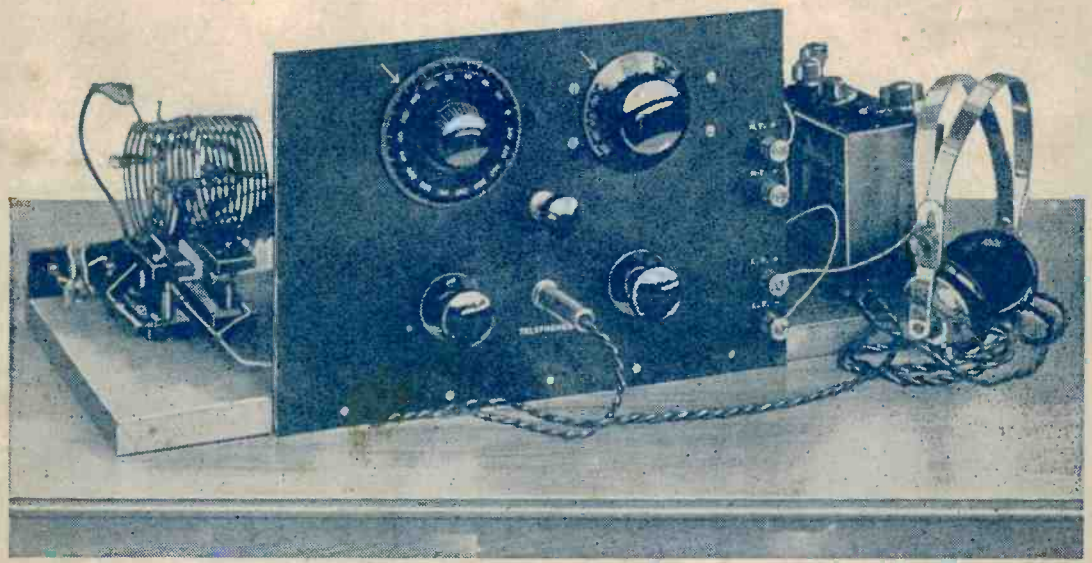
Wireless Weekly, 6d. Net. Wednesday October 7th, 1925

Wireless Weekly

Vol. 7. No. 3.

A SIMPLE SHORT-WAVE RECEIVER

By C. P. ALLINSON

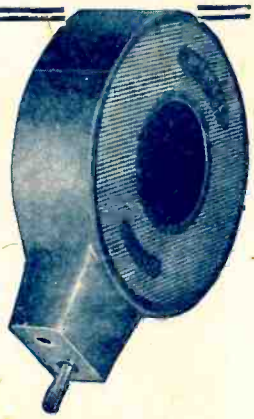


The new Burndept Coils

— cover all waves from 20 metres upwards

— are enclosed in special sealed containers

—fit all makes of tuners and coil holders



IN the latest pattern Burndept Coils, several important changes have been made. Each Coil is enclosed in an hermetically sealed moulded container, on the outside of which the tuning range and number is indicated. The new Coils, which fit all standard makes of tuners and coil holders, are numbered to correspond with somewhat similar coils of other makes, and are all the same size externally: $4\frac{1}{4}$ in. long, $3\frac{5}{8}$ in. wide, and 1-1/10 in. thick. As the Coils are perfectly protected from damp and dust, they will maintain their original high efficiency indefinitely. The complete set covers all waves from 20 to 22,000 metres.

Coils 3 to 20 are intended for ultra short waves—20 to 150 metres. They are wound with heavy gauge bare copper wire on Grade A ebonite formers; so-called "low-loss air-spaced" coils are *not* essential for successful short wave reception. Coils 3, 5, 10, 15 and 20, 5s. each.

Coils 25 to 60 are the famous Burndept Concert Coils, covering all waves from 150 to 800 metres. These coils which give unequalled signal strength and extraordinary clarity, each consist of a single-layer winding on Admiralty Paxolin formers. Coils 25, 35, 40, 50 and 60, 4s. 3d. each. Coils 75, 4s. 6d.

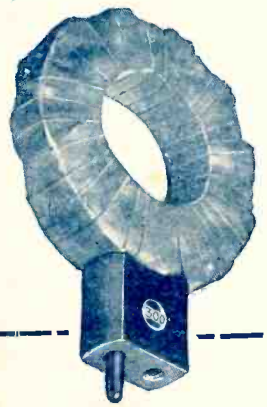
Coils 100 to 1,500 are the celebrated Burndept patent multi-layer coils, covering all waves from about 700 to 22,000 metres. Coil 100, 5s.; Coil 150, 6s.; Coil 200, 7s.; Coil 300, 8s.; Coil 400, 9s.; Coil 600, 10s.; Coil 1,000, 15s.; Coil 1,500, 17s. 6d.

These Coils may also be purchased in sets, as follows:

No. 955.—For Broadcast Reception (200 to 800 metres). Set of four Concert Coils, 35, 50, 60 and 75, 16s.

