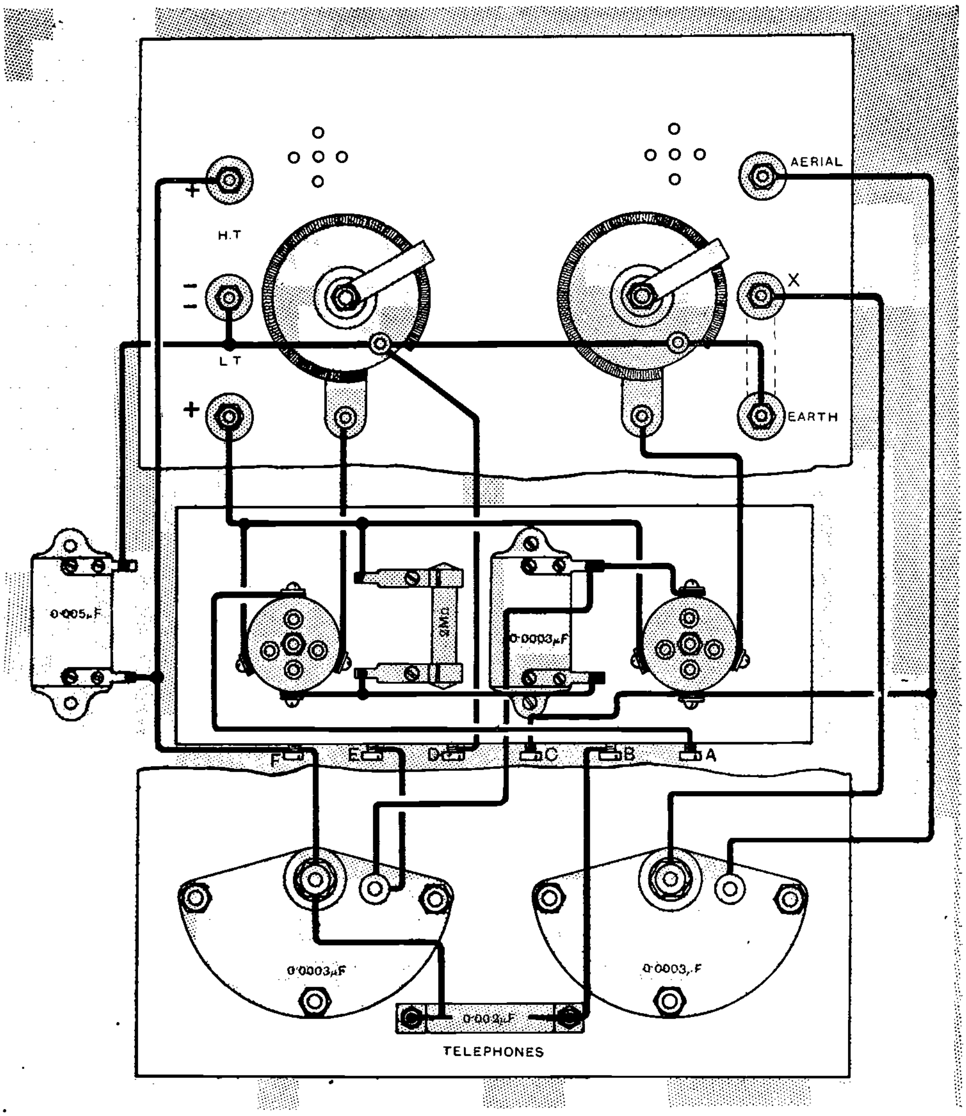
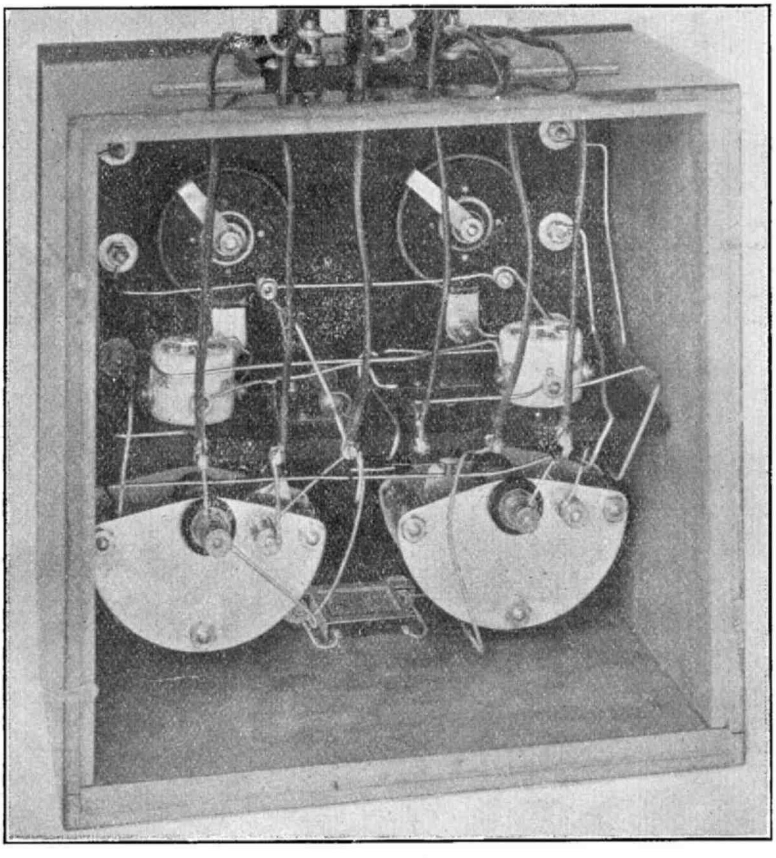


Fig. 4. Arrangement of the components and details of wiring.

used. The number of turns in the coil of the anode circuit of the first valve should be rather more than are required for the aerial coil and the turns for the reaction broadcast range with the average aerial and the aerial tuning condenser in parallel with the aerial tuning coil will be approximately as follows: aerial tuning coil 40 turns, reaction coil 40 turns, anode coil 60 turns. For winding these coils, No. 22 D.C.C. will serve for the aerial and reaction coils, but a smaller gauge such as No. 26 will have to be used in order to accommodate 60 turns on a card of this size; if preferred, all three coils may be wired with No. 26 gauge if No. 22 is not to hand. Naturally it is recommended that those who are prepared to spend a little more on the set, in order to have a more convenient arrangement, should use plug-in coils of one of the types mentioned above as they will be found to be more robust and durable, whilst the set will have a neater appearance due to the absence of loose wires from the coils.

It will be noticed from the photographs that ebonite cased terminals have been used, the reason being that they give a better appearance to the set; they can, however, be replaced by ordinary pattern terminals if cost is an important consideration. Engraving of the panel is scarcely necessary, as the only controls requiring accurate reading are the position of the dials of the condensers. By locating the screws which hold the back panels in place immediately above the position of the condenser spindles, the slot of the screws will serve as a check line.



A view of the receiver with the back removed to show the wiring.

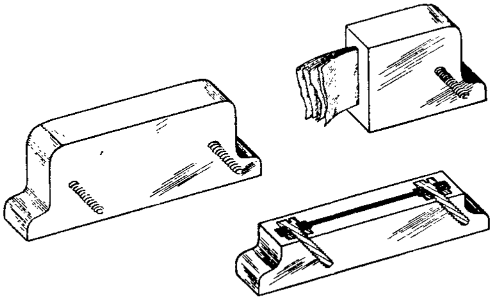
P. H.

COMPONENTS OF INTEREST.

A REVIEW OF NEW PRODUCTS OF THE MANUFACTURERS.

A One-piece Micro Condenser.

In the construction of fixed value condensers, it is most important for the plates to be securely clamped together so as to force out all air, whilst the pressure exerted upon the plates must remain constant if the



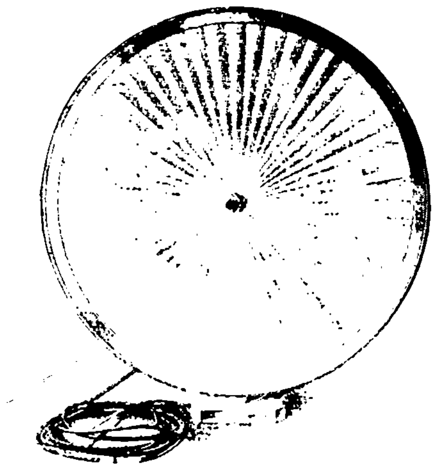
The completed condenser and a sectional view showing the appearance of the clamped plates.

capacity of the condenser is not going to change. It will be appreciated that if there is any air interspaced between the mica and metal leaves, that the capacity of the condenser will be widely different from its intended value, whilst any fluctuation in the pressure on the sides of the condenser will expel the air and greatly increase the capacity. Messrs. Peter Curtis, Ltd., have recently introduced a condenser of new construction in which the mica and foil plates, after being packed closely together, are put into a press with an insulating material, which is moulded securely on to the condenser holding all of the plates in a very rigid manner and producing complete protection. We have recently received one of these condensers and on sawing through it for the purpose of examining the condition of the plates inside, found that they were securely clamped, forming what appeared to be, in section, a solid strip.

A Hornless Loud Speaker.

Although much research work has taken place with the object of obtaining the perfect loud speaker horn, the Sterling Telephone and Electric Co., Ltd., have attacked the problem of acoustics at an entirely different angle. The result of their experimental work is combined in the new Primax Loud Speaker in which the amplification is produced by means of a very large diaphragm which is coupled directly to the vibrating diaphragm of the electro-magnetic receiving system.

Constructed of parchment material, the large diaphragm is extremely light and the effective surface is increased and rigidity obtained by pleating the material. Full control over the volume is provided by a screw at the back of the instrument. In keeping with the light nature of the instrument, all metal work is in aluminium. For the best results the manufacturers advise that this model should be used in conjunction with a power amplifier. Due to the large surface of the diaphragm the sound is equally distributed in all portions of the room, whilst the pleated appearance gives the instrument an artistic finish.

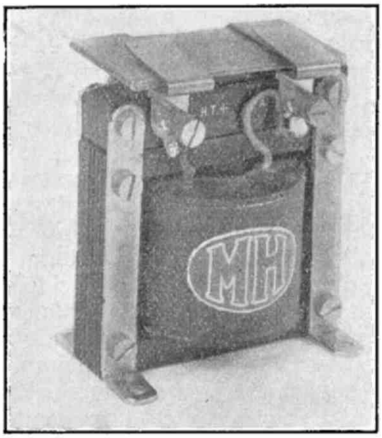


The Sterling hornless loud speaker.

New McMichael Transformer.

Although the M.H. low frequency transformer illustrated has formed part of the apparatus comprising the various standard and amplifying receiving sets of Messrs. L. McMichael, Ltd., for some time past, the transformer has only just made its appearance on the market as a separate component. It is designed as a general purpose transformer and its performance leads us to think that it is likely to be popular.

The point of novelty in the design of this instrument is the provision of clips to take a condenser across the primary winding of

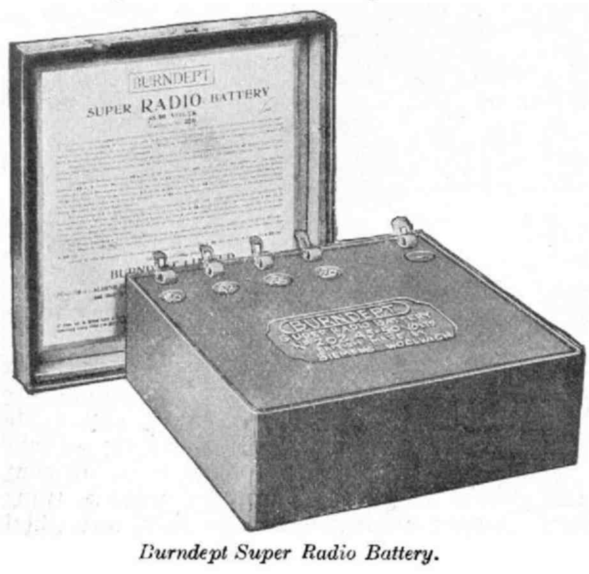


The new McMichael L.F. Transformer.

the type constructed by this firm. The condenser is of the standard flat type made by this firm and condensers of any value can be readily interchanged.

Burndept's Super H.T. Battery.

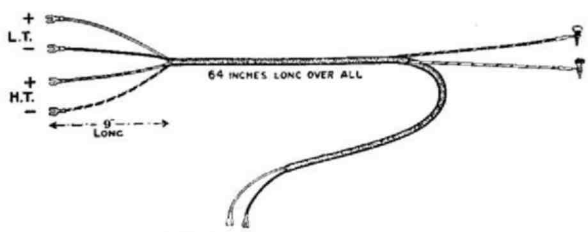
Owners of multi-valve sets will be interested in the new production of Burndept, Limited. This consists of a large capacity high tension battery, which it is claimed will operate a five-valve set for four hours a day for at least eight months. Each separate cell weighs 4 ozs., which is approximately five times the weight of the average H.T. cell. The weight of the complete battery is 12½ lbs. Encased in a stout containing case covered with special mahogany finished coating, the battery should prove proof against any changes in temperature. Tappings are provided at 20, 45, 48 and 50 volts, the object of the last two tappings being to enable one to keep the battery up to its full voltage until the end of its life by means of connecting successively to the 48 and 50-volt positions. Due to the care used in the construction of the cell, and secondly in the very high insulation of the battery, it proves absolutely noiseless in operation even when used for prolonged periods.



Burndept Super Radio Battery.

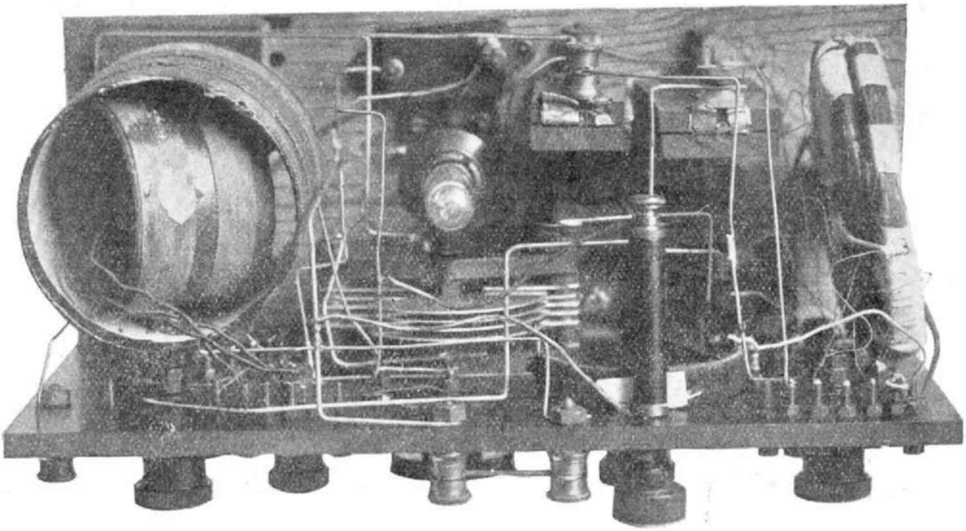
Combined Leads for L.T. and H.T. Batteries.

Apart from the risk of burning out the valve filaments through connecting the high tension battery to the low tension terminals



The Easifix battery connecting cable.

of the set, the loose and unsightly wires which are often used as connectors do not in any way improve the appearance of a set. Accidents of this nature are rendered practically impossible when use is made of the Easifix connecting cable produced by Ward & Goldstone, Ltd. Four splayed ends, fitted with suitable tags, are provided for connecting the cable to the set. A long heavy conductor is employed for the L.T., whilst shorter and lighter cable fitted at its extremities with suitably coloured wander plugs enables connection to be made with the H.T. battery. The four leads being bound together for a portion of their length a neat appearance is preserved. The total overall length of the connectors is 64 ins.



The Armstrong Super on which the results described in this article were obtained.

GETTING RESULTS WITH AN ARMSTRONG SUPER.

By J. G. W. THOMPSON.

(Concluded from page 618 of previous issue).

WHEN the first "logged" tests were made four of our stations were heard in a few minutes on the 2-ft. frame, which was used for all the tests except as described later.

The following useful and interesting points were brought out in this test:—

(1) The quenching coupling must be much looser for 200 metres than for the longer broadcast band, otherwise difficulty is experienced in getting the set to oscillate. Even if this is possible, amplification is so great that the roar drowns out everything.

(2) With this loose quenching coupling a much lower grid leak resistance is necessary to prevent loud squawking as the reaction is increased. Roughly 0.5 megohms is about right instead of the more usual 2 megohms for B.B.C. reception.

(3) Quenching frequency can be considerably raised without cutting down amplification, as is in accordance with theory.

(4) It was almost impossible to heterodyne strong C.W., as an effect similar to "frequency-locking" occurred unless the set was considerably detuned. This is, of course, ideal for telephony reception, as great stability is obtained, and the effect on 200 metres seems to take place with much weaker signals than on the broadcast band. Of course tonic train or "raw A.C." simply roared in.

These points having been duly digested and appreciated, the writer carried on with the good work and logged quite a number of British and Continental amateurs.

While experimenting with the set as an ordinary "straight" circuit, American **2 CXL** and **1 XM** were picked up when a gas-pipe aerial was used, no other aerial or earth connection being employed.

A few nights later, on resuming the frame and super-regeneration, an American broadcast station was heard, later turning out to be **KDKA**. Reception was poor, being badly mushed up by X's, spark jamming and the Armstrong roar.

Every alternate night for about a week **KDKA** and/or **WGY** were heard, but on the whole the transmissions were not a pleasure to listen to, as the utmost amplification had to be employed, which brought in spark jamming and X's too much. On one occasion, however, an organ solo from **WGY** was exceedingly clear until **QSS** started in. Since that wonderful week, American broadcasting has not been heard sufficiently well to deserve mention, so work was resumed on 200 metres.

Many British and Continental stations were read, the signals sometimes being at "phones-on-table" strength, and the first American amateur to be logged on this occasion was **2 DEY**, at just readable strength. A few minutes later **9 MC** came through at about the same strength.

About this time a short-wave buzzer wavemeter was made and calibrated, so that accurate measurements were possible, and a proper log was kept.

7 QF (Copenhagen) was heard one night, and it later transpired that he was only using five or six watts.

The next alteration was the substitution of a peanut Wecovalve and 30-volt H.T. for the Ora and 60-70-volt H.T. Hardly any difference in signal strength was noticed. This valve has been used ever since, and has made the set still more portable owing to reduced battery weight.

The next Americans to be read were **2 CPD** and **2 BY** on successive evenings, strength being just readable.

No more were heard for about three weeks, until **1 CMP** and **2 BQM** were heard at easily readable strength.

A still smaller frame aerial was then utilised—size 10 ins. by 8 ins.—wound in the box lid to make the set entirely self-contained, and the writer was surprised still to get excellent signals from many stations. As the Americans were not expected it was the more astonishing to hear **2 CPD** at just readable strength, followed the next night by **2 XAR** at easily readable strength. During reception of **2 CPD**, X's were extremely bad, and reaction at oscillating point brought them in so badly that they drowned any beat note. The signals were read, therefore, as a C.W. "hiss" off the oscillating point.

Except for several more British and Continental stations, no other Americans have been heard.

These experiments have been an extremely interesting experience from a technical point of view, but for really realiable, serious DX reception, the writer would not choose the Armstrong super circuit, for the following reasons. Atmospherics seem to be amplified to an extraordinary degree, even on the little 10 in. by 8 in. frame. The familiar "roar" makes the reading of very weak signals difficult. The fact of C.W. coming in as a bunch of notes causes much jamming owing to the overlapping of these bunches, but, of course, against this may be set the advantage of simplicity in tuning, no critical condenser setting being needed.

Jamming from harmonics of longer wave commercial stations (especially 600 and 300 metre traffic) caused much trouble. It may be interesting to note that **POZ**'s spark time signal has often been taken on a harmonic of about 150 metres.

A peculiar thing about the reception of the American stations is that it was all obtained between midnight and 1 a.m. Apart from some of the British stations, no sound has been heard at 3 a.m. on several occasions when the writer has listened.

The total "bag" for the winter season was about 143 stations, including 7 American amateurs and 2 broadcasters.

Next winter it is hoped to be able to make up a special Armstrong super for wavelengths down to about 80 or 90 metres, and it will be interesting to see what results are obtained here in view of the increased difficulty of the circuit on the shorter wavelengths.

DX ON A FIELD DAY.

In connection with the successful field day held on August 9th by the Golders Green, Hendon, Hounslow and Hampstead and St. Pancras Societies, acknowledgment should have been made to the Accumulator Maintenance Co. for the kind loan of the Ford van which housed the mobile transmitter, **2 DZ**. It is also interesting to note that both **2 DZ** and **2 AH** (Hounslow) were worked entirely by H.T. hand generators kindly lent by Messrs. Evershed & Vignolles.

The call sign **2 JB** employed by the control station was used with the permission of Mr. John C. Bird, B.Sc., owner and operator of the station allotted this sign. **2 JB** is normally situated at 72 Dyne Road, Brondesbury, N.W.6, at which address reports of reception are always welcome.

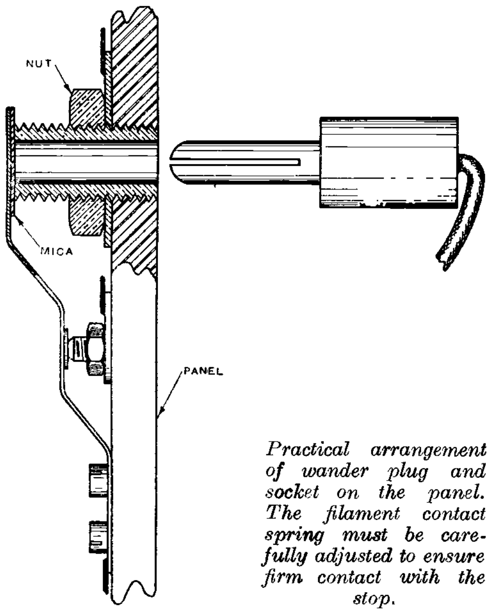
READERS' PRACTICAL IDEAS.

This section is devoted to the publication of ideas submitted by readers and includes many devices which the experimenter will welcome.

Switching L.F. Valves.

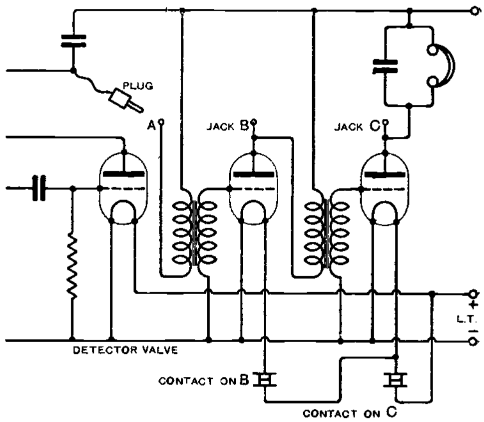
Low frequency amplifying valves are usually switched in and out of circuit either by means of a change-over switch or a telephone jack.

A much better arrangement and one that looks very well on an instrument panel can easily be made up from an ordinary plug and socket connector.



Practical arrangement of wander plug and socket on the panel. The filament contact spring must be carefully adjusted to ensure firm contact with the stop.

The socket passes through the panel, and in the type shown in the accompanying figure, is locked up in position by means of a nut. Behind this socket is a piece of springy brass which rests in contact with a small stop threaded into the back of the panel. The tip of the spring is insulated by securing to its face with shellac a thin piece of mica. Alternatively it may be wrapped with empire cloth fastened by tying with cotton, and it will be seen that when the plug is inserted in the socket, not only will contact be picked up but the spring behind the socket will be forced away from the small fixed contact. Using this device and connecting it up in the circuit shown, it is very effective for varying the number of low frequency amplifiers in operation.



Connections of switching device for two stages of L.F. amplification.

F. E. W.

Restoring Scrap Panels.

When an ebonite panel has been used in the construction of an instrument which may have subsequently been dismantled, it is usual for this panel to be used for other purposes. Attempts are often made, however, to fill in the holes by carefully inserting pieces of ebonite rod, but this is rather a tricky and laborious task.

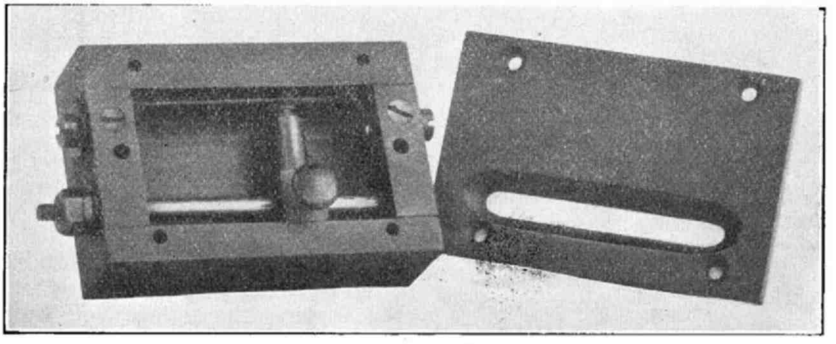
A useful method of restoring the panel to a serviceable condition consists of filling the holes with material known as "heelball." This can be purchased quite cheaply in the form of a cake from the local cobbler and is a black waxy substance, having good insulating properties. The wax can be melted and allowed to drip into the holes and the surplus removed with a sharp knife or chisel. A panel thus treated will be found to rub down and possess quite a good uniform surface, though care must be taken when drilling not to break into any previously existing holes.

F. E. P.

A Simple Potentiometer.

THE illustration, which is nearly full size, shows a simple, cheap and effective design for a potentiometer which can very easily be constructed from a piece of graphite. The graphite can be obtained by slitting up a good quality pencil of a fairly hard grade, say H.H., a length being cut off to fit the inside of the box, care being taken to ensure it fitting tightly, thus allowing the slider to run freely. Connections should be taken from both ends of the graphite to a suitable battery for a potentiometer. The easiest method of making connection to the graphite rod is by tightly binding a few turns of wire round the ends and then soldering to the screws which project through the box. To aid stability, it is advisable to coat the inside of the box under the graphite rod with thick shellac varnish, care being taken to keep the shellac from the contact surface of the graphite. The sliding contact, a miniature reproduction of the familiar slider used on tuning coils, except the body, which is drilled to take a small plunger and spring which rubs on the guide rod, is brass. Contact is picked up with the slide from either end of the guide rod. A small ebonite knob is then fitted; this is done by tapping a small hole in the slider and securing by means of a screw. The instrument is shown here complete in itself ready for baseboard mounting, but by removing the lid and slotting the panel, it can be easily mounted on the underside, only two screws being necessary for securing. Various values of resistance can be made by substituting different grades of graphite.

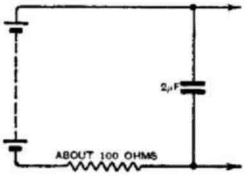
L. H.



A potentiometer utilising a length of pencil graphite for the resistance element.

Protecting the H.T. Battery.

A BRIEF short circuit on a dry cell H.T. battery is usually sufficient to ruin it and another mishap that must be guarded against is the danger of applying the H.T. battery potential across the filament of a valve which, of course, will destroy its filament. These dangers can be easily overcome by feeding the H.T. battery output through a safety resistance and connecting a large reservoir condenser across the input terminals of the receiving instrument. A large capacity condenser nullifies the effect of the resistance of the H.T. battery and its series resistance,



Method of connecting safety resistance to protect H.T. battery.

whilst the insertion of the resistance in the lead limits the maximum current output from the H.T. battery, entirely preventing the danger of burning out a valve by accidentally connecting it to the H.T. supply or destroying the battery by an accidental short circuit in the H.T. battery leads.

A. H. H.

VALVE TESTS.

THE ELECTRON COMPANY'S "SIX SIXTY" VALVE.

THERE must be, at the present time, quite a hundred or more valves of various types and makes at the disposal of the experimenter, and almost every month this already long list is constantly added to. Each one has its own particular points of recommendation, but even so, the choice of a valve for any given purpose is fast becoming a difficult problem.

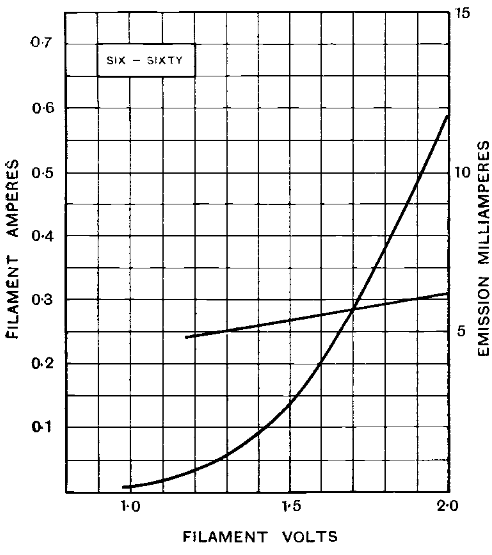


Fig. 1.

What a change from the conditions of, say, a couple of years ago! We then had but two or three types at our disposal, and consequently it was an easy matter to decide which would be the most useful for the purpose in mind.

The most recent production submitted to us for test is the "Six Sixty," manufactured by the Electron Company, Limited, of Acton Lane, London, N.W. The "Six Sixty" is a neat little valve of the dull emitting type, the electrodes of which are mounted vertically and are enclosed in a tubular bulb, the external connections being made to the usual four pins.

The filament is rated at 1·8 to 2 volts, and the characteristics of the tested sample are given in Fig. 1. Quite a liberal emission is obtained with a filament voltage of 1·8, the heating current at this potential being 0·29 ampere. As a matter of fact, the curves in question suggest that when the valve is used as a high frequency amplifier or detector it will operate satisfactorily on an even lower filament potential.

The usual plate current characteristics are given in Fig. 2, (these were taken with a filament potential of 1·8). That at 80 volts shows a comparatively long straight portion to the left of the zero grid volts line, thus predicting, with suitable grid bias, good low frequency amplification. The plate rating is given as 30 to 60 volts, but we found the use of 80 to cause no serious trouble.

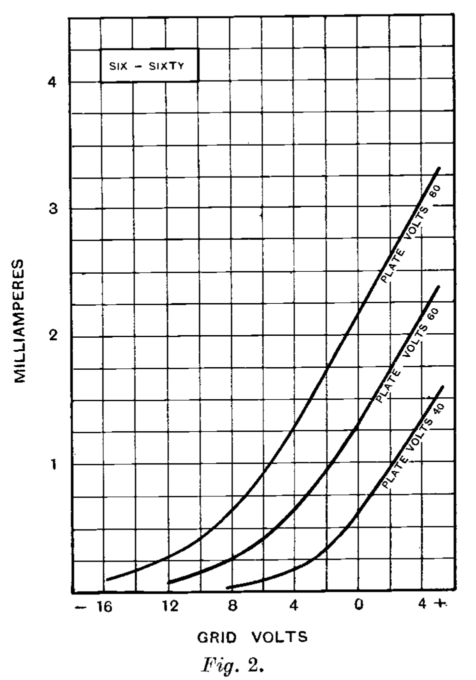


Fig. 2.

The valve has a magnification factor of about 5, and an impedance of from 35,000 to 20,000 ohms according to the plate potential used ; see Fig. 3.

CIRCUIT TEST.

As a detector 40 volts H.T. gave the best results, the grid return lead being connected to the positive of the low tension supply. As predicted by the curves of Fig. 1, we found the filament current could be quite appreciably reduced without any reduction in signal strength. For H.F. work the same order of H.T. gave optimum signals, but both as a detector and H.F. amplifier the signal strength was rather below that given by our standard arrangement.

The best results were obtained when using the "Six Sixty" as a low frequency amplifier, for although it cannot be classed as a power amplifier, its low frequency performance is excellent. Using a plate potential of 80 and a negative grid bias of 3, clear loud distortionless reception was obtained.

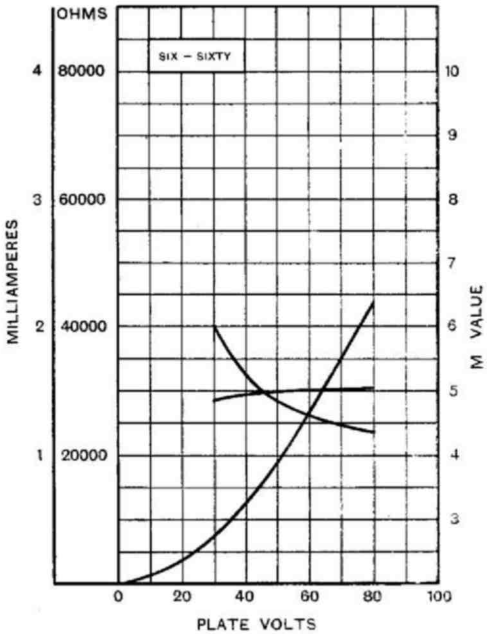
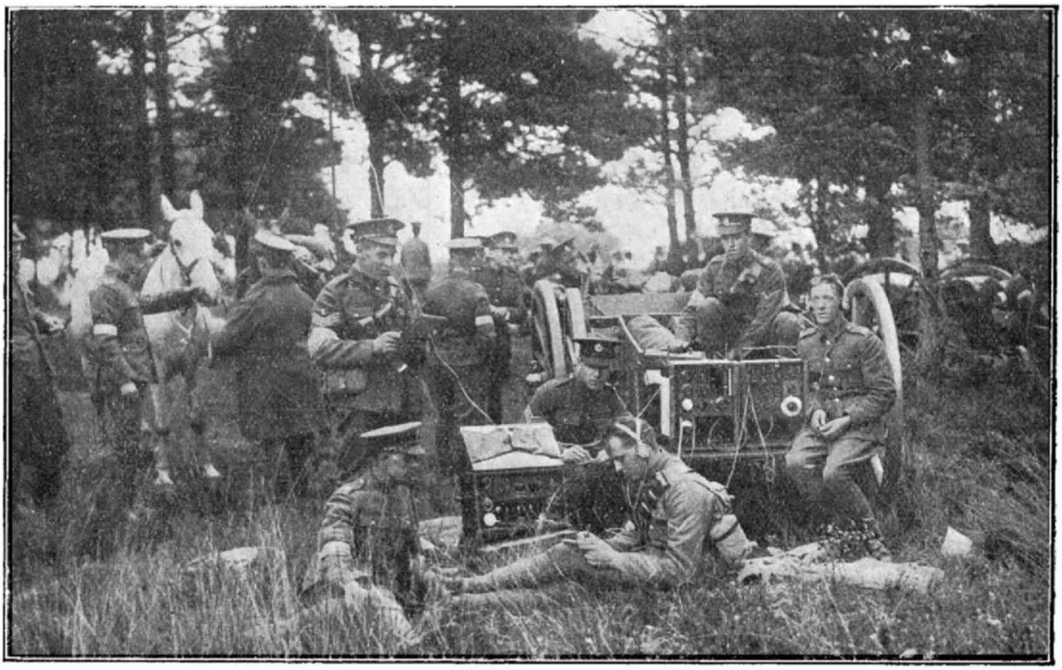


Fig. 3.

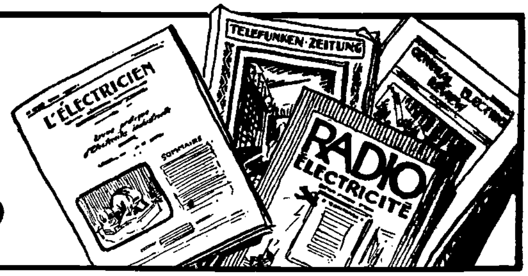
WIRELESS IN THE ARMY.



Photopress.

An army mobile transmitting and receiving equipment in operation during the recent manœuvres.

PATENTS AND ABSTRACTS



A Tuning Component which provides a Quick and a Slow Movement.

There are many occasions when, to get the desired results, it is essential to employ fine tuning adjustments. Instruments have therefore been designed which will permit of a delicate adjustment being made. One example of this is to be seen in the construction which employs gear wheels, a large gear wheel being secured to the shaft of the tuning condenser or variometer which also carries the knob for coarse adjustments, while a small gear wheel engages with the large one and is turned by a second knob, usually termed the fine adjustment knob.

This patent* describes a device which has but one knob and yet permits a coarse and fine tuning adjustment to be made. The arrangement is sketched in Fig. 1, where A is a side view, B a section and C a detail drawing of the chuck.

*British Patent, No. 197911, by W. H. Huth.

The unit comprises a bracket 1 containing a hole 4 and a stud 5. A gear wheel 6, having a rigid pinion 7, is mounted to rotate on stud 5 and the gear wheel 8 which engages with the pinion 7 is fixed on the chuck 9. The body of this chuck rotates in the hole 4 and the stem carries a pinion 13. Pins 14 on the pinion are arranged to engage in holes 15 to rotate the chuck 9 by direct connection with the knob, it being observed that at such time the pinion 13 does not engage the gear wheel 6. The shaft 18 may be that of a variable condenser or variometer and is secured to the chuck by a set screw.

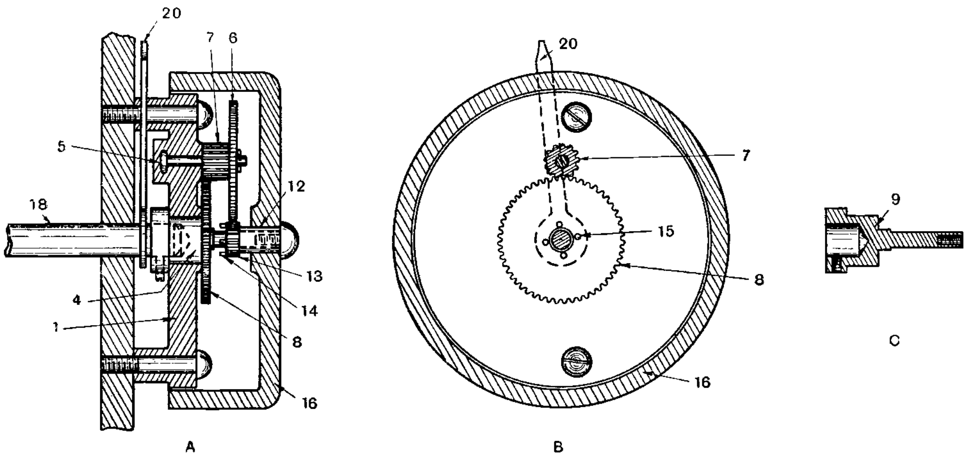


Fig. 1. The construction of a tuning device which provides a quick and a slow movement.

As the sketches show, the instrument is placed behind the panel and the adjusting unit above the panel.

It will be seen that a pointer 20 is secured to the shaft and moves just above the surface of the panel which may be engraved in the usual manner.

By turning the knob when it is in the

position indicated in the sketch, the shaft 18 is tuned very slowly because the turning movement is applied to the shaft through the gears 13—6, 7—8. When the knob is pressed towards the panel the chuck moves forward, gear wheels 13—6 are disengaged and the shaft is turned direct by the pins 14 engaging the holes 15.

A Method of Employing Electric Lighting Wires as an Aerial and as the Source of Power for the Anode and Filament Circuits.

According to this invention the power for the anode and filament circuits is taken from the electric lighting system, thereby dispensing with batteries, and the lighting system is employed as an aerial.

Referring to this figure, 1, 2 represent the electric lighting wires and 5 a valve detector. An aerial is formed by making connections 7, 8, through condensers 9, 10, and the aerial is tuned by condenser 11 and inductance 12; 13 is the usual reaction coil.

The power supply to the anode and filament circuits of the detector valve is obtained by making connections 14, 15, from the lighting wires to a potentiometer 16, 17, which enables the required voltages to be obtained. The connections to the potentiometer contain a smoothing arrangement which may consist of two chokes 18, and a condenser 19. High frequency chokes are inserted at the points marked by a star to prevent the flow of high frequency currents in this circuit and

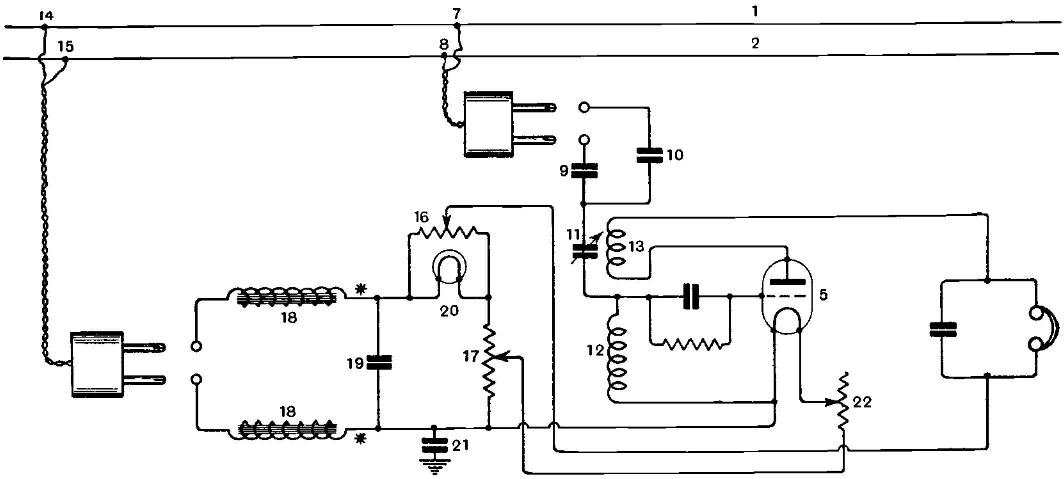


Fig. 2. Arrangement of a receiver which uses the electric lighting wires as the source of power for the anode and filament, and as an aerial.

One of the chief difficulties met with is to provide a means which will eliminate disturbing noises due to fluctuation of the voltage of the supply. This variation of voltage may be due to various causes, such as generator noises, inductive effects from other circuits, running motors and, if the supply is alternating current, to the alternating voltages.

The connections of a system arranged for working with a direct current electric lighting system* are given in Fig. 2.

thus to prevent the aerial connections being short circuited. It will be seen that the condenser 21 is connected to earth and forms the earth connection of the receiver, being also connected to the filament of the valve. The other side of the filament is connected to a point on the potentiometer 17 and the anode supply is tapped off the potentiometer 16. The potentiometer 16 is shunted by a lamp 20 to reduce the current passing through it. When more than one valve is employed it is advisable to connect the filament in series to reduce the current taken from the electric lighting supply. W.J.

* British Patent, No. 215455, by J. Robinson and W. H. Derriman.

CORRESPONDENCE.

A Lost Opportunity.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I have been a regular reader of your paper for a good many years, but I must protest against your most unwarranted attack upon the British Broadcasting Company in your Editorial in this week's number.

Surely this tireless body is entitled to its holiday too, and it would not have been unreasonable if it had curtailed its programme even more than merely to omit the hour in the afternoon of Bank Holiday. Particularly as the evening programme must have involved considerable preparation and forethought, as well as requiring an unusually large number of performers.

On the other hand, I venture to suggest that, in the industrial centres at any rate, less than 10 per cent. of regular "listeners" were at home on that day, and an even less proportion in the afternoon. All the B.B.C. stations (with the exception of Chelmsford, which does not transmit in the afternoon) are in the centre of large towns, which are largely vacated on Bank Holiday even by the humblest users of crystal sets; while the portable set cannot yet be regarded as a serious competitor of the gramophone.

Among a large circle of friends and acquaintances here and in Leicester, I have received the impression that the majority felt they had something better to do than to "listen to wireless" on Bank Holiday; so that I consider that it is to the credit of the B.B.C. that they catered for the minority.

I am a member of a profession whose briefest holidays are all too frequently the subject of criticism, and I can thoroughly sympathise with the B.B.C.

I am forwarding a copy of this letter to the British Broadcasting Company.

F. S. POOLE, M.R.C.S., L.R.C.P.

Leicester, *August* 14th, 1924.

Transmitting Licences.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—As an experimenter of three years' standing, and as a holder of a first class P.M.G. licence, I heartily agree with "Birmingham" in his letter in your issue of July 30th. I am not writing this letter merely because I applied for a transmitting licence and was refused one. How many amateur transmitters of the present day experiment with their apparatus? Nine out of ten build up a set, employing some well-known circuit or other, and leave it at that. Nor do they seem very keen on receiving reports, for in a complete transmission we generally hear the call-sign once; that is, when they begin, and at the end a curt "over." This lack of enthusiasm seems to be confined to the telephony transmitters; the spark and C.W. experimenters are really worth listening to. I suggest that applicants for transmitting licences should sit for an examination, not merely in the Morse code but in theory, etc., and also be requested to keep a log of experiments and results for inspection. I do not wonder at the fact that illegal transmissions take place, for it appears that the most deserving applications are turned down. I know several qualified operators whose applications, like mine, have recently been turned down. If a permit cannot be granted to a person who has satisfied the P.M.G. that he is competent to handle wireless transmitting apparatus, then I do not think an amateur who can receive and send Morse code at 12 words per minute should be granted permission to transmit.

"NEWCASTLE."

Newcastle-on-Tyne.

Crystal Reception.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—The articles on the above subject have given me great pleasure for some weeks now.

I cannot agree with Mr. Strachan's ideas of the catwhisker—"massive" (p. 426), "about 26 S.W.G." (p. 463). I find a very fine spiral type, sold as a "kitten whisker" to be best, and the next best, a thin strip cut from copper foil, but the latter is very easily damaged. A very light contact allows one to listen to a distant station, while a firmer contact brings in nearer stations which are not wanted, although only the distant station is tuned.

Chelmsford (5 XX) is quite clear on a good crystal set, although 400 miles distant, while both Paris and Nauen time signals are obtained daily in Edinburgh.

As regards tuning the aerial and detector circuits, I get different results from those of Mr. Colebrook (p. 477). I find that the detector circuit, to get best results, wants from 20 per cent. to 30 per cent. more turns than the aerial circuit. This holds true whether the wavelength is 300 or 3,000 metres.

The inductances of the aerial and detector circuits, although both are on the same coil, appear to be similar to those required for aerial and detector when arranged as primary and secondary, and loose coupled. When using an old coil with two sliding contacts, I noticed that the noise caused by moving the detector slider was a maximum when detector inductance was about 20 per cent. less than aerial inductance. I therefore think this may be the position for maximum current, though the maximum signal position is as mentioned above.

ALEXANDER STEUART.

Edinburgh.

NOTES & CLUB NEWS

Official permission has been given for the Chelmsford broadcasting station to remain in action pending the Government decision on high power broadcasting.

* * *

Senatore Marconi, at present conducting experiments on his yacht, refused to listen-in for communications from Mars, believing that the planet is uninhabitable.

* * *

The Belfast broadcasting station, which will commence transmitting in September 15th, will be connected by sea cable to the English stations

* * *

"The less said about them (wireless pirates) the better, but I should think there are at least as many pirates as licensed listeners-in."—*An Official of the Liverpool Relay Station.*

* * *

New relay broadcasting stations are to be opened at Nottingham on September, at Stoke-on-Trent in October, Dundee in November, and Swansea in December.

* * *

There are about eight listeners-in in Madeira. Two amateurs broadcast programmes privately.

* * *

MESSAGE FROM MARS ?

How many amateurs, asks Mr. E. J. Martin, of Cobham, Surrey, listening-in on the night of Saturday, August 23rd, at 8.45, heard the following message :—

CQ = ICI MARS = CQ = ICI PLANETE MARS = ICI PLANETE MARS = CQ DE PLANETE MARS = ICI PLANETE MARS = QRK = CQ DE PLANETE MARS.

Our correspondent adds that the signal strength was R 4, using a detector and L.F. valve. This speaks volumes for the power of the Martian transmitter !

The wavelength was approximately 140 metres.

WORKING WITH FINLAND.

Two-way communication with Finnish **1 NA**, Turku, is reported by Mr. R. W. H. Bloxam, (**5 LS**), of Blackheath.

A power input of 8 watts was employed, with a H.T. voltage of 300. The Finnish station reported reception at a strength of R.4.

AN IMPORTANT PROSECUTION.

The first prosecution in this country against a person transmitting without a licence took place at Berkhamsted, Herts., on Wednesday, August 27th.

Owing to complaints of interference in the district, the Post Office Authorities instituted a search, tracing the offence to Arthur Charles Hart, aged 20, an electrician's assistant.

Before the Hemel Hempsted magistrates Hart pleaded guilty, but without intentoin to defraud, to installing and working wireless apparatus without a licence. He was fined £2 for the offence and £2 for interfering with broadcast programmes.

In addressing the Magistrates, Mr. Gallaher, Solicitor for the G.P.O., said that the case would be noted not only by those who have rendered themselves liable to similar proceedings, but by the great mass of listeners-in throughout the country.

In fining Hart, the Chairman of the Magistrates said the conditions of licences must be kept and public rights and conveniences must not be interfered with. He hoped it would be a caution to others.

NO SETS IN CELLS.

A severe blow has been struck at the susceptibilities of convicts in the Eastern State Penitentiary, Philadelphia, through the banning of wireless sets in the cells. This step followed the discovery that messages were being received by the convicts from persons outside, planning to introduce drugs into the prison.

BROADCASTING IN JAPAN.

According to reports, the Tokio area is shortly to be served by a broadcasting service under the control of the Mitsui, Takata, and other interests. Under the title of the Metropolitan Broadcasting Company, the new organisation will be licensed by the Department of Officials, and will have a capital of 2,000,000 yen.

Subscribers to the service may either purchase or lease their receiving sets. The radius of the Company's efforts will be 100 miles only, it being the plan of the authorities to license other concerns for broadcasting in other areas through the country.

BEAM STATION FOR AUSTRALIA.

The projected construction of a beam station in Australia, to cost £120,000 and operating on a wavelength of 100 metres, was announced by Mr. Bruce in the House of Representatives at Melbourne on August 22nd. The Prime Minister, who was speaking on the second reading of the Wireless Agreement Bill, added that it was hoped that the transmission rates would be half those chargeable under the high power system.

EIFFEL TOWER SHORT WAVE TRANSMISSIONS.

In addition to the programme of short wave tests now being conducted from the Eiffel Tower, the station now transmits routine messages on 115 metres. These occur daily at 4 a.m., 2.20 p.m. and 11 p.m. (G.M.T.), and consist mainly of repetitions of the meteorological transmissions on high wavelengths from the "Maury" and "Le Verrier" observation points.

NEW TELEVISION INVENTION.

The invention of a device more sensitive than selenium to light, is claimed by Messrs. W. H. Stevenson and G. W. Walton, of the General Radio Company. Press reports state that the inventors claim that they have brought almost to perfection an instrument which will transmit photographs at the rate of 18 a second, maintaining persistence of vision as in modern kinematography.

We understand that the device, which is by no means simple in design, is covered by patents.

NEW SOUTH AFRICAN BROADCASTING STATION.

A broadcasting station is to be established near Durban in the near future, states a *Times* correspondent. This station, the second of its kind to be erected in South Africa, will be the first in the world to be municipally owned and operated. Under favourable conditions the transmissions should be heard on four-valve sets throughout the Union, while good reception should be possible on crystal sets within a radius of twenty miles.

TWO-WAY WORKING WITH SWEDEN.

On August 12th, states Mr. J. A. Partridge (**2 KF**), he succeeded in picking up several Swedish amateurs, and was able to work with **SMZP**, whose location is Marstrand, near Gothenburg. **2 KF** carried out several tests with the Swedish station, and was informed by the operator that there are now five Swedish stations licensed for experimental work, these being **SMZP, SMZS, SMZV, SMZY** and **SMZZ.** The first-named and the last two are working on short waves.

On the occasion referred to **SMZP** was using 10 watts, his aerial current being 0·45 amps. Although slight fading was perceptible the note of the station was good and fairly steady.

Mr. Partridge adds that his station has now exchanged signals with the following countries: America, Canada, Italy, France, Belgium, Switzerland, Holland, Denmark, Finland, Sweden and Germany.

AN OBJECTION TO WIRELESS.

A strange objection to wireless has been put forward by the skipper of a Fleetwood trawler, who has emphatically refused to go to sea with wireless apparatus.

His contention is that the equipment of wireless entails his reporting to the owners twice daily how his fishing is progressing. The owners then transmit instructions for him to proceed to other fishing grounds, and invariably he has discovered on carrying out these orders that the fish have migrated.

PIRATES IN FRANCE.

Amateur transmitting "pirates" are now rampant in France, according to our Paris correspondent. Between 10 p.m. and 1 a.m. the ether is filled with all kinds of amateur signals on varying wavelengths, employing the most fantastic call signs.

This chaotic state of affairs is attributable to the long delay necessitated in France before authority for amateur transmission can be obtained.

Photopress.

Children of the London Foundling School, who recently spent a holiday in Oxfordshire, derived much pleasure from listening-in.

N.P.L. ANNUAL REPORT.

As might be expected, radio has a place in the Annual Report of the National Physical Laboratory, just issued by H.M. Stationery Office.

The improvements effected in the methods of measurement of radio frequency and wavelength are of considerable interest and importance. The multi-vibrator wavemeter as now employed for frequency measurements enables an accuracy within a few parts in 100,000 to be obtained and provides a standard of high precision and wide application.

Assistance has been given in the provision of a wavemeter for the use of the radio-telegraph branch of the Canadian Department of Marine and Fisheries, and at the request of the Australian Government the Laboratory has undertaken to advise in the construction of a multi-vibrator wavemeter set similar to that installed in the Laboratory for the use of Amalgamated Wireless (Australasia), Limited.

AMATEUR TRANSATLANTIC TELEPHONY ATTEMPT.

M. Ateliers Lemouzy (**F 8ÉK**) of Paris, to whom we referred last week, is attempting to transmit by telephony to America on September 6th and 7th with a power of 50 watts. **8 ÉK** works on between 70 and 100 metres every Wednesday from 8 p.m. to midnight, using both telephony and morse.

BROADCAST ANNOUNCEMENTS IN TWO LANGUAGES.

A plea for the use of two or more languages in making announcements from the B.B.C. stations is put forward by a South London correspondent. In support of the suggestion he states that during the last few days he has picked up some half-dozen new Continental broadcasting stations, but to his great annoyance, has been unable to identify them owing to unfamiliarity with the languages used. He presumes that continental listeners must be in the same predicament in regard to the British stations.

Our correspondent is, perhaps, inclined to overlook the extra time and cost involved in such a proposal. Moreover, it should not be forgotten that broadcasting stations exist primarily for the delectation of the licence holders in the countries in which they are situated.

NEW RADIO CONTROL SYSTEM.

Considerable attention is being given in the Italian press to experiments conducted at Spezia in controlling a vessel by means of a wireless system invented by Signor Fiamma. The inventor is reported to have manœuvred a 12-ton motor boat at distances varying from 1 to 10 kilometres, the controlling apparatus being situated on board a destroyer.

Signor Fiamma claims that his system is immune from the effects of atmospherics or jamming.

WIRELESS AND SALVAGE.

No book of fiction could contain half the thrills to be found in "The Wonders of Salvage," by David Masters, which has just made its appearance.*

Probably to the wireless amateur the most absorbing story in the book is that describing the rescue of the American submarine S5 by a transport ship, working in conjunction with an American wireless amateur.

Owing to a desperate mishap, the submarine was unable to come to the surface, but hung perpendicularly, in the open Atlantic, with just the end of the stern showing above water. Fortunately, the vessel was provided with a portable telephone which could be floated on a buoy. For twenty-four hours the submarine remained in its precarious position and no answering signal greeted the constant ringing of the telephone bell.

When the supply of air to the imprisoned sailors was well nigh exhausted, a man on board the American transport ship, *General Goethals*, sailing down to Panama, was astonished to hear a telephone bell in the open sea.

Space does not permit of telling the story in the author's graphic words. Suffice it to say that the submarine crew was communicated with, a small hole was punched with great difficulty in the stern of the submerged vessel, and air was pumped in. But the transport ship was quite unable to raise the S5. Wireless messages for help were sent out, but no ship was within call.

The call *was* heard, however, by an American schoolboy named Moore, who promptly passed on the message on his own transmitter. The nearest naval depot picked it up and destroyers with special plant aboard were able to hurry to the rescue. The submarine crew was saved, after an imprisonment lasting forty hours.

A NEW RADIO GAME.

"Hare and Hounds," played with wireless, is the latest sport, instituted by a Swiss radio paper. A boat containing a small transmission set puts out after dark on one of the lakes. Twenty minutes afterwards the "Hounds," *i.e.*, boats equipped with single valve receivers, set out in chase, the prize being awarded to the first discovering the transmitting boat.

REPORTS WANTED.

Captain A. E. Anson (**2 OA**), of Morton Cottage, Port Seton, E. Lothian, would welcome reports on his transmissions, which take place on 125 metres. Hours of transmission are :—Sundays, 7 p.m. to 8 p.m. (B.S.T.) ; weekdays, 10 to 10.30 p.m.

TROUBLE WITH AMATEUR CALL SIGNS.

Mr. Dudley F. Owen (**2 AY** and **2 BC**), of Sale, near Manchester, would welcome information regarding transmissions from any station giving either of the above call signs. Both stations (the former is portable) have been inoperative for nine months, but reports have reached him recently recording tests from **2 BC** on short wavelengths.

Captain N. G. Baguley, of Newark, advises us that his call sign has been altered from **5 GL** to **2 NB**. The latter call sign was originally allotted to a station in Cheshire, now closed down, and Capt. Baguley believes that several QSL cards have been sent to that address in error.

WIRELESS IN POLYTECHNIC COURSE.

Radiotelegraphy is included in the Engineering Course of the Northampton Polytechnic Institute, St. John Street, London, E.C. the prospectus of which has been issued for 1924-1925.

"CLARITONE" PRODUCTS.

We have been asked by the Ashley Wireless Telephone Co., to whom a reference was made in a recent note, to make it clear that the well-known "Claritone" products mentioned therein are manufactured by the Automatic Telephone Manufacturing Co., Ltd.

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* "The Wonders of Salvage," by David Masters. London: John Lane, The Bodley Head, Ltd. Price, 8s. 6d. net.

THE "DUANODE" CONDENSER.

It has come to the knowledge of the Fallon Condenser Mfg. Co., Ltd., that certain dealers are offering for sale a twin condenser not manufactured by the company, described as the "Duanode." The word "Duanode" is the registered trade mark of the Fallon Co. Purchasers of "Duanode" condensers are, therefore, recommended to ensure that the name Fallon appears thereon.

Club Activities

BY kind permission of the Air Ministry, members of the West London Wireless and Experimental Association will pay a visit on Saturday, September 6th, to the Croydon Aerodrome, there to inspect the familiar Air Ministry station **GED.** The Association opens its session on the previous Thursday, September 4th, when Mr. W. T. Fair will lecture on "Aerial and Earth Arrangements."

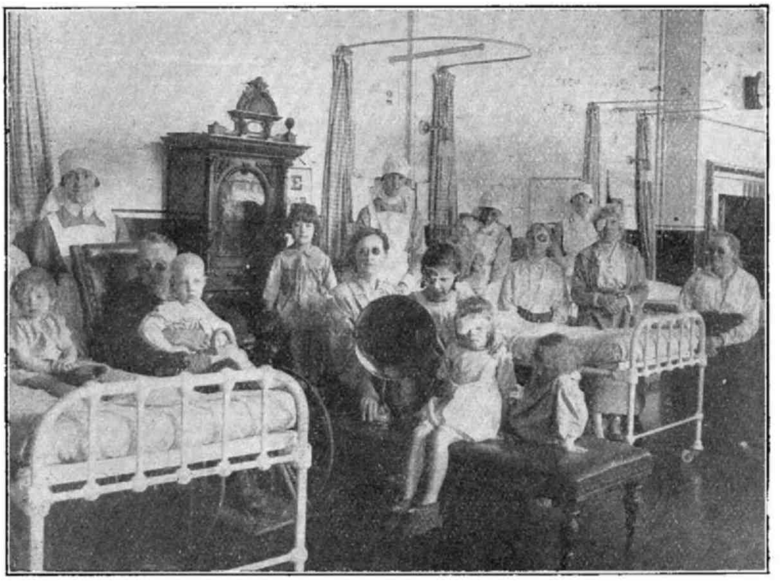
At the last meeting of the North Middlesex Wireless Club, Mr. Holton gave a lucid description of a method of measuring the capacity of an aerial, and also supplied a clear blackboard explanation of a method of determining the inductance of simple solenoid coils.

Crystal sets of the super excellent type were discussed before the Tottenham Wireless Society by Mr. Tracy on August 20th. Many valuable hints were given, and Mr. Tracy, who succeeds at Potters Bar in receiving Birmingham and Paris (Radiola) on a crystal, greatly stimulated interest in crystal reception.

TWO NEW SOCIETIES.

A Radio Association is being formed at Rugeley, Staffs. All interested are invited to communicate with the Hon. Secretary (*pro tem*), Leslie B. Adams, 31 Church Street, Rugeley.

Abertillery, Monmouthshire, is also forming a wireless association and those interested can obtain particulars from the Hon. Secretary, H. Pacy, 67A Alexandra Road, Abertillery.



Wireless has been introduced into St. Bartholomew's Hospital, London. A scene in the Ophthalmic Ward.

VALVES FOR READERS.

Somewhere in his apparatus almost every amateur experimenter has embodied an original device, an idea of his own, with the object of obtaining efficiency. Readers are invited to send in a description, and a sketch if necessary, of any such "gadget" or idea. To the readers whose suggestions are accepted for publication (see page 655) a receiving valve of standard make will be forwarded. Suggestions should be forwarded to the Editor of the *Wireless World and Radio Review* in envelopes marked "Ideas."

CATALOGUES, ETC., RECEIVED.

Peto & Radford (50 Grosvenor Gardens, Victoria, S.W.1.) Publication No. W. 100, dealing with "Gravity Float" Batteries.

Burndept, Ltd. (Aldine House, 13 Bedford Street, London, W.C.2.) An illustrated brochure describing the Burndept Auto-Broadcast System. Also leaflet dealing with valve and crystal receivers.

"*All about the Ethophone V*," a well illustrated description of the features of this popular instrument. Post free on request.

Sterling Telephone & Electric Co., Ltd. (210-212 Tottenham Court Road, London, W.1.) Abridged List of Sterling Radio Components. Publication No. 373 B. Illustrated leaflet describing the Sterling Four-Valve Cabinet Receiver, Publication No. 394. Also leaflet dealing with Sterling Radio Telephones, Publication No. 374 B.

The Carpax Co., Ltd., 312 Deansgate, Manchester· Leaflet, describing "Griptite" connector clips.

The D.P. Battery Co., Ltd., Bakewell, Derbyshire. Particulars of D.P. Batteries in operation at the British Empire Exhibition.

Ever-Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, N.7. Catalogue dealing with cells and batteries, 1924 and 1925.

The World's Messengers. An attractive brochure issued by the Western Electric Company, Limited (Connaught House, Aldwych, London, W.C.2), dealing pictorially and textually with the progress of communication and the Company's present-day activities.

"RADIO REACHING OUT FARTHER."

Continually we hear of the increasingly remarkable feats of radio transmission. There seemed to be a preconceived notion that short waves could reach only to correspondingly short distances, but such ideas are being discredited rapidly nowadays. It is becoming an every-day accomplishment for a few watts, radiated at a wavelength of a few hundred metres, to span thousands of miles of land and ocean. Of course, the transmission of these waves is no better to-day than it was a few years ago; the advance has come about in the better receiving sets which have been introduced in the short-wave receiving station.

We must always discount the statements of publicity and advertising managers because of their well-paid enthusiasm, but we are much startled to see in an English radio journal, "Get America every night." If we discount this claim 50 per cent. and think of the English boys getting America only every other night, we can realise what tremendous progress is taking place. It's only two years ago that this was accomplished for the first time by the best amateurs and apparatus America could afford!

It won't be many years before many of us consistently hear English programs, if they will run their stations sufficiently late at night for us. Incidentally there must be lots of sleep lost by the enthusiastic British listeners, who wait until about three o'clock in the morning to hear our speeches and jazz.

And not only in the British Isles are our stations being heard, and even used for modulation of local stations, but from far-off Cape Town, 8,000 miles from our eastern coast, we get reports of the reception of WEAF and WGY.—*From the "March of Radio," by J. H. Morecroft in* RADIO BROADCAST *for September.*

Calls Heard

Sidcup, Kent (Sunday, August 17th, 1924).
2 AFH, 2 JU, 2 KT, 2 LV, 2 OM, 2 NM, 2 PQ, 2 PX, 2 PY, 2 QS, 2 XAR 2 XD, 2 XO, 2 XP, 2 XR, 2 XV, 2 WY, 5 AC, 5 DT, 5 D[illegible], 5 MA, 5 OX, 5 PZ, 5 QV, 5 TR, 5 UO, 5 WN, 6 GH, 6 NF, 6 Q[illegible], 6 VX. Morse **7 FC.** (All on 150-190 metres.) (1—v—0.)
(Norman C. Smith.)

Norwich (August 1st to 6th).
British: **2 OA, 2 WJ, 5 OT, 5 SU.** American: **1 NA**(?), **3 CA.** French: **8 BA, 8 BN, 8 DU, 8 EX, 8 FS, 8 MN.** Dutch: **0 AB, 0 NM.** Unknown: **0 IE*.** (1—v—1.) (E. C. Bullard.)

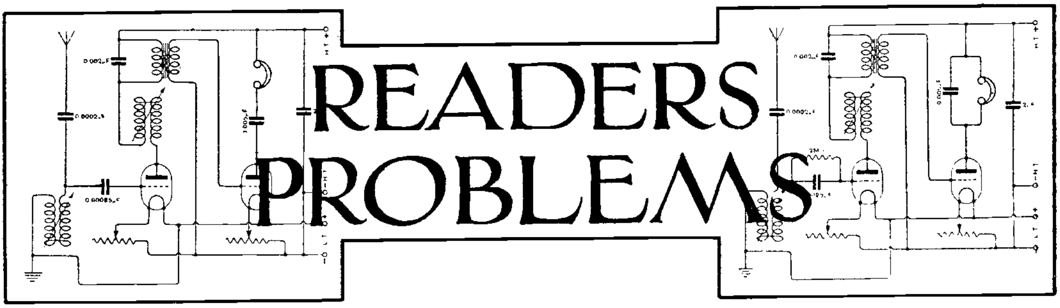
Sheffield (late June and during July).
Below 200 m. British: **2 DF, 2 FN, 2 FZ, 2 LH, 2 MC, 2 HF, 2 NA, 2 NM, 2 OD, 2 RY, 2 UV, 2 WJ, 2 XY.** Below 100 m.: **2 KF** working **2 LZ, 5 DT** working **2 XR** (all four telephony). Below 200 m., French: **8 AB, 8 AC, 8 BA** (80 metres), **8 DA** (45 metres R 9), **8 DP** (90 metres), **8 ÉM, 8 ÉU, 8 LK.** Above 200 metres: **8 AU, 8 CN, 8 CZ** (all 220 metres approx.). American: **2 XAA, 2 XAN, 3 XAR, 6 NKA**(?), **9 BM, 9 XBF** (all below 100 metres). Dutch: **0 AB, 0 BA, 0 HD, 0 NY** (100 metres and 60 metres), **0 MR.** Finnish: **F 1 NA, F 2 NM** (100 metres). Lapland: **L 0 AA** (working **1 NA**). Miscellaneous: **1 CF, 1 RER** (American ?), **9 AK** (American ?), **4 CZ, 1 AR, POZ** (90 metres). (1—v—1.) (Laurence Manning, **6 NK**).

London, S.W.11 (since July 20th).
All on C.W. below 180 metres: **2 CA, 2 CC, 2 ET, 2 JF, 2 JP, 2 KZ, 2 NM, 2 PY, 2 SX, 2 TI, 2 WJ, 2 XG, 2 XSS, 5 MA, 5 MO, 5 OX, 5 SZ, 6 AL, 6 EA, 6 GH, 6 HC, 6 NF, 6 TD.** Danish: **7 EC.** French: **8 AE 4, 8 CZ, 8 DP, 8 DX, 8 FS, 8 LM, 8 OK, 8 RR, 8 SM.** Dutch: **0 BT, 0 NN, 0 MR, 0 RK.** Luxembourg: **LOAL.**
(C. W. Picken.)

Great Shelford, Cambs. (August 9th-24th).
2 AS*, 2 XR*, 2 XY*, 2 NM, 2 DX, 2 YT, 2 SH, 2 KF, 2 JU, 2 FU, 5 SZ*, 5 MO*, 5 WI, 5 KG, 5 LF, 5 VN (or **5 UN** ?), **5 AS, 5 QV, 5 BH, 5 DY, 5 RW, 5 DT, 5 RB, 5 TG, 6 PJ*, 6 MJ*, 6 BO, 6 QO, 6 BT, 6 XX, 7 EX, 7 VG, 8 SM, 8 EN, 8 NX, 8 PA, 0 GC.** (* 1—v—2, remainder 0—v—1.) (G. A. Jeapes, **2 AUL**).

Southport, Lancs.
1 AL, 1 NA, 1 TT, 1 JW, 2 AA, 2 AAC, 2 AAT, 2 AAL, 2 ABW, 2 ADT, 2 AC, 2 ADP, 2 AFO, 2 AHT, 2 AJ, 2 ALO, 2 ALF, 2 AOI, 2 ARX, 2 ASF, 2 ASL, 2 AT, 2 ATI, 2 ATX, 2 AW, 2 CC, 2 DR, 2 DTT, 2 EL, 2 EW, 2 GG, 2 GO, 2 JW, 2 KF, 2 HT, 2 KO, 2 KQ, 2 KW, 2 KY, 2 MY, 2 NA, 2 NM, 2 PC, 2 TR, 2 UV, 2 VI, 2 UR, 2 SH, 2 OD, 2 WJ, 2 XG, 2 XY, 2 XM, 2 FFF, 2 FFU, 2 LS, 3 CA, 3 IA, 3 KM, 4 XE, 4 ZZ, 5 AH, 5 AA, 5 AO, 5 AY, 5 BA, 5 BG, 5 BH, 5 BT, 5 BV, 5 CC, 5 CM, 5 CU, 5 CW, 5 DH, 5 DS, 5 DV, 5 DN, 5 ID, 5 JX, 5 HB, 5 KC, 5 KO, 5 KZ, 5 LF, 5 LW, 5 MA, 5 MO, 5 NW, 5 ML, 5 NU, 5 OC, 5 OL, 5 OT, 5 OR, 5 PU, 5 RZ, 5 SI, 5 SZ, 5 SD, 5 SU, 5 UQ, 5 UG, 5 VN, 5 WI, 5 WU, 5 WM, 5 XM, 5 XY, 5 QM, 6 AN, 6 AH, 6 BY, 6 GM, 6 ID, 6 IG, 6 IL, 6 IQ, 6 IV, 6 KB, 6 KY, 6 LC, 6 LJ, 6 LY, 6 NF, 6 OM, 6 NK, 6 RW, 6 RY, 6 TA, 6 TD, 6 TM, 6 XY, 6 YB, 6 US, 7 EC, 7ZM, 8 AD, 8 AE 4, 8 AO, 8 AQ, 8 AR, 8 AU, 8 AY, 8 BN, 8 BP, 8 BU, 8 BV, 8 CN, 8 CK, 8 CT, 8 DA, 8 DO, 8 DP, 8 DU, 8 DY, 8 EA, 8 ED, 8 EK, 8 EM, 8 EN, 8 EO, 8 EU, 8 FS, 8 GG, 8 LM, 8 LO, 8 NN, 8 NU, 8 PP, 8 PA, 8 WV, 8 XC, 8 XY, 8 ZM, 8 ZY, 0 AA, 0 AB, 0 BA, 0 CN, 0 MR, 0 NN, 0 NY, 0 PCC, 0 QW, 0 ST, 0 US, 0 XF, 0 XP, 0 XQ, 0 XW, 0 XR, 0 XG, SMZS, SMZP. (One-valve Reinartz.) (O. B. Kellett.)

Address Required.
If Mr. Geoffrey W. Salt, of Bath (?) will forward his full address we shall be glad to insert his list of "Calls Heard."



Readers desiring to consult the "Wireless World" Information Dept. should make use of the coupon to be found in the advertisement section.

Switching a Three-Coil Tuner.

When a receiver is tuned by means of a three-coil holder, the switching from the "tune" to the "stand-by" position presents one or two difficulties. With the secondary circuit in use, it is better to couple the reaction to this coil rather than to the aerial coil; but if this is done there is some difficulty in coupling to the A.T.I. when the switch is in the "stand-by" position. The secondary coil must be removed, and even then it will not be possible to secure a very close coupling with the A.T.I. If instead of using a switch, terminals are provided so that the aerial and earth may be connected to the secondary circuit when required, the coupling difficulties are at once solved. The terminal method is perhaps not quite so convenient as a switch, but the removal of only two wires is not a very tedious matter.

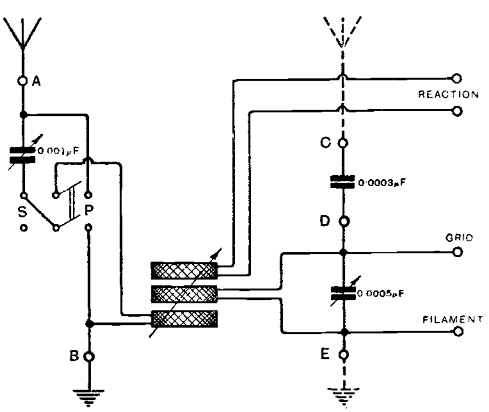


Fig. 1.

Referring to Fig. 1, it will be seen that the receiver will be inductively coupled to the aerial when the aerial and earth wires are connected to terminals A and B respectively. A directly coupled circuit will be provided when the earth is connected to terminal E and the aerial to either of the terminals C or D. On short wavelengths it will be found an advantage to connect the aerial to terminal C in order that the small fixed condenser may be connected in series with the aerial circuit.

The Metallic Deposit Inside Valves.

There is an idea prevalent among amateurs beginning the study of wireless that blackening or a silvery deposit on the walls of a valve may be taken as an indication that the valve has been in use for some time and is nearing the end of its useful life. This idea is, of course, quite erroneous and arises, no doubt, from the knowledge that ordinary metal and carbon filament electric lamps blacken in use. In receiving valves the deposit is produced during the process of exhaustion and is in no way related to the number of hours the valve has been in use in a receiver.

The high degree of vacuum necessary to ensure the proper operation of the thermionic valve cannot be attained by the usual methods, such as the mercury vapour pump or absorption by charcoal. Traces of gas are retained or occluded by the glass walls of the valve and by the electrodes. These last traces of gas are removed by the process of bombardment and by the use of chemicals technically known as "getters." The bombardment which is brought about by brightly heating the filament and applying a high anode voltage is responsible for blackening of the glass bulb and the silvery appearance is due. we understand, to the use of metallic magnesium as a "getter."

These deposits are in no way detrimental so long as they are confined to the sides of the bulb. It is only when the metal film extends to the surface between the leads passing through the glass pinch that trouble is likely to occur through leakage; but adequate precautions are taken during manufacture to prevent this taking place.

The Prevention of Self-Oscillation.

Self-oscillation in a receiver generally manifests itself as a shrill whistle or howling in the telephones. Before measures can be taken to stop the howling, it is necessary to ascertain whether the oscillation is in the H.F. or the L.F. valves. This point can be decided by observing whether the pitch of the oscillation is changed when the tuning condensers are adjusted. If no change takes place the trouble is probably located in the L.F. valves and may be cured by connecting a condenser of 2 to 4 μF between each + H.T. tapping and − H.T. If this measure does not immediately cure the trouble the primary windings of the transformers should be reversed one at a time, and resistances of the order of 0·5 to 1 megohms should be connected across the secondary windings.

Self-oscillation of the H.F. portions of the circuit may be due to stray magnetic or electrostatic coupling between the tuned H.F. circuits. In this case it will be necessary to change the relative position of the components and wiring and to introduce damping either by resistances in the tuned circuits or by the use of a potentiometer to give the valves a slight positive grid bias.

to our notice in the case of a tuner designed for long and short wavelengths. The short-wave coils were of the cylindrical type, and the long-wave coils of the plug-in type, and change-over switches were provided to disconnect entirely the coils not in use. When using the short-wave coils it was found that the set would not oscillate at certain well-defined wavelengths. Various remedies were tried without result, until it was found that the trouble disappeared when the long-wave coils were removed from their holders and placed at some distance from the set. Subsequent investigations revealed the fact that the wavelengths at which oscillation in the receiver ceased were harmonics of the natural wavelength of the long-wave coils.

No doubt many readers in reviewing their experience will be able to point to similar instances, and it is as well to bear in mind the possibility of interference of this kind taking place.

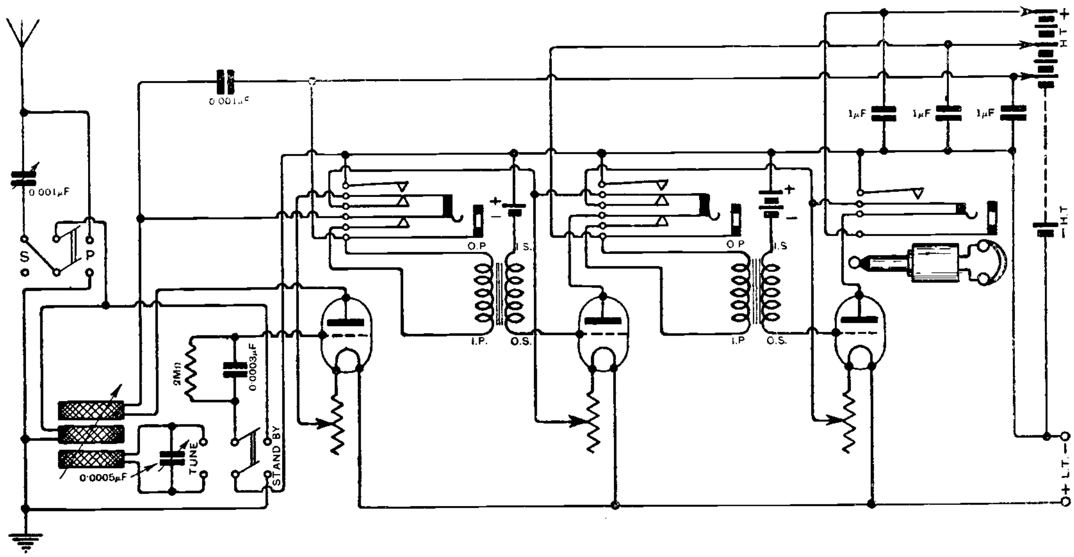


Fig. 2.

NATURAL WAVELENGTH OF TUNING COILS.

ALL tuning inductances possess self-capacity which is distributed between the turns in the coil. This capacity gives the coil a natural frequency of oscillation, so that the coil will absorb energy when placed in an oscillatory field of suitable frequency, even though no condenser is connected across the ends. In the case of air-spaced coils wound on skeleton formers the self-capacity is very low; on the other hand, tuning inductances of the plug-in type often possess considerable self-capacity and also a certain amount of resistance.

The practical consequence of this is that if a tuning coil is left on or near a receiver there is a possibility of interference with reception even though the coil may be entirely disconnected. An instance of this phenomenon has been brought

SWITCHING BY MEANS OF PLUGS AND JACKS.

IN the previous issue of this journal a method was described on page 639, showing how to switch L.F. amplifying valves without affecting the H.T. voltage applied to each valve. An alternative method which achieves the same object is illustrated in Fig. 2. The use of special telephone jacks will enable the filament current to the valves to be controlled at the same time that valves are switched in or out of circuit. When the telephone plug is removed from the receiver all the filaments will be automatically switched off.

The circuit is of a detector followed by two note magnifiers, and tuned by a loose-coupled circuit, with reaction to the closed circuit. A series-parallel switch is provided for the aerial tuning condenser.

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

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ASSISTANT EDITOR
F. H. HAYNES.

QUESTIONS AND ANSWERS DEPARTMENT:
Under the Supervision of W. JAMES.

CONTENTS.

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

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20s. per annum, post free. Single copies 4d. each or post free 5d. Registered at the G.P.O. for transmission by Magazine Post to Canada and Newfoundland.

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

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The WIRELESS WORLD AND RADIO REVIEW

RADIO TOPICS.

THE HIGH POWER SITE—CAPTAIN ECKERSLEY RE-ASSURES US.

THE site to be chosen for the permanent location of the 1,600 metre station, if this is sanctioned by the Post Office, is a matter which vitally concerns amateurs, particularly those who are located in the London area. It was on this account that we devoted an editorial paragraph to this subject in our issue of August 20th. At the time that comment was written rumours were current in wireless circles that a site had been selected in North London for the permanent erection of the station, and we had no reason to disbelieve the sources of our information.

In the following issue of *The Wireless World and Radio Review*, that of August 27th, we were pleased to have the opportunity of publishing, under "Correspondence," on page 626, a letter from the Secretary of the British Broadcasting Company, denying the rumour that a site had already been chosen, and assuring us that when the time came for the selection all the points raised in our comment would be taken into consideration.

We have now received a further letter, this time a personal one from Captain Eckersley, on the subject, in which he repeats the assurance that there was no foundation for the fears expressed in our editorial. Captain Eckersley points out that the B.B.C. never intended to erect the station in North London, and he refers us to a letter by him published in *The Times* towards the end of July. In that letter he stated that the site would probably be 30 to 40 miles from London. He explained that the present site at Chelmsford was an unsatisfactory one for the reason that so much of the energy of the station was wasted in transmission over sea. He said that it was imperative that the world's biggest Broadcasting Station should be fed from the capital of the Empire. The letter to *The Times,* also explained that it would not be possible to feed the station with a London programme by overhead lines if full reliability was to be maintained. Underground cables necessarily introduced distortion, and the maximum length of existing buried cable that would not give distortion was from 30 to 40 miles.

These two considerations, Captain Eckersley says, are sufficient to fix the location of the station at 30 to 40 miles from London in a North-West direction.

In concluding his letter Captain Eckersley points out that if the distance of 30 to 40 miles from London is maintained, then the objections which we have raised against any nearer location of the station do not apply, and, of course, we agree that under these circumstances the station would produce no greater interference with amateurs in London than in its present location at Chelmsford.

SOUND IN RELATION TO WIRELESS.

WE offer no apology to our readers for including in the *Wireless World and Radio Review* an article on the subject of sound in relation to wireless.

In this issue there appears the first portion of a contribution, which will be complete in three issues, by Professor E. Mallett, M.Sc., M.I.E.E., in which the author deals with the theory of sound and sound waves from the point of view which concerns those who are interested in the problem of the reproduction of sound by wireless.

We have on several occasions pointed out that in our opinion interest in any subject must increase very greatly as the student acquires a wider knowledge and understanding of scientific matters which are associated with the subject in which he interests himself in particular.

We realise that amongst readers of *The Wireless World and Radio Review* there are a good many who have not made a general study of scientific subjects, and who have now specialised in wireless. It is to these readers especially that this article should make an appeal, as it will present to them the problem of sound reproduction by wireless in a new light, and will do much to assist them in understanding the performance which is expected of efficient wireless transmitting and receiving apparatus.

THE RE-OPENING OF WIRELESS CLUBS.

AT the time of writing there are indications that activity amongst local wireless clubs has already started in preparation for the autumn and the winter months. There is no doubt that during the summer, outdoor recreations and various holiday occupations result in a certain amount of neglect of wireless, but now that the autumn is approaching, interest will be revived and we believe that wireless clubs are likely to be even more popular this winter than in past years.

We know, of course, that wireless clubs come and go, but failure of a club to maintain the interest of its members is nearly always due to internal circumstances rather than external influences. The greatest difficulty which club organisers have to contend with is in maintaining the enthusiasm of the members, but on the other hand many clubs have failed through over enthusiasm on the part of the organisers who have been so energetic as to do everything for the club themselves and leave the bulk of the membership as onlookers who have eventually tired of the monotony of a club run on what may be described as autocratic instead of democratic lines. Probably the failure of a number of clubs could be traced to too much formality in the conduct of the meetings.

A wireless club can be probably as much as 50 per cent. a social club and may benefit considerably by reducing the number of formal meetings with set lectures and encouraging meetings where free discussion amongst the membership can take place.

Another point which is sometimes overlooked by those responsible for the organisation of wireless clubs is the importance of a club library containing books on wireless and allied subjects available for loan to members.

Nothing will do more to increase enthusiasm amongst club members than their own efforts to add to their knowledge of wireless. It should be one of the aims of the officers of the club to encourage members to pay more attention to the study of theory, because by that means alone can an intelligent interest be taken in the operation of wireless apparatus.

WIRELESS IN POLITICS.

POLITICAL activity in America just now will result in a much wider use of wireless broadcasting than has ever been made in preparation for any other political campaign.

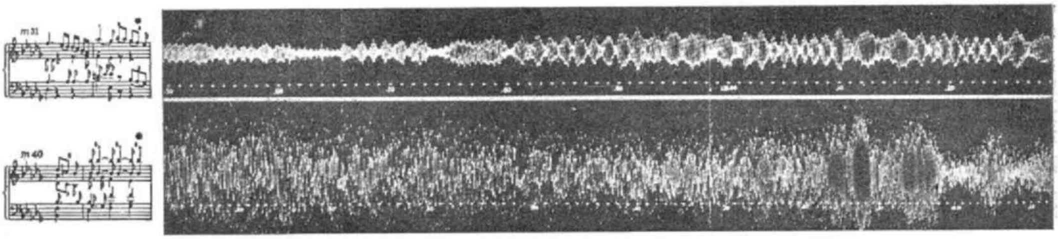
In America it is stated that wireless will be used by almost every politician as a means of giving expression to his opinions to the largest audiences which have ever listened to political speeches.

Up to the present broadcasting in this country has not found great favour with politicians, and certainly there are a good many objections to the employment of this method of canvassing for votes.

In the first place it is by no means an easy matter to judge of a man's capabilities as a statesman by his ability as an orator, and secondly, the extensive use of broadcasting in political campaigns might very well lead to the selection of representatives whose principal qualification was efficient speech making, and who might lack the more essential qualities which go to make competent units of government.

It is not surprising, therefore, that in this country broadcasting studios have not yet become political platforms, and taking into consideration the conditions under which the Broadcasting Company operates, and the fact that it is the only broadcasting concern in this country, it seems probable that older methods for conducting political campaigns will still be resorted to, and wireless will not be called in to assist in this direction.

The Editor.



The top line is a record of soprano and baritone voices singing the starred portion of the music; the bottom line shows the effect of six solo voices singing together.—From "The Science of Musical Sounds" (Macmillan Co.)

SOUND IN RELATION TO WIRELESS.

The problems met with in the reproduction of sound by wireless cannot be appreciated without a knowledge of the nature of sound waves. The following article provides information on this subject.

Prof. E. MALLETT, M.Sc., M.I.E.E.

1. SOUND A WAVE MOTION.

MANY readers will have a grasp of the essential characteristics of a wave motion; probably few have not read since broadcasting started that when a stone is thrown into a pond a wave or ripple travels outwards in a circle of ever increasing diameter, and ever decreasing size of wave. When the wave reaches the edge of the pond it may be reflected and start travelling back again. If the pond is circular and the stone is dropped in the centre, the reflected wave will be circular, of ever diminishing diameter and increasing size, until at the centre a large disturbance is again produced. This effect can be clearly seen in a teacup by simply allowing a drop to fall at the centre of the full teacup. If the drop falls to one side of the centre, a large disturbance due to the reflected wave occurs very shortly afterwards on the other side of the centre.

But a water wave of this sort is rather a complicated affair, and another illustration may be more helpful in arriving at an understanding of a sound wave.

Let us suppose that a small toy balloon which has been partially inflated, has been fitted with a tube, and that in the tube a piston can be moved up and down (Fig. 1). As the piston moves upwards very slowly the balloon will expand to the dotted line a a a and the air outside will be pushed away; as the piston moves downwards the balloon contracts to the line b b b, and the air outside

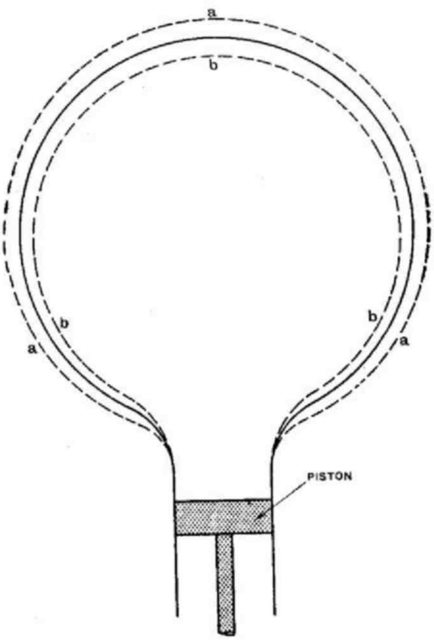


Fig. 1. Section of a toy balloon used in illustration of the production of sound waves.

moves inwards. During this very slow movement of the piston the air in the neighbourhood of the balloon is accordingly moving outwards and inwards; each air particle moves backwards and forwards along a line drawn from the particle to the centre of the balloon. If the movement were infinitely slow and the balloon in an infinitely large air-filled space this would be the whole story; the actual air movement decreasing as the square of the distance from the centre of the balloon, since the total air movement across any concentric sphere would be the same and the surface of a sphere is proportional to the square of its radius. But air, in common with all other matter, has mass, which gives it inertia, and it has elasticity. So that when the motion of the piston is not infinitely slow, the inertia of the air a little away from the balloon delays the movement of this air and the air close to the balloon is accordingly unable to move freely, but is compressed, as the piston moves upwards, between the walls of the balloon and the stationary air further away, and is rarefied as the piston moves downwards, since the air further away does not immediately move

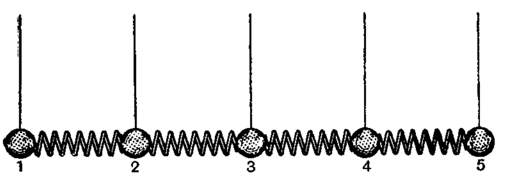
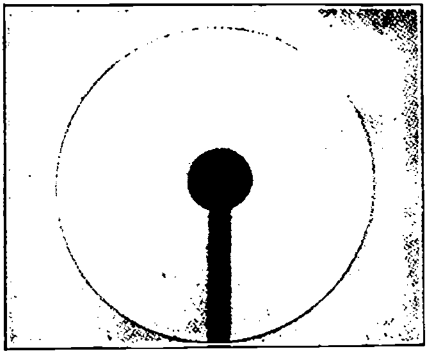


Fig. 2. *A mechanical analogy to illustrate wave motion.*

in to fill the space created. This compressed or rarefied air then acts on the air outside it in the same way as the walls of the balloon acted on it; and so on. A wave of compressed air travels outwards from the balloon in all directions for each upward movement of the piston, and one of rarefied air for each downward movement.

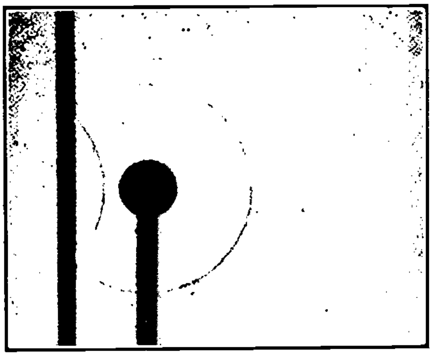
The actual mechanism of the motion is made clearer by a model such as is illustrated in Fig. 2. A number of heavy balls are suspended by long light threads an equal distance apart and between each is fixed a spiral spring. If the ball No. 1 is quickly pushed a little to the right, ball No. 2 will not at once move, owing to its inertia, but the spring between 1 and 2 will be compressed. Ball 2 will now start to move under the action of the compressed spring, and in moving will compress the spring between 2 and 3, and so on. The movements of the balls take place one after another; the disturbance travels along the line of balls from right to left. Similar action takes



[*Physical Review.*]

Fig. 3*a*.

place when ball No. 1 is moved to the left, but this time the springs are extended. This model might be taken to represent the motion of the air along any line drawn outwards from the centre of the balloon. The mass of the balls corresponds to the mass of the air molecules, a compression of the springs to a compression of the air, or a crowding of the air molecules together, and an extension of the spring to a rarefaction of the air, or a separation of the air molecules apart. An explosion, or an electric spark, gives such a wave as the one pictured by a single movement to and fro of the



[*Physical Review.*]

Fig. 3*b*.

piston in the balloon, or the end ball of the model. When the spark passes the air is very suddenly expanded, to be followed immediately by a contraction to normal, and the wave thus formed is so intense that its shadow may be photographed. Fig. 3a shows such a photograph, taken by H. L. Foley and W. H. Sonder (See *Phys. Rev.*, 1912, p. 373).

The dark and light lines are shadows of the compressed and rarefied air respectively.

If the last spring of the model is fixed to a rigid body, a pressure or pull will be exerted on the body when the wave reaches this spring, and the wave will be reflected, and travel backwards from right to left. For if the spring has been compressed it will, a little later, push the last ball back, resulting in a compression of the last spring but one, a subsequent movement of the last ball but one, and so on. In the same way when the air wave from the balloon reaches a rigid body, it causes a push or a pull on the body in being reflected. Fig. 3*b* shows such a reflected wave. If the air wave strikes the drum of the ear this push or pull produces a movement of the drum which may cause the sensation of sound.

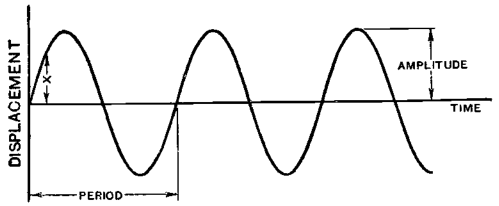


Fig. 4. Displacements of a sounding body producing a pure tone.

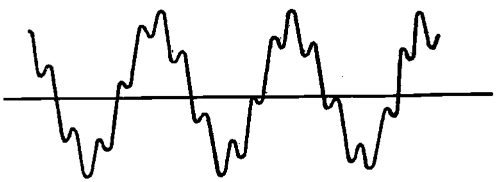


Fig. 5. A more complicated curve of displacements.

It is as well to note that the word "sound" is used in three quite distinct ways. It means generally the sensation of sound produced in the brain, but it is used by the physicist in connection with the air wave or air vibration that causes the movement of the ear drum, and also in connection with the movement or vibration of the body, in the present case the balloon, which sets up the air wave. The wave is called a sound wave, and the body a sounding body.

If now the piston of the balloon or the first ball of the model is moved continuously instead of just once to and fro, it is evident that the air movements along the radial lines or the ball movements to the right will follow the initial movements, but at a later time. If the initial piston movement is quite irregular or haphazard, the sound sensation produced will be one of noise; but if the movement is regular, that is, if it repeats itself time after time, the sensation may be of music or of speech, which depends entirely on the nature of the movement.

The simplest possible continuous movement in sound is that which follows the same law as the motion of the bob of a pendulum, and known because of this fact as simple harmonic motion. This very important discovery was made by Ohm (of Ohm's Law fame in electricity), in 1843. The sensation produced by such a motion is known as a "simple tone" or a "pure tone," or merely a "tone." Since the law of the motion is fixed, the only difference (apart from loudness) between pure tones, is the one of rapidity of the motion. The time that it takes for the piston to move to its extreme position upwards, then to its extreme position downwards, and finally up again to its initial position is known as the "period," the whole of the movement taking place during the period is known as the vibration, and the number of vibrations taking place in a second is known as the frequency. The period is evidently the reciprocal of the frequency. The pitch of a tone is determined by its frequency, the greater the frequency the higher the pitch. Sound sensations are only produced by vibrations of frequency from roughly 24 to 24,000, although these limits vary greatly in individuals.

Thus the displacements of a sounding body producing a pure tone can be represented by a diagram such as Fig. 4, where the movement of the body from its mean position is plotted vertically against the time horizontally.

This is the well-known sine curve, since it is represented by the formula $x = a \sin 2\pi ft$, where x is the displacement at any time t, a is the amplitude of the vibration and is the distance from the mean position to the extreme position, and f is the frequency $= \frac{1}{T}$ where T is the period. A tuning fork struck on a soft body will vibrate in a manner represented by this curve; that is, it will produce a pure tone. But if it is struck on a hard substance, at first at any rate, the first overtone will be present, and the curve of displacements will be as shown in Fig. 5. The more complicated wave form of the displacement curve is associated with a different quality of note, although the pitch appears to be the same. In this case the quality appears hard or metallic. The

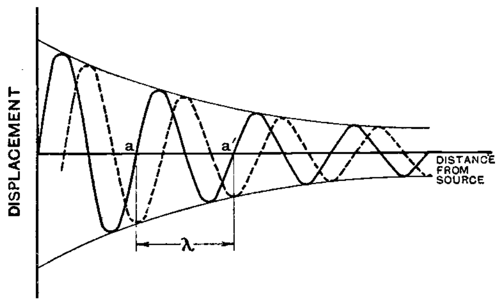


Fig. 6. Showing relationship between displacement and distance from the source of the sound wave.

overtone has a frequency about $6\frac{1}{4}$ times that of the fundamental. Figs. 4 and 5 represent not only the vibrations of the prongs of the fork; they represent also the movement of the air in contact with the fork, and hence also, from what has been said above about travelling disturbances, the movement of any particle of air influenced by the disturbance, provided the displacement scale is suitably modified to take account of the reduction in amplitude, and the time taken for the wave to reach the particle is taken account of in placing actual times on the time base. Further, if instead of considering what is happening to one particle as time goes on, a bird's eye view is as it were, taken of all the particles in a straight line drawn outwards from the source of sound, the view being taken at one instant of time only, a curve similar to Fig. 6 will be obtained if the position of each particle with respect to its mean position is plotted against the distance from the source. Each curve is repeated time after time, but with decreasing amplitude. In this curve the distance between similar points in the curve, say from a to a^1, is known as the wavelength λ. At a little later time the position of the particles will be represented by the dotted lines. The disturbance has moved to the right. After a time equal to the period the dotted line will coincide again with the firm line, as it will have moved forward one wavelength λ. And since velocity is distance divided by time, the wave velocity is = wavelength ÷ period

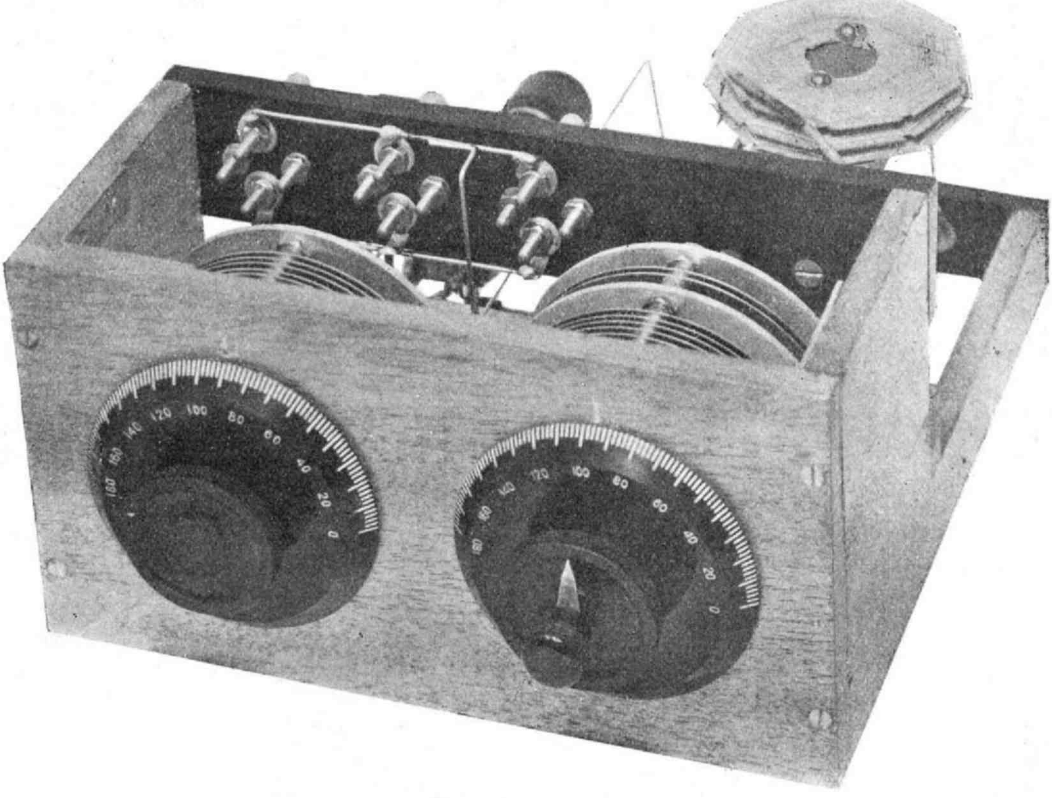
$$\text{or } v = \frac{\lambda}{T} = \lambda f, \text{ since } T = \frac{1}{f}$$

The velocity of sound from many experiments and from theory is 330·6 metres per second at 0° C., or 1,132 feet per second, or about 770 miles per hour. If thunder is heard, say, 12 seconds after a flash of lightning is seen, the lightning is $\frac{770 \times 12}{60 \times 60}$ miles away, that is, about $2\frac{1}{2}$ miles. The velocity increases when the temperature rises.

The reduction of amplitude of displacement with distance is more rapid near the source than further away. If the source is a very small one, the "point" source of mathematical physics, then close up the amplitude varies inversely as the square of the distance, but when the distance is great the amplitude varies inversely as the distance. The amplitude of the pressures produced in the sound wave always varies inversely as the distance.

The reduction of amplitude with distance from the source in the case of a wave motion is therefore enormously less at considerable distances than the reduction of amplitude in the case of a slow steady motion, since in the first case the amplitude varies inversely as the distance and in the second case inversely as the square of the distance. It is on this account that wave motions travel over such large distances before they become inappreciable.

(To be continued.)



A front view of the receiver.

A RECEIVER FOR FRAME AERIAL RECEPTION.

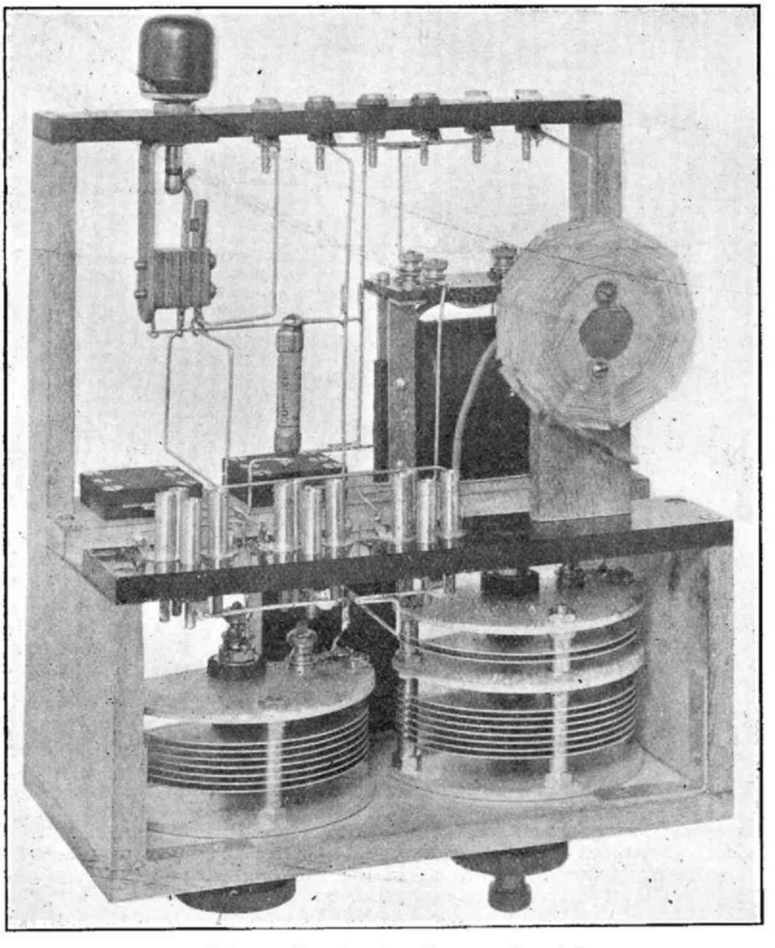
The inconvenience of erecting an elevated aerial makes frame aerial sets popular. Good results can be obtained coupled with such advantages as freedom from jamming, portability, simple tuning, and easy construction. Low cost without loss of efficiency is a feature of the design of the set here described, whilst the limitations in the skill of inexperienced instrument makers have not been overlooked.

By F. H. Haynes.

THE inconvenience of erecting an elevated aerial often stands in the way when deciding on the installation of a receiving set. It is not this consideration alone that brings about the use of frame aerial sets, which, possessing as they do, the important merit of portability, can be readily erected as required.

Technically, also, there are many points favouring the use of the frame aerial receiver. In the first place the marked directional properties of the frame supply one of the best methods of eliminating jamming. Residents in coastal areas are, of course, the chief sufferers owing to interference from ship sets, and the use of a frame is often the solution of the difficulty.

Again, where the frame forms part of one of the tuned circuits of the receiver it becomes possible to actually calibrate the set so that any particular station can be tuned in by reference to a simple table showing the relationship between wavelength and the settings of the tuning adjustments. To explain this point further by comparison with a receiver working on an elevated aerial it must be borne in mind that an aerial will be set up because of the very low damping. Damping in a circuit is analogous to a loss of the energy set up in that circuit. This can be caused in a variety of ways, and is principally brought about in receiving aerials by radiation. An elevated aerial is a good radiator, while very little radiation



An illustration of the receiver showing the mounting of the components.

of predetermined length cannot be taken as being of a certain inductance and capacity, while the operation of the reaction coupling, either on to the aerial or anode tuned circuits, considerably changes the wavelength to which those circuits will respond. In the frame aerial set reaction coupling is quite unnecessary, particularly as oscillation takes place from a frame, and thus the damping will be small. Sharp tuning will follow as a result, and there will be no necessity to introduce reaction to stimulate the circuit into self-oscillation, which would be necessary were damping by radiation taking place. Thus, by calibrated circuits, we achieve easy operation, and, by the avoidance of reaction coupling, simplified construction.

Bearing in mind that a frame aerial receiver can possess simple tuning, it should become the aim when designing such a set to maintain its simplicity in this respect, adjustments have been brought down to two, and these, as has already been stated, can be fairly accurately indicated. By having only two dials appearing on the front of the instrument with no other apparatus visible, the attention of the unskilled operator

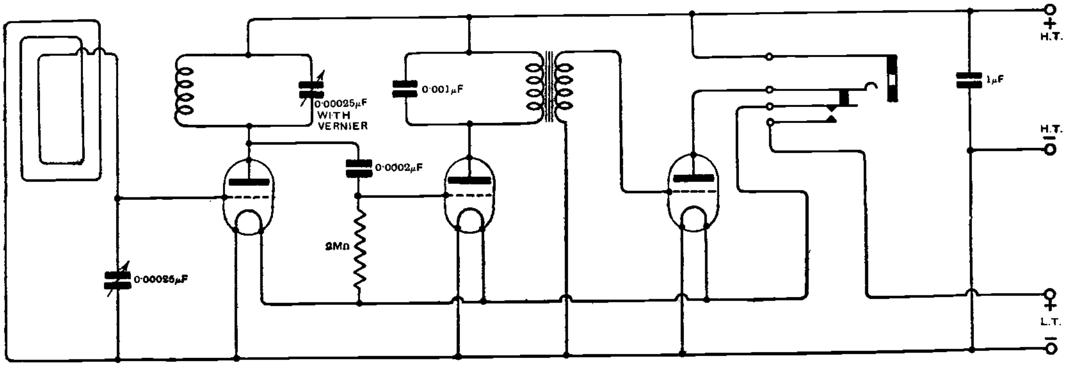


Fig. 1. Circuit of frame aerial receiver, with tuned anode high frequency amplifier, valve detector, and note magnifier. Reaction coupling is unnecessary owing to the low degree of damping possessed by the frame aerial.

particularly as frame sets are usually employed for the results they will give rather than as experimental apparatus.

In a set combining simple operation, cheapness and compactness, the tuning is not distracted, and he can concentrate on the precise settings for the dials. The circuit to which the instrument is wired is given in Fig. 1, and consists of a tuned frame circuit and a simple tuned anode high

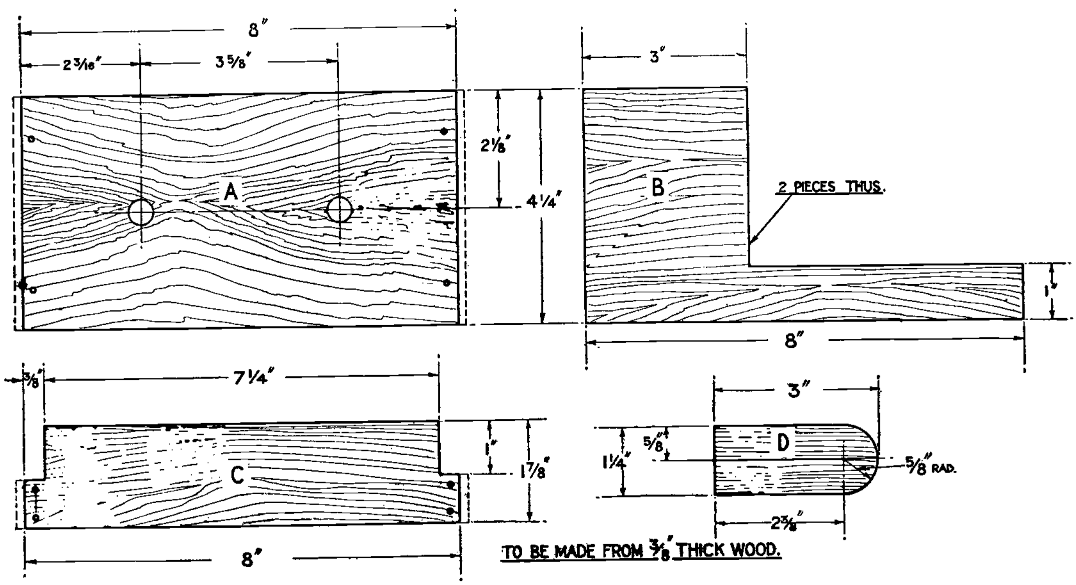


Fig. 2. Details for constructing the wooden pieces.

frequency amplifier, followed by valve detector and low frequency amplifier. This circuit necessitates the use of the following apparatus for the construction of the receiver :—

1 variable condenser, 0·00025 mdfs.; 1 variable condenser with vernier, 0·00025 mfds. (Ormond Engineering Co.); 12 valve legs with washers and back nuts; 1 intervalve transformer (almost any make can be accommodated); 1 telephone jack fitted with a pair of break contacts (Edison Bell type ·); 6 "Clix" sockets (2 white, 2 green, 1 mauve, 1 yellow); 1 grid leak, 2 megohms (Dubilier); 1 piece of 5/16 in. ebonite, from which two pieces can be cut measuring when finished 1½ in. by 8 in. and 1 in. by 8 in.; 1 piece of 3/16 in. ebonite (6 ins. by 1½ in.) for constructing the two fixed condensers; 2 dozen small brass tags for making connection to "Clix" sockets, valve stems and intervalve transformer; 4 bent brass brackets with sides about 1¼ in. by ⅜ in., with suitable brass screws, about No. 3 by ⅜ in., countersunk heads (these brackets are optional but recommended); 4 ozs. No. 18 tinned copper wire; 2 ozs. No. 28 D.C.C.; 1 condenser (1 or 2 mfds.) for bridging H.T. battery; 4 dozen screws, No. 4 by ¾ in. brass with countersunk heads; pieces of mica 2/1000 in. in thickness (this is the size usually supplied by wireless dealers), from which 15 pieces 1½ in. by ¾ in. can be cut; some thin copper foil, from which 12 pieces can be cut 1¼ in. by ⅜ in.; about 6 ins. of "Sistoflex" for covering the leads from the coil; sufficient planed mahogany (⅜ in. thick) for constructing the framework—2 sq. feet. will be ample. ("Hobbies" supply suitable planed wood in small quantities).

As has already been stated, this frame aerial receiver can be operated by the novice and the design is suitable for construction by the beginner. The outstanding difficulty in making the simplest of sets is not the squaring up or the drilling of the panels. It is the woodwork and the wiring up that usually floors the unskilled. To simplify construction, wood takes the place of the usual display of ebonite without loss of efficiency, while tapped holes are avoided.

The tools necessary are a hand brace and several twist drills, which is an indispensable tool in all wireless instrument work, a medium file, steel square, screwdriver, small pliers, and soldering iron.

Putting the woodwork in hand first, the pieces for the front, sides, transformer platform and coil bracket, can be made up from the details given in Fig. 2. The firm lines on pieces A and C show the exact finished size, and it is advisable to leave about 1/16 in. over on the ends as shown by the dotted lines so that they can be trued up by filing after fitting up. Use the steel square liberally when setting out lines, filing to size, and assembling. The front and sides should be glued (or "Seccotined") and screwed together, and when set, squared up with the transformer platform screwed (and not glued) in position.

(The concluding instalment, to appear in the next issue, will give complete details for the construction of the receiver.)

SURFACE TENSION AND CRYSTAL STRUCTURE.

The following note from *The Chemical Age* is of interest in connection with the articles recently published in this Journal on the subject of crystal detectors.

IN the joint discussion with the Mathematics and Physics Section at the British Association Meeting recently, Professor C. H. Desch presented a paper on "The Crystal Surface." He pointed out that the atoms of a crystal being arranged in a space lattice, all atoms in the interior of a crystal must be symmetrically disposed. At the surface of a crystal this symmetry disappeared, so that the properties there would be different from those of the mass, and a part of this difference manifested itself as surface tension. With the increase of temperature the cohesion and surface tension in general diminished, but not necessarily at the same rate. At high temperatures the surface tension might be sufficient to cause rounding of the sharp angles of a crystal. This had been shown by experiments with gold. Beads of gold, slowly cooled from the liquid state, had a skin which had properties like those of a film of gelatin, the normal structure being exposed when the film was removed by etching.

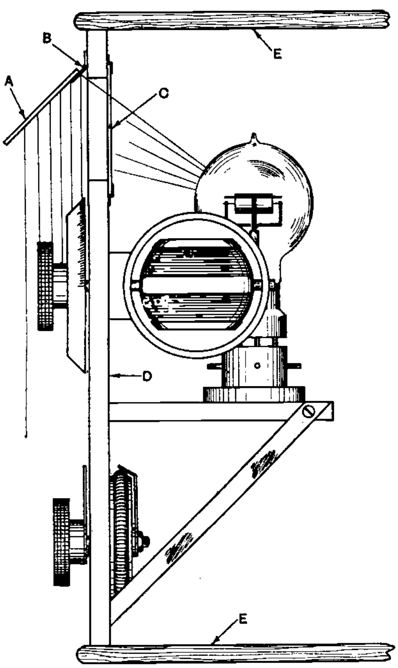
The sharp octahedral "etch-figures" on large crystals of gold, or the angles of minute crystals prepared by precipitation, became rounded at temperatures several hundred degrees below melting-point.—*The Chemical Age.*

READERS' PRACTICAL IDEAS.

This section is devoted to the publication of ideas submitted by readers and includes many devices which the experimenter will welcome.

Illuminating the Instrument Dial.

FOR those who operate their receivers for many hours each evening, adjusting the condenser dials and critically controlling the tuning arrangement, the following suggestions may be found useful.



A mirror may be provided to reflect the light from the valve on to the tuning dial.

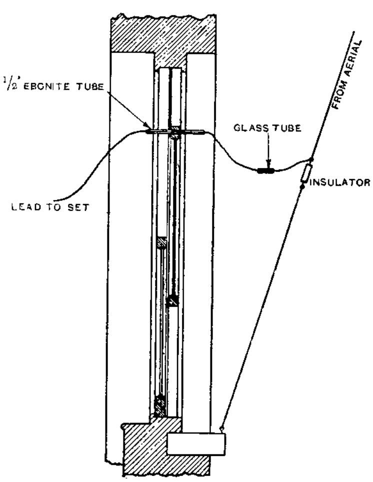
The light emitted from the bright emitter valves becomes very tiring to the eyes, whilst it makes concentration on the accurate setting of the tuning adjustment somewhat difficult owing to the blackness of the panel and contrast to the brightness of the light emitted from the filaments. The direct glare from the valves must be avoided, whilst the light emitted may be quite usefully employed for illuminating the front of the receiving instrument. With the valve supported by a platform behind the instrument panel, the arrangement consists of leaving a gap near the top of the set so that the light can fall on a piece of mirror which reflects it right on to the edges of the tuning dials.

When concentrating on the weakest of signals, many operators feel that their ears are more sensitive in a darkened room, whilst this method of illuminating the front of the panel leads to a condition of complete concentration.

E. A. A.

A Method of Leading-in.

IT is often found much more convenient to fix the lead-in tube in the sliding window frame than through the sash. The difficulty is immediately met with when the window is opened as the tension on the lead-in exerts a pull on the aerial and may drag it into contact with the wall or some other earthed point. This difficulty may be overcome by tying down the lead from the aerial by means of an insulator to the sill or lower



By fixing your lead-in in this way opening and closing the window is not interfered with.

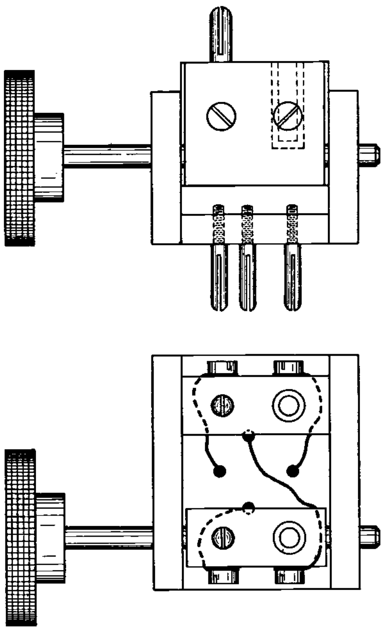
part of the window frame and arranging the insulator so that it is about midway between the top and middle of the window.

The lead-in wire from the insulator can now be raised or lowered without exerting any pull on the down lead from the aerial. If a small piece of glass tube is threaded on the lead-in wire, rain which runs down the lead will be caused to run off.

L. F.

New Style of Plug-in H.F. Transformer.

A FEW years ago plug-in H.F. transformers with four-pin connectors, having spacing the same as a valve socket, were very popular. As the amateur began to understand the properties of H.F. amplification more correctly it became apparent that this form of construction was not all that could be desired. The high capacity between the windings was undesirable, whilst the coupling as a rule was far too tight, and under these conditions a potential step-up which was often aimed



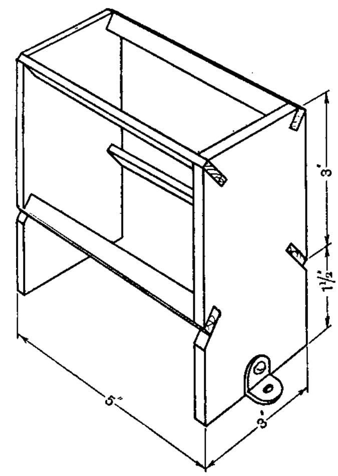
A new mounting for H.F. transformers.

at became quite unobtainable. H.F. transformers now more usually take the form of coupled plug-in coils and a useful device permitting of the interchanging of the two styles of transformer with the usual four-pin mounting is shown here. The usual pattern of two-coil holder can be quite easily fitted with four valve pins, so as to plug into the usual form of valve holder so often adopted in H.F. transformer work.

S. W. C. C.

Tuning Coil Construction.

THE adoption of air spaced tuning coils for short wavelengths has been emphasised in the pages of this journal and several very useful forms of construction have been given.



A former for short wave tuning coils.

One of the easiest methods of setting up an air spaced coil is to construct a wooden framework with four, six or more sides and running the wire from edge to edge. The wooden end pieces supporting the runners from which the wire is wound may also be used to support the winding away from the face of the instrument. One form of construction is shown in the diagram, whilst it is quite an easy matter to add additional runners to more completely support the winding.

G. C. D.

VALVES FOR IDEAS.

Readers are asked to submit ideas for inclusion in this section. A receiving valve will be despatched to every reader whose idea is accepted for publication. Letters should be marked "Ideas" and addressed to the Editor, *Wireless World and Radio Review*, 12 Henrietta Street, Strand, W.C.2.

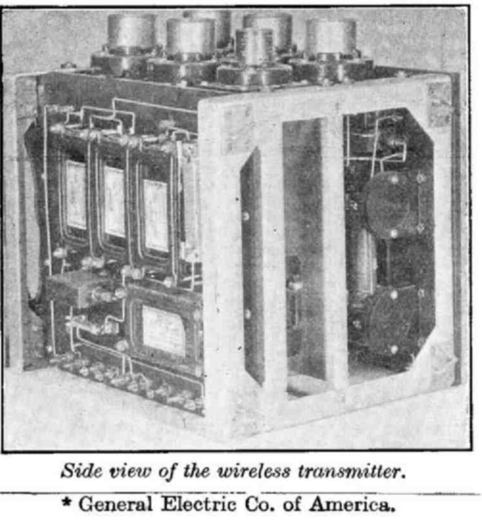
AIR MAIL WIRELESS EQUIPMENT.

In this article we give particulars of the wireless equipment of aeroplanes of the U.S. Post Office Department, as described in the *General Electric Review.*

THE accompanying illustrations show views of wireless equipment* specially designed for the air-mail service.

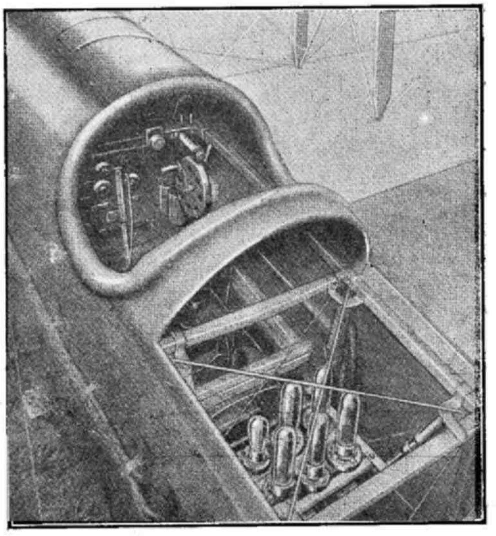
The transmitter is secured with leather holding straps and spiral springs to provide the necessary cushioning effect. Only one adjustment—a variometer that may be locked in any position—is provided on the panel.

The connections of the transmitter are given in Fig. 1. It will be seen that the transmitter contains six valves. Of these, one is the master oscillator, and excites the grid circuit of the power amplifier, which



Side view of the wireless transmitter.

* General Electric Co. of America.



The wireless equipment installed in an aeroplane.

contains two valves connected in parallel. The choke control method of modulation is employed, and the speech frequency currents are amplified by a one-valve speech amplifier, and passed to the modulator, which contains two valves in parallel. All the valves, with the exception of the speech amplifier, operate at a normal plate potential of 1,000 volts, and will conservatively deliver 75 watts output, as a power amplifier or oscillator. The filament consumption is 3·25 amperes at 10 volts. A " $7\frac{1}{2}$ " watt valve is used as the speech amplifier. This valve operates at 400 volts plate potential, and requires a filament supply of 1·2 amperes at 7·5 volts.

A wavelength range of approximately 190 to 290 metres is covered by the transmitter. This range is controlled by means of the calibrated master oscillator variometer A. It will be seen that the tuned circuit of the master oscillator is made up of the variometer and condensers C_1, C_3 and C_4 in series. The direct current input to the plate of the master oscillator is fed through the high frequency choke coil CH. Condenser C_2 is the usual plate circuit blocking condenser. The alternating current plate voltage of the master oscillator is determined by the drop across the condensers C_1 and C_3, and the alternating current grid voltage is built up across condenser C_4. Grid excitation for the two power amplifiers is obtained

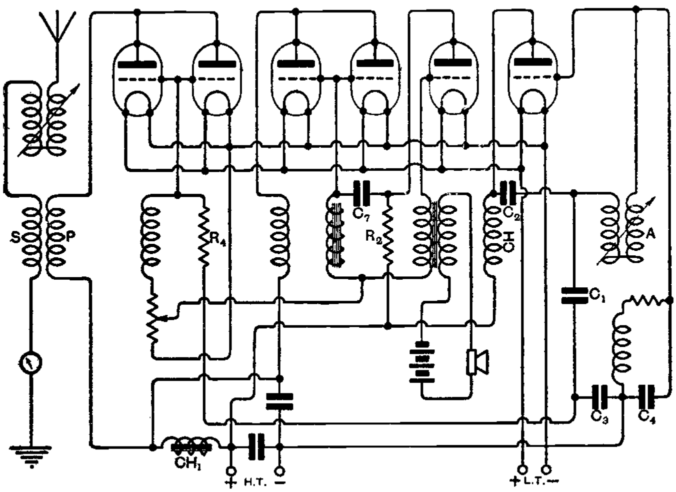


Fig. 1. Connections of the wireless telephone transmitter. It will be seen that a master oscillator is employed to excite the grids of two power valves connected in parallel. The modulator comprises two valves in parallel, and a speech amplifier.

from condenser C_3, with a current limiting resistance R_4 in series with the circuit.

Coupling between the power amplifier plate circuit and the aerial is obtained by means of a high frequency transformer PS. This is a simple transformer made up of a single layer plate coil and a single layer aerial coil, with the correct ratio of turns to efficiently match the plate impedance of the valves to the aerial resistance. The coils are arranged to provide close coupling between the circuits, and the constants are such that the amplifier valves are protected against overloading.

This may be explained as follows: suppose the master oscillator variometer is set at any position, and that the aerial circuit is not in resonance to the particular frequency of the master oscillator. The power amplifier grids are being excited by the high frequency currents from the master oscillator, and in the usual circuits a large high frequency plate current would flow with correspondingly large plate losses. In this transmitter the plate winding offers a high reactance to the flow of plate current; as long as the frequency of the master oscillator and the aerial circuit are not the same, plate losses are held at a safe value. Upon tuning the aerial circuit by means of the aerial variometer to the frequency of the master oscillator, the high reactance of the plate winding is in effect reduced when resonance is secured and the power amplifier valves take up their normal load. An aerial transformer of this type can be built to cover frequency ranges of about three to one with good efficiency, and no adjustments are necessary over the entire range. Greater frequency ranges are rather difficult to obtain with a single transformer, due to the distributed capacity of the plate winding at the higher frequencies and insufficient inductive reactance at the lower frequencies. Either of these conditions may destroy the

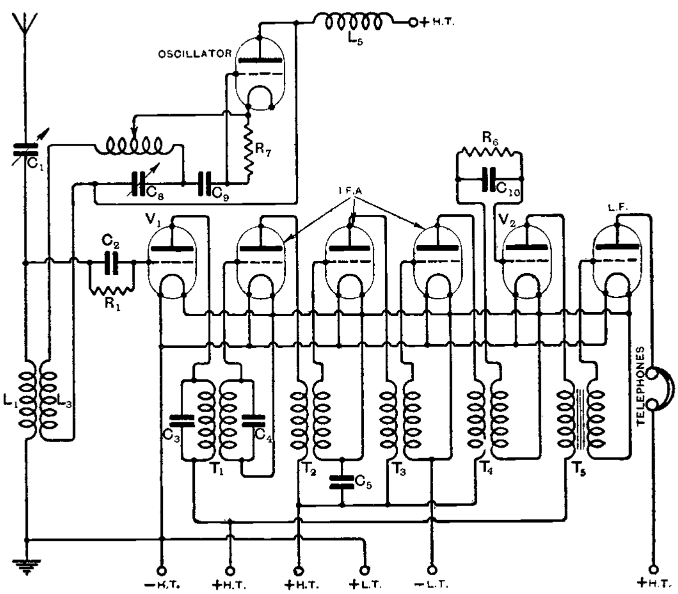


Fig. 2. Connections of the receiver.

safety feature of the transformer under detuned conditions.

The plate circuit of the speech amplifier is connected in series with the resistance R_2, which serves the double purpose of reducing the plate voltage on the valve to a safe value, and acting as a coupling resistance. Speech voltages set up across the coupling resistance are transferred to the grid circuit of the two modulator valves through condenser C_7. A fixed negative bias is maintained on the modulator and speech amplifier grids by utilising part of the voltage drop in the power amplifier grid leak.

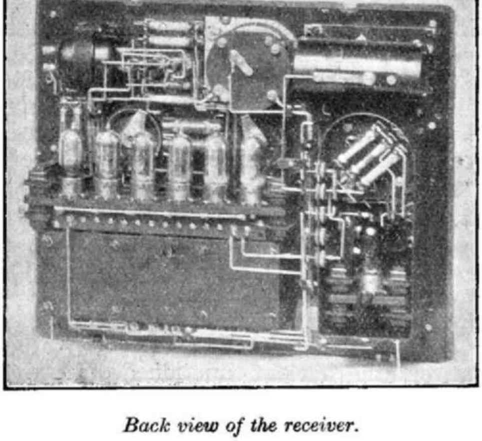
The plate current for the power amplifier and modulator passes through an iron core choke coil CH_1, which operates as the modulation choke.

Front view of the receiver.

A super-heterodyne receiver is employed, and the connections appear in Fig. 2. It will be seen that there are seven valves, one being used in the high frequency oscillator, one in the high frequency detector, three as intermediate frequency amplifiers, one in the low-frequency detector, and one as a low frequency amplifier.

The incoming signal is tuned by means of a condenser, C_1, connected in series with the aerial coil L_1, and the voltage is supplied through the first detector valve, V_1. At the same time locally generated high frequency oscillations are impressed on the grid by means of the coupling coil L_3, that is connected in series with the tuned circuit of the oscillator. Connected in the plate circuit of the first detector is a circuit $C_3 T_1$, tuned to a frequency of 50,000 cycles. This circuit is coupled to a similarly tuned circuit in the grid of the first intermediate amplifier. When the local oscillator is tuned so that its frequency is 50,000 cycles above or below the incoming signal, maximum current at 50,000 cycles will flow in the plate circuit of the detector.

Three stages of intermediate-frequency amplification adjusted for best operation at 50,000 cycles are used. Signals are finally rectified by a valve V_2 and grid condenser and leak $C_{10}R_6$, and are applied through the transformer T_5 to the note magnifier LF.



Back view of the receiver.

COMPONENTS OF INTEREST.

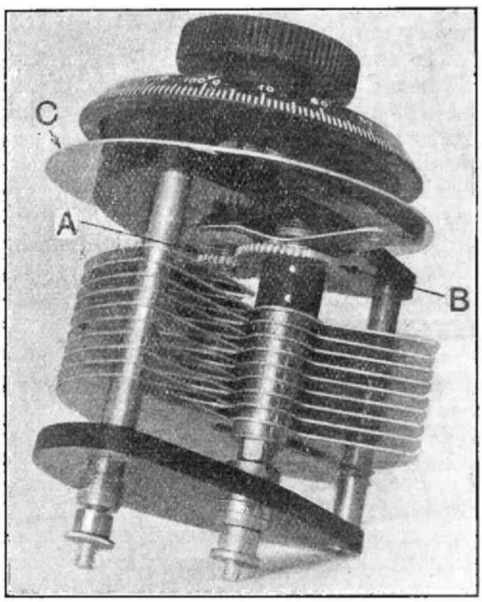
A REVIEW OF NEW PRODUCTS OF THE MANUFACTURERS.

A Variable Condenser.

The accompanying illustration shows an interesting variable condenser,* which will probably be found extremely useful by many experimenters.

There are two special features, the aluminium shield which lies between the top plate of the condenser and the dial, and the slow motion device.

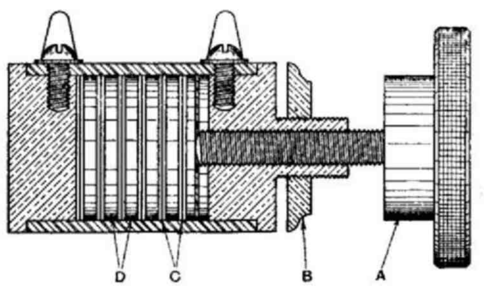
The knob is secured to a spindle which carries a small toothed wheel A. The moving plates are carried by a separate spindle, to which is fixed a toothed disc B. The disc engages with the toothed wheel, hence the condenser plates are turned at a slower rate than the knob. The gears are arranged to provide a half reduction, one complete revolution of the dial moving the condenser plates 180 degs. Thus, it is possible to make a very fine adjustment, and a vernier condenser is not required. To fix the condenser to a panel, one hole is drilled, and the fixing nut screwed up. Ebonite discs (suitably engraved) to fit into the recess of the knob are provided with each condenser.



* The "Fullstop" condenser, Messrs. J. H. Taylor, Central Brass Works, Wigan.

A New Filament Resistance.

Now that there are so many new types of valves, taking different filament currents and voltages, on the market, it is important that the experimenter should choose carefully the filament resistance to be used to regulate the filament heating current. Ordinary wire-wound resistances are obtainable with a wide range of values, but those resistances which have a high value are designed for valves taking a small current, and cannot usually be employed with valves which take a larger current.



The "Oojah" rheostat. A is the knob, B the fixing nut, C the discs of copper foil, and D the resistance elements (graphite).

The "Oojah" graphite pile rheostat, according to the makers, may be varied in resistance between 0·15 and 35 ohms, which would appear to make it suitable for bright and dull emitter valves. The construction of these resistances may be gathered from the accompanying sketch. We are not sure that the resistance is carefully designed. It would appear that a small turn of the knob will make a big change in the resistance when the resistance is set at a high value, or would make a small change in the resistance when set at a low value. However, the rheostat functioned quite well when tried with a 60 miliampere valve, and with an R valve.

FREQUENCY FILTERS

ACOUSTIC FILTERS AND THEIR APPLICATIONS

In the last issue the author dealt with the subject of electrical filters, illustrating their function by a comparison to mechanical filters. In the following contribution acoustic filters are dealt with and their application to sound reproducing instruments.

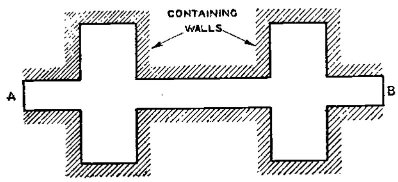
By E. K. Sandeman, B.Sc.

THE acoustic filter is probably the most difficult of all for the mind to appreciate and also is one which departs most from the ideal. In Fig. 1 is shown an arrangement constituting an acoustic filter, and also an approximate equivalent electrical network.

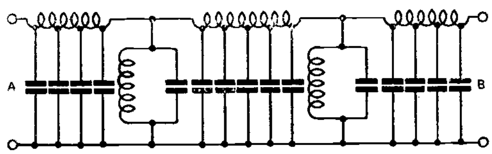
As is seen, the acoustic filter consists of a number of air chambers connected together by air passages; the material of the walls may be anything as long as it is rigid. The shape in cross section may be anything we like, but circular is the most ideal for uniformity of results.

In this case the allocating of the shunt and series elements in the equivalent network is perhaps not quite so simple, although easy to appreciate when the general idea has been grasped. It is evident that the large chambers are in the nature of shunt elements since the lower their impedance the greater displacement will take place into their volume and the less along the connecting passage. It is equally evident that the connecting passages are in the nature of series elements. Assuming that there is no friction between the air and the containing walls, and neglecting the effect of eddies, it is evident that, to a first degree of approximation, all we are concerned with in the passage of waves through air is the mass or density of the air and its elasticity or reciprocal capacitance. It is evident that the mass of the air being uniformly distributed behaves like the uniformly distributed inductance in a transmission line, while the capacitance or reciprocal elasticity behaves like the uniformly distributed capacity in a transmission line. That the mass is a series element and the capacitance a shunt element, is evident from a consideration of the resultant reaction or a diaphragm moving in air if we increase or decrease either. If we increase the density we should oppose the oscillatory movement of a diaphragm (normal to its plane), while if we were to increase the capacitance (*i.e.*, reduce the elastic strength), we should decrease the impedance to movement of the diaphragm. It should be remembered that an increase in impedance is equivalent to a decrease in the rate of energy transmission for a given applied force.

It is not possible to portray distributed capacity and inductance, but we have indicated this by a number of small inductances and small capacities. These should



Acoustic filter.



Approximate electrical equivalent.

Fig. 1.

be considered as tending to zero in size and to infinity in number.

Similarly for the shunt elements we have the same thing but viewed from one end. Why, then, have we portrayed the shunt elements as consisting of one condenser shunted by one inductance? The reason for this is that, although it is quite true that the arrangement has an impedance which behaves like the impedance of one end of a transmission line, yet this transmission line is very short, and further, is "open-circuited" at the "far" end if the walls may be considered to be of infinite elastic strength compared to air. It is quite easy to see why a wall of infinite elasticity and so infinite impedance is the equivalent of an open circuit in the electrical case, since an open circuit is in effect itself an infinite impedance. Reflection effects from the "end" wall modify the impedance so that it is fairly nearly represented as we have shown it.

In practice, of course, owing to frictional effects on the walls of the tube, and owing to eddy currents in the passage and chambers, quite appreciable resistance or frictional components are experienced which to a large degree modify the selective nature of these filters.

PRACTICAL APPLICATIONS OF THE ABOVE FILTERS.

Electrical filters are used for the suppression of noises from generators and batteries, for the selection of frequencies in wireless and "carrier" telephony and telegraphy (*i.e.*, wired wireless), for the improvement of frequency response characteristics, for the elimination of the higher frequencies in repeater operation, and for a multitude of other things too numerous to tabulate.

The mechanical filter, as such, may hardly be said to have come into its own yet, although, as indicated under, there seems to be some probability of its doing so in the near future.

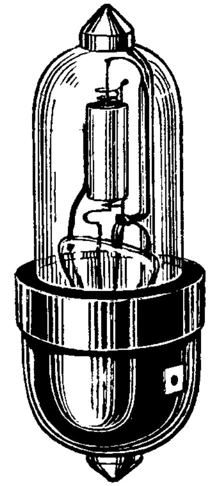
The acoustic filter as a physical device has been employed in the American "Clearphone" for the suppression of atmospherics. It is, however, difficult to see in this case what advantage the acoustic filter would have over an electrical filter, especially in view of its cumbersome nature. Probably the most interesting example of an acoustic filter is that which occurs in the passages of the throat traversed by the voice in speech; this fact has already been referred to by Dr. Fletcher. Speech production depends firstly on the production of a "carrier" wave or "drone" of rather a composite nature by the larynx "reed." This carrier wave is then "modulated" in two entirely separate ways. The most obvious and evident way is that action of the lips and tongue which causes this carrier "drone" to vary in intensity, giving rise to most of the explosives, such as *m*, *n*, *p*, *t*, *b*, etc. This is the exact equivalent of ordinary modulation and each component frequency in the carrier drone undergoes this modulation. The second type of modulation, which is not so closely allied to modulation although correctly so termed, if we go back to the original meaning of the word, is that effected by the filter action of the passages of the throat and nose. The effect of these is to present an attenuation to the "drone" which is different for different frequencies, and, of course, as we know, varies with time, giving rise to the various vowel sounds.

An interesting application of the mechanical filter, upon which patents have been filed by the Western Electric Company, is to gramophone recording and reproducing. In the past this has been developed upon more or less empirical lines and has undoubtedly reached a surprising state of efficiency. It is now possible, however, by utilising the devices described above, and by applying the same principles for avoiding distortion which have been used in the development of telephony and broadcasting, to produce records and reproducing devices which, when used in conjunction, give a faithfulness of reproduction which leaves all previous efforts far behind. This achievement has been realised by the employment of mechanical attenuators and impedance equalisers between the motor and the cutting stylus in the record producing device, and between the needle and a form of magnetophone in the reproducing device, the sound finally being reproduced on a loud speaker in which mechanical impedance matching has been specially studied. It is possible that such a reproducing system as the above will constitute the gramophone *de luxe* of the near future.

VALVE TESTS.

THE EX-R.A.F. "C" VALVES.

Although this section is usually devoted to valves of current manufacture, we have had so many enquiries regarding the "C" valve that we decided to include this type also in our tests.



AT the present time there are offered for sale to the public a number of ex-R.A.F. "C" valves, a type which is very little known to the average experimenter. In order, therefore, that the intending purchaser may know what performance to expect, we have obtained and applied our usual tests to valves of this type.

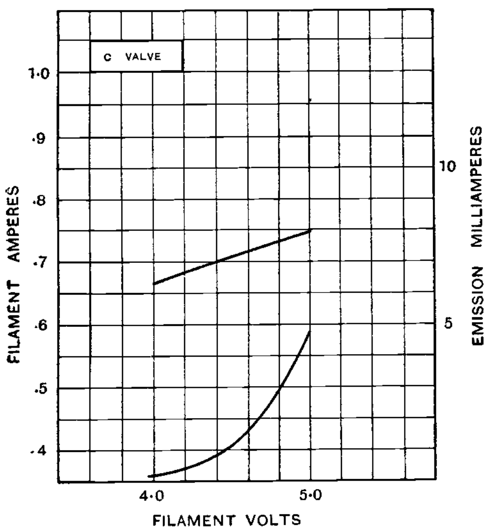


Fig. 1.

In appearance the valve resembles an acorn, and the mounting required in that of the test tube or "V.24" type.

The filament caps are at the ends, the grid and plate leads being brought out to the sides. The filament is not of the straight-through variety, however, and actually the bulb is what is known as "single ended." All the leads to the electrodes are brought out from one end, and a thin copper strip passes over the outside of the bulb, joining up to the other filament cap.

On the samples tested there was nothing to indicate which was the grid terminal, but the standard mounting appears to be this. On the black composition cap is the word "top," and when the valve is held so that this word is uppermost then the grid connection is the one to the left.

Standard characteristics are shown in Figs. 1, 2 and 3, the first giving, as usual, the

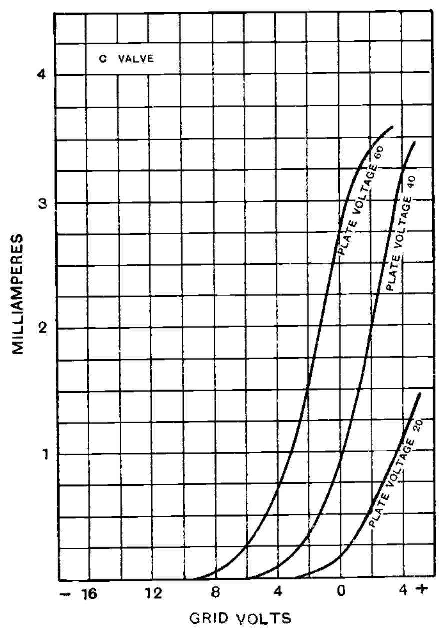


Fig. 2.

filament characteristics. The valve works with a normal filament potential of 5, the current and emission being of the order of 0·75 ampere and 5 milliamperes respectively.

Fig. 2 shows the plate current, grid voltage characteristics for three values of plate potential, and these suggest satisfactory performance as an amplifier.

The valve has a magnification factor of just over 6, with an impedance varying from 30,000 to 16,000 ohms, according as the plate potential is raised from 30 to 70.

On test the valve was first tried as a high frequency amplifier (actually the purpose for which it was designed), and quite good results were obtained operating with a plate potential of 40. The same value of H.T. gave good results when the valve was operating as a detector, using the usual 0·00025 mfd. grid condenser and 2 megohm leak, the grid return lead being connected to the negative end of the filament.

On the low frequency side a great improvement in signal strength resulted when the plate potential was increased to 60, which, in view of Fig. 2, was to be expected.

It must be remembered, however, that these valves were designed for multi-stage amplifiers, using a comparatively low plate voltage, and it is for this particular purpose that they are most suited.

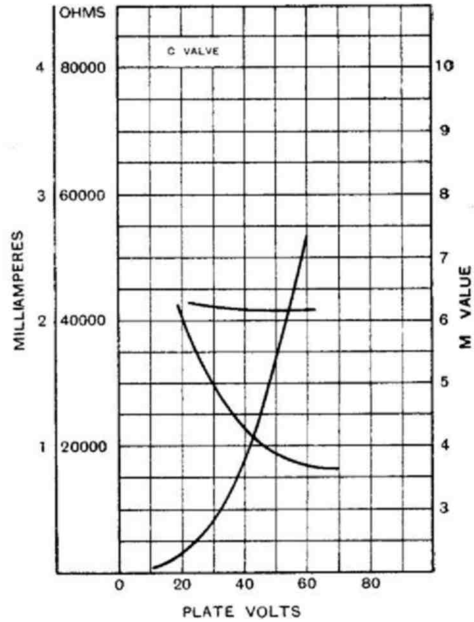
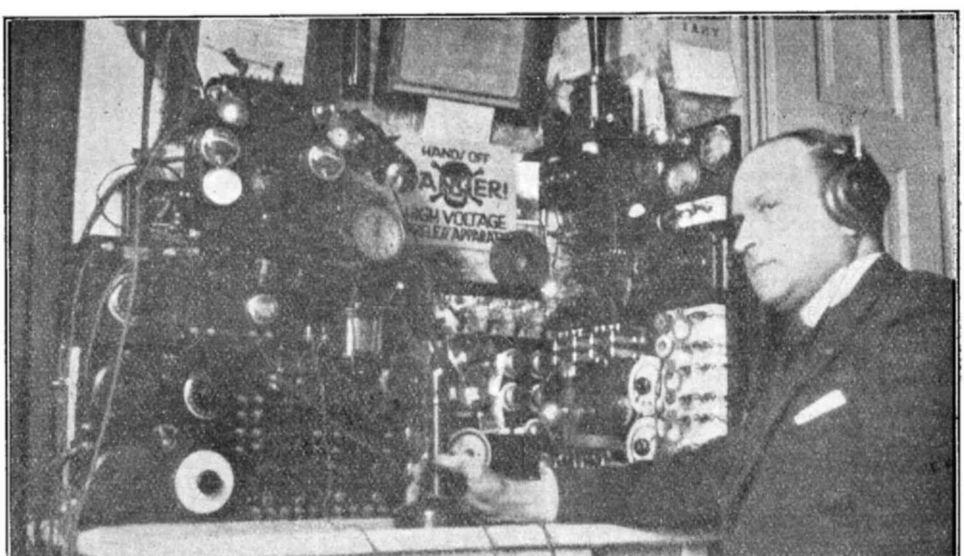


Fig. 3.

U.S. 3 MS TO ATTEMPT TRANSATLANTIC COMMUNICATION.



Mr. C. W. Gilbert (**3 MS**) *of* 1,546 *North Gratz Street, Philadelphia, Pa., U.S.A., who we understand has recently redesigned and improved his transmitting equipment in the hope of getting signals across to this country during the winter months.*

PATENTS AND ABSTRACTS

A Lead-in Tube with a Safety Device.

Most amateurs have a safety spark gap of one form or other fitted to the aerial to take care of electrical discharges. A neat combination* of lead-in tube and safety spark gap is sketched in Fig. 1.

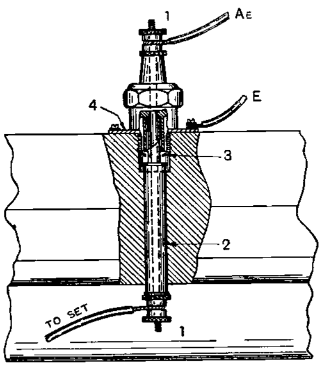


Fig. 1. A lead-in tube.

It will be seen that the body of a sparking plug is employed, to which is fitted a metal rod and an insulating tube. The rod is marked 1, insulating tube 2 and sparking points 3. The points 3 are connected to the plate 4, which is connected to earth. In the event of the aerial receiving a high voltage a discharge can take place between the rod 1 and the earthed points 3.

Preventing Interference.

Generators of high-frequency oscillations do not, as a rule, give waves of pure sine form, the currents and voltages being distorted according to the type of the generator; hence harmonic oscillations are set up besides the fundamental oscillation which the generator is really intended to produce. These harmonics produce a disturbing effect, hence means are usually provided for reducing the amplitude of the harmonic oscillations. In many instances blocking circuits or frequency traps consisting of capacity and inductance are connected in the circuits of the generator. Another method consists in connecting tuned circuits in parallel to an oscillatory circuit and thus to short-circuit the harmonics.

In yet another method which is sometimes employed in valve generating sets, a loosely-coupled circuit is employed between the generator and the aerial. This reduces the efficiency of the transmitter somewhat, and is only reluctantly employed.

This patent * describes a loosely coupled circuit which is designed to suppress harmonics, and is employed in connection with a machine generator of oscillations. Referring to Fig. 2, 1 is the high frequency generator, 2 and 3 the tuning coil and condenser, 4 the frequency changer, 5 the condenser of the secondary frequency circuit, 6 the coupling coils, and 7 the coupled circuit.

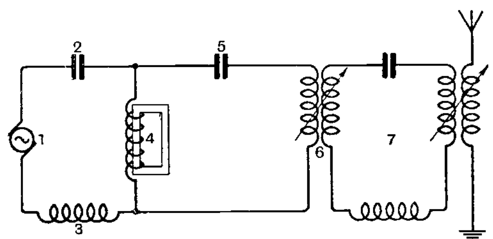


Fig. 2 Showing the use of a tuned circuit to reduce the strength of harmonics generated by the machine generator.

The coupled circuit should be carefully designed, in order that its resistance shall

* British Patent, No. 217,022, by R. W. Robins.

* British Patent No. 207,781, by W. Dawnig.

be small, and it is preferable to arrange variable couplings between the circuits.

A Novel Switching Device.

To enable tuning to be effected over a wide range of wavelengths, it is usual to employ a variable condenser and a number of plug-in coils, and when the tuner is employed to tune an aerial, arrangements are usually made for the condenser to be connected in series or in parallel with the aerial coil. It is therefore usual to employ a switch with which the position of the condenser in the circuit may be changed. It is possible,* however, to dispense with the switch as a separate unit and to combine it with the plug-in coil and holder, as may be seen from Figs. 3 and 4. Fig. 3 shows a side view of a plug-in coil which is provided with the usual contact pin 2, which is arranged to fit in a socket 3, of the arrangement 4. The insertion of 2 into 3 causes the member 5 to move to the left, and to push contact spring 8 away from contact 9, and to make contact with 10. The circuit may be arranged as in Fig. 4*a*, where 11 is the aerial coil and 12 the aerial condenser of a receiver. When the wavelength range has to be increased, the plug-in coil is placed in the socket which operates the springs and disconnects coil 11. When a variometer is employed as in Fig. 4*b*, the wavelength may be varied by using fixed condensers arranged for plugging in the socket. As may be seen from the circuit, condenser 14 is replaced by 16 when the latter is plugged into the socket.

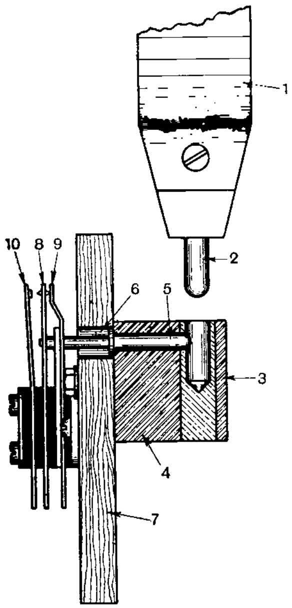


Fig. 3. A coil holder provided with a switching arrangement.

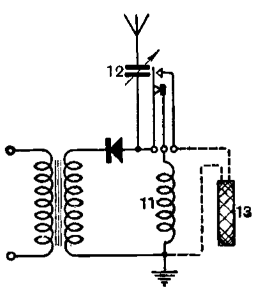


Fig. 4a.

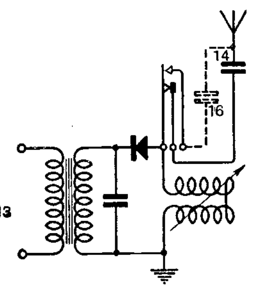


Fig. 4b.

* British Patent No. 219,371, by the Western Electric Company and S. T. Buer.

Valve Holders.

It is standard practice to mount valve holders on the face of the panel carrying other components or alternatively to attach the valve holder to the back of the panel, allowing the contacts to project through a hole in the panel. With both of these arrangements it is usually possible to damage the valve by an attempt to insert the valve in an incorrect position.

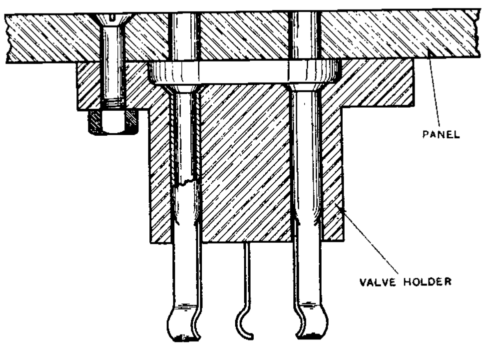


Fig. 5. Sketch of a valve-holder which is designed to be fitted below the panel.

It is therefore proposed to employ a valve holder which may be mounted on the back of the panel as in Fig. 5. Holes are drilled in the panel to permit the valve legs to pass through it and fit the sockets in the valve holder. If now an attempt is made to fit the valve incorrectly in the sockets, the valve cannot be damaged by an accidental contact.

W. J.

* British Patent No. 219,826, by A. P. Welch.

NOTES & CLUB NEWS

The new transcontinental and transatlantic station at Gothenburg, Sweden, is almost completed.

*   *   *   *

A wireless exhibition is to be held in the Exhibition Hall, Deansgate, Manchester, from October 14th to 25th, under the auspices of the *Manchester Evening Chronicle.*

*   *   *   *

Lord Balfour and Lord Grey of Fallodon are shortly to broadcast talks on international subjects from the London Station.

*   *   *   *

The Oxford University Arctic Expedition is contemplating a move southwards owing to the severity of the weather. The party has heard the Chelmsford broadcasting station distinctly every evening.

*   *   *   *

EIFFEL TOWER CONCERTS.

Earlier statements to the effect that the Eiffel Tower Station has suspended the broadcasting of concerts are not quite correct, states a *Daily News* correspondent. The military authorities have decided that concerts shall be broadcast on Mondays, Wednesdays and Fridays at 6.15 p.m. The transmission of weather reports, Bourse and market quotations will be continued at the usual hours.

AMERICAN SHORT WAVE WORKING.

Further interesting notes on the reception of signals on very short wavelengths from America have been forwarded by Mr. R. E. Williams, of Holyhead.

At midnight on August 16th **8 XW** was heard on approximately 10 metres, calling **9 XW**, the following message being sent :—

"QRK GA. Our line is down if you get this pse K." Telephony followed on the same wavelength and proved to be that of **KDKA**. Another station was heard on a still lower wavelength, perhaps as low as 5, but was unidentified owing to the critical tuning necessary.

MARCONI IMPROVING THE "BEAM"?

A message from Funchal, Madeira, states that Senatore Marconi left there on September 1st for Cadiz after a five days' stay, during which experimental work was carried on with short wave wireless, the results being excellent.

FREEDOM FOR SWISS AMATEURS.

At the recent opening of the new broadcasting station at Zurich, the inaugural speech was delivered by M. Haab, Minister of Posts and Railways. In the course of his remarks, the minister said that the State did not intend to interfere in any way with the development of broadcasting or amateur work, although a certain amount of supervision would be necessary in the interests of national security.

OPEN AIR BROADCASTING.

Broadcasting at a garden party, carried on just as in the studio, features on the programme of the Cardiff station. This interesting event is to take place on Saturday, September 13th, when John Henry and "Blossom" and many other wireless celebrities will broadcast from the Sophia Gardens, Cardiff, at a Carnival to be given in aid of the Cardiff Royal Infirmary.

POWER INCREASE AT RADIO-PARIS.

Radio-Paris is shortly to increase its power. Although for nearly six months the station has been in possession of a 10-kilowatt transmitter, official permission to use it has been difficult to obtain, and at present Radio-Paris is still limited to two kilowatts.

SPAIN—AMERICA BROADCASTING TESTS.

An interesting series of transatlantic tests is to take place during the last week of September. From 2 a.m. to 4 a.m. G.M.T., on the 23rd, 24th, and 25th the Madrid Station, Radio Iberica, will transmit on 392 metres with the object of being heard in America.

On the American side the tests are being carried out by **WKAQ** (San Juan de Puerto Rico), which will transmit on 360 metres at the same time on the 26th, 27th and 28th.

The following details have been arranged :—

On the 23rd, 24th and 25th the Madrid Station will call Puerto Rico by telegraphy (c.w.) from 2 to 2.15. A series of 5 dashes will be then given, each of 50 seconds duration and separated from each other by intervals of 10 seconds ; the concert will then begin. The American station will reply in a similar manner on the dates given above. Reports of these tests, which will be in both English and Spanish, will be gladly welcomed by the management at Radio Iberica, Paseo del Rey, 22, Madrid.

DISTANT CONTROL FEAT.

An experiment in the distant control of machinery by wireless was carried out with complete success at Wembley on September 3rd.

A wireless signal transmitted from Manchester by the Metropolitan Vickers Company to the firm's stand at the Exhibition was passed on to a selective relay. By means of valve amplifiers a series of automatic switches was set in motion, thus starting up an automatic sub-station.

This fascinating demonstration, which attracted considerable interest, will be repeated at given intervals during the remainder of the Exhibition.

BROADCAST BATTLE.

An original broadcast entertainment, involving a gigantic sham battle, in which the U.S. Army Signal Corps and the 38th Division of the National Guard were engaged, was recently transmitted from **WHAS** (Louisville, Kentucky). Listeners-in were treated to a sound picture of a heavy cannon barrage supplemented by the noise of machine guns, rifles and hand grenades.

RECEPTION EXTRAORDINARY.

The reception of Chelmsford and Radio-Paris without aerial or earth at Aguila, Italy, is reported by an agent of the Rome office of Marconi's Wireless Telegraph Co., Ltd. This feat was accomplished on a five-valve M.S.I. receiver, made at the Company's Genoa works. Both stations were tuned in on the loud speaker with sufficient volume to be heard clearly at a distance of 15 yards.

FRENCH TRANSMITTING REGULATIONS.

Amateur transmitters in France are subject to a curious legal limitation. While they are entitled to work at any time between the wavelengths of 180 and 200 metres, they may not drop below this figure until after midnight. This ruling recently frustrated an attempt of M. Léon Deloy to get in touch with Australia on short waves.

EDUCATIONAL BROADCASTING.

Definite plans have now been framed under the direction of Mr. J. C. Stobart for the adoption of broadcast talks for schools during the term now approaching.

The programme will consist of a daily half-hour, from 3.15 to 3.45, and the lectures, which will be intended for children between 12 and 15 years of age, will be arranged as follows :—

Monday —Sir Walford Davies, on Music.

Tuesday.—Mr. E. Kay Robinson, on Birds.

Wednesday.—Mr. J. C. Stobart, on Stories in Poetry (with various reciters).

Thursday.—Professor A. J. Ireland, on Lives of Great Men (with picture postcards to illustrate them).

Friday.—L'Institut Français, Elementary French.

[Photo; Barratt's;

John Henry and "Blossom," photographed in the aeroplane from which they broadcast an amusing duologue on Tuesday, September 2nd. Transmission was at first good, but fell off in quality later.

Members of the Wimbledon Radio Society enjoyed a successful field day on August 28th, when transmission and reception were carried out on a car. The photograph shows the party on the Hog's Back, in Surrey.

HELPING LAME DOGS.

Interesting examples of the various calls for help addressed to the Radio Society of Great Britain were given by Mr. J. H. Reeves, M.B.E., speaking from **2 LO** on behalf of the Society on September 4th.

Help is sought by crystal users, by those experiencing faulty reception, and by unfortunate individuals who imagine they are being jammed by their neighbours.

Not long ago a letter was forwarded by the B.B.C. from a crystal user who complained that his reception was being constantly interrupted by the owner of a four-valve set residing in the same block of flats.

After considering the case Mr. Reeves, as President of the local affiliated society (Kensington), suggested that the aggrieved listener should call and discuss the matter with the alleged offender. This was done and the trouble was subsequently traced to the crystal set! Both parties became staunch friends.

5 XX AND DANISH LISTENERS.

The reception of the Chelmsford Broadcasting Station on a Hertzite crystal set at Copenhagen is reported by Mr. V. A. Ramsing.

Although this reception is excellent it should be noted that our correspondent was equipped with an aerial more than 300 yards long and 70 ft. high! On a single-valve receiver **5 XX**, in addition to the other British station, is heard at great strength.

WIRELESS FOR OCEAN SURVEY.

An extensive programme for an oceanographic survey of the world's waters is being prepared in Washington. The vessel undertaking the work will be equipped with the most efficient type of radio installation. The scientists engaged will thus be able to ascertain their exact locations by wireless compass, and obtain standard time signals essential for hydrographic work.

CLUB ACTIVITIES.

Enquiries regarding membership, etc., of the various societies, which should be addressed to the Hon. Secretaries concerned, may be sent *via* the offices of this Journal, whence they will be forwarded.

A NOVEL competition was carried out by the Lewisham and Catford Radio Society on August 28th. Members were required to discover and correct twelve mistakes occurring in an ordinary three-valve tuned anode circuit, comprising H.F. detector and L.F. The prize, viz., a ticket for the Society's charabanc trip to Littlehampton on September 7th, was won by Mr. Endicott, who rectified eleven out of the possible twelve mistakes.

The Hon. Secretary welcomes applications for membership.

A home-made loud speaker, comparing very favourably with a large trade product, was demonstrated by Mr. W. J. Samson before the Hackney and District Radio Society on August 28th. The loud speaker was of the hornless type, using a paper diaphragm, and reproduction was extremely good. The Society desires more new members.

Great progress has been made by the Radio Research Society, Peckham, which is holding its half-yearly general meeting on September 17th. An attractive winter programme has been arranged and applications for particulars of the Society are invited.

All enthusiasts of 16 and over, living in Barnsbury and the surrounding district, are invited to attend a general meeting of the Holy Trinity Meccano and Radio Club, to be held at 7.30 p.m. on September 19th, in the Parish Hall, Richmond Road, Islington, N.1.

The Leeds Radio Society is about to commence its fifth session and applications for membership are invited from all local experimenters.

CORRESPONDENCE.

To All Transmitters.

The Transmitter and Relay Section Committee is at work preparing the programme of lectures and meetings for next session, and I should be grateful if any members willing to open a discussion on any popular subject connected with transmission will communicate with me, giving an idea as to the month during which they would be available and willing to open such a discussion, and also the title of the talk which they would give. Meetings will be held at the Institution of Electrical Engineers, Savoy Place, W.C.2, twice a month, usually on Fridays, at 6.30 p.m. The following meetings have been arranged, and you are invited to attend and take part :—

12th September at 6.30 p.m. : "My Experiences whilst Visiting American and Canadian Amateurs," by Mr. Gerald Marcuse.

26th September at 6.30 p.m. : "Aerial Insulation," by Mr. J. E. Simmonds.

Considerable dissatisfaction seems to exist in the minds of various members, the causes of which appear to vary, but the feeling is, I believe, that we require a periodical of our own, similar to *Q.S.T.* Well, it is up to you to do it. Over in America and Canada there are about 18,000 contributors to draw from, and *Q.S.T.* has many more regular readers. What we want is more co-operation and good fellow feeling in this country, where we have 921 transmitting amateurs, of which number only 260 are members of the T. & R. Section. Now, in an endeavour to assist as much as possible in furthering the interests of amateur transmitters, the Editor of *The Wireless World and Radio Review* has very generously offered the T. & R. Section space in that paper every week.

Remember that the British amateur stands well in the foreground of International amateur radio. That position must not be endangered in any way, therefore, let us pull together as one, and so through closer co-operation and good fellowship unite into a strong body of earnest experimenters, and maintain our position in the front rank of International amateur radio. We are on the eve of great things ; do not let us hinder them ; rather let us show the world that, as in the past, we can do whatever we set out to do. Last year, through patience and many sleepless nights we showed the way by exploring the short wavelengths, and further, we demonstrated that the British amateur could accomplish, on low power, what the high power stations are now doing with several hundred times the power we then used.

I believe I am right in predicting that we are going to do even greater things this year, so let us put aside our grievances and adopt the proverb "Actions speak louder than words." Remember, your Committee sits twice a month, and if you have any grievances send them along to us, instead of harbouring them in your minds, or just voicing them among yourselves.

With best wishes,

Yours faithfully,

GERALD MARCUSE

Hon. Sec., Transmitter and Relay Section.

September 3rd, 1924.

Push-Pull Speech Amplifier.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

DEAR SIR,—The push-pull speech amplifier referred to by W. James in your issue of June 4th, 1924, is broadly covered by our British Patent 275/1915, to which patent no reference was made by Mr. James.

With regard to the last paragraph of Mr. James' article, we wish to state that we have not granted licences to any other firm under this patent, and that therefore radio receiving sets embodying this invention can only be obtained from us.

It is presumed that you will desire to give the same publicity to this letter as was given to the article in question.

THE WESTERN ELECTRIC CO., LTD.

Accurate Wavemeters for Transmitters.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—May I be permitted to encroach on your space to remark upon the apparent dearth of accurate wavemeters. Numbers of transmitters today do not seem to have the faintest idea of their wavelength—e.g., within, say, 40 metres each side.

Surely the first thing a transmitter should have is an accurate heterodyne wavemeter to check his transmission.

WALTER G. SHERRATT (5 TZ).

Cowes.

Errata.

In the article on the Armstrong Super Receiver, appearing in our issue of August 27th, the following errors occurred in the diagrams.

In Fig. 1 no connection to earth should be shown.

In Fig. 3 the three fixed condensers shown as having a value of 0·0005 mfds. should each be 0·006 mfds.

FORTHCOMING EVENTS.

WEDNESDAY, SEPTEMBER 10th.

Radio Research Society, Peckham. At 44 Talfourd Road. Discussion : "Effect of Heat on Resistance," "Elementary Principles of the Valve."

THURSDAY, SEPTEMBER 11th.

West London Wireless and Experimental Association. At Belmont Road Schools, Chiswick, W.4. "Woodwork and Finishing." By Mr. S. A. Tomes.

Bournemouth and District Radio and Electrical Society. Lecture : "The Valve and the Theory of its Operations." By Mr. W. H. Peters.

Walthamstow Amateur Radio Society. Lecture : "Short Wave Reception." By Mr. J. E. Nickless (**2 KT**).

FRIDAY, SEPTEMBER 12th.

Radio Society of Great Britain. Transmitter and Relay Section. At 6.30 p.m. At the Institution of Electrical Engineers. "My Experiences whilst Visiting American and Canadian Amateurs." By Mr. Gerald Marcuse.

Leeds Radio Society. At 8 p.m. At the Woodhouse Lane U.M. Schools. 58th General Meeting.

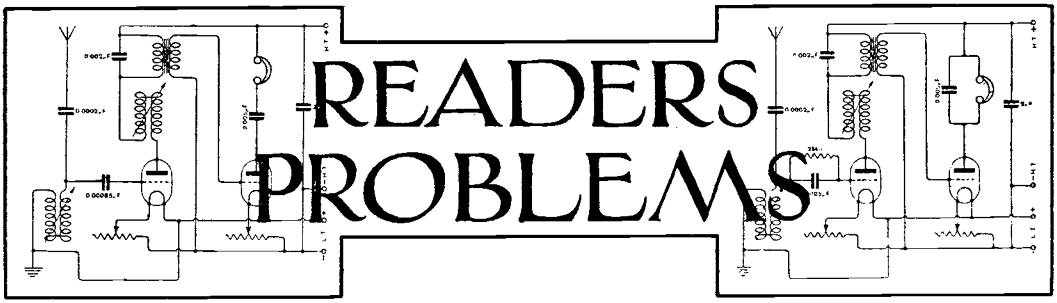
TUESDAY, SEPTEMBER 16th.

Leicestershire Radio and Scientific Society. At the Y.M.C.A. Lecture : "Some Tested Circuits." By Mr. A. E. Walker.

WEDNESDAY, SEPTEMBER 17th.

Tottenham Wireless Society. Lecture : "Wireless in Schools." By Mr. Usher.

Radio Research Society, Peckham. At 44 Talfourd Road. Half-yearly General Meeting.



Readers desiring to consult the "Wireless World" Information Dept. should make use of the coupon to be found in the advertisement section.

Interference from Lighting Mains.

INTERFERENCE from lighting mains and electrical machinery is often picked up by the earth wire from the receiver. If the earth connection is made *via* the water system of the house, it is often worth while to try the effect of using a separate buried earth instead of the water pipe. A counterpoise earth erected underneath the aerial is often effective and in some cases it is possible to dispense entirely with an earth connection, the earth wire being removed from the set. In many cases the signal strength is only slightly reduced when the earth wire is removed and although hand-capacity effects are greater this inconvenience is entirely compensated for by the freedom from extraneous noise, once the receiver has been tuned.

Noises are often picked up as a result of placing the receiver in the magnetic field surrounding lighting wires running behind the wall, and the receiver should therefore be moved to another part of the room in order to make sure that the iron cores of the intervalve transformers are not picking up interference from this source.

An Unusual Cause of Self-Oscillation.

WE were asked recently to suggest a possible cause of self-oscillation in a two-valve low frequency amplifier, which refused to succumb to the usual remedies applied in such cases. Large condensers were connected across the H.T. battery and the connections of the primary winding changed over. In addition, the relative position of the transformers was changed and the wiring redistributed—still without success. Whenever the second valve was switched on, the set developed a persistent howl.

An examination of the wiring revealed the fact that a common grid battery was used for both valves, with two tappings to give a variable bias to each valve. When one of the tappings was connected directly to the filament, oscillation ceased, proving that the coupling was taking place through the grid bias battery. When oscillation is due to this cause, a large condenser of 1 or 2 μF should be connected between each tapping on the grid battery and — L.T. to neutralise the effect of the internal resistance of the battery. Another way of getting over the trouble would be to use two separate grid batteries.

An Efficient Crystal Circuit.

PROVIDED that the sliding contacts are of efficient design, the double circuit type of crystal set illustrated in Fig. 1 is capable of giving excellent results. Essentially the tuner consists of an aerial circuit and closed secondary circuit, across which the crystal and telephones are connected. The same coil is used for both circuits, so that the coupling is necessarily very close. Under favourable conditions a step-up of voltage is obtained across the crystal and telephone circuit, with a consequent increase in signal strength.

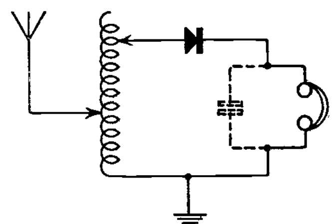


Fig. 1.

For the range of wavelengths between 300 and 500 metres, the tuning coil may consist of 150 turns of No. 20 enamelled copper wire on a cylindrical former 4 inches in diameter. A condenser may be connected across the telephones if an improvement is thereby obtained in the quality of reception.

Ebonite Panels.

A CORRESPONDENT writes to ask what steps should be taken to render a sand-blasted ebonite panel non-conducting on the surface.

Sheet ebonite often carries a coating of conducting metallic sulphides below the polished surface, owing to the use of metal separators between the sheets during the process of rolling. The object of sand-blasting is to remove this film, or at least to break it up into isolated particles. There is no need, therefore, to treat a sand-blasted panel unless the appearance of the surface produced by rubbing down with glass paper is preferred to the pitting usually produced by sand-blasting.

It should be remembered that the surface resistivity of ebonite often depreciates as a result of exposure to the air. The depreciation is generally accompanied by a slight yellowish or greenish tinge on the surface of the panel. When this is observed it is often an advantage to take the receiver to pieces and rub down the panel with glass paper to remove the surface film. In electrical standardising laboratories the panels of certain instruments are treated in this way annually as a matter of course.

Long Wavelength Frame Aerial Reception,

THE adoption of the wavelength of 1,600 metres for the tests of the high-powered station at Chelmsford has made it possible to use resistance-capacity coupling for high frequency amplification. When a good outdoor aerial is used, high frequency amplification is necessary only in the far North, owing to the extraordinary power used by this station. On the other hand, the high power will enable many people in the south of England to obtain satisfactory loud-speaker results with the use of an indoor frame aerial.

A diagram of a five-valve set suitable for this purpose is given in Fig. 2. Two stages of resistance-capacity coupled H.F. amplification and two stages of L.F. amplification are used with transformer coupling. The H.F. amplifying valves should have a high amplification factor, and the L.F. valves may be low impedance power valves. The values of the anode resistances will of course depend upon the make of valve and the value of H.T. voltage that can conveniently be used. The anode resistance should be at least two or three times the impedance of the valve, and the H.T. voltage must be high enough to ensure that the valve receives its correct anode voltage after allowing for the drop of voltage through the external resistance. A low resistance loud speaker used in conjunction with a suitable transformer is recommended in view of the fact that power valves are to be employed. Condensers should be connected between each H.T. tapping and – H.T.

The resistance-capacity method of coupling is aperiodic, and therefore non-selective. A frame aerial is therefore recommended in preference to a short indoor elevated aerial, as the directive properties of the frame will be of considerable value in eliminating interference.

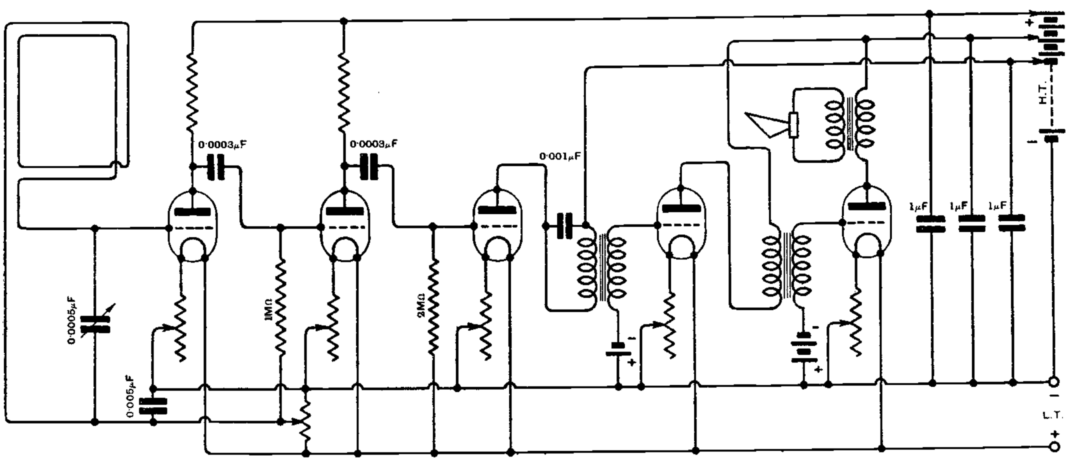


Fig. 2.

Methods of Detecting Radiation from a Receiver.

IT is essential to have some means of knowing whether oscillations are being set up in the aerial circuit of a receiver during experimental work in order that interference with other receivers in the neighbourhood may be avoided. The simplest method, of course, is to tap the aerial terminal with a moist finger. If the aerial circuit is oscillating, a loud click will be heard in the telephones. When carrying out this test it is necessary to detune from any strong transmissions that may be in progress at the time, otherwise clicks will be heard due to the stoppage of the aerial oscillations induced from the transmitter. Although simple, this method is by no means conclusive. A better method would be to listen with another receiver situated at a distance of half-a-mile, and try and detect any actual radiation taking place.

The most reliable and scientific method would be to insert a sensitive thermo-galvanometer in the earth lead. Instruments of this type are available which measure only a few micro-amperes, but their price is unfortunately rather high.

The WIRELESS WORLD AND RADIO REVIEW

RADIO TOPICS.

THE VALUE OF QUANTITATIVE MEASUREMENTS.

THE amateur who takes up wireless as a hobby is often engrossed in trying out different circuits and experimenting in a more or less haphazard manner from the outset. Unfortunately, the tendency is for him to continue his experimental work in this way instead of introducing more systematic methods and reasoning out for himself the causes of the various effects which he obtains. It is impossible to study wireless intelligently unless the experimenter is familiar with at least the more usual methods of making quantitative measurements. Amongst the simplest and most essential measurements are those of capacity, inductance and resistance, and yet we believe that there are very many who, although they consider themselves experimenters, are not able to make measurements of this kind.

A wavemeter, accurately calibrated, should be regarded as an indispensable accessory to an amateur station, and yet those who possess such an instrument only cover a very small percentage of the total number of experimenters. We would urge all readers who have not equipped themselves with standard calibrated instruments to do so as early as possible for by using them they will learn more in days than they can in months of experimental experience where quantitative measurements are ignored.

For the benefit of new readers we may mention that in back numbers of *The Wireless World and Radio Review* articles have appeared dealing with practical measurements of all kinds and particulars of the instruments necessary have been included. We are always pleased to give references to these back numbers to any new readers who wish to obtain them.

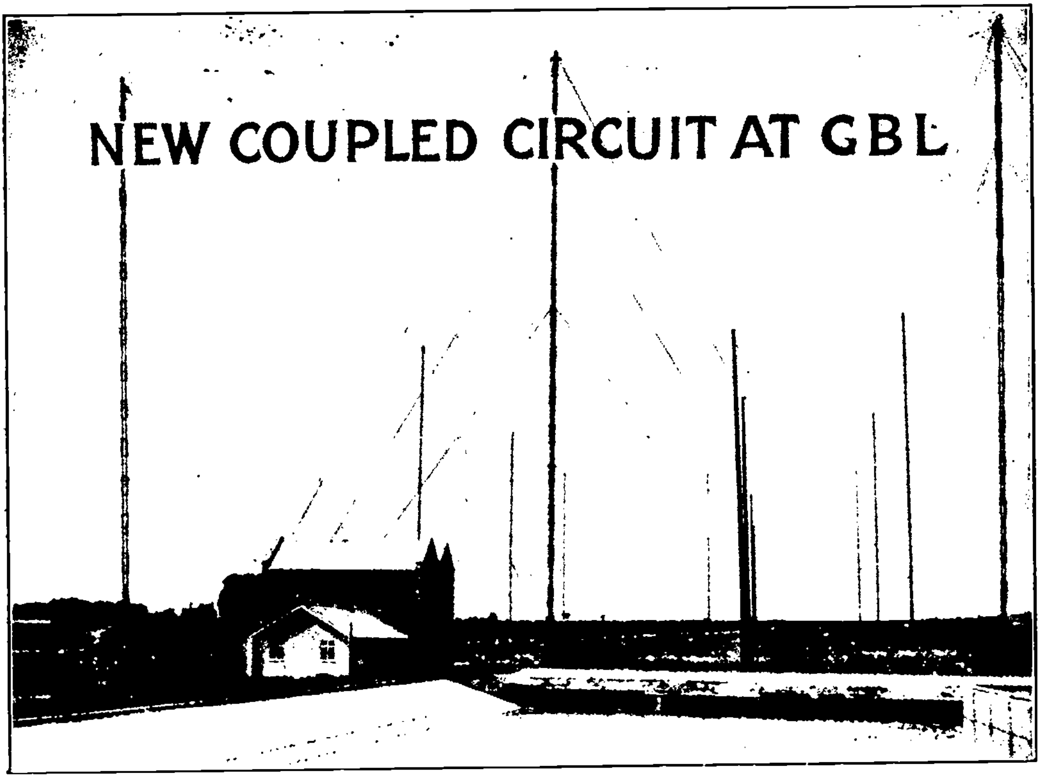
IS THE AMATEUR LOSING HIS STATUS?

WE are of the opinion that, collectively, the amateur has not improved his status to anything like the extent which might have been expected of him. We do not mean, of course, that individual amateurs or even amateurs as a body have fallen short in technical qualifications; on the contrary we believe that the British amateur is far ahead of amateurs in any other country in his practical capabilities. When we speak of status we refer rather to the politics of wireless and the degree of recognition which the amateur has earned for himself.

Considering the achievements which have been made by British amateurs, the status of the amateur in this country should be at least equal to that of the amateurs of America, and one must look for the causes which have hindered the British amateur from establishing himself on the same footing. These causes are not far to seek. The trouble lies in the fact that the British amateurs are not "knit together" to anything like the extent that the Americans are. The American amateur spirit is typified in the American Radio Relay League, which is not only recognised by the American amateur as his spokesman and representative, but the organisation is wholeheartedly and enthusiastically supported by every amateur worthy of the name. In this country one cannot find a parallel, due perhaps in part to the difference in national spirit, but more largely to a want of appreciation on the part of the amateur of the responsibilities and obligations which he undertakes when he assumes the title of "wireless amateur."

THE EDITOR.

NEW COUPLED CIRCUIT AT GBL



INCREASING THE EFFICIENCY OF THE LEAFIELD STATION.

The Post Office station at Leafield, Oxford, is probably the best known of all the high-power stations in this country. In the following pages we give details of recent circuit alterations to this transmitter which have resulted in greater efficiency.

THE Wireless Station at Leafield has undergone one or two modifications since it was originally designed; in fact the station was never built to the original plan which was got out in 1913 because the outbreak of war delayed the construction.

A 300 kilowatt spark transmitter was decided upon prior to the war but developments in arc transmitters during the years of the war resulted in the decision to equip Leafield with high power arcs when the building of the station was eventually commenced.

The harmonics emanating from Leafield Station in the past have been so much talked about that they need not be referred to again here. The latest modification to Leafield Station has been an attempt to increase the efficiency of the station and reduce the radiation of harmonics.

The accompanying illustrations show apparatus recently installed at the Leafield wireless station, by means of which the transmitter has been modified from a direct transmitter to a coupled transmitter.

In Fig. 1A the original circuit is shown, while B indicates the arrangement now in use. The new inductance in Fig. 2, consists of spiral coils of strip copper. The four lower spirals are mounted on a moving carriage, and slide beneath the upper spirals

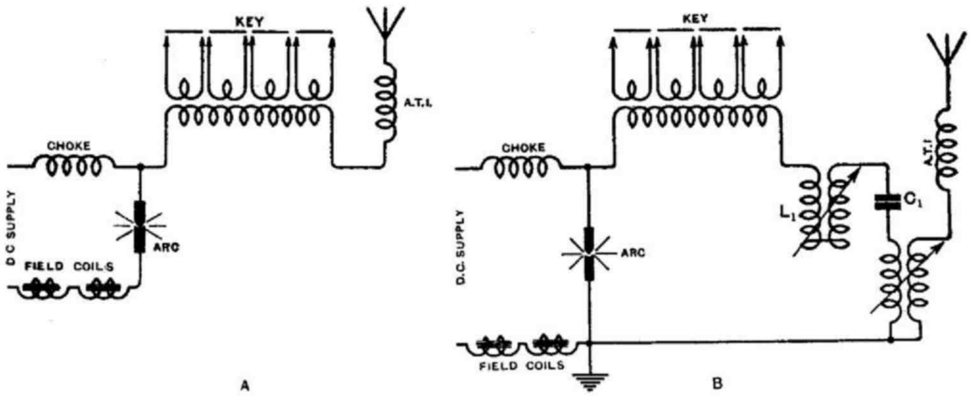


Fig. 1. (A) *the original circuit at Leafield*; (B) *the new coupled circuit.*

This constitutes an effective variometer, and enables the primary circuit containing the arc generator to be brought into accurate tune with the aerial or secondary circuit. This inductance is 16 ft. high, and contains over a ton of copper. It is operated by a geared handwheel on the control gallery. The transference of energy from the primary to the secondary circuit is carried out by the variocoupler shown in Fig. 3 (L_1 Fig. 1). This variocoupler stands 6 ft. high, and has two moving coils connected in the primary circuit. These coils are surrounded by two fixed coils connected in the secondary circuit between the A.T.I. and earth. The coupling can be adjusted while the transmitter is

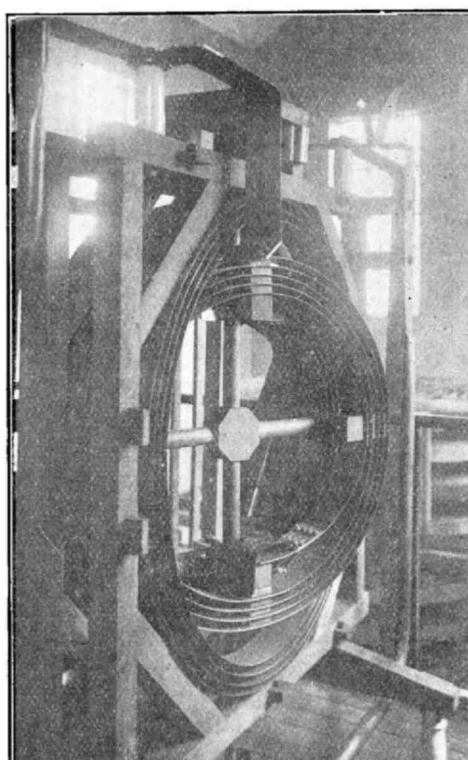


Fig. 3. *The vario-coupler.*

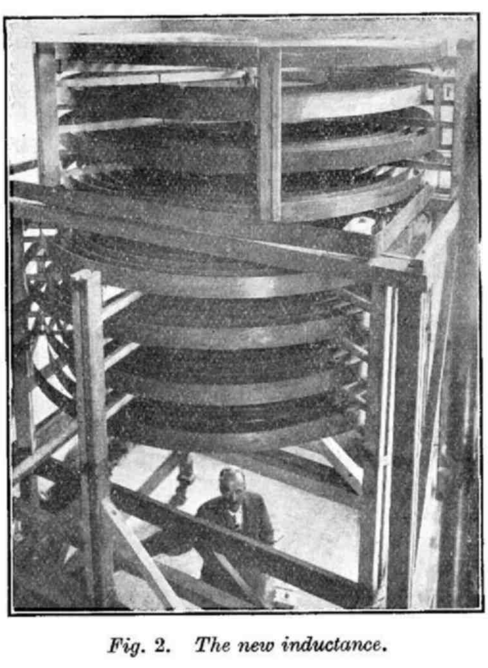


Fig. 2. *The new inductance.*

running, and by rotation of the moving coils the aerial current can be brought to a maximum of 260 amperes or reduced to zero.

Perhaps the most interesting problem in connection with this new plant was the provision of a condenser for the primary circuit capable of handling the high frequency current without appreciable loss.

Preliminary experiments carried out at Northolt with an oil condenser gave satisfactory results, and the design of a condenser suitable for Leafield was prepared.

The condenser is formed by sets of aluminium plates suspended in oil, the whole being in steel tanks. There are four units each of 6,250 micro-microfarads capacity connected in parallel. The maximum working current is about 260 amperes at 12,350 metres wavelength, and under these conditions the working voltage is 68,000 R.M.S., and the energy handled is 18,000 K.V.A. The complete condenser weighs 25 tons, and contains 5,000 gallons of oil. In order to maintain the oil in perfect condition it is periodically cleaned and dried by passing it through a centrifugal separator. The bank of 4 condenser units is shown in Fig. 4, while the centrifugal separator and tanks are shown in Fig. 5. The oil is pumped through the separator, and any water or foreign substance is removed. It will be noticed that the leading-out insulators are of unusual pattern. They are shaped like inverted bowls, and are designed to reduce losses due to dielectric currents passing through the earthenware.

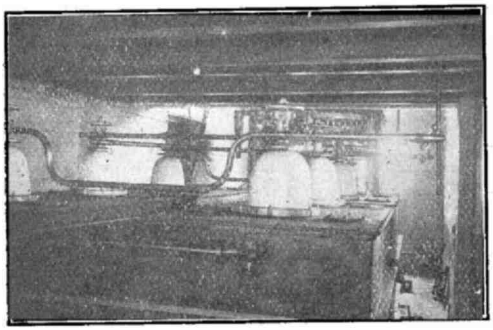


Fig. 4. The bank of four condenser units.

The installation was carried out by the Post Office Engineering Department, and has been entirely successful.

On 12,350 metres wavelength the new circuit produces the same aerial current as the old circuit, with about the same expenditure of power. On a wavelength of 8,750 metres there is a saving of about 25 per cent. of power with the new transmitter.

The new circuit causes much less interference on shorter wavelengths than did the old circuit. For example, it is now possible to receive **5 XX** comfortably at the station itself while the arc transmitter is actually working.

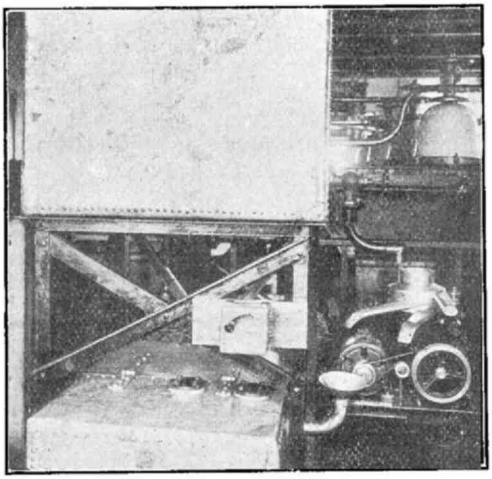
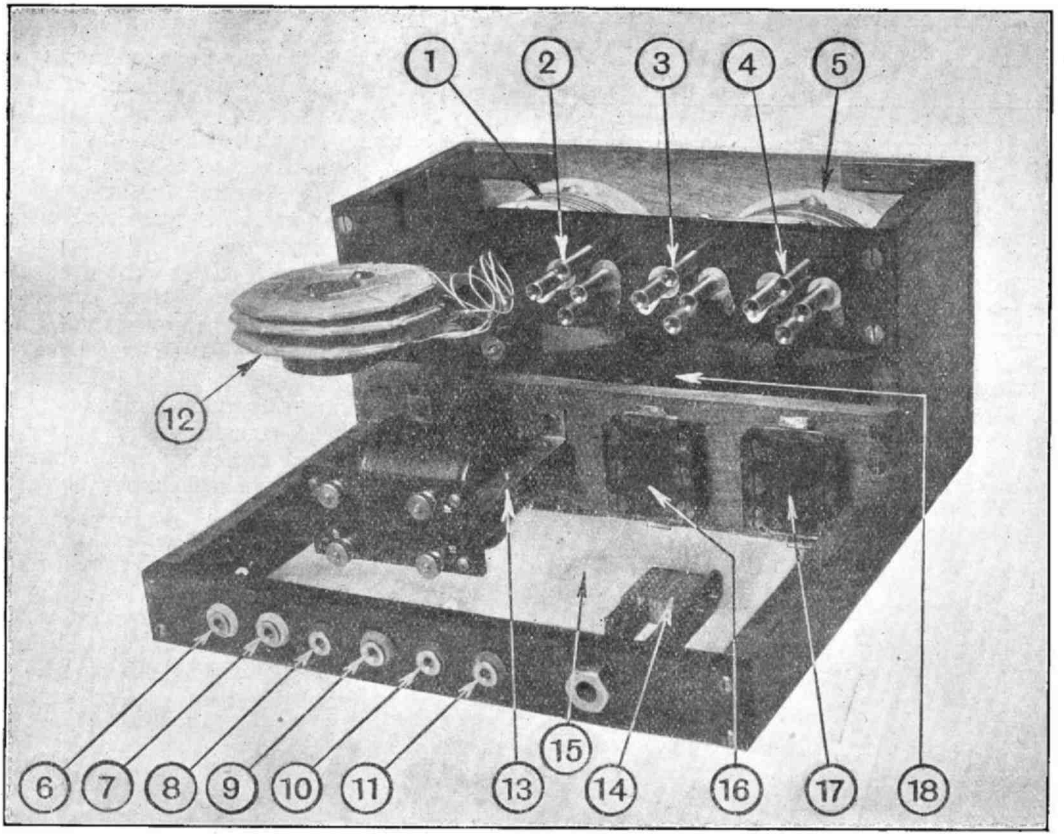


Fig. 5. Centrifugal separator and tanks.

Many curious effects occur in the vicinity of a high power continuous wave transmitter such as that at Leafield. High potentials in the vicinity of the tuning coils cause appreciable charging currents to flow into near-by objects ; electric lamps burn with a dull glow on open circuits ; while persons coming into proximity with each other or any conducting object can draw out sparks even when both are insulated from earth.

It will be interesting to see what effect these changes have brought about. Perhaps it is significant that complaints of interference by this station are now not nearly so frequent as they have been in the past.

We are indebted to the Engineering Department of the General Post Office for the loan of photographs and for the technical information published.



The receiver assembled ready for wiring. 1 *Tuned anode condenser,* 2 *L.F. valve,* 3 *detector valve,* 4 *H.F. valve,* 5 *frame tuning condenser,* 6, 7 *frame terminals,* 8 *H.T. –,* 9 *H.T. +,* 10 *L.T. –,* 11 *L.T. +,* 12 *tuned anode coil,* 13 *intervalve transformer,* 14 *telephone jack with break contacts for filament circuit,* 15 *position for grid leak,* 16 *primary bridging condenser,* 17 *grid condenser,* 18 *H.T. battery bridging condenser.*

A RECEIVER FOR FRAME AERIAL RECEPTION.

By F. H. HAYNES.

(*Concluded from page* 650 *of previous issue.*)

THE ebonite must be shaped to the dimensions shown in Fig. 3. The setting out of the positions for the valve legs must be done very carefully, and when the positions for the holes have been centre-punched or marked with the sharp tag end of a file, it is advisable to stand a valve over them to observe whether the pins exactly coincide with the markings. The hole for the telephone jack will require a drill somewhat larger than is usually possessed by the beginner, and again the tag of the file can be put to good service, using it from both sides of the ebonite. The importance of drilling precisely vertically through the ebonite panels cannot be over-emphasised. The pieces E and F, which are $\frac{5}{16}$ in. in thick-

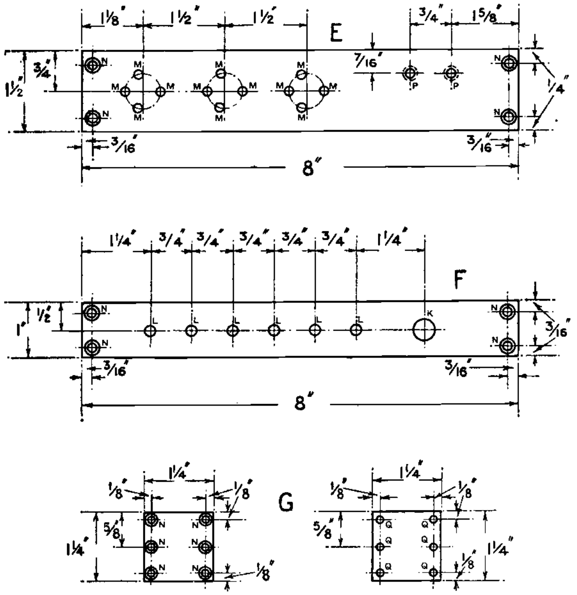


Fig. 3. The ebonite pieces, for valve holder platform, terminal strip and condensers. Size of holes; K $\frac{3}{8}$″, *L 7/32″, M 5/32″, N* $\frac{1}{8}$″ *countersunk on top side for No. 4 wood screws, P* $\frac{1}{8}$″ *countersunk for No. 4 wood screws, Q* $\frac{1}{8}$″.

ness, may be left a little long until screwed in position, when the ends can be filed down flush with the woodwork.

The two small condensers may now be finished right out. The four pieces should be made up as two pairs, and those pieces which are intended to be at the top, drilled with six holes. Holding the pairs securely together so that they exactly coincide, holes in opposite corners can be put through and the pieces screwed down to a piece of waste wood. This will keep them exactly in register for making the remainder of the holes. In assembling the condensers three pieces of copper foil are needed for the grid condenser, *i.e.*, two pieces in one direction and one in the other, separated by two pieces of mica and with two more pieces of mica on the outsides (Fig. 4). The primary bridging condenser for the transformer may consist of five pieces of foil in one direction, four in the other, and using ten pieces of mica. The two condensers should be screwed down into position straight away on completion, with plates carefully assembled to give an overlap of $\frac{3}{8}$ in. by $\frac{3}{4}$ in., and while the metal foil is still bright and clean the projecting ends soldered together. The assembling of the transformer platform is completed by attaching the intervalve transformer, which is preferably carried out with four 4 B.A. screws and nuts, though this detail will depend upon the type of transformer selected.

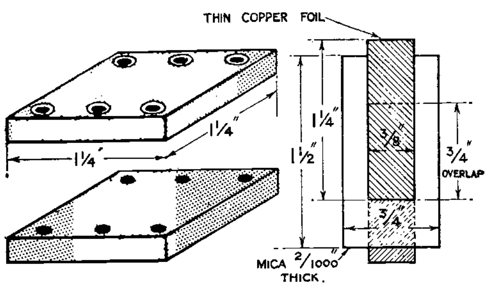


Fig. 4. Details for assembling the small condensers.

The valve platform provides ample spacing for the insertion of dull emitter valves of the .06 or ARDE types in the holders. In assembling

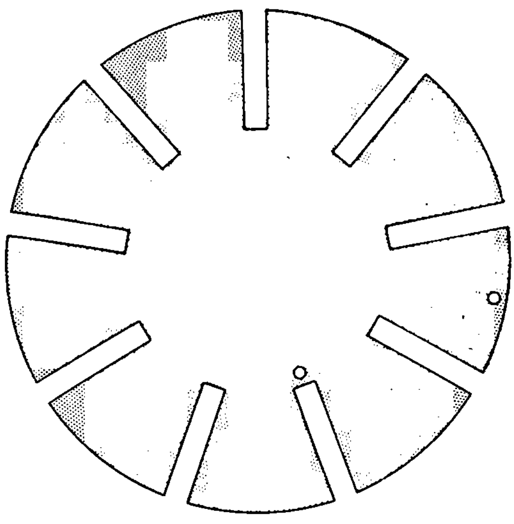


Fig. 5. Card for winding the inductances (exact size).

the valve stems small brass tags, easily obtainable from dealers, are inserted on the under side in the case of the filament connections, and on the top face for the grids and plates.

The flat inductances, three in number, are wound on formers accurately cut to the size given in Fig. 5, which can be pricked through on to card of the stiffness of postcards. They are all wound in exactly the same direction, commencing and finishing in the same positions on each with 28 turns of No. 28 D.C.C. wire. The cards may be immersed in molten wax before winding, but it is not advisable to impregnate them after the wire is wound on, as the self-capacity of the coil would thereby be increased unnecessarily. They are assembled, spaced about 3/16 in. apart with small wooden spacers, so that the direction of the turns is continuous, joining the side end of one to the outside end of another. This is most important, and every care must be taken to see that the direction of winding does not reverse. This home-made inductance can be replaced, if desired, by a No. 75 plug-in coil. The valve panel fitted up with the inductance is shown in accompanying illustrations.

Proceeding with the assembly of the set, the two variable condensers are set up and the remainder of the equipment screwed in position. It is necessary, of course, to join up the tags on the filament stems before fixing the valve platform.

The remainder of the wiring is carried out with the apparatus in position, using No. 18 tinned copper wire well straightened by stretching. Consider carefully the route to be taken by every lead before it is fitted, and only make use of right-angle bends so that the leads run only in three planes. The wiring is not unduly complicated and can be followed from Fig. 6.

The instrument thus completed is intended to slide into a containing cabinet, which is

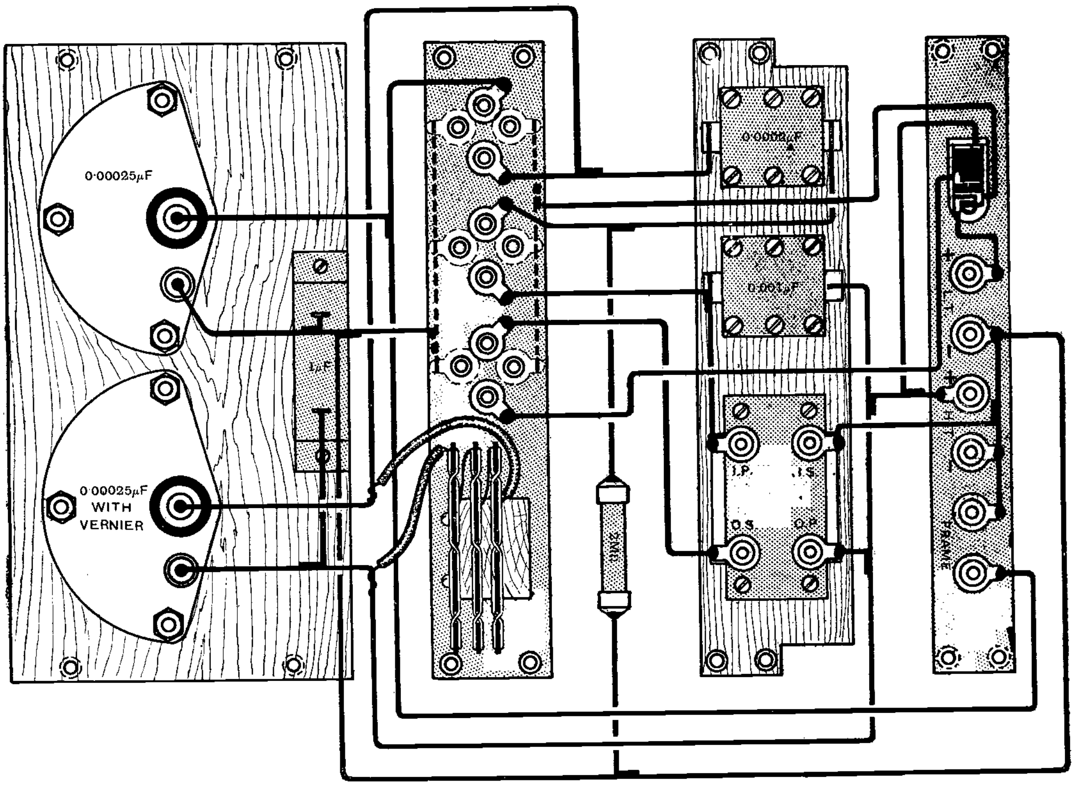
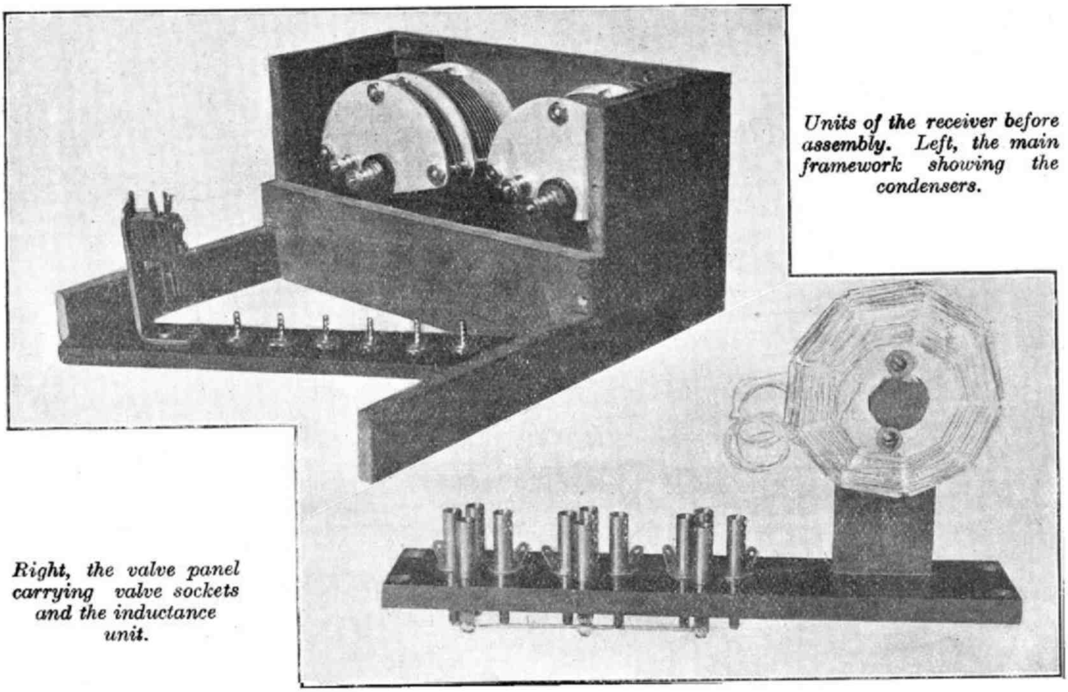


Fig. 6. Diagram of connections showing the actual points between which leads are run.



Units of the receiver before assembly. Left, the main framework showing the condensers.

Right, the valve panel carrying valve sockets and the inductance unit.

used to house the necessary dry batteries and give support to a frame aerial. The arrangement used by the writer is shown in Fig. 7, in which valve windows appear at the top and clearance is left in the wiring of the instrument so that the lower stem of the frame can pass right through.

The dimensions of the frame should be as large as possible ; say, up to sides of 3 ft. 6 ins. Eleven turns spaced 3/16 in. will no doubt be found suitable, but small final adjustments can easily be made if the tuning position is not found to fall suitably on the condenser scale.

The two tuning condensers should operate together, and each cover approximately the same wavelength range. The set will be found to oscillate when the two circuits are correspondingly tuned, and it is in this position that an extensive receiving range will be obtained, while the extent of oscillation will not be found so excessive as to introduce appreciable distortion into telephony reception.

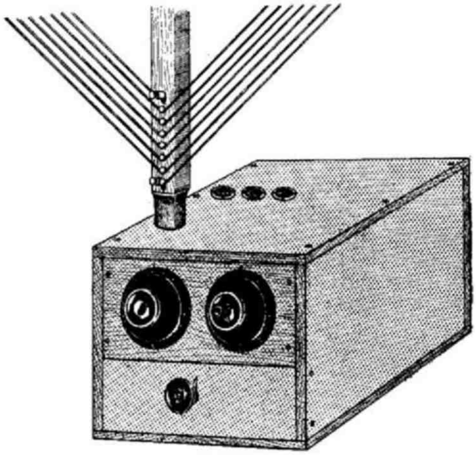


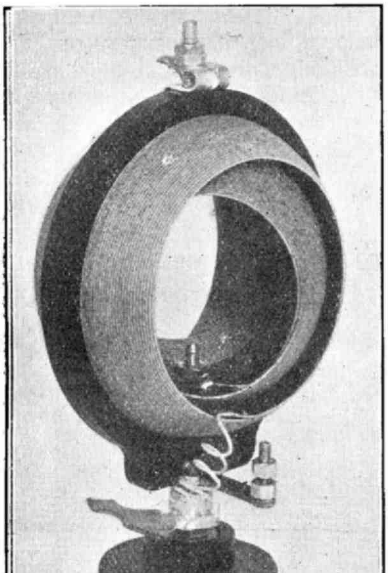
Fig. 7. The containing cabinet with lower portion for accommodating the H.T. and L.T. batteries. The stem of the frame aerial passes clear through the wiring of the instrument, and the weight of the batteries makes a suitable base for giving vertical support to the frame.

COMPONENTS OF INTEREST.

A REVIEW OF NEW PRODUCTS OF THE MANUFACTURERS.

The Acme Variometer.

A good variometer should have a high ratio of maximum to minimum inductance, and a low value of high frequency resistance and of self-capacity. To obtain the desired range of inductance the windings may be constructed in such a way that there is but little clearance between them. However, the self-capacity is usually high when the windings are arranged very close together.



Hence in well-designed variometers we find the windings are separated by a distance which is considerably more than is required from a mechanical point of view. It is well known that the effective resistance of a coil may be reduced by the employment of a large gauge of wire, and by reducing the amount of material in the supports of the coils to a minimum.

A variometer which appears to have desirable electrical properties is shown in the accompanying illustration. It will be

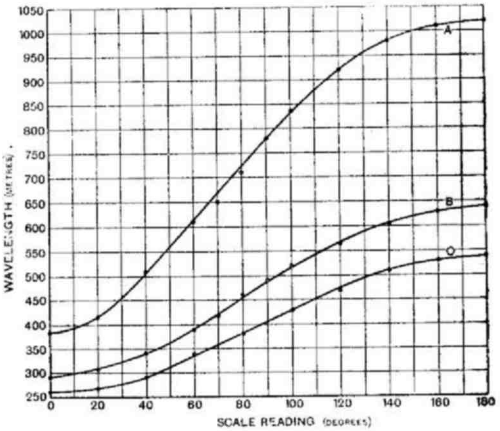


Fig. 1. Tuning curves of the Acme Variometer.

observed that the coils are secured to rings of insulating material, and that the larger portion of them is self-supporting.

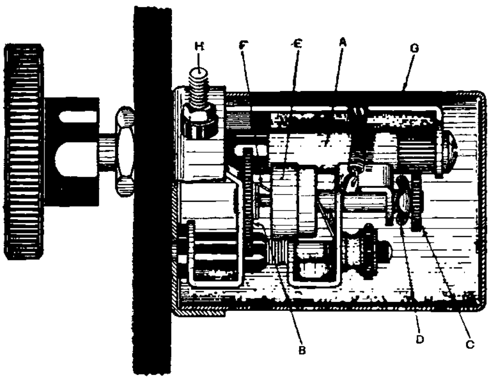
The curves of Fig. 1 show the range of wavelengths over which a normal (100 ft.) aerial may be tuned when (A), a fixed condenser of 0·0004 microfarads is connected across the variometer; (B) when used alone; and (C), when a 0·0004 μF condenser is connected in series. It may be seen from the curves that an inductance range of 6 to 1 is obtained.

The variometer is mechanically sound, and may be secured to the panel by the usual " one-hole fixing " method.

The Utility Automatic Crystal Detector.

This detector is of the wire contact type, and comprises arrangements for simultaneously rotating the wire contact and the crystal cup, while the latter is also given an up and down movement.

As may be seen from a study of the accompanying sketch, the knob is attached to a spindle A, and on being turned rotates gear wheels B and C. The wire contact F is secured to the gear wheel B, and is electrically connected to terminal H. Hence, as the knob is turned, the wire contact rotates in a circular path of radius determined by the distance between the centre of B and the wire point. At the same time the crystal cup E, which is attached to the gear wheel C, rotates and also moves up and down by the action of the cam D. Thus, by turning the knob, the wire contact is moved over the surface of the crystal, and a sensitive spot may quickly be found.



The Utility Automatic Crystal Detector.

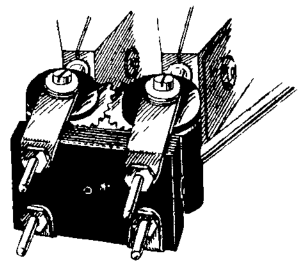
The detector is cleverly arranged, but the writer doubts whether the average amateur would prefer a detector constructed in this way to one where he is able to see the contact and to make close adjustments. The detector is completely enclosed in a metal case G.

A Geared Plug-in Coil Holder.

A novel plug-in unit,* consisting of two coils mounted in a holder, is sketched in the accompanying figure. The platform of the holder has four pins which fit in four sockets provided in the receiver. Toothed wheels are secured to each holder, so that when the handle attached to one of the holders is moved, the coils move away from or towards each other. Hence a variation of the inductance of the circuit is obtained, the inductance being a maximum (for a given pair of coils) when the coils are close together, and a minimum when they are at right angles. The desired wavelengths may be tuned in by selecting suitable size coils.

* Messrs. A. J. Stevens & Co., Ltd.

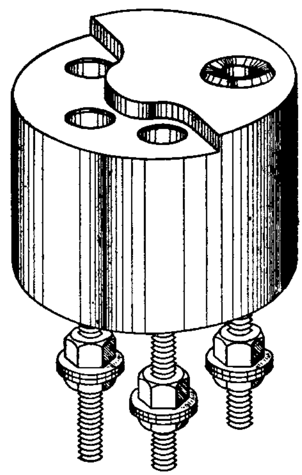
A plug-in unit of this type is a useful component, especially when employed with a receiver having enclosed tuning coils.



The Geared Coil Holder.

A Safety Valve Holder.

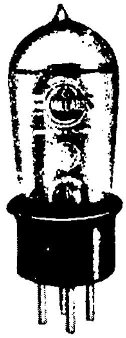
The accompanying sketch shows a valve holder* which is designed with a view to easy mounting, and avoiding the possibility of accidental contact between the filament legs of the valve and the anode socket of the holder. The anode socket stands above the others by about 1/16th of an inch, and the body of the holder is shaped to form a ridge about 1/16 in. high round the anode socket.



A Safety Valve Holder.

Thus the anode socket is easily identified, and we have found it almost impossible to insert the filament legs of the valve in any but the correct sockets.

* Beswinning's, Connaught Mews, Ilford.



VALVE TESTS.

THE NEW MULLARD H.F. AND L.F. VALVES.

THE subject of our review this week is the new Mullard valves, of which one of each type have been submitted to us by the manufacturers, The Mullard Radio Valve Co., Ltd., Balham, S.W.

These valves, which are stated to be the outcome of considerable trial and experiment, are designed on lines completely different from previous products of this well-known maker.

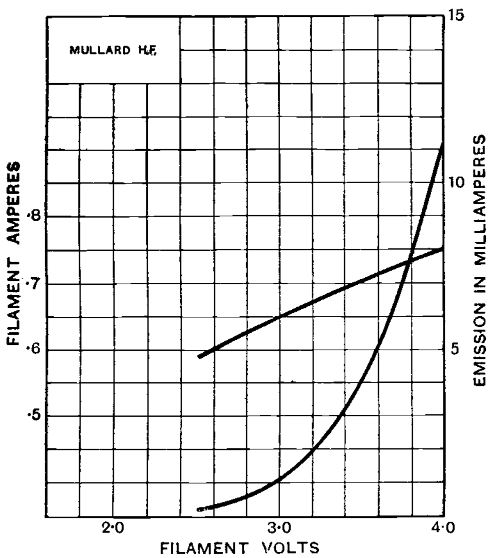
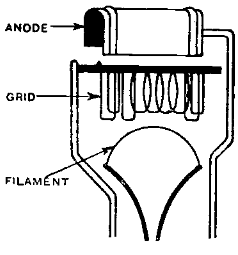


Fig. 1.

The first thing to claim attention is the cap. This is made with a ridge around the top for safe handling, and is particularly useful when withdrawing the valve from its holder, and prevents any necessity for the actual pull being applied to the bulb itself.

As regards the electrodes, a "tunnel" shaped anode, open at the bottom, takes the place of the tubular construction heretofore employed. The filament, instead of being straight, is now in the form of an arch in order to accommodate which the grid has been considerably altered, but it is to be noticed that this electrode, as well as the anode, is supported only at one end (see sketch).



Sketch showing details of the construction of the electrodes.

Both types, the "H.F." (designed for high frequency amplification and detection) and the "L.F." (designed for low frequency

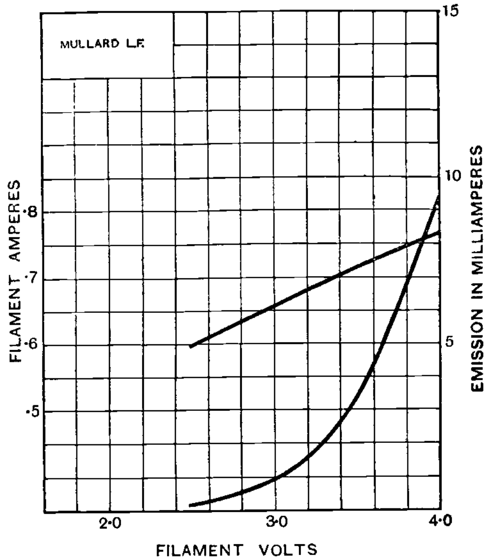


Fig 1*a*.

amplification), are bright emitters fitted with similar filaments, which are rated at 3·2 to 3·8 volts, 0·6 ampere. As far as one can see without actual measurement the anodes are

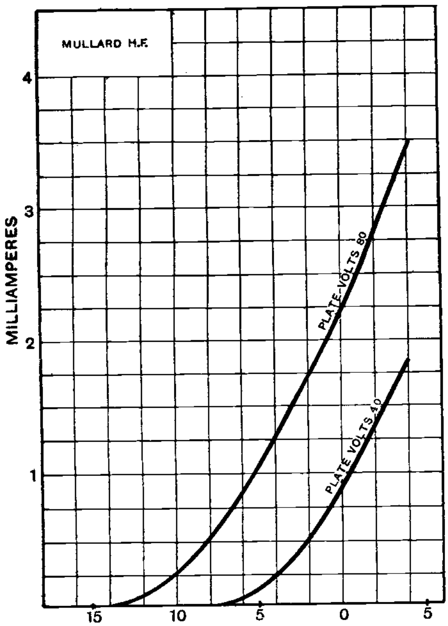


Fig. 2.

also the same in both valves, and the high tension rating is 30—90 volts.

Bench tests have been carried out and the results are given herewith, Figs. 1, 2 and 3 referring to the " H.F." valve, and 1A, 2A and 3A to the " L.F." valve.

Dealing first with the " L.F." green ring valve, Fig. 1A shows the emission and filament current plotted against filament volts. At normal brilliancy the filament current of the tested sample is 0·73 ampere at 3·63 volts, or approximately 2·65 watts of heating energy. Plate current, grid volts curves are given in Fig. 2A, the 80-volt curve showing every indication of good low frequency amplification.

The valve has a magnification factor of approximately 6, the plate impedance at the higher voltages being a fraction over 20,000 ohms, and whilst the impedance, of course, increases with lower plate potentials, the magnification factor remains fairly constant.

Regarding the " H.F." red ring valve, the filament characteristics shown in Fig. 1 are very similar to those of Fig. 1A, which, of course, is to be expected, since the two valves have the same filament rating. The anode current, grid volts curves of Fig. 2 are also much the same as those of Fig. 2A, excepting that those of the former are shifted a little to the right and are somewhat closer together, and assuming the plates of the two valves to be the same, this suggests a somewhat closer grid with consequent higher " m " value. That this assumption is correct is seen from Fig. 3, where the magnification factor is of the order of 7·3, with an impedance of approximately 30,000 ohms.

A circuit test was next carried out using the two Mullard valves, with a standard bright emitter as detector. Good signal strength was obtained, the " H.F. " valve operating with a plate potential of 40, that applied to the " L.F." being 80 volts backed off with a negative grid bias of 2 volts. The plate current, grid volts characteristics of these two valves being so similar suggested

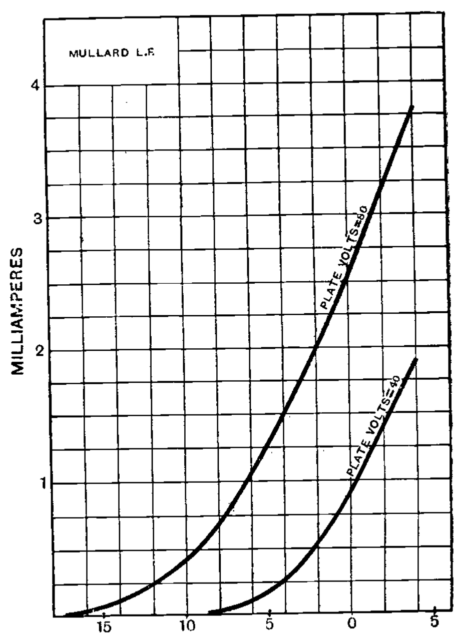


Fig. 2a.

that either valve with appropriate H.T. would work either on the high or low frequency side. The " L.F." valve was consequently put in a high frequency position and the " H.F." on the low frequency side, and, using the same plate potentials as before, very little, if any, difference in signal strength could be noted. The "H.F." valve was next tried as a detector, but the results did not equal those obtained from bright emitters of other well known-types.

This may be due to the shape of the grid current curve, which extends rather far into the region of negative grid potential. In all

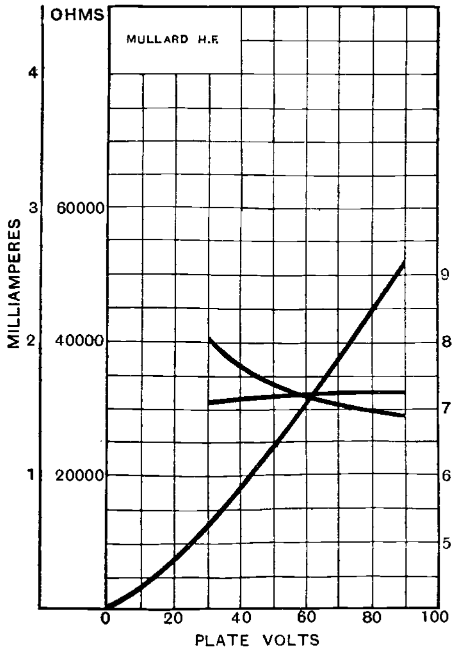


Fig. 3.

other respects we found the valves very satisfactory, though we rather feel that with

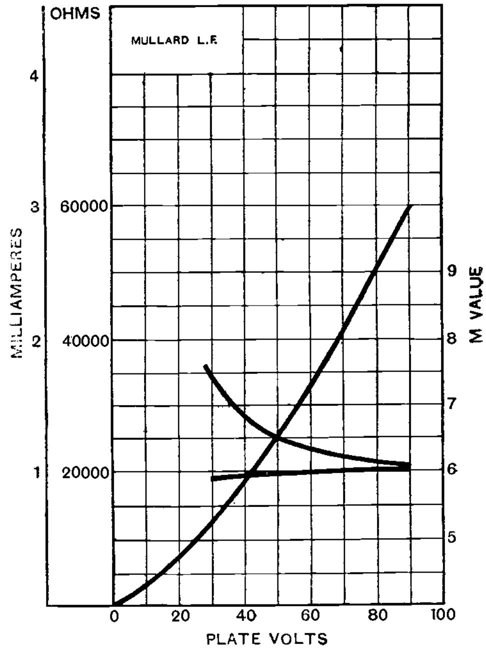


Fig. 3a.

a valve designed for H.F. amplification and detection only, and therefore not falling in the class of general purpose valves (that is, it is not required to perform low frequency work), it is a pity that the magnification factor has not been given a higher value. When a valve is intended for general purpose working the "m" value has, of necessity, to be kept at a moderate figure, but in the case under consideration this does not apply.

SIMPLIFIED WIRING.

AN INGENIOUS AID TO THE CONSTRUCTOR.

An interesting system of wiring instruction, aiming at the removal of one of the principal difficulties confronting the beginner, makes its appearance with the publication of the W.P. Ezi-Wiring Series. The essential feature of the system is the use of wiring diagrams printed in colour. By this means the constructor can distinguish between different sections of the wiring at a glance, and is able to trace H.T. and L.T. leads without risk of confusion.

The three books at present comprising the series are :—

1. "A Three-Valve Portable Receiver," by Hugh S. Pocock.
2. "A Three-Valve Receiver," by F. H. Haynes.
3. "A Two-Valve and Crystal Reflex Receiver," by W. James.

The keynote of each of the series is compactness. Between the covers of each will be found all the information that can possibly be required in building the particular set. There are no loose sheets, but the task of the constructor is rendered unusually simple by means of large progressive diagrams drawn on the W.P. Ezi-Wiring principle which can be spread out for reference without obscuring the text. The value of the series is still further enhanced by the use of excellent photographic plates.

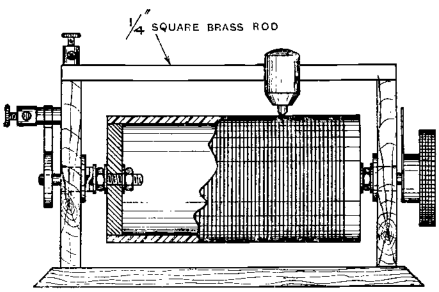
The W.P. Ezi-Wiring Series are obtainable from all booksellers and newsagents, price 2s. net each, or from the Wireless Press, Ltd., 12-13, Henrietta Street, London, W.C.2, price 2s. 2d. post free.

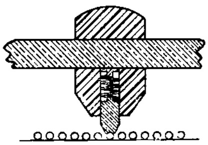
READERS' PRACTICAL IDEAS.

This section is devoted to the publication of ideas submitted by readers and includes many devices which the experimenter will welcome.

Making a Variable Inductance.

A WELL-KNOWN arrangement of making a variable inductance by means of a sliding contact can be elaborated upon by causing the inductance former to rotate and thus give a very careful degree of adjustment. Of course, this refinement will not





be required when using an inductance of large value, but for tuning the short wavelengths when the turns may be spaced, it will be found very helpful to set up the coil so that it can be rotated, causing the sliding contact to connect upon the turns of the wire and advance as the former revolves.

A. E. S.

Keeping the Aerial Taut.

MAINTAINING the tension on the aerial wire is very necessary when either of the points to which it is attached is not perfectly secure, which condition arises when an aerial wire is attached to a tree which may sway in the wind. One method of maintaining tension on the aerial consists in passing the halliard over the pulley, and instead of terminating it by tying it off to a fixed point, attaching to it a heavy weight that can rise and fall as the tree sways.

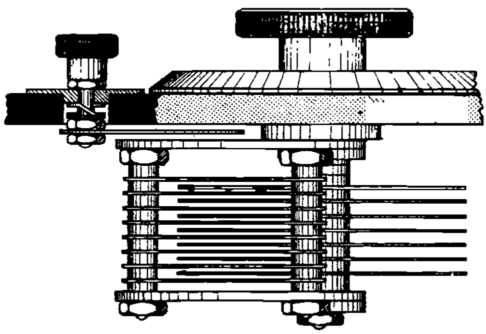
Another and very useful method is the insertion of a spring near the aerial insulators.

The use of springs in aerial wires is a very good practice, even when the aerial is tied off, as the elasticity of a spring will counteract the contraction which occurs when the halliard shrinks during rain.

W. J. E.

Attaching a Vernier Plate.

VERNIER adjustment on tuning condensers which is usually essential for the easy setting of critically tuned circuits is commonly fitted to variable condensers so that it operates concentrically with the remainder of the plates. This form of construction is usually beyond the scope of the amateur who may therefore set up a vernier plate near to either of the metal end plates of the condenser. One form of construction is shown in the accompanying drawing, and can usually be fitted to a receiver without

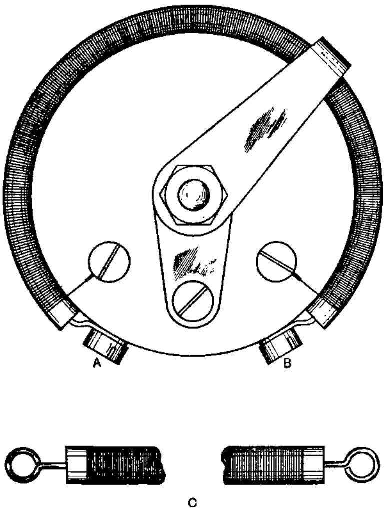


rearranging the existing equipment on the panel. The constructional details given in the drawing are sufficient to work to without further description.

W. E. M.

A Cheap Potentiometer.

THE accompanying diagram shows clearly the construction of a typical type of potentiometer. The usual difficulty met with in making a potentiometer is that of suitably supporting the turns of fine wire. A useful support for the winding of the instrument is provided by a piece of insulated cable such as is used for wiring house electric light circuits. Single No. 16 V.I.R. cable suits the purpose quite well. The ends of the wire are bent round to be held in position by the screws, whilst the potentiometer wire is wound over the



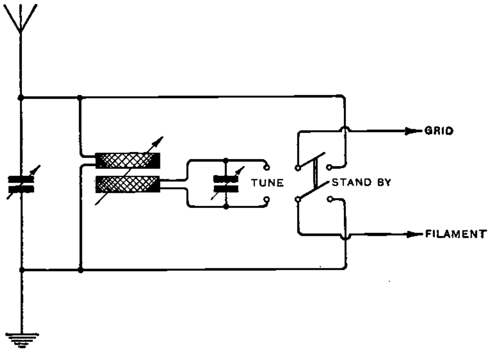
insulated covering. A suitable winding is No. 36 Eureka wire.

J. S.

Closed Circuit as Wave Trap.

SELECTIVE receiving sets are usually provided with a tuned, closed circuit which is brought into operation by means of a two-position switch. It is often said that this switch should have three arms so that the tuned closed circuit may be completely broken when not in use. This breaking of the closed circuit is recommended on the grounds that the tuning of the aerial circuit will not be influenced by the proximity to it of the closed oscillatory circuit.

The closed circuit, however, can be made to serve a very useful purpose, and if not broken in this manner it may be tuned and brought near to the aerial inductance, and



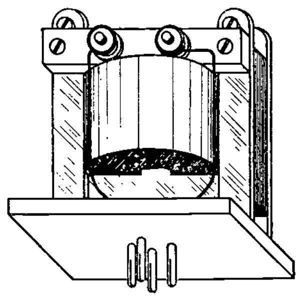
used as a wave trap on the absorption principle.

The tuned closed circuit is thus approximately tuned to the signals which it is desired to reject, and suitably coupled to the aerial inductance. Coupling must not be too tight, however, otherwise the aerial and closed circuits will respond to one wavelength and the rejecting properties of the closed circuit will be destroyed.

T. J. C.

Interchanging L.F. Transformers.

COMPARATIVE tests on the operation of L.F. transformers is very desirable in order to judge the merits of the many types. In comparing results given by different transformers it is necessary to interchange them rapidly and a good method of doing this is to mount the transformer on a small ebonite panel fitted with four valve pins. These pins can be made to engage in



four valve stems, suitably spaced. The spacing, of course, need not be necessarily that of the usual valve holder.

J. W. G.

SOUND IN RELATION TO WIRELESS.

By Prof. E. Mallett, M.Sc., M.I.E.E.

(*Continued from page 674 of previous issue.*)

2. Delineation of Wave Form.

A CURVE similar to Fig. 4 or 5 is called the wave form of the wave motion. It shows the displacement of the air particles at successive instants of time at the same place, or the displacements of the sounding body. Similar curves are obtained if, instead of displacements, the air particle velocities, or the air pressures, are plotted against the time. Such curves are of very great importance in a study of sounds, as if they can be accurately obtained the exact nature of the sound will be known. For this reason many instruments have been devised from time to time by which a wave form picture can be obtained. In all of these the air pressures of the sound wave cause a diaphragm to vibrate, and there is usually a horn to increase the effect by concentrating the sound wave on to the diaphragm. The diaphragms are usually circular pieces of thin material, heavily clamped round the circumference, and may be stretched or not, or made of such different substances as parchment, rubber, steel, glass or animal tissue, as in the case of the ear drum. Such a diaphragm will respond more or less faithfully to the influence of the sound wave, that is, displacement of the diaphragm at any instant from its position of rest will be more or less proportional to the air pressure at that instant in front of the diaphragm. That this is so to a great extent is proved by the achievements of the telephone and the gramophone, and it is wonderful to think that such a simple device as a diaphragm can be the means of reproduction of such complicated sounds as those of an orchestra or of speech, but that the proportionality is ordinarily by no means exact, is also apparent when one considers the resonances of diaphragms in general.*

* See *The Wireless World*, June 18, 1924.

When the diaphragm is made to vibrate, the problem of finding the wave form of speech is reduced to finding that of the motion of the diaphragm, and, if exact work is aimed at, to apply a correction to the curve obtained to make allowances for the inaccuracies introduced by the diaphragm with its horn.

Since the movements are in general very rapid, it is necessary to obtain some means or recording them graphically. Such an instrument, called the phonautograph, was invented by Scott and Koenig in 1859. The diaphragm, or membrane, carried a stylus which traced a wavy line on smoked paper on a rotating cylinder. Another method, used by Koenig in 1862, is to mount a small rubber diaphragm in such a way that as it vibrates it alters the pressure of the gas supply to a small burner, and hence the height of the flame. The fluctuations of the flame are observed in a rotating mirror, or by a more recent development may be photographed. In another arrangement used by Prof. D. C. Miller in some extensive work on musical sounds (" The Science of Musical Sounds," D. C. Miller, Macmillan & Co., 1922), and called by him the phonodeik, a glass diaphragm has attached to its centre a very fine thread which is passed once round a tiny cylinder before being attached to a tension spring. The cylinder is mounted in jewelled bearings and carries a tiny mirror whose movements are recorded by a beam of light falling on a rotating film. Probably the most commonly known sound wave traces of all are those found on a gramophone record, and they have been enlarged by various workers to readable dimensions.

These devices are purely mechanical. Another class of sound-recording. device is obtained by first converting the sound wave into an electric current as in ordinary telephony and then finding the wave form of the current by means of an oscillograph. The starting point is again with a diaphragm, that of the microphone, but this may be stretched and have a very thin air cushion to raise its natural frequency in order to place its resonances beyond the frequency range of the sound under investigation, and as valves may be used to amplify the resulting currents, the condenser microphone may be used instead of the far more sensitive but unstable carbon granule microphone. So that the electric currents, up to a frequency say, of 5,000, may be made faithful copies of the sound wave, and the Duddell oscillograph will give a faithful record of the electric current up to about the same frequency. But for higher frequencies, and it appears that the quality of music, especially vocal music, depends very largely upon higher frequencies, more delicate arrangements having less inertia are required. As far as the oscillograph is concerned there is the cathode ray, which has been made recording, but there is always left the initial problem of the diaphragm.

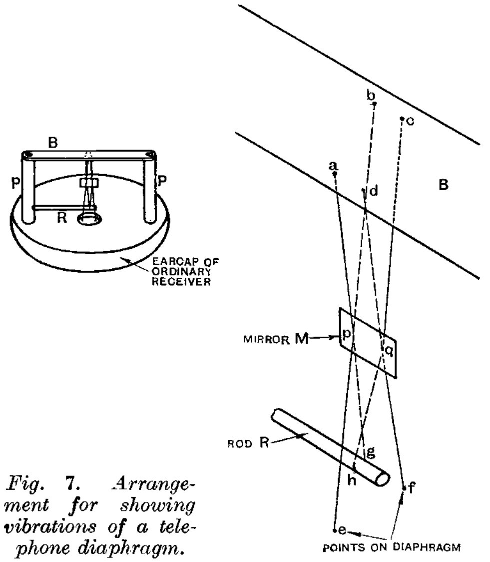


Fig. 7. Arrangement for showing vibrations of a telephone diaphragm.

Oscillographs are expensive instruments, however, but very interesting results may be obtained by much simpler means. Irwin has invented an arrangement for showing the vibrations of an ordinary telephone diaphragm which he has called the "Optiphone," and which can be readily made in any amateur workshop. Two brass pillars PP (Fig. 7), screwed into the earcap of an ordinary receiver at opposite ends of a diameter carry at their ends a bridging strap of brass B, and at the foot of one a bent piece of stout rod R projecting over the hole in the earpiece. Four fine copper wires run from the bridge piece B, two to the diaphragm, to which they are fixed about a quarter of an inch apart, and two to opposite sides of the rod R. The enlarged diagram shows how the wires are run taut from a to e, b to g, d to h and c to f, and then tied in at the points p and q, across which a tiny mirror is fixed by shellac. Dotted lines are fixed to rod R and firm lines to diaphragm. All the wires are in tension, so that when the diaphragm moves upwards the tension in e p a is relaxed somewhat, and the wire g p b pulls the point p backwards. Similarly the point q is pulled forwards and the mirror has been rotated. So that if a beam of light is caused to fall on the mirror M, and the reflected beam is viewed in a rotating mirror a trace of the movements of the diaphragm is seen. By simply connecting the receiver to a microphone various sound wave forms can thus be obtained.

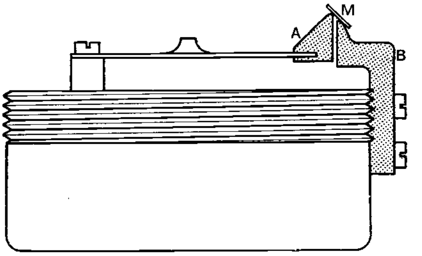


Fig. 8. A simple arrangement for showing telephone diaphragm vibrations.

An even simpler arrangement can be made with a Brown receiver of the reed pattern. The conical diaphragm (Fig. 8) is removed, and a piece of brass A, shaped as shown, is sweated on to the end of the reed, and a second piece B screwed on to the case of the receiver, so that the faces of A and B are a small fraction of an inch apart. A tiny mirror M is then attached to A and B by rubber solution. As the reed vibrates under the action of the telephone currents through the coils, the mirror M will be tilted up and down about the corner of B, the rubber solution giving sufficient elasticity.

The overtones of musical instruments are, in general, harmonic, that is to say, they are exact multiples of the fundamental, and an examination of the sound wave forms obtained consists in finding the frequencies of the harmonics present and their amplitudes compared with the fundamental. There is a third factor entering into the appearance of the wave form—that of phase. For instance, in Fig. 9 is a sine wave a of frequency, say 250, and its octave or second harmonic, b, of frequency 500, starting together at o. These may represent two pure tones sounded together. The resulting tone formed by adding the two displacements

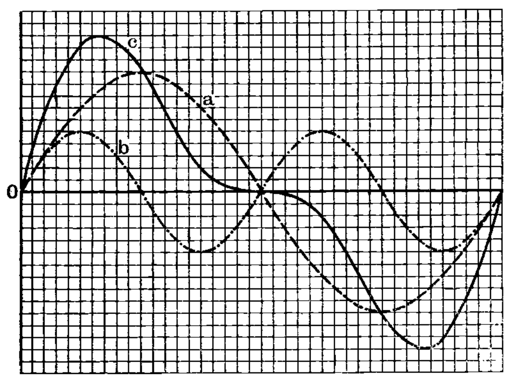


Fig. 9. Resulting tone c *formed of sine wave* a *and its octave* b,

at every instant is given by the heavy curve c, which is the wave form of the sound that is heard. In Fig. 10 we have the same fundamental and octave, with the same frequencies and amplitudes, but the octave has started one-eighth of a period before the fundamental, and the resulting wave form (c) is quite different in appearance. In spite of this difference in appearance, however, the two sounds would appear to the ear to be precisely the same. The only factors that the ear takes into consideration are the frequencies and the amplitudes of the tones, and not their relative phases, or positions in time, with regard to each other.

It is evident from this consideration that a mere glance or cursory examination of the wave form from any record will not in itself enable the sounds to be compared. The complicated wave must be split up into its component harmonics, which can be done,

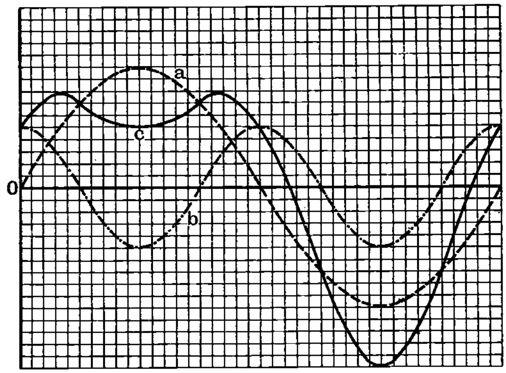


Fig. 10. Another example where the octave b *has started before the fundamental* a.

however complicated the wave, by Fourier's Analysis. The sound will be sufficiently defined by a table giving each frequency present and its relative amplitude. If, now, the sound recording apparatus gives a different response for sounds of the same amplitude but of different frequency (and nearly all do), it may be calibrated by drawing a response frequency curve, and a correction applied from the curve to the amplitudes found by Fourier's Analysis of the recorded wave to obtain the true relative amplitudes in the original sound wave.

3. Wave Forms of Music and Speech.

Some beautiful records of the wave forms of various musical instruments have been obtained by Prof. D. C. Miller* with his phonodeik, and one or two are reproduced here. Fig. 11 shows the pure sine wave record obtained from a tuning fork on a resonating box. Fig. 12 shows the record from a violin, and Fig. 13 that from an oboe. It will be seen how very much they differ from one another. The violin wave form depends enormously upon the way the violin is bowed, and this is true generally that the wave form of an instrument depends to a great extent upon the manner of its

* See "Science of Musical Sounds": D. C. Milʮə (Macmillan).

excitation. This is where the skill of the instrumentalist comes in. If the same note is sounded by the three instruments there is one thing in common—the time that is taken for the whole cycle of changes to be gone through before a repetition takes place. The pitch of the note is determined by the period, and this is the period of the fundamental. The character of the note is determined by the harmonics.

In Fig. 14 (Miller) are collected the results of the corrected analysis of many curves, showing the frequency richness of various instruments. The height of the dots is a measure of the amplitude of the harmonic. In the tuning fork there is only the funda-

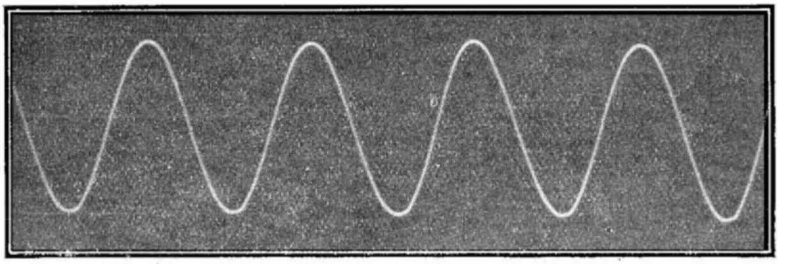


Fig. 11. Photograph of the simple tone from a tuning fork.

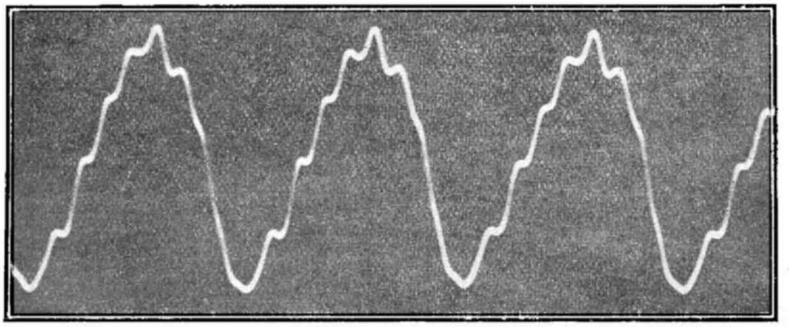


Fig. 12. Photograph of the tone of a violin.

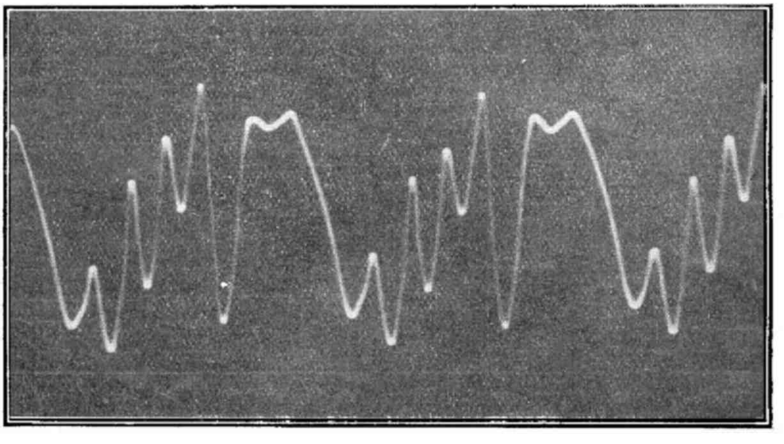


Fig. 13. Photograph of the tone of an oboe.

mental. In the flute the octave has an amplitude greater than the fundamental, and harmonics up to the 15th are present, though of small amplitude. In the violin the first five frequencies are all prominent, and in the French horn the first four. It is the overtones which give the character of the instrument. If the overtones were all removed all the instruments would sound like a tuning fork. If the instruments could be excited by a pure sinusoidal excitation, none of the overtones would appear, but only a pure note of the frequency of the exciting current. All the instruments would again sound like tuning forks. But the excitation of musical instruments is never purely sinusoidal; it is more often of the nature of shocks, and all of the harmonics of which the instruments are capable are sounded.

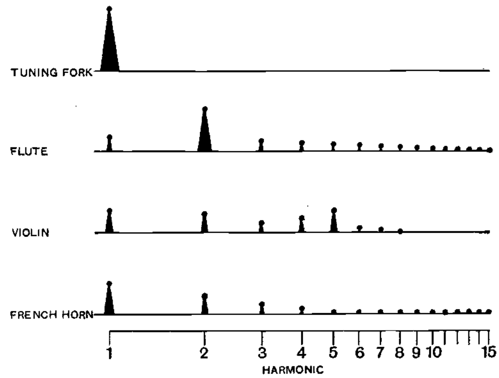


Fig. 14. Illustrating the frequency richness of various instruments.

(To be concluded.)

CORRESPONDENCE.

Transmitting Licence Regulations.

To the Editor of The Wireless World and Radio Review.

Sir,—The correspondence under this head in your recent issues will, it is to be hoped, make more and more obvious the anomalies of the present regulations.

Your correspondent **5 HM** appears somewhat nettled over the question of satisfying the P.M.G. on the definite experiment point. The question is, does he honestly carry out his experiments and keep to them only, on the occasions when he is transmitting? If he does, good fortune attend his labours and may the P.M.G. be lenient to him and make every concession he asks. If he does not, allot his call sign to some more honest experimenter forthwith. I think many experimenters in transmission and reception will agree with me.

I live not a score miles from **5 HM**. Does he ever listen in between noon and 3 and 5 and 7.30 on Sundays? If not, let him take a wavemeter and check local amateur transmissions, and he will find a dozen folk between 310 and 410 metres, all grinding out gramophone records.

Why gramophone records? Simply because they know of nothing else to do. They have no definite experiments, and never had. What experiments can a person conduct when all he possesses is a straightforward circuit direct from the text book, with usual components, straightforward power supply and a common aerial? None! He may try various forms of modulation, true. If he does, in 99 cases out of 100 an artificial aerial will serve all his purposes. Why should a man without wavemeter, without a single instrument to measure his input, or even a H.W. ammeter of any use, be allowed to grind out gramophone records—microphone pushed down the gramophone horn—for the benefit of those only who happen to be listeneing in at the moment? Why should a man who never gives his call sign be allowed to retain his licence?

In conclusion I would remind everyone that wireless transmitting apparatus is scientific gear, and its user should inspire confidence in listeners of his ability to keep the thing from becoming a mere toy.

Artificial Aerials.—Referring to your editorial comments from time to time on the question of the necessity for a permit for an artificial aerial. It would be extremely interesting to have an official pronouncement as to where a heterodyne ends and a transmitter begins, as I have recently seen a wavemeter which takes approximately one watt.

John P. Wilson.

Halifax.

The High Power Station.

To the Editor of The Wireless World and Radio Review.

Sir,—As a regular reader of your valuable paper I must confess that I am rather puzzled over some of the replies to your questions regarding the new high-power station.

Why accept opinions from London readers at all? The new station was never primarily intended for them, as they were and still are adequately served by the existing station. I think they certainly show rather a dog-in-the-manger attitude simply because they cannot perhaps get Radiola as well as they used to before Chelmsford's advent. After all, Radiola, with all due respect, is not in the same street as any of the B.B.C. stations as regards quality or interest.

Up to the present, we on the coast have had very little enjoyment out of our receiving sets; they cost us far more than the average Londoner pays for his set, and we get constant interruption. Evening after evening 'phones are laid down in disgust, the cross-Channel boats interrupting every five minutes. I can say with certainty, and many others with me, that after our short experience of what broadcasting *can* be, should the high-power station be closed down we should never be able to carry on under the old conditions, but should give up radio.

So let the more favoured persons please keep their hands off *our* station !

T. C. GILBERT.

Folkestone.

Crystal Reception.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—In reply to the letter from Mr. Steuart in your issue of September 3rd, I do not think that Mr. Steuart's experiences in crystal reception are inconsistent with the principles I have endeavoured to establish in connection with this subject. My chief contention is that in any given case there is a definite optimum potential difference for the operation of the detector. In most practical cases this optimum P.D. is less than that developed across the whole of the tuning inductance. More particularly is this likely to be the case when a series tuning condenser of very small value is used, say $0{\cdot}00025\mu F$. On the other hand, in cases where the aerial resistance is higher than usual, or where a high resistance detector circuit is used, it is easily possible that this optimum P.D. may exceed that developed across the tuning inductance, in which case some "step-up" arrangement such as that indicated in Mr. Steuart's letter will be advantageous.

Mr. Steuart further suggests that the maximum rectified current does not necessarily coincide with maximum signal strength. I am quite willing to concede this possibility, though it implies a detector having characteristics different from those of any that I have investigated. It implies, in fact, that the rectified current high frequency e.m.f. characteristic shall have a negative second differential coefficient.

Mr. Strachan will possibly reply on the question of crystal contact. Measurements that I myself have made certainly seem to indicate that pressure on the contact tends to lower the effective high-frequency resistance of the crystal without appreciably increasing its detecting efficiency. This decrease of H.F. resistance would, as I have shown, cause a considerable reduction of selectivity, which result is in accordance with Mr. Steuart's observations.

F. M. COLEBROOK.

Signal Strength Tables.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—All the "R" tables which I have seen so far for conveniently comparing signal strength, seem to have been compiled purely for amateur C.W. signals. Might I suggest that the code given herewith be adopted when reporting the reception of broadcasting stations ? Experimenters' reports on results from different sets and circuits would be of much greater value if this simple standard were used when giving comparative signal strength :

R1 .. Carrier wave irresolvable.
R2 .. Music faint and unstable.
R3 .. Music faint but clear.
R4 .. Music quite clear but speech barely readable.
R5 .. Speech clear and readable.
R6 .. Music and speech fairly strong.
R7 .. Music and speech strong—faintly heard on loud speaker.
R8 .. Music and speech very strong—loud speaker clear.
R9 .. Loud speaker strong.

Intermediate strengths, if desired, would be denoted by decimal divisions.

W. J. POTTER.

Leigh-on-Sea.

Reception in Porto Rico.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—On page 487 of your July 23rd issue I observe a letter from B. J. Archer (**2 VJ**), advising reception of **POZ** on 95 metres.

These same tests are received strongly in Porto Rico, using only one detector valve. **UFT** (Saint Assise) and **FL** (Paris) are also heard well on **100** metres. There is a noticeable back wave on the **POZ** signals.

JOAQUIN AGUSTY (**4 JE**).

Porto Rico.

Technical Data and Radio Components.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—May I ask for a corner of your valuable publication to make a suggestion which is, I think, of considerable interest to the experimental amateur, as well as to the general "listening public."

I refer to the matter of the supply of technical data with all radio components. At least one manufacturer of coils has led the way by supplying, with each coil, an "average" calibration curve. Could not this practice be extended to other components ?

For instance, I do not know of any valve manufacturer who includes, in the packing-box, a set of characteristic curves, and many variable condensers only have the capacity printed on the containing box and not stamped on the instrument itself as a permanent indication.

At least one make of L.F. transformer gives no indication of the connections beyond the cryptic markings "P1—P2—S1—S2"—although, in this particular instrument, the connections of the secondary winding are of considerable importance, one end of the winding being connected to the metal screening case.

With regard to mounting templates, it is encouraging to note that an increasing number of instruments are supplied with these necessary adjuncts, but there is still room for improvement in this respect.

For the protection of the customer, might I also suggest that H.T. batteries should be clearly marked with the date of manufacture.

JOHN W. BOYS.

London.

MORE ABOUT 6ZZ.

DETAILED REPORT ON THE R.S.G.B. TRAIN TESTS.

A general account of these tests has already been published in these columns and reference may be made to that account for a fuller description of the conditions under which they were carried out. In recording results it has been necessary to resort to the utmost brevity owing to considerations of space.

THE objects of the test were primarily to experiment with transmission and reception on an express train using short wavelengths; and secondly to test the reception of broadcast transmissions under the same conditions. All tests were made with an aerial entirely inside the coach (see previous descriptions*).

DURATION OF TESTS.

From 7.38 p.m. (B.S.T.), July 4th, to 1.32 a.m. (B.S.T.), July 5th, 1924.

ROUTE.

King's Cross to Newcastle Stations (London and North Eastern Railway).

PERIODS OF SHORT WAVE COMMUNICATION TESTS :—

From 7.38 p.m. to 8.58 p.m.; 9.50 p.m. to 11.20 p.m.; 11.22 p.m. to 1.32 a.m. The intermediate periods were used for broadcast reception on "main" aerial; at other times (except during actual transmissions from the train) the small auxiliary "side" aerial was used for broadcast reception (see below).

SUMMARY OF SHORT-WAVE RECEPTIONS MADE ON TRAIN.

Time p.m.	Miles from King's X.	Remarks.
7.40	—	Reception from **6 XX** immediately outside "Gas Works" Tunnel (King's Cross). Signals faded out entirely in Copenhagen Tunnel. Signals R.7 at Finsbury Park, but fading noticed passing sidings and under bridge. Fading also noted in Harringay Station.
7.56	9½	Signals from **6 XX** weak; rising to R.6 as Hadley Tunnel approached. Signals lost on entering tunnel.
8.1	10¾	Potters Bar, signals from **6 XX**, R.7 to R.8 strength.
8.10	23	Welwyn North Tunnel—no signals received.
8.35	47½	Tempsford—Signals from **2 WD** (Bedford), strength R.3 to R.4.
8.35 to 8.58	47	Two-way working with **2 WD** (Bedford).
	70	Signals from **2 WD** weak at St. Neots, 50¾ miles from London.
9.57	109	Signals from **6 XX** (London). strength R.7, on leaving Peasecliffe Tunnel.
10.16	127½	Intercepted signals from **5 GL**, strength R.3 to R.5.
10.29	133	Retford—Message received from **6 XX** (London) to effect that signals from train were becoming too weak to be read.
10.50	158	Arksey—Message received from **2 WD** (Bedford).
10.52	160	Shaftholme Junction — Message received from **6 XX** (London).
10.50 to 11.02	158 to 167	Two-way working with **2 WD** (Bedford), strength R.3 to R.5.
11.3	167	Heck—Further interception from **6 XX**, strength R.7. Intermittent fading was noticed passing through Selby.
11.9	174	Selby Junction—Tests made with varying antenna current at **6 XX** were all received, a reduction of transmitting aerial current to one-fifth of its original value decreasing the signal strength

*_The Wireless World and Radio Review_, XIV, pages 446 to 451, July 16th, 1924. See also pp. 561-563, August 13th, 1924.

Time p.m.	Miles from King's X.	Remarks.
		from R.7 to R.5. During these tests intermittent fading was noticed, the strength fluctuating between R.5 and R.8.
11.39	184	Naburn—Message received from **6 XX** *re* interceptions of signals from train at intervals throughout the tests, but with local interference by "phone" stations. Strength of signals from **6 XX**, R.7 to R.8.
a.m.		
12.08	—	Noted that the application of brakes on train greatly improved reception of weak signals, and eliminated most of the irregular "static" noises which were heard in the receiving phones under normal conditions.
12.38	227	Five miles south of Darlington—First signals heard from **5 MO** (Newcastle) in reply to call from train. Strength, R.3.
12.45 to 1.30	230 to 271	Two-way working with **5 MO** (Newcastle).
12.56	242	Bradbury—Strength of signals from **5 MO**, R.5.
12.57	243	Strength of **5 MO**, R.2.
1.4	250	Signals from **5 MO** weak when train passing through cutting, with rapid increase of strength on approach to Durham viaduct.
1.11	253	On viaduct strength of **5 MO**, R.7.
1.12	254½	Durham — Signals dropped in strength to R.2 on approaching station, rising again as train emerged from station.
1.24	264½	Lamesley—Strength of signals from **5 MO**, R.8, rising further as Newcastle approached.
1.30	271	Newcastle Bridge — Signals from **5 MO** very loud. Communication closed down on approach to Newcastle, with final message from **5 MO** of "Welcome to Newcastle."

RECEPTION OF BROADCASTING.

The following report summarises the results obtained by Messrs. R. H. Carpenter and B. Hesketh on the train.

The apparatus employed for broadcast reception was a standard M.H.B.R.4, one H.F., one detector, two L.F., broadcast receiver, and also a standard R.M. Radio four-valve broadcast receiver.

Since the main object of the run was to effect two-way Morse communication on 185 metres, much valuable information (which undoubtedly would have resulted from a continuous test on broadcasting) was not obtained.

Conditions.

Two aerials were employed alternatively :—

(*a*) "Main" aerial, being that installed for the 185 metre tests.

(*b*) "Side" aerial, consisting of a length of approximately 25 ft. of rubber covered flexible "Tee'd" off at the middle and stretched without any precautions or refinements along the side of the coach at a height of about 6 ft. from the floor. The general frame of the coach was used in both cases as an earth.

Details of Test.

Using the rather unsatisfactory side aerial **2 LO** came in at very full 'phone strength up to approximately 45 miles on three valves (H-D-L), and with four valves (H-D-L-L) up to 61½ miles, at which point **5 IT** was of sufficient strength to make music enjoyable.

At 83 miles on the main aerial **2 LO** and **5 IT** were approximately equal strength, very strong and clear in 'phones (H-D-L-P).

At 97 miles **5 IT** was at full loud speaker strength for ordinary rooms, but not sufficient for the coach. In an ordinary railway "restaurant car" it would have been quite sufficient. **2 LO** at this point was just at the limit for 'phones, being strong enough for clear reception of music, but with speech only just intelligible (H-D-L-P).

The main aerial had to be handed over again to Morse at this point, and **5 IT** was last heard (music) just prior to his closing down at 187 miles (side aerial H-D-L-P).

One final opportunity for using the main aerial was made just on entering York, when Glasgow was received very strongly on 'phones, while Aberdeen was just audible (both results with H-D-L-P). The closing down of these two—the only remaining stations—concluded the Broadcast Reception Tests.

Conclusions.

The general points brought out were, the absolute practicability of continuous and enjoyable broadcast reception on telephone receivers between London and Aberdeen; the desirability of further and more critical tests to verify and examine the conditions governing the reception of Glasgow at 200 miles, and certain effects referred to below.

Technical Points.

As has been pointed out, the test was concentrated on 185 metres Morse working, so that only superficial observations on broadcasting were possible, not only by reason of the fact that the main aerial was only available for two short periods, but also due to the train transmissions regularly and effectively preventing attempts at broadcast reception on the side aerial. Further, even when 185 metres reception was in progress and permitted the use of side aerial, searching on this was materially hampered by having to make only a very timid approach to oscillation point in order to avoid jamming the 185 metre reception. The swaying of the radio coach—the last on the train—transmitted to the set itself and to the connecting leads made precise adjustment almost impossible.

Log of Broadcast Reception.

Abbreviations used below.

J.I. = Just intelligible speech or recognisable music.

F. = Faint speech or music.

C. = Clear speech and music (pleasurable).

S. = Strong.
L.S. = Loud speaker strength.

Where a number follows the above abbreviations it denotes the number of valves used ; for instance, V.S. 3 would mean very strong on three valves.

Unless otherwise stated, the figures given in "Position" column refer to miles from King's Cross.

Log of Broadcasting Receptions on Train.

Time.	Position.	Aerial.	Station Received.	Strength and Remarks.
p.m. 6.30	King's Cross Siding	Main	2 LO	L.S.
6.30	King's Cross Tunnel	,,	,,	Carrier only.
6.35	King's Cross (just inside station under roof)	,,	,,	33 per cent. of previous full strength.
6.37	Centre of Station	,,	,,	Signals 10 per cent. of full strength.
6.37	Far end against buffers.	,,	,,	Signals 45 per cent. of full strength.
Waiting now for train to start and later for continuous broadcasting.				
8.00	—	Side	2 LO	V.S.3, L.S.4 (but not enough volume for trains). Bridge effect noticed here.
8.15	Knebworth	,,	,,	S.3.
8.17	—	,,	,,	Slightly less than S.3. Here in passing through deep cutting signals dropped to faint carrier wave. Again, passing across flat landscape signals faded completely for 10 seconds.
8.25	—	,,	,,	S.4.
8.47	61½ miles	,,	,,	S.4. Clear for music and announcer's voice.
8.47	,,	,,	5 IT	F.4 for speech, but judged sufficient to hear music with a certain amount of pleasure.
—	83 miles	Main	2 LO	S.4.
—	,,	,,	5 IT	S.4. At 88 miles signals dropped.
9.33	97 miles	,,	5 IT	L.S. normal 3 and one power. V.S. on 'phones with 3 and 1 P.
9.33	,,	,,	2 LO	J.I.3 and 1 P. Speech, probably quite good for music.
—	178 miles	Side	5 IT	3 and 1 P. Clearly audible for music.
			5 NO	3 and 1 P. Just possible to detect music.
—	York	Main	Glasgow	S. 3 and 1 P. Perfectly clear. Remarkable strength for distance.

The following points were noted in detail, however :—

Shunting at King's Cross.

In the siding **2 LO** was received at very powerful loud speaker strength (H-D-L-P) (side aerial), but became only just audible on 'phones when going through local tunnel (carrier wave only).

Passing into the station under the main roof loud speaker strength fell to about one-tenth at centre, and rose again to 45 per cent. at the barrier end. The signal strength might be judged to have followed a curve approximating to a parabola.

Throughout the tests during the run all metal bridges, however small, reduced reception strength from 40 to 60 per cent. Iron roofed stations naturally had greater effect, although in York station Glasgow was clear (H-D-L-P on the main aerial) when the train was at rest.

Just beyond Knebworth, when **2 LO** was very strong (H-D-L side aerial), the passage of the train through a deep cutting cut out all but a faint trace of the carrier wave.

Approximately 2 miles farther, and for no apparent reason, very marked fading took place for 10 seconds, apparently coinciding with a curve in the line.

At 88 miles there was a very noticeable falling off in strength from **2 LO** when passing over and on to a limestone strata.

Care was taken in noting all effects to eliminate the possibility of their production by de-tuning of the aerial circuit, due to masses adjacent to, or passing by the coach.

In the foregoing H = H.F. valve ; D. = detector valve ; L = ordinary transformer coupled L.F. stage ; and P = power stage (transformer coupled).

(In the next issue the report of reception of transmissions from the train will be given.)

"YARNS" ON WIRELESS.

Uncle Jack Frost, whose "Wireless Yarns"* make their appearance this week, is known officially as Captain C. C. J. Frost, M.I.R.E., of the Engineering Department of the B.B.C.

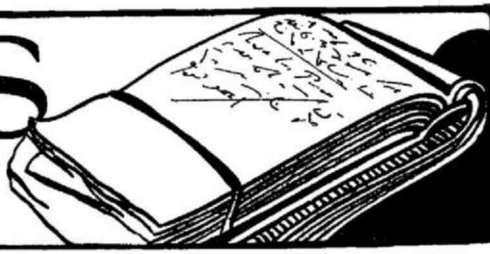
In this intimate series of talks, originally broadcast for the benefit of newcomers to wireless, Uncle Jack Frost discourses pleasantly upon the fundamental principles of the science without boring the beginner with a lot of technical detail. Such information as he gives may well form the jumping-off ground for more serious study in the future. The concluding remarks in the preface, written by Mr. J. C. W. Reith, Managing Director of the B.B.C., are interesting in this connection.

"In fifteen or twenty years," he writes, "maybe, not a few wireless engineers of distinction, perhaps even some pioneer of thought, will recall with gratitude an introduction to the fascinating study of radio and the ether, and Uncle Jack Frost's Wireless Yarns will be as bread cast upon the waters, returning after many days."

We can warmly commend these very readable little Yarns to the notice of the elementary reader.

* "Uncle Jack Frost's Wireless Yarns on Good Reception and How to Get It." London: The Wireless Press, Ltd., 12-13 Henrietta Street, W.C.2. 102 pages. Numerous diagrams. Price 2s. net. Post free 2s. 2d.

NOTES & CLUB NEWS



Plans are being prepared for a broadcasting station in Bouzaria, Algeria. The studio will be located in Algiers and connected to the station by ground cable.

* * * *

Loud speakers are being placed in prominent positions in the Huddersfield football ground so that the crowds may enjoy broadcasting during intervals.

* * * *

A portable radio set has appeared in Paris having as an aerial a cloth, into which the wires are sewn. The "aerial" can thus be folded up and placed in the pocket.

* * * *

The B.B.C. hopes to broadcast weekly from **5 XX** one of the provincial programmes. Birmingham, Glasgow and Bournemouth are the first to be relayed in this manner.

* * * *

An order has been issued forbidding the erection of aerials in rooms at the Royal Marine Barracks, Plymouth. Frame aerials are permitted subject to the general approval of the occupants.

* * * *

WIRELESS AND THE PRESS.

What is computed to be the longest press wireless message ever dispatched was Reuter's verbatim account of the Prime Minister's speech at Geneva on Wednesday, September 3rd. Most of the sections were received in London in an average of fifteen minutes, notwithstanding a severe thunderstorm.

NEW EUROPEAN D.F. SCHEME.

A network of seven D.F. stations is to be established in England, Belgium, France and occupied Germany, according to press reports. The system, which will comprise main and sub-stations, should prove of great benefit to the Continental Air Services.

NKF HEARD ON SUPER HETERODYNE.

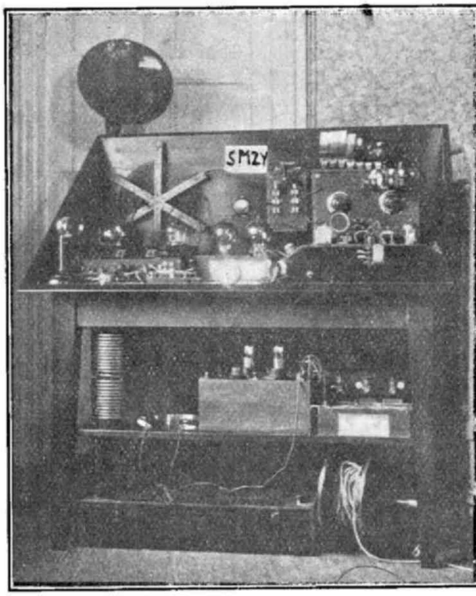
The short wave tests from **NKF** Washington, particulars of which were announced on page 582 of our issue of August 13th, have been heard clearly by Mr. E. J. Simmonds (**2 OD**), of Gerrards Cross, Bucks, using a super-heterodyne receiver.

At 12.10 a.m. (G.M.T.) on Monday, September 8th, **NKF** was sending the following message :—"Test on 54 metres. Reports of these signals are invited and will be appreciated by the U.S. Naval Research Laboratory at Belle Vue, Washington, D.C., U.S.A." Although atmospherics were strong on the British side, the signals were very strong and absolutely steady. Moreover, the signals were still readable with the aerial coil removed. An important feature of this reception is that Washington must have been in daylight throughout the test.

SWEDISH AMATEUR SEEKS TESTS.

The photograph below depicts the Swedish amateur station **SMZY**, owned and operated by Mr. Gustav Lamm, of Roslagsnaesby, near Stockholm.

For DX work **SMZY** employs unrectified A.C., with an input power of between 40 and 100 watts.



The transmitting and receiving equipment of **SMZY**, *owned and operated by Mr. Gustav Lamm, a Swedish amateur.*

Transmissions take place every Wednesday at 12 midnight (G.M.T.) on wavelengths between 98 and 130 metres, 108 metres being the most usual. Mr. Lamm welcomes reports on these transmissions and would be pleased to arrange two-way tests.

DEFYING D.F. STATIONS.

A description of an ingenious transmission system, designed to evade discovery by D.F.

stations, has been given in an interview accorded to our Paris correspondent by Mr. Reginald Gouraud, **8 DZ**, the American amateur working in France. For four months the military authorities sought for Gouraud's transmitter, situated in the heart of Paris, without success.

Actually the transmitter consists of two oscillators separated by a short distance. The transmitter proper is of comparatively low power, using three valves of 60 watts each and an aerial of sixteen copper wires forty feet long.

In practice the main station transmits on a wavelength between 1,200 and 1,500 metres. The auxiliary "oscillator" tunes in at the same wavelength. A concert transmitted by the main station is therefore "reinforced" by the auxiliary station acting in much the same way as a heterodyne.

When Gouraud began his transmissions the two goniometric stations of Issy-les-Moulineaux and Porte d'Orleans, at two different gates of Paris, made a united effort to discover his whereabouts. As a result the mystery station was traced to the Rond-Point des Champs Elysées, a point actually midway between the two transmitters. A D.F. motor-car then came into action, but merely wandered aimlessly through the Paris streets, hopelessly confused by the double transmission. Gouraud finally disclosed his position voluntarily, having completely baffled the authorities.

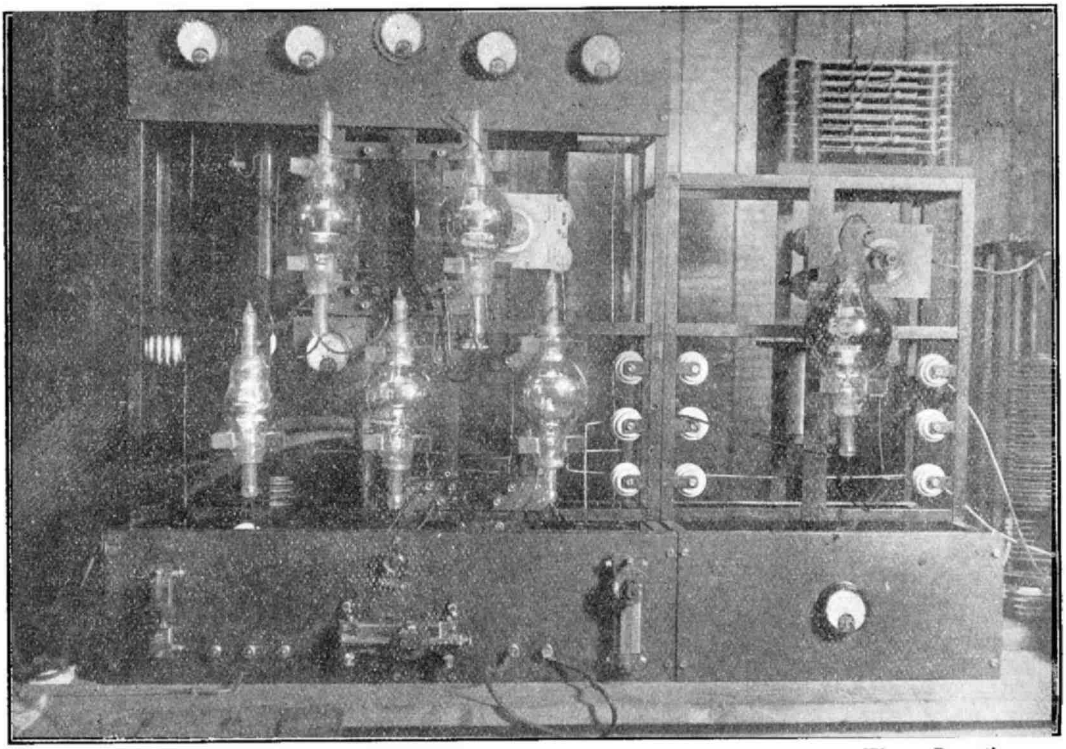
BROADCAST PHOTOGRAPHY COURSE.

The Association Générale des Amateurs de T.S.F. in Paris is broadcasting a series of talks on photography from L'Ecole Supérieure des P. & T. Station.

DISTANT RECEPTION OF ECOLE SUPERIEURE.

An analysis and summary of reports of distant reception prepared by the management of l'Ecole Supérieure des P. & T., Paris, reveals that the station is heard regularly as far away as Cadiz, Spain; Saltjosbaden, Sweden; Zagreb, Yugoslavia; and some 1,600 miles out to sea.

In addition, reports of reception have come from Toronto and Montreal, as well as from Amarillo, in Texas, and Covington, in Ohio. These, however, are regarded as freak results.



[Photo: Barratt's.

The Edinburgh Relay Broadcasting Station **2 EH**, *is now giving great satisfaction. The photograph provides a clear view of the transmitting panel.*

AMATEURS IN U.S. RADIO CONFERENCE.

A national conference, to consider the better voluntary regulation of wireless in the United States, is to be held at Washington on September 30th under the direction of Mr. Hoover, Secretary for Commerce. One of the most important questions to be considered is the inter-connection of broadcasting stations by long distance telephones. Other proposals include a revision of the present wavelengths to reduce interference, the limitation of transmitting power, zoning of broadcasting stations, means for distinguishing amateur calls for foreign countries and future relations between the Government and commercial services.

The advisory committee of the conference will comprise wireless listeners and broadcasters, the marine service, engineers, manufacturers of wireless apparatus, transoceanic communication experts, several Government departments, and amateurs.

"AIRWAYS."

Maintaining the interest promised by the first issue, the September number of "Airways" provides a selection of admirably illustrated articles describing the activities of the Cross-Channel and Continental Air Services. It is published at sixpence monthly by Messrs. Newton & Co., of 48 Russell Square, London, W.C.1.

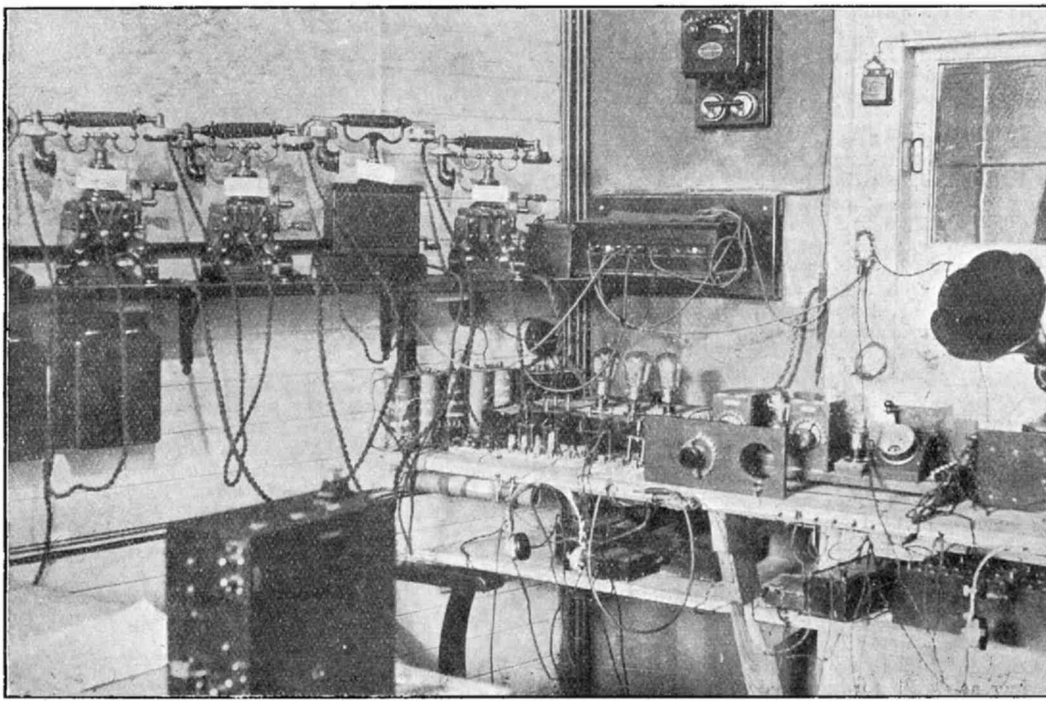
WIRELESS APPARATUS FOR LIGHTHOUSES.

Wireless transmitting apparatus is to be installed in all lighthouses on the British coast. A skilled operator will be put in charge, whose duty it will be to warn ships at sea of impending danger.

A Trinity House official stated that it may be some months before the wireless sets are fitted, but there is no doubt that they will greatly increase the warning capabilities of lighthouses. Reports on weather conditions and heavy seas will be sent out to mariners, who will also have the light to warn them of dangerous coasts and shoals.

SOUTH AFRICAN BROADCASTING TESTED.

Conclusive demonstrations of the efficiency of the Johannesburg broadcasting station have been given by Mr. J. C. Carpenter, who has completed a lengthy motor tour through Zululand, testing the strength of **JB**'s signals. A seven-valve frame aerial set was carried and the results were highly satisfactory; one of the most successful tests being made in the veldt fifty miles from Vryheid. The natives in the district, many of whom have never seen a motor-car, were at first amazed by the novelty, and were with difficulty persuaded to listen-in. Ultimately they became enthusiastic.



[Photo Barratt's.

The control room at the Edinburgh Relay Station. Many of the components used will be recognised.

FILMS BY WIRELESS.

An invention by which it is hoped to broadcast cinema dramas within the next twelve months is claimed by Colonel E. H. R. Green, of New York. According to press reports, the inventor has given a demonstration in which a film story was transmitted a short distance in the presence of experts, who share his confidence that a new era in transmission will soon be opened up.

NAVY AND THE "BEAM" SYSTEM.

While the "beam" method of wireless is being received with acclamation for the purpose of colonial communication, Admiralty opinion of the system is tempered with a certain coolness owing to the present limitations of beam communication to the hours of darkness. An Admiralty authority stated the position to a *Morning Post* representative in these terms:

"Business men and other private users of the wireless system may so regulate their despatches as to take the maximum advantage of the darkness, when the transmission is good, and 'lie off' during the daylight. But the Navy is in a different position."

The Marconi Company replies that the "beam" system is only a year old; that it has already justified itself within a period of months as fully efficient during darkness and for some part of the daylight when the sun is at a low altitude; and that with almost each succeeding day the daylight gap of reduced efficiency is being gradually narrowed.

WIRELESS AERIALS AND POWER WIRES.

In the fourth annual report of the Electricity Commissioners, reference is made to representations which have been made to the Commission by the Incorporated Association of Electric Power Companies with regard to wireless aerials placed near overhead power lines. As a result of correspondence between the Commission and the Post Office, the Postmaster-General has given notification that he has decided to insert in all future wireless licences a condition to the effect that an aerial which crosses above or is liable to fall upon any overhead power wire (including electric lighting and tramway wires) must be guarded to the reasonable satisfaction of the owners of the power wire concerned.

PUBLIC WIRELESS AUDITIONS.

In the Passage des Lions, Geneva, a large hall has been opened for public auditions of European broadcasting. An admission fee of 50 centimes is charged.

EXTENSION OF A.J.S. WORKS.

Owing to the rapidly increasing demand for their wireless products, Messrs. A. J. Stevens & Co. (1914), Ltd., have again found it necessary to increase still further their already extensive works at Walsall Street, Wolverhampton. The building operations now in progress, will, when completed in about two months time, add some 50,000 super feet to the works and office accommodation.

BOOK RECEIVED.

Where to Seek for Scientific Facts. By Alec B. Eason, M.A. (Cantab.), A.M.I.C.E., A.M.I.E.E. (London: S. Rentell & Co., Ltd., 36 Maiden Lane, W.C.2. Pp. 42 + vi. Price 1s. net).

CORRECTIONS.

Two small errors occurred in the advertisement of Messrs. The General Electric Co., Ltd., appearing on page xx of the issue of this Journal of September 3rd. In the phrase "a companion valve to the Detector R.5v. and Power Amplifier D.E.3" the latter should have read "D.E.5." "Filament volts 5 to 5·1" should have read "5 to 5·5."

Club Activities

Correspondence for Secretaries of Societies will be forwarded if addressed to the office of this Journal, c/o The Editor.

Many societies have still to get into swing for the winter session, and at present the number of meetings held falls far short of what may be expected in a month's time. The reversion to "winter time" will give the necessary stimulus and it is quite possible that this session may be a record one in the annals of many clubs.

* * * *

An authority on crystals, in the person of Mr. Baldhatchett, A.M.I.E.E., lectured before the Lewisham and Catford Radio Society on Thursday, September 4th. Mr. Baldhatchett brought with him many specimens of crystals, some of which were unknown to the members, and delighted his hearers with a wealth of information on the subject. The Society spent an enjoyable Field Day at Littlehampton on September 7th.

* * * *

Bringing in Brussels on a loud speaker with a two-valve receiver was accomplished by Mr. Battell, demonstrating before the Hackney and District Radio Society on September 4th. London was entirely cut out without the use of a wave trap. At the same meeting Mr. Heath created interest with his self-contained two-valve portable set, which proved to be very stable in operation.

* * * *

The Radio Experimental Association of Nottingham has opened its session with the election of a new chairman, Mr. R. Pritchett, B.Sc. The next ordinary meeting of the Association takes place on September 25th.

FORTHCOMING EVENTS.

WEDNESDAY, SEPTEMBER 17th.

Tottenham Wireless Society. Lecture: "Wireless in Schools." By Mr. Usher.

Radio Research Society, Peckham. At 44 Talfourd Road. Half-yearly General Meeting.

Golders Green Radio Society. Lecture: "The Care of Accumulators and Rectifiers." By Captain I. A. J. Duff.

THURSDAY, SEPTEMBER 18th.

West London Wireless and Experimental Association. At Belmont Road School, W.4. Lecture: "Measurement of Wireless Quantities, Part I." By Mr. F. E. Studt.

Bournemouth and District Radio and Electrical Society. At 7 p.m. At the Canford Hall, St. Peter's Road. Lectures: "The Valve and the Theory of its Operation." By Mr. W. H. Peters, B.Sc. "Simple Wiring Diagrams." By Mr. L. O. Sparks.

Walthamstow Amateur Radio Society. Lecture by Mr. Stanley Ward.

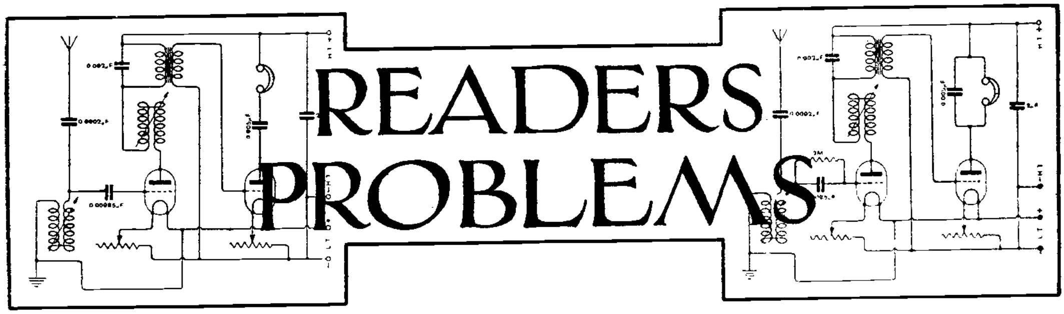
FRIDAY, SEPTEMBER 19th.

Holy Trinity Meccano and Radio Club, Barnsbury. At 7.30 p.m. In the Parish Hall, Richmond Road. General Meeting to open Session.

Leeds Radio Society. At 7.30 p.m. At the Woodhouse Lane U.M. Schools. Fourth Annual General Meeting.

SUNDAY, SEPTEMBER 21st.

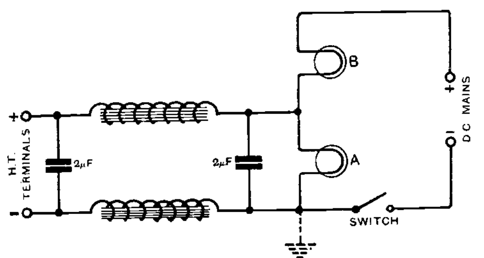
Golders Green, Hendon and Hounslow Radio Societies. Joint Field Day.



Readers desiring to consult the "Wireless World" Information Dept. should make use of the coupon to be found in the advertisement section.

H.T. Supply from D.C. Mains.

THE use of power valves for low frequency amplification makes very great demands on the H.T. battery, and many amateurs who have been in the habit of buying the standard type of H.T. battery are beginning to find the frequent renewals rather costly. Manufacturers are getting over this difficulty by increasing the size of the cell units forming the battery, but this makes the battery much more costly, and many amateurs will prefer to pay a little more and get a set of accumulator H.T. units, which work out cheapest in the long run.



H.T. supply from D.C. mains.

If D.C. lighting mains are available, the method indicated above may be used to obtain the anode current for the valves. Two metal filament lamps of low candle power and current consumption are connected in series across the mains. Both lamps should have a voltage rating equal to the voltage of the mains. This will have the effect of approximately halving the current consumption from the mains, and if the H.T. terminals were accidentally short-circuited, the worst that would happen would be the application of the full voltage to one of the lamps, which would burn at full brilliancy. The two lamps act as a potential divider, and the H.T. voltage may be varied by altering the relation between the resistances of the lamps, bearing in mind that for a given voltage the resistance is roughly inversely proportional to the candle power. Thus the voltage of the mains will be halved if two lamps of equal candle power are used and the voltage will be less than half if the lamp A has a higher candle power than the lamp B.

Condensers and choke coils are connected in the H.T. circuit to smooth out the hum due to the commutator ripple on the mains. Ordinary Mansbridge type condensers are suitable for this purpose, and Fullerphone 500 ohms choke coils or old induction coils may be used for the smoothing coils.

While this method of obtaining H.T. is most satisfactory when the negative side of the mains is earthed, it can be used with a positive earth provided that a condenser of good quality is connected in series with the earth lead from the receiver. When the positive main is earthed, it should be remembered that the set as a whole is above earth potential, and that the operator is therefore liable to receive a shock if he touches any metal parts of the receiver, or if the insulation of the telephones is faulty.

Negative H.T. Terminal to − L.T. or + L.T.?

WE are often asked to compare the advantages to be gained by connecting the minus side of the H.T. battery to + and to − L.T. respectively. When the − H.T. terminal is connected to + L.T., the voltage of the L.T. battery is added to that of the H.T. battery, and a saving of two or three cells may be effected in the case of the H.T. battery, assuming that the H.T. voltage is critical. With this connection, however, the anode current is made to traverse the L.T. battery, since most of the anode current returns to the valve *via* the negative side of the filament.

When the negative H.T. terminal is connected to − L.T., one looses the small addition to the H.T. voltage, but in this case the anode current is able to return directly to the filament. A definite rule for connecting the H.T. battery cannot be given, and the best position should be found by trial; but experience shows that in the majority of cases best results are obtained when − H.T. is connected to − L.T., particularly in the case of short wave reception.

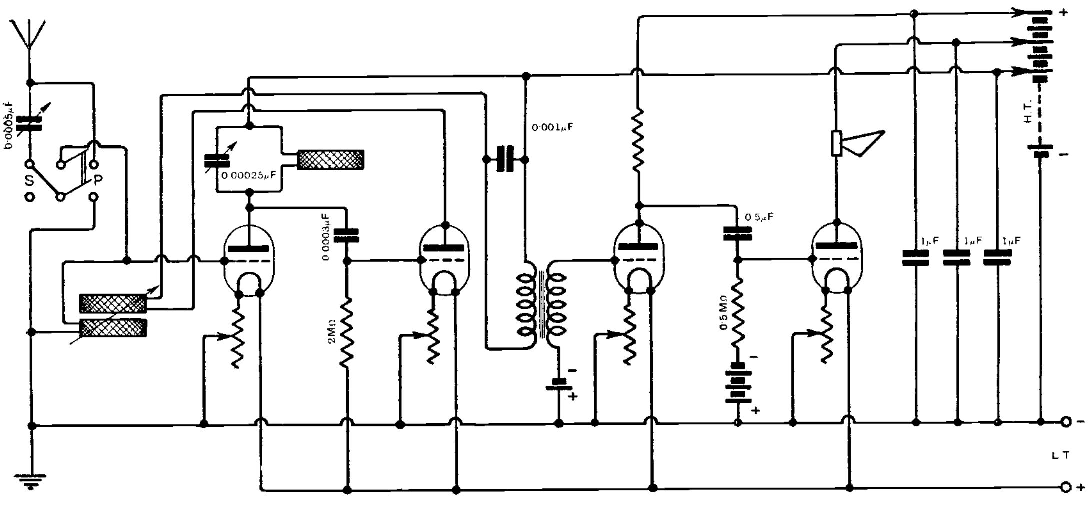
Grid Potential.

IN connection with the reports of valve tests which have been published recently in this journal, many readers have asked us to define the exact meaning of the grid potential values appearing along the base of the grid voltage—anode current characteristic. The grid potential is defined as the difference of potential between the grid and the negative end of the filament. The plate potential is also measured with respect to the negative end of the filament, since most of the anode current returns to the filament via the negative leg of the valve. If the potential were measured with respect to the positive end of the filament, its apparent value would be affected by variations of the filament temperature due to changes in the value of the external filament resistance, or in the value of the anode current.

rings. In actual practice there is little difference between the results obtained with these two arrangements, but it is significant to note that in the case of most of the B.B.C. stations, the spacing rings are in direct contact with the aerial wires. We think that this method is to be recommended, as the maintenance of a satisfactory degree of insulation at the rings presents a somewhat difficult problem.

Coupling in Three Coil Tuners.

AN amateur who has been taking notes of the angular coupling between the coils in his three-coil holder for different wavelengths writes to ask for an explanation of the fact that the angle of minimum coupling between the A.T.I. and closed circuit is less than 90 degs. The closed circuit is mounted in the centre fixed coil holder, and the



Circuit for a four-valve receiver.

Circuit for a Four-Valve Receiver.

WE were recently asked to supply a circuit diagram for a four-valve receiver in which the first stage of L.F. amplification is transformer coupled to the detector valve, and the second L.F. valve is resistance capacity coupled. The circuit is reproduced above, and suitable values are indicated where possible. The anode resistance of the first L.F. valve should be about three times the impedance of the valve. A single stage of H.F. amplification is employed, and the reaction coil is coupled to the aerial circuit.

Cage Type Aerials.

THERE seems to be an idea prevalent among amateurs that one particular method of spacing the wires of a cage aerial will give better results than any other. While some maintain that the rings used to separate the wires should be entirely insulated from the wires themselves, others prefer to connect the wires together through the spacing

A.T.I. and reaction coils are movable and are mounted on either side of the closed circuit.

On decreasing the coupling between the A.T.I. and closed circuits he finds that signals decrease and finally cease when the A.T.I. is at an angle of about 70 degs. with the closed circuit coil. When the angle is increased to 90 degs., when theoretically there should be zero coupling between the coils, signals are comparatively strong.

The explanation of this phenomenon will probably be found in the fact that a reaction coil is being coupled to the closed circuit. Under these conditions the axis of the resultant field linked with the reaction and closed circuits is not necessarily at right angles to the plane of the closed circuit coil. For this reason the angle of minimum coupling with the A.T.I. may differ from 90 degs. In order to check this hypothesis, it will be necessary to change the position of the reaction coil, and to observe whether this makes any alteration in the angle of minimum coupling between the A.T.I. and the secondary circuit.

The WIRELESS WORLD AND RADIO REVIEW

RADIO TOPICS.

OPENING OF THE WIRELESS SEASON.

IT has come to be recognised, perhaps even more in the United States than in this country, that wireless has its seasons. The season here is about to open, and several events of importance are to take place in the near future.

The presidential address by Dr. W. H. Eccles, F.R.S., to the Radio Society of Great Britain will be given on Wednesday, September 24th, and it is believed that a rousing speech on the future of the amateur may be expected. This address will open the new session of the Society, and a number of important lectures are being announced for future dates.

THE WIRELESS EXHIBITION.

THE Exhibition is announced to open on Saturday, September 27th, at 12 noon, at the Albert Hall, and this will provide a good start for public interest in broadcasting for the autumn and winter.

Elsewhere in this issue reference is made to the Exhibition, and some of the new apparatus which will be seen there is reviewed.

BROADCAST RECEIVING SETS ON BOARD SHIP.

IT is now becoming so usual a practice for travellers to carry with them a portable receiving set, especially when making a voyage, that it has been considered necessary by the General Post Office to issue a special notice on this subject.

The notice explains that under the Wireless Telegraph Act, 1904, the Postmaster-General's authority is necessary before wireless apparatus can be installed or worked on board a British ship. It is not necessary for individual passengers to take out licences, but is sufficient that the shipowner should obtain a licence for each ship on which broadcast receivers will be used.

This decision has its parallel in what we understand to be the regulations with regard to obtaining a licence for hospitals and similar institutions where one licence is sufficient to cover the use of several receiving sets in the institution. The Post Office make it quite clear that the employment of broadcast receiving sets on board ship must not be allowed to interfere in any way with the commercial wireless installation on board. The use of the ship's main aerial is strictly prohibited, except when a ship is in port. The broadcast apparatus must not be connected in any way with the ship's main wireless installation, and the ship's operator is prohibited from concerning himself with the operation of broadcast apparatus during his hours of watch.

We note that those who make use of the broadcast receiving apparatus must sign the usual declaration of secrecy to guard against the disclosure of any information which might result from the interception of any private telegrams.

BROADCASTING IN SOUTH AFRICA.

ALTHOUGH the broadcasting station at Johannesburg has been in operation for some little while, broadcasting began in earnest in South Africa with the opening of the Cape Town Station, which took place on September 15th. The wavelength is 375 meters, and the call sign **WAMG**. It is interesting to note that South Africa has decided to model its broadcasting organisation on the lines of the home country, and both as regards the arrangement of the studio and apparatus employed, the London station has been taken as a model.

Mr. King, of the B.B.C., has been exported to Cape Town as musical director, whilst Mr. Thomas, a Marconi engineer, has gone out to take charge of the technical side of the station.

The transmitter itself is a 6 kW. Marconi installation. Another station which will be similarly equipped is being opened at Durban in November.

THE INTERNATIONAL CHARACTER OF WIRELESS.

IT was naturally to be expected that as wireless broadcasting developed in various countries, and stations of higher power were employed, that broadcasting would tend towards becoming an international affair. Some remarkable developments have taken place recently in this direction. First of all, we may make reference to the broadcast transmissions which are being arranged by *The Wireless World and Radio Review* and *Radio Broadcast* in America, to constitute International Radio Week.

These transmissions will take place at the end of November and, it is hoped, will take the form of broadcasting from Continental, British and American stations on different nights, whilst periods of silence will be observed in the various countries, so that interference shall not take place with the reception of the broadcast stations transmitting according to schedule.

It has been recently announced from **KDKA**, the powerful American broadcasting station, that special programmes are to be arranged, when broadcast transmissions will be directed to various countries at different dates, and the entire programme will be conducted in the language of that country. Already at some Continental broadcasting stations the announcements are made in more than one language, and the same remark applies to stations in South Africa, which, it is understood, will make their announcements and conduct their programmes in both Dutch and English.

Esperanto, we note, has been adopted by the American Radio Relay League for international amateur communication, and in this connection it is also of interest to learn that in Switzerland it is proposed that broadcasting from one station shall be conducted entirely in Esperanto.

DO WE NEED A NEW DICTIONARY ?

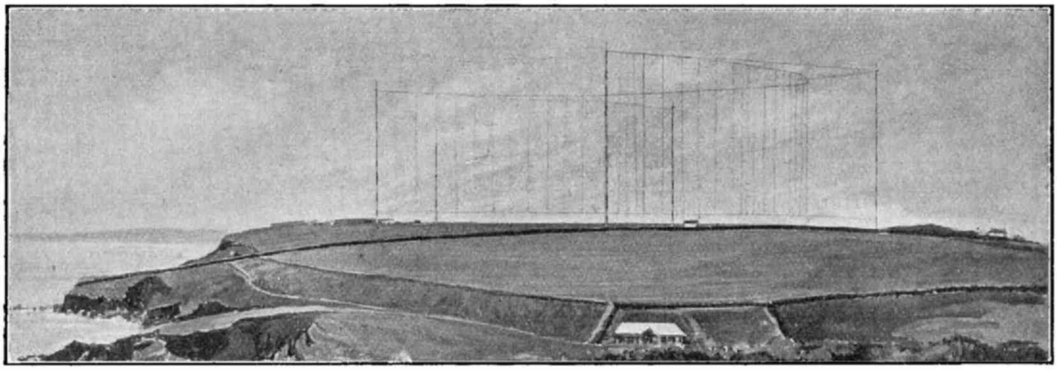
WRITING of international wireless and the question of language reminds us that we have been approached by one or two enthusiastic long distance amateurs who want us to compile a dictionary of amateur wireless terms more particularly for the benefit of those who hope to communicate with our friends in the U.S.A. this winter.

Perhaps we ought to explain what has prompted such a suggestion. British amateurs who like to read American wireless papers and follow what is happening on the other side soon find that they meet unfamiliar words not to be found in an English dictionary, nor even in a Wireless Press "Dictionary of Technical Terms." Fortunately, when reading an American article the context is usually a sufficient help to understanding the approximate interpretation of "ham," "shack," "oodles," "hard-boiled owl," "Hi," and the rest, but in handling transatlantic traffic it is rather a different matter, especially as even these terms have their abbreviations.

We have thought of Esperanto as a way out of the difficulty, but even this does not help us much, because the equivalents do not exist in the international language.

What then is the solution ? Are we going to set to work to learn this new wireless language of the American amateur or is English good enough for us ? Surely our own English dictionary is rich enough as it stands to supply us with the vocabulary we need—then why should we attempt to follow a bad example of our American friends ?

Unfortunately the tendency amongst some of our amateurs is to adopt the American mode of expression and to practice it at every opportunity. Personally we do not like it and see no necessity for it. The suggestion that we should compile the dictionary will not be acted upon and we hope our expression of opinion may meet with the support of the majority.

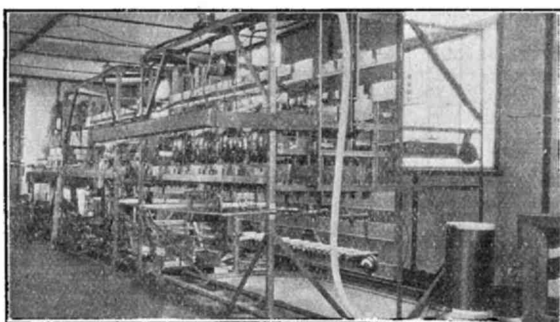


The Reflector at the Poldhu Station.

TRANSMITTING A 10° BEAM.

Ever since the question of the beam system for long distance communication was first mooted, great interest has been displayed in the experiments conducted by Senatore Marconi at the Marconi Station at Poldhu, Cornwall.

THE general principle of the invention lies in the concentration of the whole energy of a transmitter into a narrow angle so that a distant receiver working within the arc of the angle would receive a consequently greater proportion of the energy radiated. It is also obvious that if each transmitter is limited to an angle of about 10 degrees it would be possible for 36 stations all transmitting from the same locality, and all using exactly the same wavelength, to work simultaneously and without causing interference.

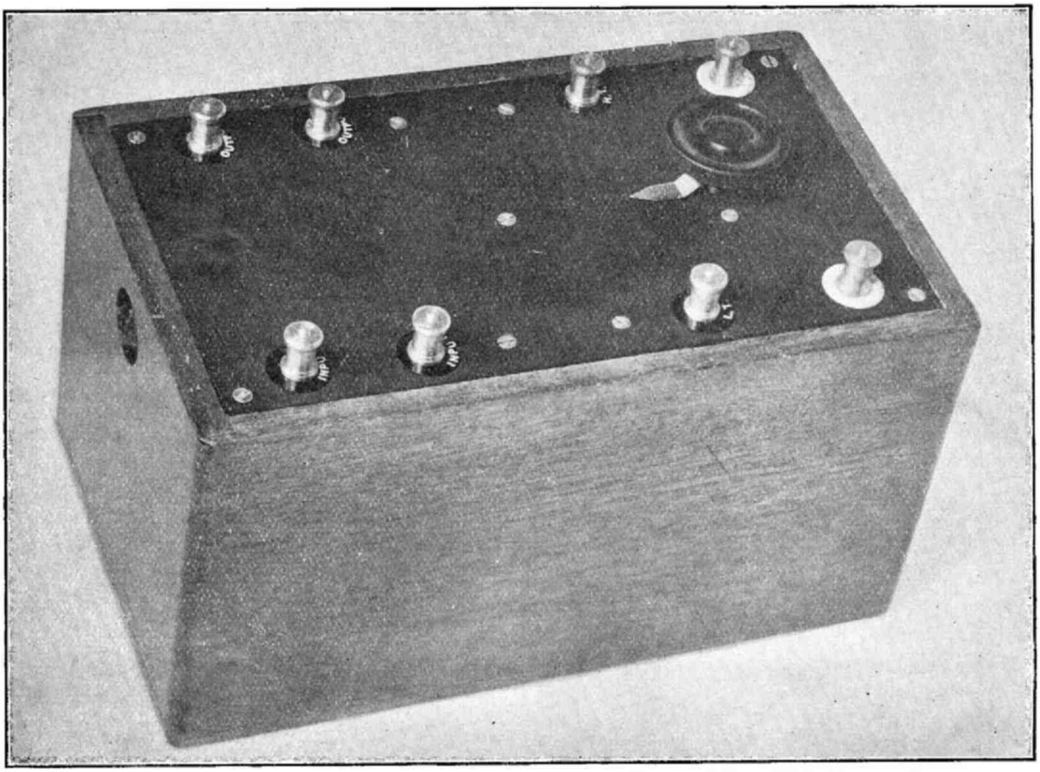


Above : Short wave valve transmitting equipment at the Poldhu station.

The transmitting aerial used consists of a number of vertical wires, fed simultaneously by a special feeding system. A second series of wires placed parallel to the first and one quarter of a wavelength behind acts as a reflector and renders the system unidirectional. The receiving aerial and reflectors are of the same general construction as that used for the transmitter.

It has been stated that the ratio of the loss by radiation to the loss by ohmic resistance, and therefore the efficiency, remains constant for all sizes of the aerial at the same frequency. This efficiency figure is very high and it is claimed that it is of the order of 80 %.

Below : The station building.
[Courtesy Marconi's Wireless Telegraph Co., Ltd.]



The complete instrument, suitable for measuring small potentials at high frequencies.

A HIGH FREQUENCY VOLTMETER AND RECORDER.

Many experimenters must have felt the need for an instrument capable of measuring low voltage alternating and oscillating currents at radio and speech frequencies. This instrument is not difficult to construct and is suitable for indicating on signal currents either before or after detection.

By A. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

THE instrument to be described serves the dual purpose of a high frequency voltmeter and a slow speed recorder, or rather relay for operating a recorder, for morse signals. It is an adaption of the voltmeter originally devised by Moullin, with the advantage of having an effective resistance of many megohms, and thus not loading up circuits where potential differences are being measured.

The circuit is essentially that of a rectifying three-electrode valve, the volts to be measured being applied to grid and filament through a 4½-volt battery, so arranged as to give a permanent negative bias to the grid. In the plate circuit is placed the moving coil of a Weston relay and a plate battery. By using a grid bias battery of 4½ volts it is possible to measure voltages of nearly 3 R.M.S. volts without disturbing the circuit under test.

The Weston Relay, when fitted with a mirror, makes an excellent galvanometer for the purpose, being quite deadbeat in action. The addition of the mirror is all the alteration that is required to convert the relay.

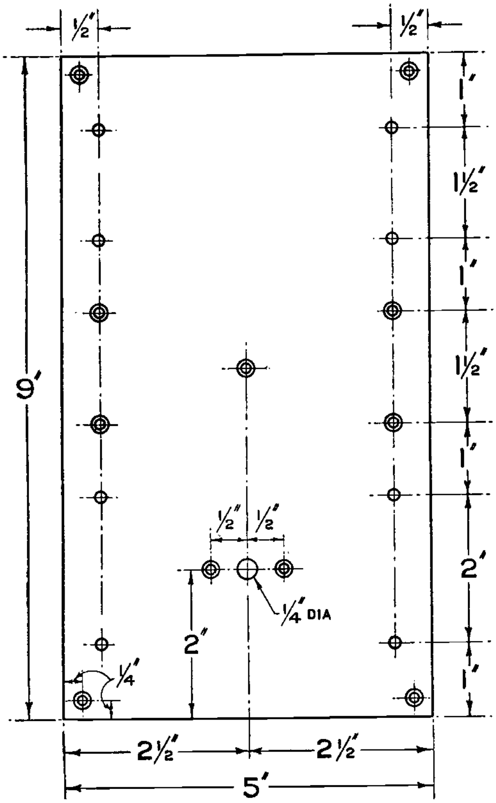


Fig. 1. Details for setting out the top panel.

The following is a list of the components used :—

Weston Relay.
Ebonite panel (9 ins. × 5 ins. × ¼ in.).
Wood box (9 ins. × 5 ins. × 5 ins. inside dimensions), to take panel flush.
Filament resistance.
Ebonite (5 ins. × 2 ins. × ¼ in.).
4 valve sockets.
8 terminals and suitable name tags—H.T. + and — ; L.T. + and — ; input (2), output (2).
17 ⅝ in. brass wood screws and 2 2-in. iron wood screws, and 2 1¾-in. iron wood screws.
Heavy gauge tinned copper wire, and ½ in. wood for clamps.
Small concave (or flat) mirror and scrap of aluminium foil.
4½-volt flash lamp battery,

Begin by marking out the panel and drilling it for the various terminals, etc., as given in the dimensioned drawing. (Fig. 1.)

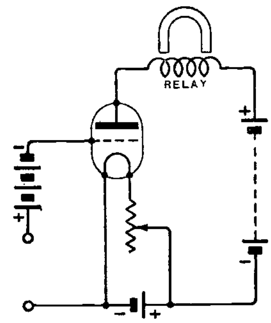


Fig. 2. The circuit.

Cut out a piece of the ½-in. wood, 5 ins. long by 2¾ ins. wide, to fit under the panel and take the relay. Before proceeding further, screw this piece of wood to the panel

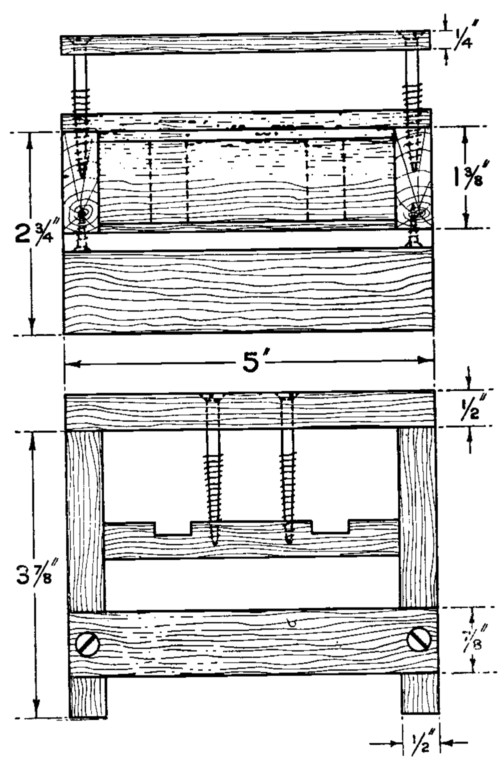


Fig. 3. Details of the wooden framework which carries the Weston relay, grid battery and valve platform.

in its proper position, and then take the screws out again. This is to save trouble later on when the relay etc., is clamped to this piece of wood, as it would not then be easy to screw on the panel without damaging the relay unless the screw holes were already made.

This piece of wood should be drilled and countersunk as required, after which it may be shellacked and put to dry. Meanwhile the two wooden legs and the clamp should be cut out. The legs should be long enough to reach the bottom of the box and so take the weight of the relay from the panel.

The piece of ebonite (5 ins. × 2 ins. × $\frac{1}{4}$ in.) should next be squared up, drilled and tapped o B.A. to take the four valve legs, also screwed o B.A. When the valve legs have been screwed in tight they should be countersunk. The valve platform may then be screwed in position on the wooden legs.

wiring up, keep the wires well spaced and carry on until everything except the relay contact, is finished.

In the present design only two " output " terminals have been allowed, one for the

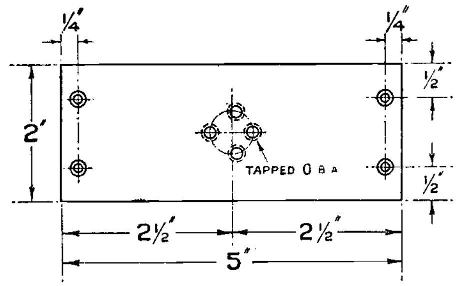


Fig. 5. The valve platform.

moving relay tongue and one for the stop, to which the tongue moves. To find which one this is, connect up H.T. and L.T.

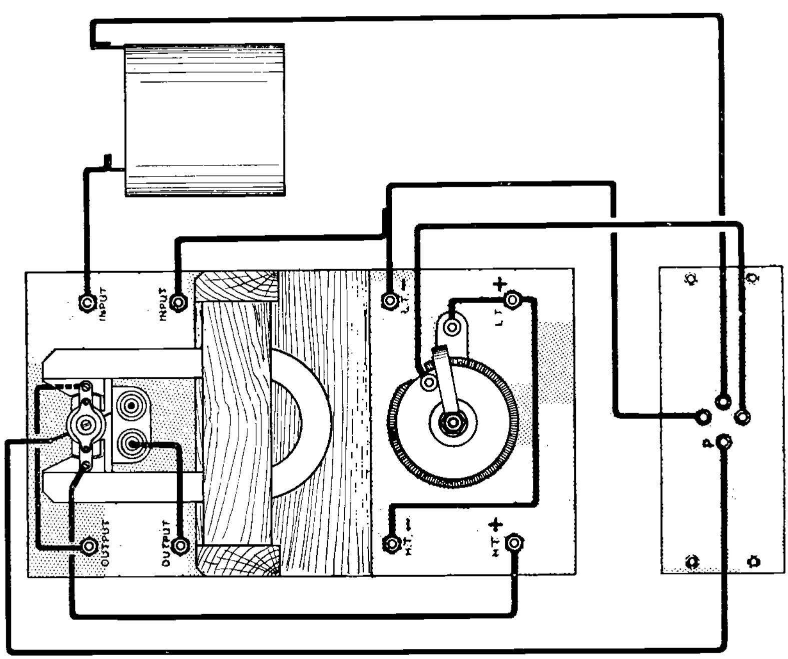


Fig. 4. The internal connections.

Before fixing the $4\frac{1}{2}$-volt battery in position tinned copper wires, about 8 ins. long, should be soldered to the four valve sockets.

Clamp the battery in position, making sure that the negative lead is uppermost. Cut half this lead off and tin both. When batteries and put in a valve. On turning on the filament resistance, with the input terminals *not* shorted, the relay coil will be seen to move over to one side. The stop towards which the tongue moves will be the required one.

Of course, if it is desired, two more terminals may be added, one for the other stop and one for the grid of the valve (without going through the grid bias battery).

The last thing to be done is to fix a mirror on the moving coil of the relay.

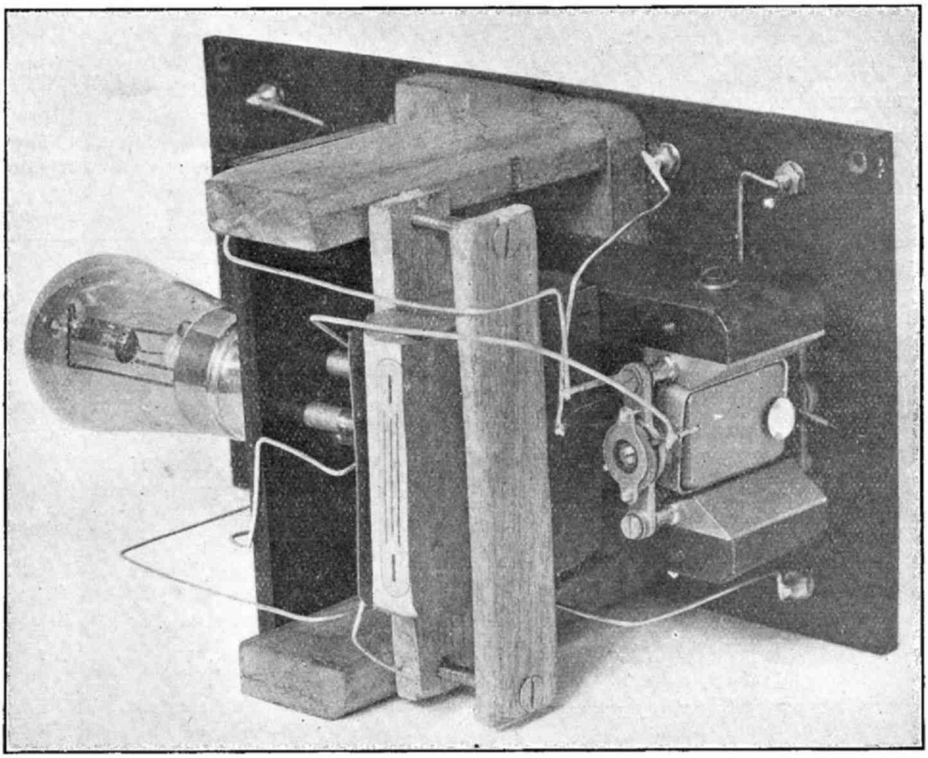
This mirror may be a tiny piece of plain mirror about $\frac{1}{8}$ in. square stuck straight on to the aluminium frame of the coil, or preferably a 60-in. or 80-in. focus concave mirror, which may be obtained from Morlands, of Croydon.

A few remarks on the method of using the instrument will not be out of place.

Using a D.E.R. valve the filament battery will have to be 2 volts, while for all usual types of valves 36 volts H.T. is a good value to use.

Assuming that all batteries have been connected and filament not alight, short circuit the input terminals and focus the reflected spot of light on to a screen.

A convenient screen is made by a piece of board 3 ft. by 1 ft., with a $\frac{1}{2}$ in. hole bored



View of the interior of the instrument. The small concave mirror is attached to the moving coil by means of an aluminium foil bracket.

in the centre, behind which a light is placed. A centimetre scale may be marked out on a strip of drawing paper and stuck to the board.

The concave mirror is mounted in a little cage of aluminium foil shaped as shown in the sketch.

The foil is stuck with shellac on the underside of the aluminium frame of the coil and left to dry overnight.

Two $\frac{3}{4}$ in. holes should be made in the ends of the box opposite mirror and valve respectively, when the instrument is finished.

The position of the spot should be on the zero of the scale. Now turn on the filament resistance slowly to about two-thirds of its full movement, and mark the new position of the spot—call it the working zero.

If desired, the instrument can now be calibrated by noting the deflection produced when the voltmeter is connected across a non-inductive resistance carrying a known A.C. current.

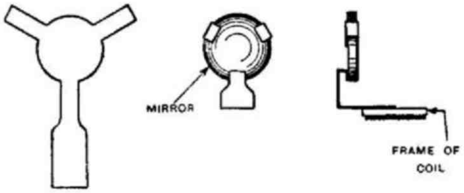


Fig. 6. Details for securing the mirror.

Whenever the voltmeter is used the true zero must first be checked, with the valve out, and, if necessary, corrected by moving the screen and scale, and then the filament resistance turned on until the spot has moved to the same scale reading corresponding to the working zero. In this way the voltmeter will be operated under the same conditions every time it is used.

For those who cannot calibrate their own instruments, or have them calibrated, the calibration curve may be assumed to be a parabola, *i.e.*, the scale reading varies as the square of the voltage or the voltage is proportional to the square root of the scale reading.

Thus the voltage is roughly proportional to the square root of the deflection, starting from the working zero. (Fig. 7).

In conclusion, this type of voltmeter is, and has been for some time, extensively used both in research and in class work in the telegraphy and telephony laboratories of the City and Guilds Engineering College, and the actual design which has been described in this article has been adopted as standard in these laboratories.

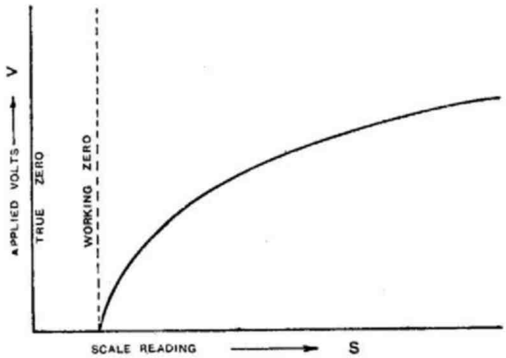
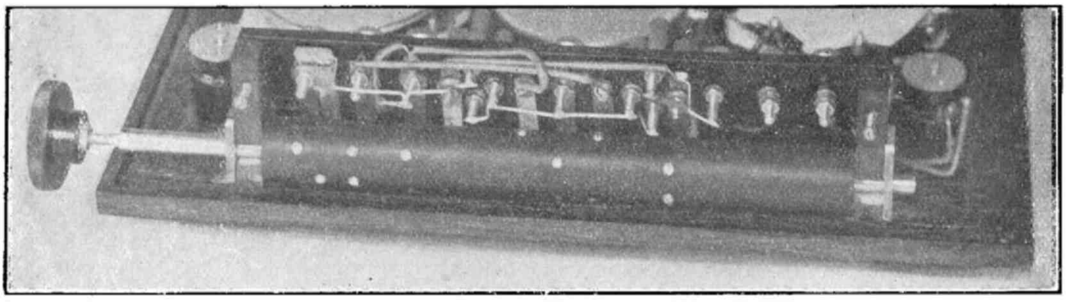


Fig. 7. Relationship between the applied voltage and scale deflection.

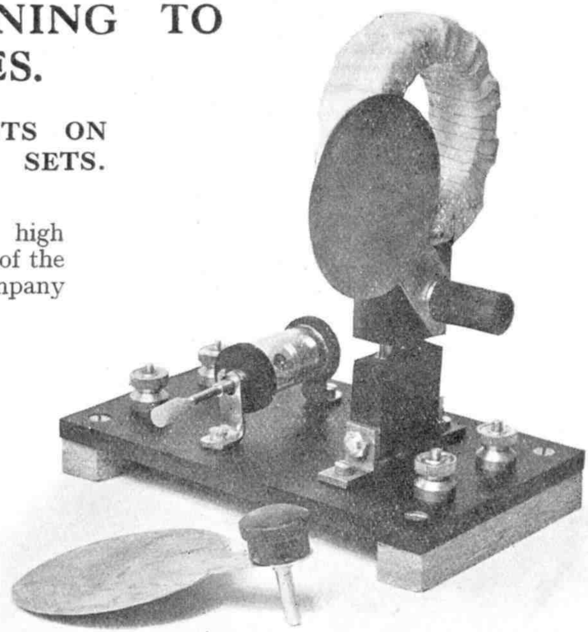
A USEFUL BARREL SWITCH.



One of the most efficient methods for changing out valve circuits, when switching H.F. and L.F. amplifiers in and out of action, is by means of a barrel switch. The switch shown here is of simple design and is attached immediately beneath the valve platform so that many of the spring contacts are actually carried by the valve stems. The switch, which has been designed by Mr. E. J. Baty, B.Sc., is here shown fitted to a Baty receiver.

METHODS OF TUNING TO 1,600 METRES.

SOME FURTHER HINTS ON ADAPTING CRYSTAL SETS.



THE transmissions of the high power experimental station of the British Broadcasting Company at Chelmsford have focussed a good deal of attention on the reception of telephony on fairly long wavelengths. At the time of writing it is still uncertain whether the Company will obtain official sanction for the institution of a permanent service from a station of this kind. As, however, it is fairly common knowledge that the Post Office has no particular objection to the scheme, and as it has already received the blessing of all except one of the Services, it appears highly probable that the experimental transmissions which have so far taken place will lead at an early date to the erection and daily use of a permanent station. It is also nearly certain that if this station is allowed by the Post Office, it will work on a wavelength in the neighbourhood of the 1,600 metres used for the experiments.

The location is to be determined by a desire to get as near as possible to the centre of the country, and the distance by the limit of absolutely safe working over land lines.

In deciding the best way to set about the reception of this station, an important point is, of course, the nature of the apparatus already available. It is generally fairly simple to convert an existing set, designed for short wavelengths only, in such a way as to make it quite efficient for long waves also. Dealing here only with the crystal set, a number of models on the market are provided with a couple of sockets to enable a loading coil to be inserted in the circuit. Many of the crystal sets on the market, however, which are provided with means for plugging in a loading coil for long wavelengths are not provided with any satisfactory means of tuning the set when these coils are inserted. When the sets were designed the only long wave stations receivable on a crystal were of spark type, which tune so flatly that no accurate tuning of the loading coil was necessary. On telephony, however, the tuning is much sharper, and unless means of tuning are accurately provided the results will be poor. The trouble arises because nearly all these sets are tuned by varying the inductance of the original short-wave coil, and when the large invariable loading coil is added, the variation obtainable on the short wave coil is such a small proportion of the whole inductance of the circuit that it has very little effect on the tuning. It is then a mere matter of luck whether with the aerial in use the wavelength comes out somewhere near the desired value. This difficulty can be got over in at least three ways. The simplest at first sight is to provide a coil which is without doubt larger than necessary to tune the set up to the wavelength, and then to adjust it by peeling off turns until the desired result is obtained.

A more satisfactory way of providing the necessary tuning is to fit the set with a small adjustable condenser in parallel with the windings. A parallel condenser is admittedly inefficient on short wavelengths, but at about 1,600 metres it will do no harm, and unless the type of loading coil used is specially free from losses, may even improve results. The value adopted should not be too high. About 0·00025 as a maximum is suitable, and with this the loading coil can have 150 turns.

A third method which is very convenient, in that it requires no alteration to the set itself, except the addition of sockets where they are not already provided, depends on the following fact. Whenever a sheet of metal is brought near to the face of a coil, the inductance of the coil is reduced. This reduction may by suitable design be made quite large, say 50 per cent., without any serious losses being introduced; and by attaching a tuning plate of this nature to the loading coil itself all the necessary tuning for the set can be obtained without difficulty. The arrangement as fitted to a Burndept coil is shown in the accompanying illustration, in which it will be seen that a spindle of brass is passed through the moulded base of the coil. To the spindle is soldered a plate of No. 20 gauge sheet copper, and the spindle and plate can be rotated in front of or away from the face of the coil as desired by means of an ebonite knob. Sweetness of motion as well as sufficient friction to retain the plate in any desired position is obtained by means of a pair of locknuts and a split washer. This method is applicable to all wavelengths, but for 1,600 metres the coil should be one of 200 turns unless the aerial is very small, in which case it may be rather larger.

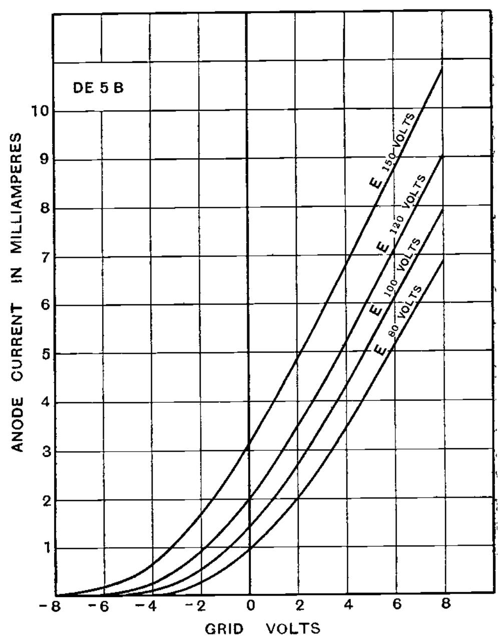
A NEW VALVE.

THE D.E. 5B. OF THE M.O. VALVE CO., LTD.

IN the issue of August 20th, we commented editorially on the need for a new valve, pointing out that for resistance or choke coupled amplifiers, it was desirable to employ valves having a high amplification factor with a fairly low internal (anode filament) impedance.

The M.O. Valve Co. have just introduced a new valve (designated D.E. 5B) having these characteristics.

The usual grid-voltage anode-current curves are given in the accompanying figure. Upon examination, it will be seen that, considering the point of zero grid potential, for example, a change in the grid voltage of 1·5 volts (from 0 to − 1·5) reduces the anode current by the same amount as a change in anode voltage of from 150 to 120. Hence the amplification factor under these conditions is $\frac{30}{1{\cdot}5} = 20$. Again, when the anode voltage is 150, the anode current for zero grid voltage is 3·15 milliamperes, while the anode current is only 2 milliamperes when the anode voltage is 120. Hence the internal impedance under these conditions is $\frac{30}{0{\cdot}00115} = 26{,}000$ ohms.



The valve takes a filament current of 0·22 ampere at 5 volts, which is similar to that taken by the D.E. 5 valve.

DESIGNING SMALL POWER TRANSFORMERS

In a recent issue the theory of the design of small transformers was dealt with. In this article practical information is given from which to construct transformers for amateur requirements.

By W. JAMES.

ESTIMATING THE DIMENSIONS.

THOSE who wish to construct a transformer for experimental work will find that quite a good idea of the dimensions of the core and the number of turns required may be obtained by making a few assumptions, and then by calculating whether the design is likely to prove satisfactory.

The fundamental equation

$$E = \frac{4{\cdot}44\, TFf}{10^8} \text{ volts,}$$

where T = the number of turns of wire connected in series
F = the maximum value of the flux, and
f = the frequency in cycles per second

gives us the relation between the voltage, frequency, magnetic flux and turns.

THE WINDINGS.

The first factor to be cleared up is the number of primary and secondary turns. We will assume, from our previous experience, that there will be between three and four turns per volt. If we take an average figure of 3·5 turns per volt, we may estimate the number of turns at once. For the primary winding we assume (3·5 × primary voltage) turns, and for the secondary winding (3·5 × secondary voltage) turns.

THE GAUGE OF WIRE AND ITS INSULATION.

The gauge of the wire to be used may be found by allowing a current density of 1,000 amperes per square inch. The nearest gauge corresponding with the area found in this way may be taken from Table 1.

As to the insulating covering of the wire, a double cotton covering is usually employed with relatively thick wires, and a double silk covering with thin wires.

THE SPACE REQUIRED FOR THE COILS.

Now the space required for the wires of the coils themselves may be estimated. For instance, if No. 22 D.C.C. is to be used, we know we can wind 26 turns per inch, or 676 turns per square inch. This is the theoretical space required for the winding. It is advisable to estimate a space at least 25 per cent. greater than this to allow for uneven winding.

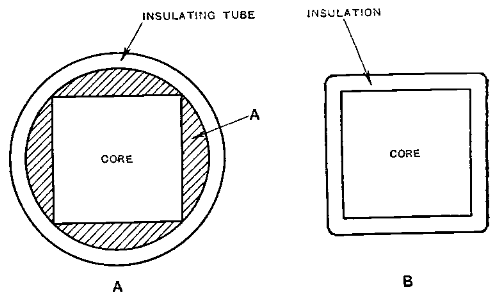


Fig. 1. In sketch A, a circular former which just fits over the core is employed; hence, the space marked A is wasted. In sketch B, the coil is wound on a rectangular former.

The total space occupied by the winding is obviously equal to the space required for the wires of the coil, plus the space required for insulation, plus that wasted because of the shape of the core and coils. Thus if the coils are wound on a circular former, there is the space between the core and the surface of the insulating tube supporting the windings (A, Fig. 1A) to be added. When the coil is wound on a rectangular former, Fig. 1B, a suitable allowance should be made for the space occupied by the insulation between the core and the coil.

THE SIZE OF THE CORE.

We may now work out the formula and

Table I.—Properties of copper wires.

Standard Wire Gauge.	Diameter in Inches.	Area in Square Inches.	Resistance in Ohms per Yard at 60° F.	Resistance in Ohms per lb. at 60° F.	Single Silk Covering. Turns per Inch.	Double Silk Covering. Turns per Inch.	Double Cotton Covering. Turns per Inch.	Standard Wire Gauge.
10	·128	·012870	0·001868	0·0120	7·64	7·55	7·04	10
11	·116	·010570	0·002275	0·0200	8·41	8·30	7·69	11
12	·104	·008495	0·002831	0·0280	9·35	9·22	8·48	12
13	·092	·006648	0·003617	0·0550	10·5	10·4	9·43	13
14	·080	·005027	0·004784	0·0820	12·1	11·8	10·6	14
15	·072	·004072	0·005904	0·1400	13·3	13·1	11·6	15
16	·064	·003217	0·007478	0·2021	14·9	14·6	13·2	16
17	·056	·002463	0·009762	0·3423	16·9	16·5	14·7	17
18	·048	·001810	0·01328	0·6351	20·0	19 4	17·2	18
19	·040	·001257	0·01913	1·315	23·8	23·0	20·0	19
20	·036	·001018	0·02362	2·012	26·3	25·3	21·7	20
21	·032	·0008042	0·02990	3·221	29·4	28·2	23·8	21
22	·028	·0006158	0·03905	5·498	33·3	31·8	26·3	22
23	·024	·0004524	0·05313	10·14	38·5	36·4	29·4	23
24	·022	·0003801	0·06324	14·38	42·1	40·0	31·3	24
25	·020	·0003142	0·07653	21·08	46·0	43·5	33·3	25
26	·018	·0002545	0·09448	32·21	50·6	47·6	35·7	26
27	·0164	·0002112	0·01138	46·55	55·1	51·6	37·9	27
28	·0148	·0001720	0·1398	70·12	60·4	56·2	40·2	28
29	·0136	·0001453	0·1655	98·65	65·2	60·2	42·4	29
30	·0124	·0001208	0·1991	142·75	72·0	67·1	44·7	30
31	·0116	·0001057	0·2275	185·80	76·3	70·9	46·3	31
32	·0108	·0000916	0·2625	248·20	81·3	75·2	50·5	32
33	·0100	·0000785	0·3061	337·50	87·0	80·0	52·6	33
34	·0092	·0000665	0·3617	471·00	93·4	85·5	54·9	34
35	·0084	·0000554	0·4338	676·50	101	91·8	61·0	35
36	·0076	·0000454	0·5300	1,009·0	110	102	64·1	36
37	·0068	·0000363	0·6620	1,574·0	120	110	67·6	37
38	·0060	·0000283	0·8503	2,598·0	133	121	71·4	38
39	·0052	·0000212	1·132	4,645·0	149	134	75·8	39
40	·0048	·0000181	1·328	6,360·0	159	142	78·1	40
41	·0044	·0000152	1·581	9,020·0	169	150	—	41
42	·0040	·0000126	1·913	13,150·0	191	167	—	42
43	·0036	·0000102	2·362	20,120·0	206	179	—	43
44	·0032	·0000080	2·989	32,210·0	225	192	—	44
45	·0028	·0000062	3·904	54,980·0	247	208	—	45

find the total flux. Thus

$$E = \frac{4{\cdot}44\ TFf}{10^8} \text{ volts}$$

and as E, f and T are known

$$F = \frac{E \times 10^8}{4{\cdot}44 \times fT}$$

Thus, if $E = 200$ volts, $f = 50$ cycles, and $T = 700$ turns,

$$F = \frac{200 \times 10^8}{4{\cdot}44 \times 50 \times 700} = 130{,}000 \text{ lines approximately.}$$

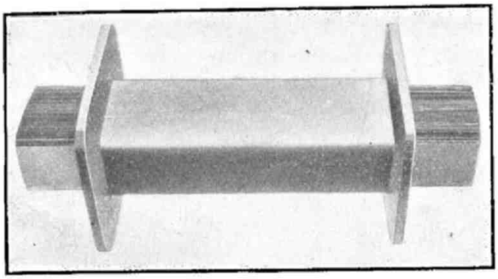
If good quality laminations, such as stalloy, are to be employed, a safe flux density is about 65,000 lines per square inch. When ordinary transformer iron is to be employed, it is not advisable to take a value higher than about 40,000 lines per square inch. If we take 65,000 lines per square inch as the flux density, obviously the core in the above example should have a cross-section of

$$\frac{130{,}000}{65{,}000} = 2 \text{ square inches.}$$

The actual area should be 10-15 per cent. above this, because of the space occupied by the insulating material and the surface of the laminations.

LEADING DIMENSIONS.

Having now estimated the cross-section of the core and the space required for the windings and insulation, a scale drawing may be made. It is usual to use a core of rectangular cross-section, the depth being about one and a half times the width. Of course, a core of square cross-section may be employed if desired.



[Courtesy: General Electric Co.

A standard G.E.C. transformer core ready for winding.

ESTIMATING THE LOSSES.

From the scale drawing find the total weight of the core, assuming one cubic inch weighs 0·27 lb. The iron loss is then found by multiplying the weight in pounds by the appropriate quantity taken from Table 2, which gives the maximum power losses for stalloy* laminations due to the combined effects of hysteresis and eddy currents.

Table 2. Maximum power losses for stalloy laminations.

Thickness of Lamination. Inches.	Watts per lb.			
	Maximum Flux Density, 64,500 lines per sq. inch.		Maximum Flux Density, 96,750 lines per sq. inch.	
	50 cycles	60 cycles	50 cycles	60 cycles
0·012	0·68	0·85	1·71	2·09
0·014	0·68	0·85	1·71	2·09
0·015	0·70	0·87	1·75	2·16
0·016	0·71	0·89	1·77	2·20
0·017	0·73	0·92	1·82	2·27
0·018	0·75	0·94	1·87	2·32
0·020	0·78	0·99	1·93	2·43
0·022	0·82	1·05	2·02	2·57
0·024	0·87	1·11	2·14	2·70
0·025	0·90	1·15	2·18	2·80

The copper loss is estimated by finding the total lengths of the wire in the primary and secondary windings from a knowledge of the number of turns and the mean length as determined from the drawing, and then finding the resistance from Table 1. The copper loss of the primary is then given by the primary current squared times its resistance, and the secondary copper loss by the secondary current squared times its resistance.

The permissible total loss is usually about 10 per cent. in small transformers. This loss may be about equally divided between the iron and the copper.

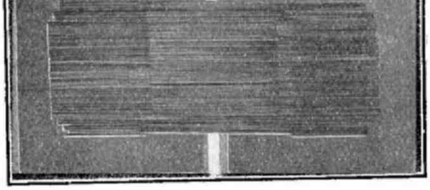
THE MAGNETISING CURRENT.

The ampere-turns per inch of the magnetic path necessary to produce the estimated flux density may be found from Table 3.

Table 3. Giving ampere-turns per inch length of core.

Flux Density Lines per square inch.	Ampere Turns per inch length.
77,400	26
83,850	46·5
90,300	67
96,750	121
103,200	202

The magnetising current is then given by the ampere turns divided by 1·41 times the primary turns. A reasonable value is about 10 per cent. of the full-load primary current. If it is too high, the cross-section of the core must be increased, or its length reduced, or more turns may be added to the primary winding.



[Courtesy: General Electric Co.

A standard G.E.C. transformer yoke and core.

* Courtesy Joseph Sankey & Sons, Ltd., Bilston, Staffs.

Example.

What would be suitable dimensions for a transformer to be employed with a full wave rectifier for charging accumulators (Fig. 2)? The transformer is to work off a supply of 200 volt 50 cycle current, and to deliver 22 volts across each half of the secondary winding and a maximum current of 8 amperes.

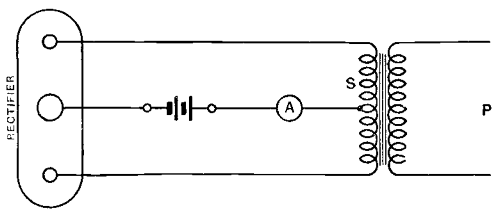


Fig. 2. Connections of a step-down transformer to a chemical rectifier for accumulator charging.

1. The power taken from the secondary is equal to the product of volts and current, that is, $22 \times 8 = 176$ watts.

2. Assuming the transformer has an efficiency of 90 per cent., the load taken from the mains is 196 watts. Hence the full load primary current is $\frac{196}{200} = 0{\cdot}98$ ampere.

3. The number of turns in the primary winding may be estimated as 3·5 times the primary voltage, or 700 turns. The total number of turns in the secondary winding is then $2 \times 22 \times 3{\cdot}5 = 154$, or, say, 160 turns, to allow for the fall in voltage due to the resistance of the windings. A tapping will be made at the centre turn.

4. As the full load primary current is 0·98 ampere, a suitable gauge of wire at 1,000 amperes per square inch is No. 20 S.W.G. The secondary current being 8 amperes (which, however, only flows for one alternation per cycle in each half of the winding) requires a conductor of about No. 14 S.W.G. Both wires should have a double cotton covering.

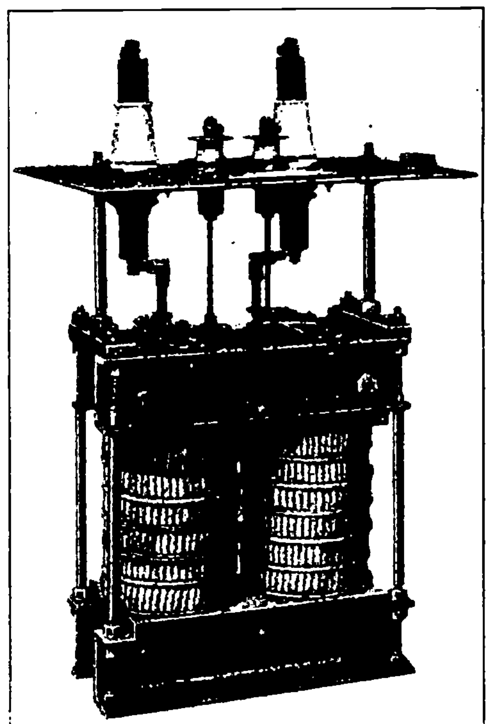
5. Number 20 D.S.C.* winds 25·3 turns per inch, or 640 turns per square inch, and No. 14 D.S.C. winds 11·8 turns per inch, or 140 turns per square inch. Hence the space required for the wire of the windings is $\frac{700}{640}$ + 25 per cent. = 1·4 square inches for the primary and $\frac{160}{140}$ + 25 per cent. = 1·43 square inches for the secondary.

The total space occupied by the windings is therefore 2·82 square inches, to which must be added the space taken by the insulation, making the total space, say, 5·0 square inches.

6. From the formula

$$F = \frac{E \times 10^8}{4{\cdot}44 \times f \times T}$$

we find the total flux to be 130,000 lines. Allowing a flux density of 65,000 lines per square inch, the cross-sectional area of the core should be two square inches, or say, $1{\cdot}25 \times 1{\cdot}7$ inches, which allows for the space occupied by the insulating surface of the laminations.



[Courtesy General Electric Co.

Interior view of a typical G.E.C. high tension transformer.

7. The area of the opening or window of the transformer being 5·0 square inches, we can arrange for the long side to be $2\frac{1}{2}$ inches and the short side 2 inches (Fig. 3). A

* Double silk covered wire is employed in this design in order that the transformer may be compact, and the iron losses and magnetising current made a minimum.

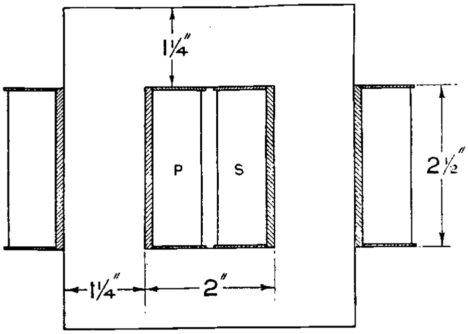
scale drawing of the transformer may now be made.

8. The total length of wire in the primary winding is about 150 yards, having a resistance of 3·5 ohms, and the length in the secondary winding about 35 yards, having a resistance of 0·17 ohms. Therefore the primary copper loss is about 3·5 watts, and the secondary copper loss about 5·5 watts.

The core weighs about 10 lbs., producing a loss of 7 watts.

Hence the total loss is 16 watts.

9. The windings should be wound on a former of rectangular cross-section, and as an allowance for insulation of $\frac{1}{8}$ inch is made over the core, the winding former may be 1·5 × 1·95 inches. It is convenient to place the primary winding on one limb of the core, (Fig. 3), and the secondary winding on the other limb. Constructional details may be gathered from the drawing of the former.



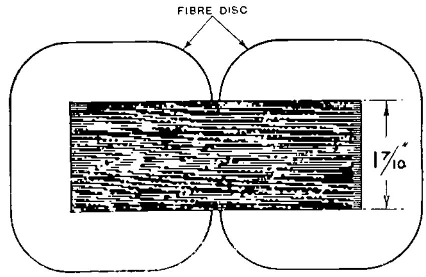


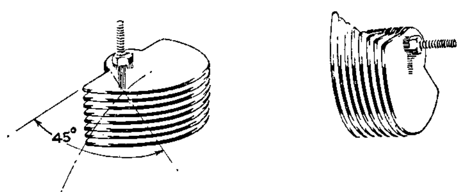
Fig. 3. Scale drawing of the transformer.

READERS' PRACTICAL IDEAS.

This section is devoted to the publication of ideas submitted by readers and includes many devices which the experimenter will welcome.

Square Law Condensers.

VARIABLE condensers of the semi-circular vane type pattern possess the disadvantage that the adjustment is much more critical near the minimum end of the scale. Square law condensers, of course, produce uniform wavelength change for any given ratio of the dial, which is a distinct advantage. The usual pattern of condenser may be made to possess this property by clipping off portions of the moving plates, removing sections of increasing size, as shown in the accompanying diagram.



Square law condenser construction.

The easiest way of marking the plates is to draw a curve with a sharp instrument across the curved edges. The angle of the largest sector of plate removed should not exceed about 45 degs. Scratch lines can be made on the other plates drawn from near the centre to the point on the edge marked by the curved scratch line. When the plates of a condenser are cut in this manner, tuning of the minimum position is rendered much more easy.

S. K. L.

Keeping the H.T. Battery in Good Condition.

THE use of the ordinary type of 4½-volt pocket cell when constructing a H.T. battery is often unfavourably reported upon, though it is essentially due, no doubt, to the lack of attention given to the cells when in use. In the first place the cause of failure is not always due to the current consumption by the valves but in a good many instances is caused by leakage and the drying up of the solution which is used as an electrolyte in the cells.

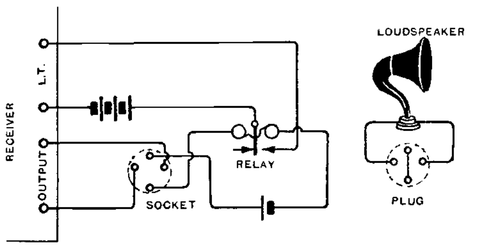
To avoid these troubles, obtain a sheet of window glass of sufficient size to cover the number of batteries in use. Carefully test each battery to see that it is in good condition and then completely immerse it in paraffin wax which is just hot enough to remain in a liquid condition. Take the cells out of the wax, arrange them in rows of one dozen, spacing about ¼ in. apart. As each cell is placed on the glass the wax immediately hardens and the cell will adhere firmly in position, thus insulating each cell from its neighbour by a small air gap, while each cell itself is completely enclosed in wax, which effectively prevents drying up of the solution.

The time and trouble which this operation takes is negligible in view of the vastly longer life obtainable from the battery.

A. G. W.

Loud Speaker Extensions.

MANY suggestions have been made from time to time for the purpose of providing remote control of the wireless receiving set so that it can be used to operate loud-speakers in other rooms of the house as required.



Circuit for loud speaker extension with remote control.

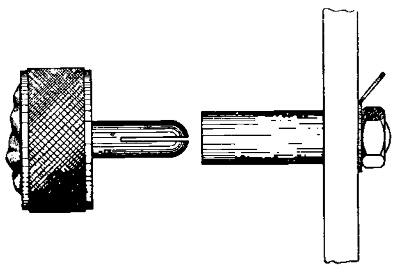
Some of the proposed systems are complicated, inasmuch as the designers have aimed at operating the system on only two leads. There is no great objection to using more than two leads on such circuits, for the distances from room to room are usually very short and suitable wire for the purpose is easily obtainable. The simplest form of plug and socket for loud speaker connection is one making use of the base of a burnt-out valve and a valve holder. The valve holder can be mounted on a suitable wooden sub-base to facilitate attaching to the wall and the four wires connected up to the socket as shown.

The grid and plate pins of the valve socket are short circuited, while the filament pins are connected to the flexible cord of the loud speaker. On inserting the socket in the valve holder it will be seen that the circuit through the relay coil is completed so that the receiver is brought into action whenever the loud speaker is plugged in.

H. S.

Interchanging Crystals.

WHEN various crystals are secured with Wood's metal or fixed by means of screws into separate cup mountings, they can be interchanged in a crystal detector.



An interchangeable crystal device.

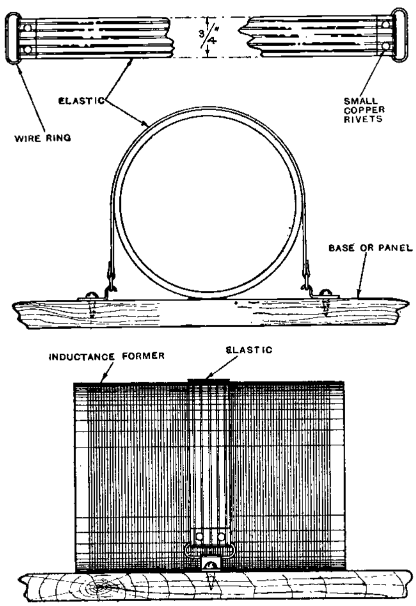
This usually necessitates, however, removal of the screw, and the process of substituting new crystals is not very rapid and it is essential when making comparative tests to be able to move one crystal from circuit and rapidly substitute it by another. The accompanying illustration shows a very simple method of doing this in which the crystal cup is attached to a valve pin, for it will be found that both of these parts are usually made with a 4 B.A. thread.

By fitting a valve stem to the base of the detector, preferably of the flush type, crystals are interchanged merely by plugging them in as required.

E. L.

Useful Coil Fixing,

WHEN an inductance is wound upon a cardboard tube, difficulty arises in the method by which the tube is to be attached to the instrument panel. The usual method adopted consists of blocking one or both ends with a piece of wood and screwing this to another vertical wooden bracket. Suitable shaping with pieces of wood is not always an easy process, and a very much easier method consists of strapping the coil to the face of the panel by means of a band of elastic.



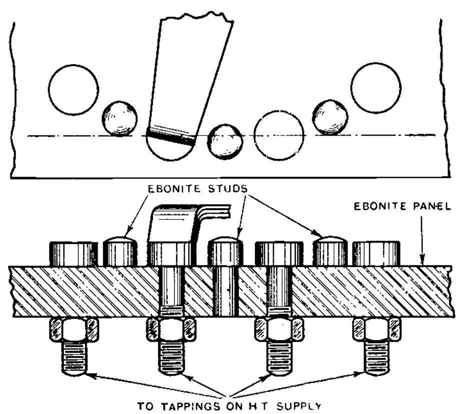
Coil fixing with elastic band.

The elastic, which preferably should be about $\frac{3}{4}$ in. in width, is terminated at its ends with small wire rings, whilst clips must be made, into which these rings will engage. It is only necessary to stretch the elastic band across the coil, thus producing a secure fixing without any risk of damaging the former or its winding.

N. W.

H.T. Battery Switch.

MANY experimenters prefer to enclose the H.T. battery in a cabinet to protect it to some extent from temperature changes and mechanical damage. When the battery is thus enclosed, it is no longer possible to produce the desired potential by means of the usual wander plug, and it becomes necessary to fit up some form of rotary switch. To avoid short circuiting sections of the battery, the switch is connected up so that every other stud is out of circuit. A simple method of preventing short circuit of the sections is to interspace between the studs small studs of wood or ebonite, so that the switch blade lifts as it moves from stud to stud. These studs should have rounded surfaces so that the switch arm will ride smoothly over them. As many types of valves require critical H.T. voltage the rotary switch will be found most useful.



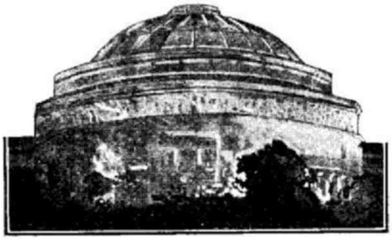
H.T. safety switch.

VALVES FOR IDEAS.

Somewhere in his apparatus almost every amateur experimenter has embodied an original device, an idea of his own, with the object of obtaining increased efficiency.

In order that others may benefit by individual experience, *The Wireless World and Radio Review* now includes a special section devoted to useful ideas and "gadgets." To every reader whose suggestion is accepted for publication in these pages, a receiving valve of one of the standard makes will be forwarded.

Send in your suggestion now, together with a sketch, if necessary, marking your envelope "Ideas."

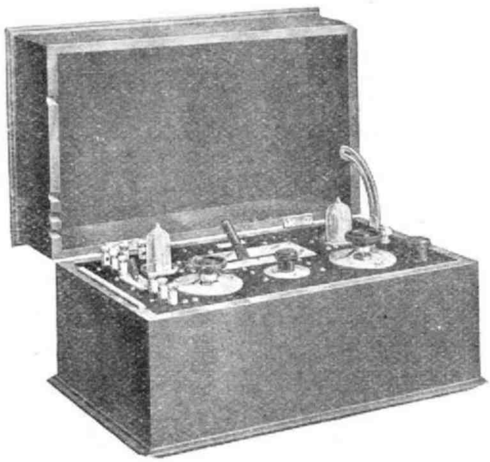


THE WIRELESS EXHIBITION

A REVIEW OF EXHIBITS.

THE Wireless Exhibition to be held at the Albert Hall opens on Saturday, September 27th, and will remain open until October 8th.

The Exhibition this year is conducted by the trade organisation known as the National Association of Radio Manufacturers and is confined to members of that Association manufacturers of allied accessories and the Wireless Publishers.



A compact two-valve set by the Metropolitan Vickers Electrical Co., Ltd.

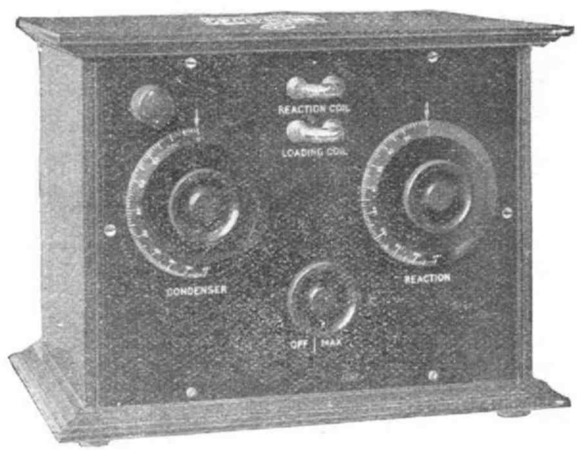
The All-British Wireless Exhibitions of previous years have been open to any manufacturers of British apparatus and not restricted as on this occasion to the members of a particular trade organisation.

We understand that the choice of the Albert Hall has been made on account of its central location and consequent convenience of access from all parts of the metropolis. Apparatus will be exhibited on some 50 stands and we shall endeavour to make brief reference in the pages of this journal to some of the principal exhibits to be seen. In particular, it is interesting to note that the apparatus shown this year will include a very large variety of component parts, many of which will be new to our readers, as they embody designs which have been specially prepared so as to be ready for display at the Exhibition.

In briefly reviewing the exhibits it would appear that the most noticeable innovations as regards accessories are in connection with variable condensers and loud speakers. The increasing popularity of the square law pattern condenser is evidenced by the large number of concerns who are showing these, whilst recent notable developments in loud speaker design will form a prominent feature on many of the stands.

The increasing use of resistance capacity coupling is recognised by the Metropolitan Vickers Electrical Co., Ltd., who have introduced a new Radiobrix unit incorporating this principle. A further addition to Radiobrix components consists of a high frequency choke coupling unit, including a valve holder which enables a tuned anode to be used with dual amplification without introducing low frequency coupling between the valves and consequent howling which usually renders this difficult. Among the new components of this concern, special mention may be made of the Polar Precision condenser and the Cosmos strip coils. These coils are constructed on an entirely new principle, being wound with a paper strip in which a number of wires are embedded, the several wires being cross connected at the ends, so that they are all connected in series.

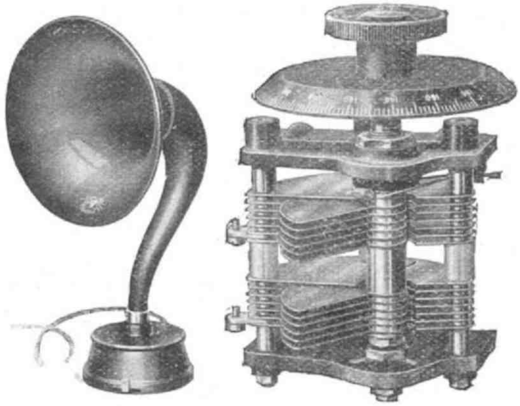
Amongst the range of Gecophone sets which will be shown by The General Electric Co., Ltd. is included an entirely new series of one, two and three-valve receivers. They are constructed for receiving over a wavelength range of from 300 to 500 metres, but provision is made for the insertion of loading coils. The single valve set employs a conventional reaction circuit whilst the two-valve model comprises a detector and low frequency



An efficient self-contained receiver which will be shown by the General Electric Co., Ltd.

amplifier, two low frequency stages being included in the three-valve receiver.

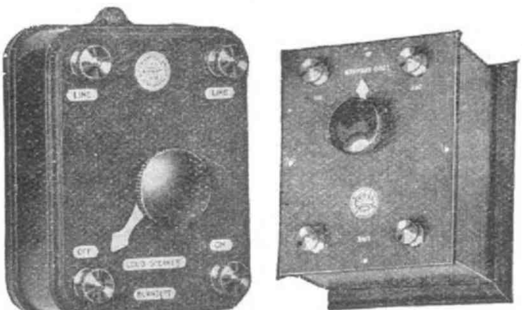
The Sterling Dinkie, one of the most recent additions to the range of loud speakers produced by the Sterling Telephone and Electric Co., Ltd., will be available for inspection, as will also the Primax and Amplivox models. The novel construction of the Primax was recently dealt with in these pages, whilst the Amplivox is a combined loud speaker and amplifier which may successfully be employed in conjunction with a crystal receiver. To the already extensive selection of Sterling components have been added an interchangeable



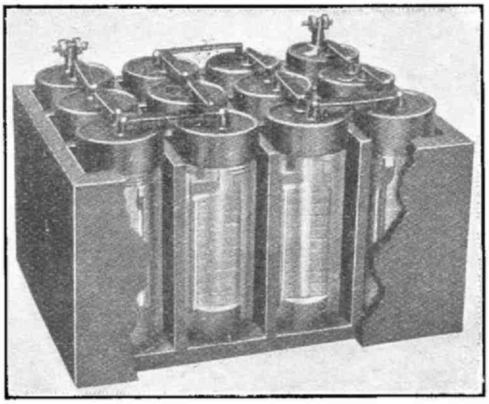
Sterling's latest introductions. The Dinkie loud speaker and square law pattern double condenser.

filament rheostat, double and triple condensers of the square law pattern and a 0·0005 geared condenser.

There are few components of a wireless installation which will not be found upon the stand occupied by Burndept, Ltd. One of their most recent introductions is a newly designed wave trap for eliminating interference on wavelengths between 250 and 600 metres. Three new types of steel-clad transformers, variable condensers, and



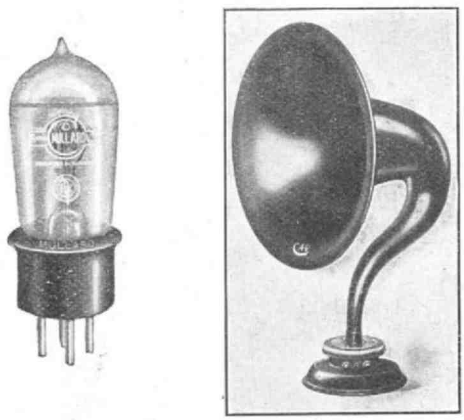
Two specialities of Burndept, Ltd. Automatic switches for switching on loud speakers in various rooms.



Showing the construction of the C.A.V. H.T. battery (C.A. Vandervell & Co., Ltd.).

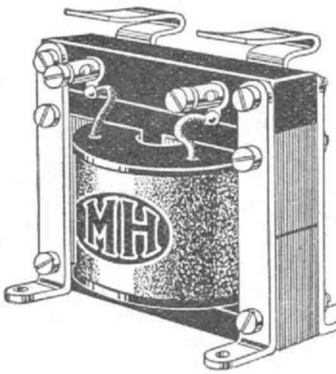
H.T. batteries will be on view, side by side with a complete range of Burndept broadcast receivers.

C.A.V. batteries, which will be seen on the stand of C. A. Vandervell & Co., Ltd., are too well known to need description. A further speciality of this concern is a handsome swan-neck pattern loud speaker finished in black satin enamel. The Radiosun loud speakers will be the sole exhibit on the stand of Messrs. Auto Sundries, Ltd. Special models in cabinets of true period reproduction will be shown in addition to the standard horn type and the de luxe cabinet model in oak and mahogany.



(Left) The new Mullard special purpose valve. (Right) An attractive looking loud speaker by C.A. Vandervell & Co., Ltd.

A visit to the stand of The Mullard Radio Valve Co., Ltd., will reveal literally a valve for every purpose, ranging from dull emitter receiving valves consuming only a fraction of an amp. to transmitting valves with a current consumption of over 5 amps. The Mullard high and low frequency valves bearing the distinctive red and green rings will be on view, in addition to the Wecovalve and the ·06 dull emitters. A valve of particular interest, of which three types will be displayed, is the D.F.A. dull filament power amplifier, which has been designed to give great volume with freedom from distortion.



The McMichael low frequency transformer fitted with special condenser clips.

A component on the stand of Messrs. L. McMichael, Ltd., which should call for special notice is the new M.H. intervalve low frequency transformer. This is fitted with special clips at the top designed to hold a fixed condenser. The usual receiving sets and high class components will be prominently displayed, the majority of which need no introduction. The portable receivers which will be featured by the Rees Mace Manufacturing Co., Ltd., should appeal particularly to flat dwellers and to people living in cities.

The stand occupied by Houghtons Ltd., is being organised in the nature of a service bureau devoted to the needs of wireless retailers. The concern have organized a central source of supply through which a retailer may obtain British made wireless goods. A comprehensive catalogue of wireless apparatus of interest to the trade generally will be available.

For converting a gramophone to a loud speaker. (S. G. Brown, Ltd.).

A complete and comprehensive range of condensers both fixed and variable will be exhibited by the Dubilier Condenser Co. (1921), Ltd. The varying types of condensers manufactured by this concern are too well known to need reiteration. A new departure, however, consists of a series-parallel variable condenser whereby the condenser may be placed in the circuit either in series or parallel without any gap in the tuning range of wavelengths. For use in converting a gramophone into a loud speaker a special gramophone adaptor has been produced by S. G. Brown, Ltd., and this instrument will form a prominent feature of their stand. A further exhibit of interest is the Crystavox—a loud speaker which can be operated from a crystal set. Various types of microphone amplifiers and the Frenophone will be displayed by this concern.

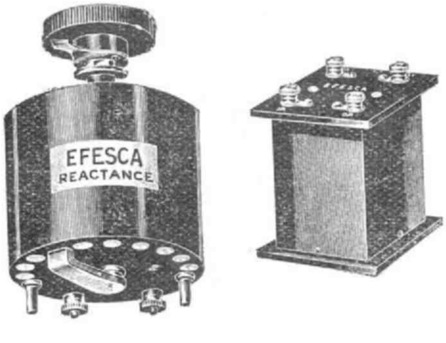
A series-parallel variable condenser by Dubilier.

Capable of being operated by a crystal set. The Brown Crystavox.

A stand which should be of interest to the experimenter will be that occupied by Messrs. A. W. Gamage, Ltd. A comprehensive range of accessories and components for the home constructor will be on view, whilst expert advice will be available regarding the selection of suitable equipment.

A considerable amount of experimental work has been expended in the production of Tangent tuning coils, examples of which will be seen on the stand of Gent & Co., Ltd. Apart from their electrical efficiency, they are extremely robust and substantially built. The majority of the experimenter's needs are catered for by this concern, who will show radio fitments and accessories of practically every description. Mention may be made of the novel Tangent pan switches in which particular care has been taken to eliminate stray capacities, so rendering them suitable for use when dealing with high frequency currents.

A new type accumulator which will retain its charge for long periods without detriment and which is therefore eminently suitable for use with dull emitter valves will be shown by Falk, Stadelmann & Co., Ltd. A further feature of this stand will comprise a new series of Efesca one-hole fixing components, including high frequency and aerial tuning units, variable condensers and low frequency transformers. Particular attention is drawn to the H.F. and aerial tuning units which represent a departure in design from conventional practice. They embody a dead-end device so that unused portions of the coil are short circuited. The advantages of these one hole units for making up experimental circuits will at once be appreciated.

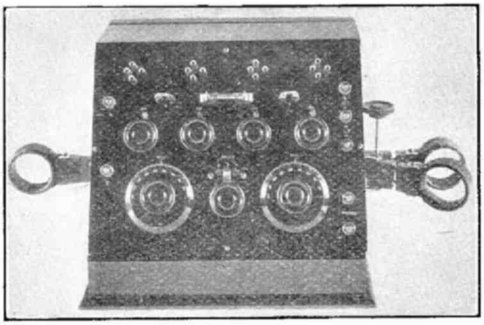


The Efesca reactance unit and encased L.F. transformer (Falk, Stadelmann & Co., Ltd.).

The well-known Clix plugs will figure prominently among the various other accessories shown by Autoveyers, Ltd.; a full range of accessories will include air and mica dielectric condensers, in addition to the Bridge tuning and rejector unit. Selected crystal receivers and long range valve sets will also be displayed

To the enquiring mind interested as much in what a battery is, as in what it does, the various component parts of Exide batteries, which will be exhibited on the stand of the Chloride Electrical Storage Co., Ltd., in various stages of construction will provide a field for study. The small D.T.G. battery in a glass case with a capacity of 20 ampere hours for short intermittent discharges will specially interest the user of dull emitter valves, whilst the B.K. and A.Y.G. high tension batteries which give the steady flow of current and constant voltage which cannot be obtained from dry batteries are also worthy of notice.

At the stand occupied by the Eagle Engineering Co., Ltd., a speciality will be made of home constructor's sets which consist of drilled and engraved ebonite panels with a complete set of components for building a two, three or four-valve set. In addition, a full range of Chakophone components will be available for inspection. Special attention is drawn to the series-parallel switches of unique design which eliminate stray capacities.



The new 4-valve home constructor's set by the Eagle Engineering Co., Ltd.

An extremely neat and compact example of a portable valve set will be noticed at the stand of the British Thomson-Houston Co., Ltd. It is a three-valve set contained in a suit case. An internal frame aerial obviates the necessity for any outside connections. Dry batteries for both the high and low tension are also contained in the case. A full range of B.T.H. valves and head telephones will be in evidence, in addition to four types of loud speakers. The unit amplifier which will be shown is so made that two or more units can be connected together when required.

The stand occupied by Brown Bros., Ltd., should prove of special interest for it will contain the products of many of the leading manufacturers. Few components will be absent from their display whilst complete sets and amplifiers will be shown. It should prove extremely convenient for the prospective purchaser who will be afforded the opportunity of examining and comparing the different types and makes of instruments. Nine different makes of loud speakers will be displayed, amongst which appear such well-known names as Brown, Amplion, Claritone, Sterling and Western.

The stand held by A. J. Dew & Co., will be similarly concerned with the sets and equipment of the chief manufacturers: McMichael, Marconiphone and R.I. sets will figure prominently in the display. The special accumulator charging plant which will be available for inspection is worthy of special notice and should interest those who have the necessary facilities for charging their own batteries.

SOUND IN RELATION TO WIRELESS

Prof. E. MALLETT, M.Sc., M.I.E.E.

(Concluded from page 716 of previous issue.)

THE overtones from the electric current produced by an instrument may be removed by means of an electric filter, and this has been done by K. W. Wagner.* A circuit such as that shown in Fig. 15 will cut off all harmonics having frequencies above a certain value given by $f_0 = \frac{1}{\pi\sqrt{LC}}$.

So that if the values of L and C are so chosen that f_0 is between the fundamental and the octave, all of the harmonics will be cut off and the fundamental alone remain. This is shown in a and b of Fig. 15, where a is the wave form, obtained by means of an oscillograph, of the electromotive force impressed on the terminals AB, and b is that appearing at the terminals C D. Sounding an instrument in front of a microphone and including in the circuit between the microphone and the receiver a filter such as that of Fig. 15, arranged with its cut-off frequency f_0 just above the note sounded, the sound heard in the receiver had no characteristic of the instrument sounded. Playing the same note on one instrument after another and listening in the receiver in a distant room it was impossible to say which instrument was being sounded. It is seen from this how very important it is in order to obtain really good reproduction of the sounds of musical instruments to take care that the apparatus and circuit arrangements make it possible for high frequencies, even up to the fifteenth harmonic of the note being sounded, to be reproduced.

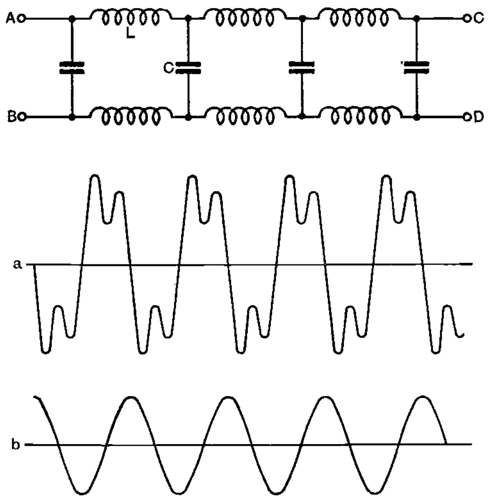


Fig. 15. *An electric filter circuit which will remove overtones.*

Similar considerations apply in the case of speech sounds. Here the vowel sounds are probably all comprised in a frequency range up to 4,000, but for the correct reproduction of a voice with all its naturalness and consonants, up to 10,000 cycles per second and even beyond are required. The Duddell oscillograph will not go so far, but it can give records showing clearly enough how complicated speech sounds may be. The photographs of Fig. 16 show some really fine records taken by the late Mr. W. Duddell.

Miller has analysed the vowel part of curves such as these, but obtained with his phonodeik. A large number of records were examined, taken with various speakers speaking or singing various vowel sounds, and it appeared that whatever the note on which the vowel sound was sung, and whoever was the singer, a large part of the energy of the sound was found round about one particular frequency or two particular frequencies, and that these frequencies were different with different vowel sounds, and so actually characterised or defined the vowel sound. The average of a large number of analyses showing the distribution

* *E.T.Z.*, May 8th, 1924.

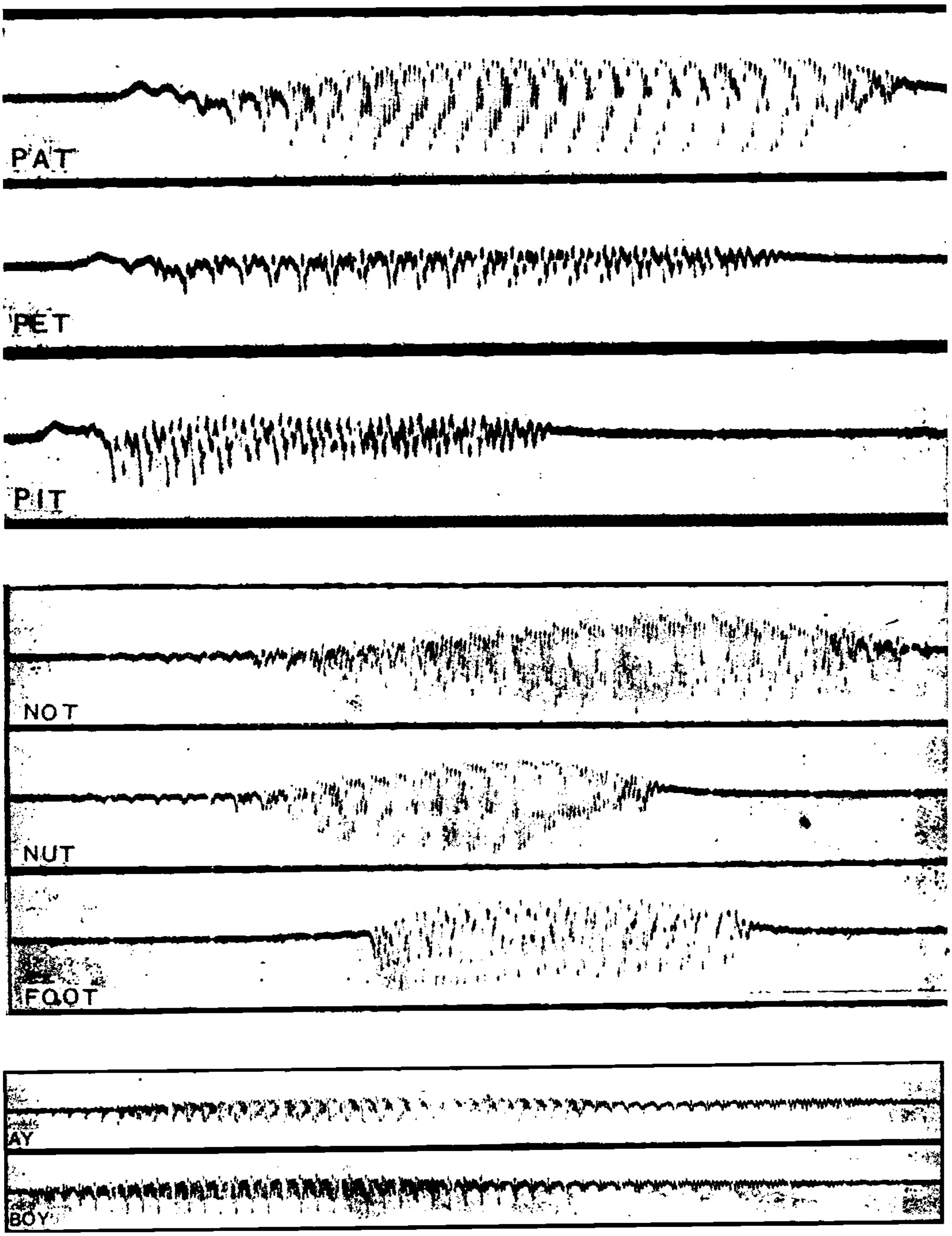
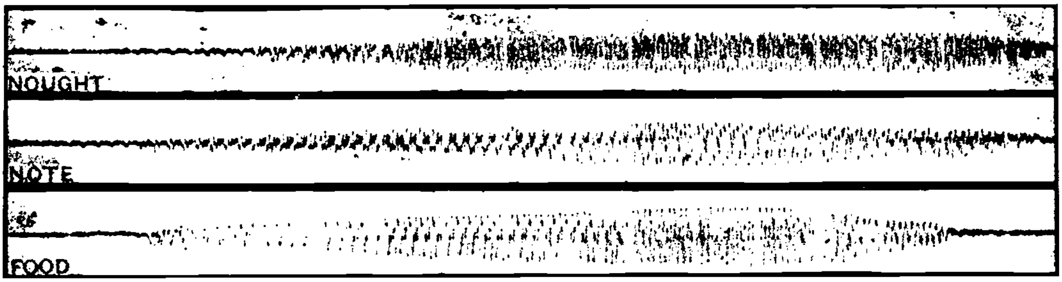
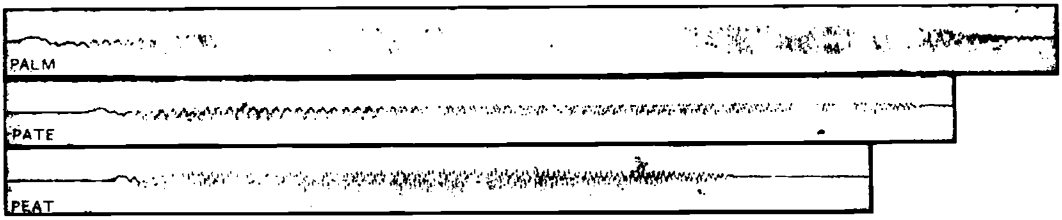
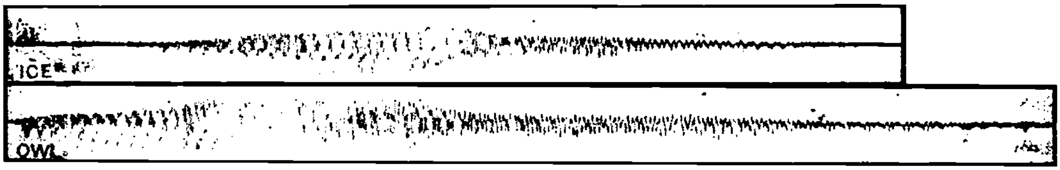


Fig. 16. These curves, and those shown on the next page, were taken on cinematograph film continuously rotated, and show whole syllables. Unfortunately no details of the apparatus used, and the conditions under which they were taken are available, but even so, they give a valuable insight into the nature of spoken words.

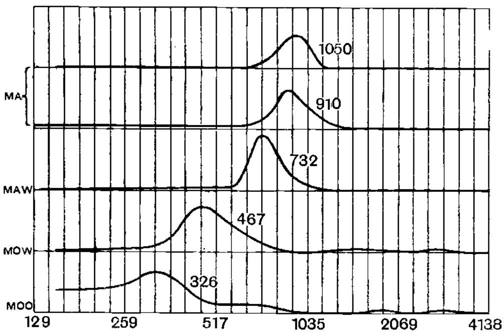


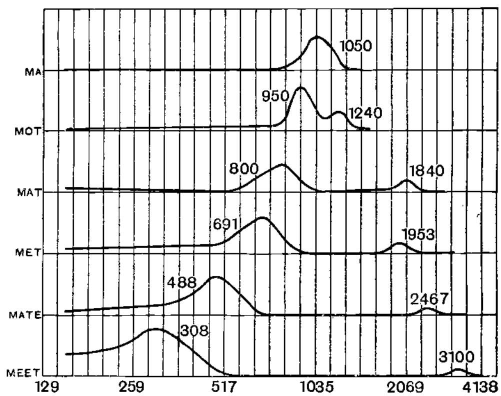




of energy over the frequency range are set out for various vowels in Figs. 17 and 18, while Fig. 19 shows in ordinary musical notation the characteristic frequencies of the vowels.

the second class are very nearly the same as the frequencies of the vowels of the first class. For instance, the "ee" sound in "meet" has frequencies of 308 and 3,100, while the





Figs. 17 *and* 18. *Showing the energy distribution at different frequencies for various vowel sounds.*

It will be seen that the vowels may be divided into two classes according to whether they are characterised by one frequency or two. It will also be seen from the diagrams that the lower frequencies of the vowels of

"oo" in "gloom" has a frequency of 326. If, therefore, the frequency 3,100 were cut off from a vowel sound "ee," one would expect the vowel to degenerate to "oo," and Wagner has carried out this experiment by means of electric filters, and found, as would be expected, that when the higher notes are cut off, ee becomes oo, and the a (as in mate) becomes o (as in no). This work with the filter thus confirms Miller's analysis. Sir Richard Paget,* working synthetically from the shape of the cavities of the mouth and throat, and the way in which they are modified by movements of the tongue, arrives at similar conclusions to Miller's,

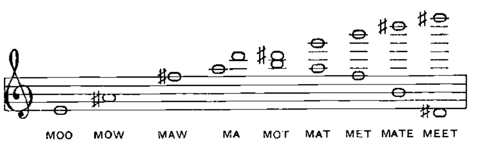


Fig. 19.

though he ascribes two frequencies to each vowel sound. He has made models consisting generally of two cavities with an opening between by means of which the various vowels may be reproduced. If a telephone receiver is connected to a valve oscillator giving a frequency of 1,000, and the hand placed over the ear cap to cut off the sound, and then the hand is raised and replaced twice, the receiver very distinctly says "Mamma."

This recent work of Miller's and Paget's would appear to settle the old controversy as to the nature of vowel sounds in favour of Helmholtz, who first stated the fixed pitch theory and produced vowel sounds mechanically by means of tuning forks in front of resonators.

A vowel sound may be defined as a sound that can be indefinitely sustained without losing its characteristic, while the sounds called consonants, are not persistent, but are practically only different ways of commencing and ending a vowel sound. Much less work has been done on the consonant sounds than on the vowel sounds, though the curves of Fig. 16 will give some idea of one or two. C. Stumpf† has analysed some consonant sounds (German) and finds that their frequency range is very great, up to 9,300 and down to 130. All of which goes to show that the perfect reproduction of speech must be a most difficult matter by mechanical means such as a diaphragm, and to cause one to marvel that such great success has been obtained.

* Phys. Soc. Vol. 36 p. 45, 1923.

† See R. W. Wagner, loc. cit.

RECEPTION OF TRANSMISSIONS FROM THE SCOTCH EXPRESS.

A report on the receptions on a moving train carried out recently by the Radio Society of Great Britain was given in our last issue. The following report relates to reception of the transmissions from this train made by a small power short wave set.

A SUMMARY of the chief receptions made of the signals sent out on the short wave transmitter, **6 ZZ**, installed on the train, gives some interesting information. At the London station of the Radio Society of Great Britain **6 XX**, signals from the train were heard from as far north as Escrick, but were very weak. Between Crow Park and Dukeries signal strength was almost as good as when the train started from King's Cross. One listener at Sheffield was still able to receive part of a message some while after the train had passed Darlington. At Newcastle-on-Tyne, Mr. Dixon received the train transmissions with occasional interruptions from just north of Huntingdon until the arrival at Newcastle.

Mr. Clarabut, of Bedford, was able to receive well from about Doncaster, until the completion of the test at Newcastle and at times the signal strength was extremely good.

Full details are not given on account of space, but a general summary has been prepared at the offices of the Society. The evidence of the logs of the receiving stations indicates that a better organisation of relay work between the fixed stations would have resulted in all transmissions made by the train being forwarded to the central London station, since apparently every transmission was intercepted by at least one receiving station.

The following conclusions are arrived at as a result of these tests and the observations recorded.

1. That it is quite feasible to use an aerial entirely inside a railway coach not only for reception of radio signals but also for their transmission as well.

2. That short-wave transmission and reception is quite feasible on a train using such an aerial.

3. That the same aerial can also be used for the reception of broadcast from the various B.B.C. stations during the train journey.

4. That signals on 185 metres wavelength transmitted from the train under the conditions described above can be read over ranges of at least 275 miles by ordinary fixed "amateur" stations.

5. That under these conditions two-way communication can be carried on over a range of approximately 100 miles.

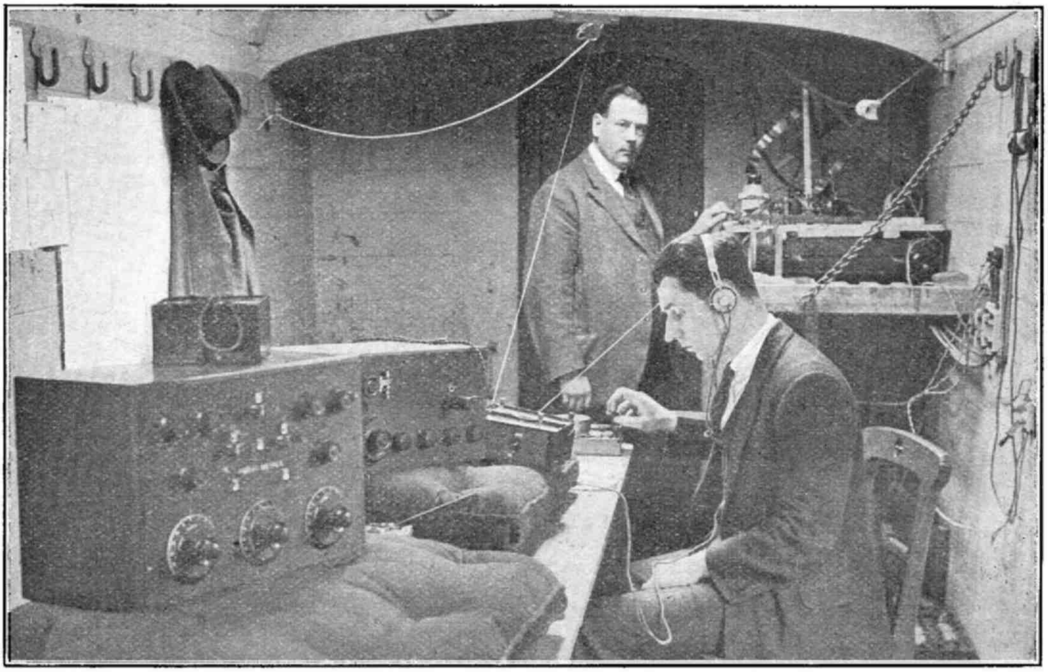
6. That the range of two-way communication during these tests was limited mainly by the sensitivity of the receiving apparatus, and by the extent of the interference experienced due to defective earth connection.

7. That with the radio coach at the rear of the train better signalling results were obtained backwards as compared with forwards.

8. That the electrical connection between the steel chassis of the coach and the wheels was a comparatively poor one, as far as radio signals are concerned.

9. That the influence of this partially defective earth connection was much affected by the state of the track—the "G.N.R." track south of York being much superior to the "N.E.R." track north of York in this respect.

10. That for reliable work a more sensitive receiver than that used is required. This should preferably (in all probability) be of the super-heterodyne type.



This photograph illustrates the conditions under which the transmissions from the train were made.

11. That tunnels (and deep cuttings to a less extent) cause an almost complete fading of the signals received on the train.

12. That other periodic fading was experienced due to an unknown cause—which may possibly be connected with the nature of the soil under and round the track. There is insufficient evidence, however, in this direction for definite conclusions to be reached.

P. R. C.

NOTES & CLUB NEWS

Fortnightly wireless messages to farmers from the Ministry of Agriculture are to begin on October 3rd.

* * * *

A radio beacon has been installed at Cape Bauld, New Brunswick, to transmit continuous signals during thick or foggy weather for the benefit of shipping.

* * * *

Up to the end of August, 912,000 licences had been issued for wireless reception. It is expected that the million mark will be reached in October.

* * * *

The Rome broadcasting station **1 CD** is shortly to increase its power. A new modulating system is to be adopted and transmissions are now taking place on 426 metres.

* * * *

During a recent Trans-Pacific broadcasting test from San Francisco, the Japanese broadcasting station at Hiraiso reported faint reception which lasted for over two hours.

* * * *

IMPROVEMENTS AT MADRID.

Radio Iberica, the Madrid Broadcasting Station, has, we understand, undergone a complete reorganisation, a new Board of Directors having been appointed.

The announcement is made that greater efforts will be put forward with the idea of improving the programmes. The celebrated municipal band of Madrid is to give daily concerts from 10 a.m. to 12.30 p.m.

SOUTH AFRICAN **WMG.**

The Cape Town Broadcasting Station, which was opened on Monday, September 15th, transmits on a wavelength of 375 metres, its call sign being **WMG.** Both as regards the arrangement of the studio and the apparatus employed, the London station of the B.B.C. has been taken as a model. The installation comprises a Marconi 6 kW. transmitter and a microphone of the kind used in the British main stations.

The station is under the control of the Cape Peninsular Publicity Association, which is in close touch with the Municipality and is responsible for the Cape Town orchestra.

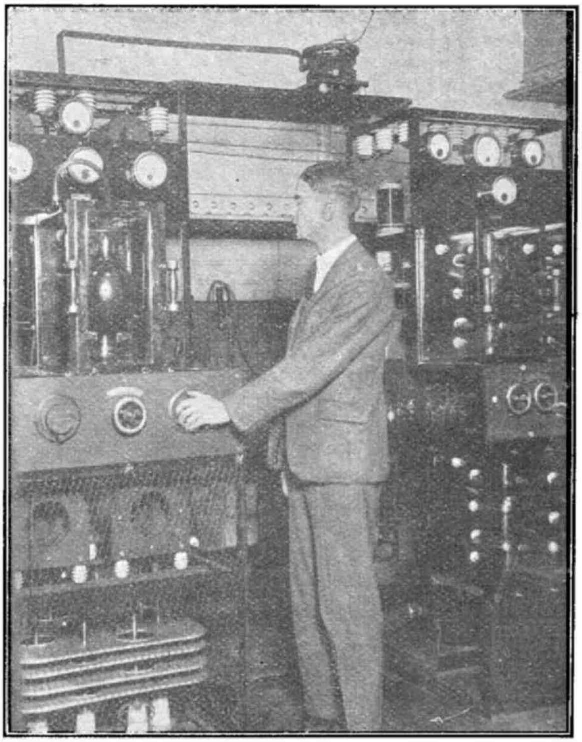
The Durban Station, which is similarly equipped, is expected to open in November.

TWENTY TRANSMITTERS IN ONE.

With the opening of the new transmitters at Koenigswusterhausen, which include a 50 kW. Poulsen arc transmitter, a H.F. alternator of 50 kW. and a 20 kW. valve set, there will be twenty-one different transmission units in the station. This, it is believed, is a record.

FRENCH AMATEUR TESTS.

M. Joseph Roussel (**8 AD**), of 12 rue Hoche, Juvisy-sur-Seine, is carrying on a series of tests on Fridays, Saturdays and Sundays between 8 and 8.30 p.m., employing a wavelength of 140 metres.



[Photo: Barratt's

Mr. H. M. Hill, Assistant Maintenance Engineer of the Glasgow Broadcasting station, seen before the main oscillator at the Power Station, Port Dundas.

ZEPPELIN D.F. TESTS.

The Zeppelin ZR3, recently built by a German firm for American use, carried out successful experiments in wireless direction finding on Saturday, September 13th. While cruising over South Eastern Switzerland the airship kept in touch with Rome and Copenhagen and was able to determine her position with great accuracy.

THE R.N. SHORE WIRELESS SERVICE.

Members of the R.N. Shore Wireless Service, the formation of which was announced on June 21st, are to be provided with a distinctive uniform. This will include a free issue of two cap ribbons, bearing the words "R.N. Shore Wireless," with the crown appearing between the words "Shore" and "Wireless."

A.R.R.L. SUPPORTS ESPERANTO.

The adoption of Esperanto for international amateur use is to be supported by the American Radio Relay League at the first Conference of the International Amateur Radio Union to be held in Paris next Easter.

NEW TELEPHONE CABLE TO HOLLAND.

The possibility of satisfactory relaying of Continental broadcasting is suggested by the completion of the longest successful submarine telephone cable yet laid.

This cable, constructed by Messrs. Siemens, of Woolwich, has been laid between this country and Holland.

A feature of the new cable is the use of a special device dispensing with loading coils at intervals of a mile or so, which have hitherto been necessary.

CALLS HEARD MINUS AERIAL AND EARTH.

Interesting experiments with a single valve low-loss receiver have been carried out by Mr. Hugh N. Ryan (**5 BV**), using no aerial, earth or loop. The set was taken to a point on the north coast of Kent, some 60 miles east of London, and the following stations were heard working on wavelengths between 70 and 150 metres: **2 GW, 2 KT, 2 NM, 2 OD, 2 PC, 2 XD, 2 BH, 5 LF, 5 LS, 5 MA, 5 NW, 5 RZ, 5 SI, 6 TM, 8 BV, 8 DP, 8 JHL, 8 MN, 8 PP, 8 PQ, 8 RG, 8 UU, 8 WJ, 8 WL, 8 ZZ, 0 BA, 0 BQ, 0 GC, 0 MS, SMZP, SMZV, SMZY, 7 EC, 7 ZM, W 2, 4 C 2, LOPG**, Finnish **2 NM**, Italian **1 FP**, American **2 BRB**, **WGY** (weak), **KDKA** (Wills-Firpo fight) (strong).

WIRELESS FOR LIGHTHOUSES.

The statement which recently appeared in the press that all lighthouses on the coast of Great Britain are to be fitted with wireless transmitting sets is at variance with the information in the possession of the Mercantile Marine Service Association, who are able to state authoritatively that the whole question of fitting lighthouses with wireless transmitting sets to warn ships at sea of impending danger is still in the experimental stage, but at the same time receiving the careful consideration of the lighthouse authorities.

MORE TWO-WAY WORKING WITH SWEDEN.

An exchange of signals with Swedish **SMZU** is reported by Mr. E. A. Wilson (**6 GM**), of N.W. London. Two-way working was established on Sunday, September 7th, at 2245 B.S.T. With an aerial current of 3 amps., **6 GM** was heard at fair strength by the Swedish amateur, using a detector and low frequency receiver.

SMZU was heard at R4 strength, with a single valve receiver.

WHO IS 2 IS ?

We are indebted to a correspondent for the information that the Rev. H. W. Doudney, original owner of **2 IS**, left England three years ago. Reports of the reception of **2 IS** are, however, still being received at St. Luke's Vicarage, Bath. As there is no station at this address and the whereabouts of the present **2 IS** are unknown, these reports are, unfortunately, useless.

"BEAM" SYSTEM FOR AUSTRALIA.

After a precarious passage through the Australian Senate, the Wireless Agreement Bill has been passed. There are now no obstacles to the erection of an Australian "beam" station, and it is understood that the Amalgamated Wireless Co. will endeavour to complete the installation simultaneously with an English station.

JERSEY WIRELESS STATION.

The Jersey States have decided to erect a wireless telegraph station with a radius of fifty miles near Corbiere at a cost of fifteen hundred pounds, for the requirements of shipping.

WESTERN METROPOLITAN ASSOCIATION OF AFFILIATED SOCIETIES.

An exhibition of amateur radio work is to be shown under the auspices of the above Association on Friday, October 3rd, at 7.30 p.m., at the Paddington Technical Institute, Saltram Crescent, Paddington, W.9. The Exhibition will also be open on Saturday, October 4th, from 3 p.m. till 9.30 p.m. A number of invitation cards have been set aside for members of provincial societies who may be in town for the All-British Wireless Exhibition. These cards will be forwarded on application to Mr. L. Bland Flagg, 61 Burlington Road, Bayswater, London, W.2.

R.S.G.B. AT THE EXHIBITION.

The Radio Society of Great Britain will occupy Stand No. 116 at the All-British Wireless Exhibition at the Royal Albert Hall. Members of the Society, its sections and Affiliated Societies visiting the exhibition are invited to use this stand as a *rendezvous*.

No apparatus will be exhibited by the Society, the stand having been taken solely for the purpose of giving any information possible to members or intending members.

Radio Society of Great Britain.

The Autumn Presidential Address to members of the Radio Society of Great Britain will be delivered by Professor W. H. Eccles, D.Sc., F.R.S., at the Institution of Electrical Engineers, Savoy Place, W.C.2, at 6 p.m., on Wednesday, September 24th, 1924, on which occasion the President will deal with the latest developments of the position of the scientific amateur under the Wireless Telegraphy Regulations.

TRANSMITTER AND RELAY SECTION.

TRANS-OCEANIC TESTS.

With reference to the announcement regarding the Trans-Oceanic Tests, which appeared in these columns in the issue dated August 20th, 1924, owing to the fact that many members of the Transmitter and Relay Section are unable to bring their wavemeters to the offices of the Radio Society of Great Britain, and do not wish to send them by other methods of transit, it has been decided to remove this stipulation, and instead, to arrange for the appointment of amateur stations in all areas, from which calibration can be carried out by radio methods.

It is particularly requested, therefore, that all members of the Transmitting and Relay Section who are in possession of standard calibrated wavemeters covering a range of 90 to 200 metres, will communicate with the Hon. Secretary, the Transmitter and Relay Section, The Radio Society of Great Britain, 53 Victoria Street, London, S.W.1, stating the fact, also giving information as to whether they are prepared to operate their stations for this purpose, and if so, the dates and times on which they would be available for calibrating, by radio methods, the wavemeters belonging to members of the Section.

(Signed) G. MARCUSE,
Honorary Secretary.
Transmitter and Relay Section.

T. & R. DINNER.

It is thought that a number of members of the Transmitter and Relay Section, who normally are not in London, will be in town for the Wireless Exhibition. It is, therefore, proposed to hold a little Dinner amongst members of the Section on October 3rd. Will those who wish to be present please communicate at once with the Hon. Secretary, G. Marcuse, at the offices of the Society, 53 Victoria Street, Westminster, London, S.W.1.

FOREIGN AMATEURS.

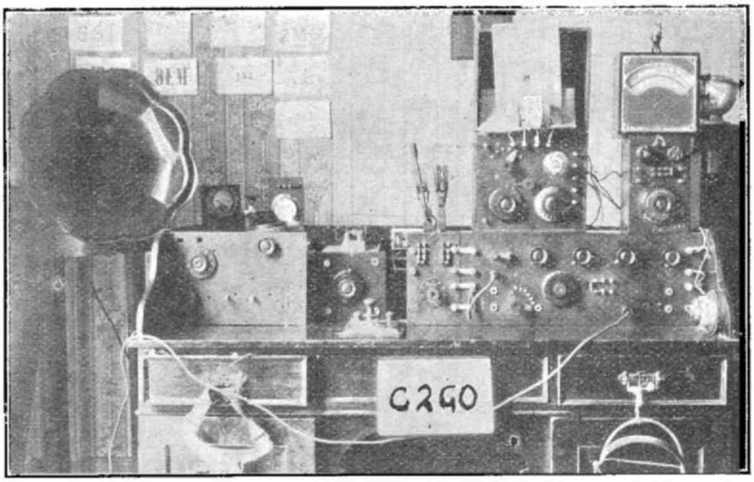
Owing to frequent requests by members of the Transmitter and Relay Section of the Radio Society of Great Britain, for the names, addresses and call signs of various foreign amateurs, and the constant increase in the number of the latter, it has been decided that they will, whenever possible, be published in these columns in future.

As, therefore, this journal circulates among the foreign amateurs, it will be greatly appreciated if they will forward to the Secretary, The Transmitter and Relay Section, The Radio Society of Great Britain, 53 Victoria Street, London, S.W.1, the following particulars :—

Name.
Address.
Call Sign.
Wavelengths.

The following list of Swedish amateurs has just been received and is published for information :—

Call Sign.		Wavelengths
SMZZ.	Mr. G. Fant, Postbox 55, Norrviken	**100, 127**
SMZY.	Mr. G. Lamm, Nasby Slott, Roslags Nasby	120
SMZX.	Mr. K. G. Eliasson, Vallgatan 8, Goteborg	**460****
SMZW.	Mr. K. G. Eliasson, Vallgatan 8, Goteborg	**460****
SMZV.	Dr. G. Alb. Nilsson, Skolgatan 5, **Lund**	**100, 120**



A well-known British amateur station, owned by Mr. L. Bland Flagg, of Bayswater, London, W.2. **2 GO** *has been heard in the U.S.A. and Sweden, and carries on two-way communication with Belgium, Holland and France.*

SMZU.	Mr. K. G. Eliasson, Portable Station, in automobile.	
SMZT.	Svenska Radioaktiebol, Astromergatan, Stockholm	470*
SMZS.	Mr. T. Elmquist, Jacob Nilsgatan 23, Malmo	120
SMZR.	Mr. E. G. Hedstrom, Villa Eklunda, Ronninge	Unkw.
SMZQ.	Mr. G. Hok, Ruddamsgatan 12, Eskilstuna	,,
SMZP.	Mr. F. Jonsson, Marstrand ..	,,

* Broadcasting station, not an amateur.

** Wavelength for broadcasting purposes. Other wavelengths can be arranged for tests.

(Signed) G. Marcuse,
Hon. Secretary.
Transmitter and Relay Section.

CLUB ACTIVITIES.

Correspondence for Secretaries of Societies will be forwarded if addressed to the office of this Journal, c/o the Editor.

One of the most active of the London societies, the Hampstead and St. Pancras Radio Society, is opening its winter session with the advantage of a new club house, fitted with constructional benches, lathe and tools, and a library stocked with text books and the current wireless periodicals. The Society also owns a transmitting room, which is at the service of all qualified members and those who wish to qualify for transmitting licences.

The club house, situated at 56 Crogsland Road, Chalk Farm, is open every evening and lectures and demonstrations are given every Thursday. New members are warmly welcomed.

* * * *

The Kingston and District Radio Society will open its winter session on Monday, September 29th, at St. Agatha's Hall, King's Road. This meeting will be social in character and wireless enthusiasts and ladies are cordially invited.

* * * *

"Amateur Transmission" was the theme of an instructive lecture given before the Tottenham Wireless Society on September 10th. After dealing with the various types of transmitting circuits, the lecturer dwelt on grid and choke control methods of telephonic transmission. Special attention was given to the question of H.T. supply, a serious problem to many amateurs. Rectification by means of Neon tubes was discussed and a T.V.T. unit was described and demonstrated.

* * * *

A receiver designed to avoid the detrimental effects of stray capacities in H.F. circuits was described before the North Middlesex Wireless Club by Mr. G. H. Wass on September 3rd. A great increase in selectivity was noticeable with the use of a H.F. transformer wound with much thicker wire than that usually employed. Other very ingenious arrangements were incorporated in the set, and exceptional freedom from distortion was obtained. A small movement of the H.F. tuning condenser sufficed to cut out **2 LO.**

Calls Heard

Norwich (August 14th-September 1st).
British: **2 KF, 2 OA, 5 MA, 5 RQ, 5 RY, 6 JO, 6 TD, 6 XX.** French: **8 AQ, 8 AY, 8 BS, 8 CO, 8 DO, 8 DP, 8 DX, 8 ÉNN, 8 ÉP, 8 FN, 8 FSF, 8 IP, 8 JHL, 8 MK, 8 NS, 8 PS, 8 RBR, 8 SR, 8 UU, 8 WZ.** Dutch: **0 BA, 0 GC, 0 KN, 0 MS, 0 QC, 0 QW,** Italian: **1 MT.** Unidentified: **1 KA, 3 AD, H 8 RL.** (1—v—1.)
E. C. Bullard.

Walton-on-Thames, Surrey (April to August, 1924).
British: **2 AKS, 2 AQL, 2 ARX, 2 ATI, 2 DQ, 2 FV, 2 GN, 2 JA, 2 KC, 2 KG, 2 KAR** (QRA ?), **2 OA, 2 OP, 2 QR, 2 QL, 2 SG, 2 TO, 2 VQ, 2 VO, 2 XQ, 2 XAO, 2 XSS, 5 AS, 5 BH, 5 GH, 5 IZ, 5 JX, 5 JP, 5 NU, 5 OC, 5 OY, 5 TZ, 5 UQ, 5 VN, 6 AL, 6 BT, 6 FG, 6 GY, 6 LJ, 6 RG, 6 RW, 6 UD, 6 US, 6 OB, 2 BBN.** French: **8 AE 3, 8 CK, 8 CO, 8 DP, 8 DI, 8 DO, 8 EN, 8 EU, 8 FQ, 8 FSF, 8 GN, 8 IPK, 8 JC, 8 JBV, 8 LO, 8 MN, 8 NS, 8 OK, 8 PO, 8 PP, 8 PA, 8 RO, 8 RAR, 8 SR, 8 WJ, 8 ZM, 8 ZY, 3 AD, 3 CA, 3 XO.** Dutch: **0 AM, 0 GN, 0 GC, 0 RB, 0 ZN.** Others: **ARRL, SMZZ, GB, GB 1, PP, 11 KK, 16 YA, 9 AA, 7 BJ, 4 C 2, 1 CF, 7 FY, 4 LA, 9 OC, P 2, 4 RG.** (Pse QSL, all cards answered.) (F. Walker).

Louvain (Belgium) (August 25th-30th).
British: **2 CA, 2 CC, 2 CK, 2 TA, 2 YT, 2 YT, 5 MO, 5 TZ.** French: **8 BAN, 8 BU, 8 CN, 8 CO, 8 CZ, 8 DO, 8 DX, 8 ÉM, 8 FQ, 8 MN, 8 OK, 8 PA, 8 RR, 8 WY, 8 XR, 8 ZZ.** Dutch: **0 BA, 0 BQ, 0 MS, 0 NN, 0 XO, 0 YX.** Belgian: **4 GP, 4 QS, 4 WR.** (None under R.5). (A. Stainier).

Newcastle-on-Tyne (August 16th-September 1st).
2 CC, 2 GV, 2 NM, 2 VI, 2 YT, 5 FZ, 5 IZ, 5 MA, 5 MO, 5 SI, 5 SY, 5 SZ, 5 TZ, 5 UL, 6 FL, 6 QZ, 6 RY. Danish: **7 AES, 7 LYD,.** French: **8 AE 4, 8 DO.** Belgian: **4 IX, 4 UA.** Dutch: **0 NK, 0 NN, 0 RG.** Argentine: **CB 8.** Miscellaneous: **3 AD 8 JHL, 8 XLW.** (o—v—o.) (All below 200 metres.)
(F. Thompson).

Sheffield (August 16th-September 8th, 1924). (All below 200 metres)
British: **2 AC, 2 CA, 2 CC, 2 DX, 2 FN, 2 FV, 2 GW, 2 IP, 2 JF, 2 KF, 2 KZ, 2 NM,* 2 OA, 2 OD, 2 OG, 2 VW, 2 WI, 2 WY, 2 XY, 2 YT, 5 CS, 5 DN,* 5 FA, 5 ID, 5 IK, 5 LF, 5 LS, 5 OC, 5 OL, 5 TZ, 5 WI, 5 YW, 6 AV,* 6 GM, 6 LJ, 6 MP, 6 NK,* 6 RM,* 6 TD, 6 XX.** French: **8 AP, 8 BA, 8 BN, 8 BU, 8 BV, 8 CA, 8 CN, 8 CT, 8 CZ, 8 DI, 8 DO, 8 DQ, 8 ÉK, 8 ÉM, 8 ÉN, 8 ÉO 8 ÉU, 8 FD, 8 FL, 8 FN, 8 FQ, 8 FSF, 8 HN, 8 IP, 8 JHL, 8 KK, 8 OK, 8 PP, 8 PQ, 8 QR, 8 RR, 8 SM, 8 SR, 8 UU, 8 VG, 8 WJ, 8 WL, 8 WZ, 8 XR, 8 ZZ.** Dutch: **0 AB, 0 BA, 0 BQ, 0 GC, 0 HD, 0 KH, 0 KN, 0 MR, 0 MS, 0 NG, 0 NN, 0 QR, 0 RB, 0 XQ, 0 YW.** Danish: **7 EC, 7 ZM.** Swedish: **SMZP, SMZS, SMZZ.** Belgian: **GB, P 1, W 2.** Italian: **I1FP, 1MT.** Finland: **1 NA, 4 ENTN.** Geneva: **9 AD.** Miscellaneous: **3 AD, 3 CA, 3 XO, 4 AA, B 4 YZ, FL, MM, ICS, IDO.** (o—v—1.) * Telephony.
(F. M. Cooper.)

FORTHCOMING EVENTS.

WEDNESDAY, SEPTEMBER 24th.

Radio Society of Great Britain. At 6 p.m. At the Institution of Electrical Engineers. Autumn Presidential Address by Prof. W. H. Eccles, D.Sc., F.R.S.: "Latest Developments in the Position of the Scientific Amateur under the Wireless Regulations."

Radio Research Society, Peckham. At 44 Talfourd Road. Discussions on "Amplification" and "Electric Clocks."

THURSDAY, SEPTEMBER 25th.

West London Wireless and Experimental Association. At Belmont Road Schools. Questions Night.

Bournemouth and District Radio and Electrical Society. At 7 p.m. At the Y.M.C.A., St. Peter's Road. Western Electric Film: "Aiding the Art of English Conversation: by Cable and Radio."

Walthamstow Amateur Radio Society. General Meeting.

Nottingham and District Radio Experimental Association. Lecture by Mr. F. R. Bodenham.

FRIDAY, SEPTEMBER 26th.

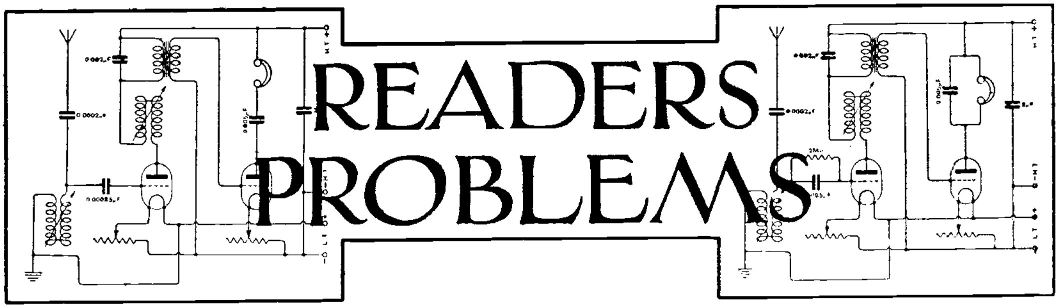
Radio Society of Great Britain (Transmitter and Relay Section). At 6.30 p.m. At the Institution of Electrical Engineers. **Lecture:** "Aerial Insulation." By **Mr. J. E. Nickless.**

MONDAY, SEPTEMBER 29th.

Kingston and District Radio Society. At St. Agatha's Hall, King's Road. Social Evening.

TUESDAY, SEPTEMBER 30th.

Leicestershire Radio and Scientific Society. At the Y.M.C.A., Leicester. Lecture: "H. F. Amplification." By **Mr. J. W.** Pallett.



Readers desiring to consult the " Wireless World " Information Dept. should make use of the coupon to be found in the advertisement section.

A THREE-VALVE AND CRYSTAL CIRCUIT.

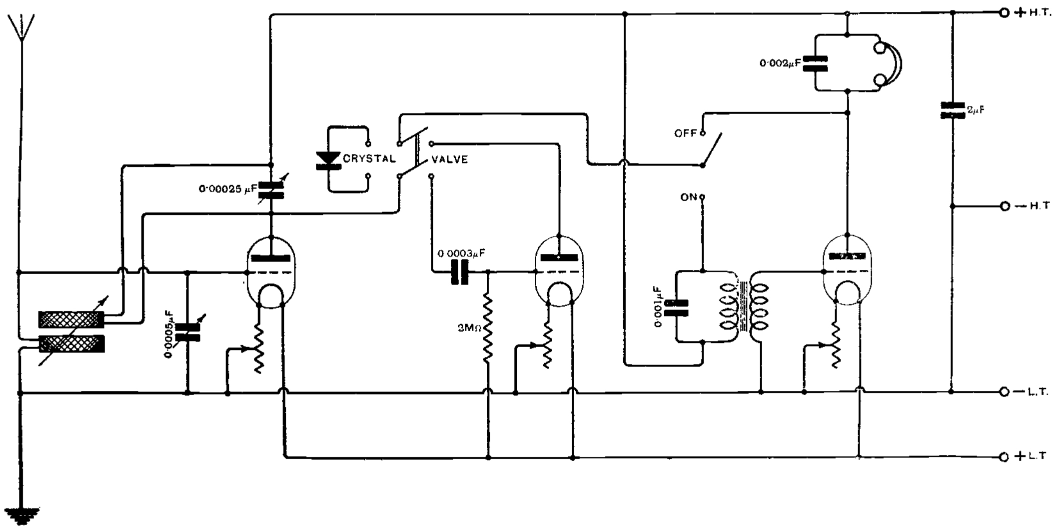
A DIAGRAM of a three-valve receiver with an alternative crystal detector is given below. The first and last valves operate as H.F. and L.F. valves respectively. Tuned anode coupling is used in conjunction with the H.F. valve, and the aerial and anode circuit coils are coupled together to obtain reaction. When the crystal detector is in use, the reaction coupling will have to be increased slightly to compensate for the damping introduced by the resistance of the crystal circuit.

The switching of the detectors is carried out by means of a D.P.D.T. switch, which gives crystal rectification in the left-hand position and valve rectification in the right-hand position. The L.F. valve is switched in and out of circuit by a S.P.D.T. switch. In all cases the filament current to the valves is regulated and switched off by means of the filament rheostats.

CONDUCTIVITY OF WATER.

THE dielectric constant of pure water is 81, and a correspondent has suggested its use as a dielectric in variable condensers, supporting his suggestion by the assumption that the conductivity of pure water is zero.

As a matter of fact the preparation of chemically pure water is a most difficult matter, as water is capable of dissolving to a small extent the substances of which the containing vessel is made. By means of a laborious process, the physicists Kohlrausch and Heydweiller have succeeded in preparing a specimen of pure water in vacuo, and in measuring its conductivity. It was necessary to measure the conductivity in vacuo, in order that the water might not become acid through the absorption of carbon dioxide from the air. The result they obtained for the conductivity was $0{\cdot}04 \times 10^{-6}$ reciprocal ohms.

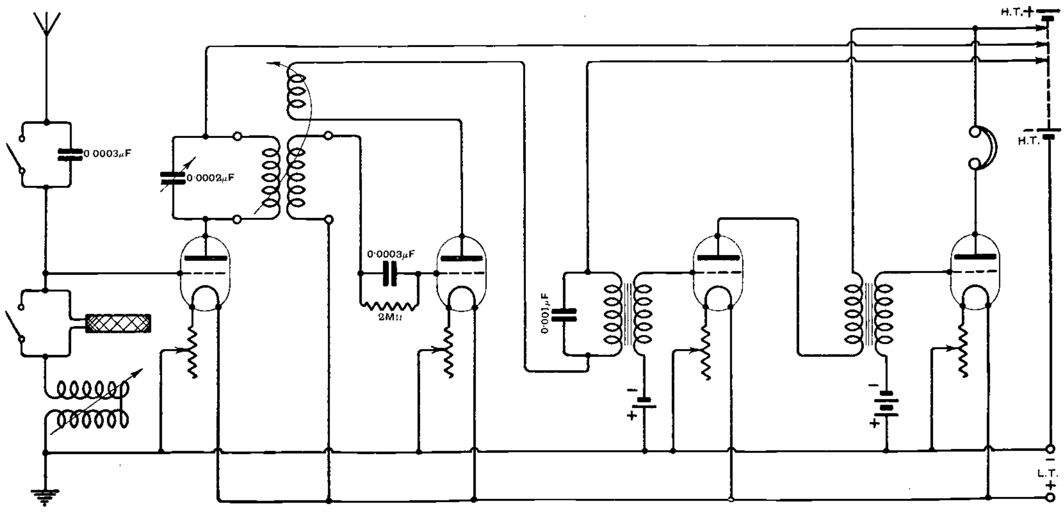


A three-valve and crystal circuit.

In actual practice the conductivity of the water used as a dielectric in a condenser would be very low, owing to the presence of salts of the metals used for the condenser plates. Very small traces of impurity are capable of lowering the conductivity of water to a value which would render its use as a dielectric impracticable.

A Four-Valve Receiver.

A READER has sent in a list of components, and asks us to supply a suitable circuit for a four-valve receiver. The circuit diagram is given below. It will be observed that the aerial circuit is tuned by means of a variometer, and that a series aerial condenser and a plug-in loading coil are included in the aerial circuit to extend the tuning range of the receiver. Single-pole switches are provided to short-circuit the aerial condenser and the plug-in coil holder when necessary. The transformer coupling between the H.F. and detector valves may be of the plug-in type, and a reaction coil may be mounted to swing over the transformer when in position. The H.F., detector, and L.F. valves are provided with separate H.T. tappings, and there is consequently a possibility of setting up oscillations at low frequency in the circuit. If this is found to be the case, condensers of 1 or 2 μF capacity should be connected between each H.T. tapping and − H.T.



A four-valve receiver.

Effect of Gauge of Wire on Inductance.

A READER asks if the thickness of wire used in an inductance coil exercises any influence on the inductance, provided that the number of turns is kept the same.

The reply to this question will depend upon the method of winding the coil. If, when the thinner wire is used, the turns are wound so that they touch one another, the inductance will be increased, since the number of turns per unit length is increased and the inductance varies as the square of this number. The values of the constant K, and L the length of the coil are decreased, but the increase in the square of the number of turns is greatest, and the result is a net increase in the inductance of the coil. If, on the other hand, the same spacing is maintained when the diameter of the wire is decreased, the inductance of the coil will remain unchanged. The only effect of using thinner wire will be to increase the resistance of the coil, and consequently the degree of damping. The coil will therefore be slightly less selective.

Choice of Intervalve Transformers.

A CORRESPONDENT writes to ask if it is possible to use two intervalve transformers of similar design in a two-valve L.F. amplifier, as he has heard that this is not good practice.

There is nothing fundamentally wrong in using two similar transformers, provided that the ratio of the transformers is suitably chosen. The idea has probably arisen through the experience of amateurs who have been using two similar transformers of high ratio in conjunction with general purpose valves. If the transformers had been given a ratio of 1 : 2 or 1 : 3, it is probable that little distortion would have been experienced, but with the high ratio transformers, not only is the primary winding too small for use in conjunction with high impedance valves, but the higher ratio gives a fluctuation of grid potential at the succeeding valve which extends beyond the straight portion of the valve characteristic. Transformers should be chosen with these considerations in view, and if it so happens that the same type of transformer will fulfil the necessary requirements in both cases, there can be no objection to using them in conjunction.