No. 956.—For Long-Wave Reception (700 to 22,000 metres). Set of eight Coils, 100 to 1,500, £3 17s. 6d.

No. 957.—Complete set of nineteen Coils, covering all waves from 20 to 22,000 metres, £6.



The 1924-25 pattern Burndept Coils have been considerably reduced in price. Full particulars of these reductions will be sent free on request.

Full particulars of these new Coils are given in Burndept Publication No. 44, a copy of which will be sent to any reader of this journal on application. The Burndept Range includes everything for radio reception from components to complete installations. Build your set with Burndept Components and be sure of best results.

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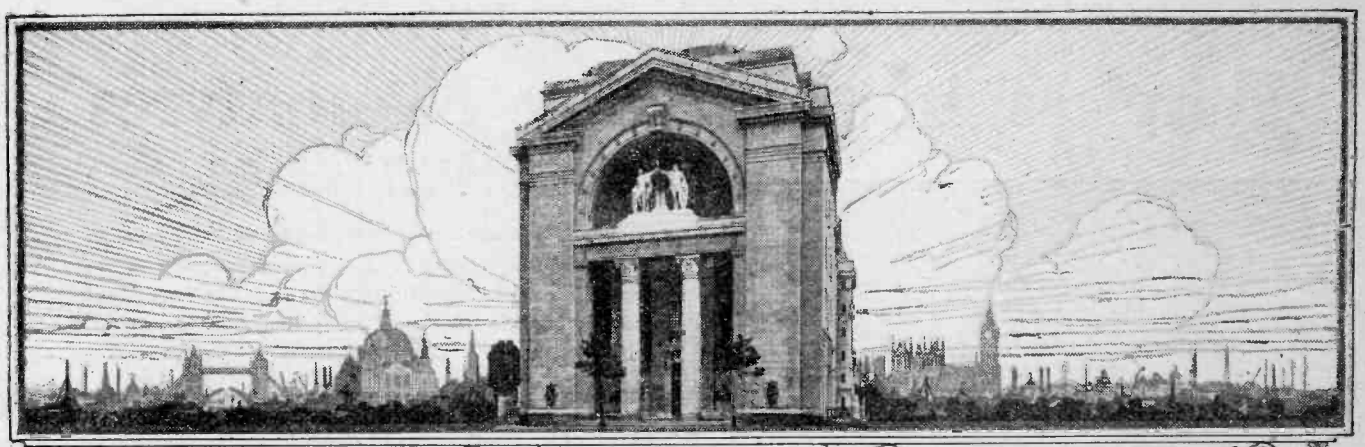

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Alarums and Excursions

CONSIDERABLE apprehension has been aroused by a statement which appeared in a daily paper recently to the effect that the British Broadcasting Company contemplated closing down certain of the relay stations to avoid interference with certain Continental stations. Hundreds of thousands of listeners in the neighbourhood of relay stations rely entirely upon crystal receivers, and it is therefore not surprising that consternation has been caused in thousands of homes by the possibility of their broadcasting service being cut off.

Wireless Weekly would be failing in its duty to the public if it were not closely observant of any proposed changes of this kind, and we can state at once that much of the fear expressed by numerous correspondents and inquirers is groundless. Although the British Broadcasting Company is considering the practicability of closing down certain relay stations, such steps will not be taken unless an equivalent service is immediately offered to the crystal user. To make this point clearer, let us imagine that, for example, the B.B.C. were to consider the closing down of the Plymouth Relay Station. At the present time crystal users in the Plymouth area are entirely dependent upon their local station for broadcast programmes. They are outside the range of Bournemouth or Cardiff. The British Broadcasting Company has on more than one occasion expressed the hope that it will be permitted to increase the power of its main stations, and therefore to increase their range. If it were permitted to increase the power of both Cardiff and Bournemouth to, say, 10 kilowatts (the power we believe they would like to use), Plymouth might conceivably come on the edge of the crystal range of both Bournemouth and Cardiff stations. In our opinion, however, this would not be a satisfactory service. It is therefore unlikely that the Plymouth station will be shut down. When, however, we come to consider other relay stations, such (to take a case at random) as Liverpool, a considerable increase in the power of the Manchester station might possibly give a crystal service in Liverpool equivalent to that of the present Liverpool station.

We understand that the British Broadcasting Company will in no case shut down a station without an equivalent service being provided to all present crystal users.

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YOUR CRITICISMS!

On another page we publish a number of questions addressed to our readers, which we should much like them to answer. Such question forms have been a feature of Radio Press publications from time to time, and have enabled us to improve the journals in a number of directions. Only by maintaining an intimate contact with our readers can we give them the full service we are desirous of providing, and if they will kindly fill in the answers to these questions and forward the replies to us, we shall be greatly assisted in still further improving *Wireless Weekly*.

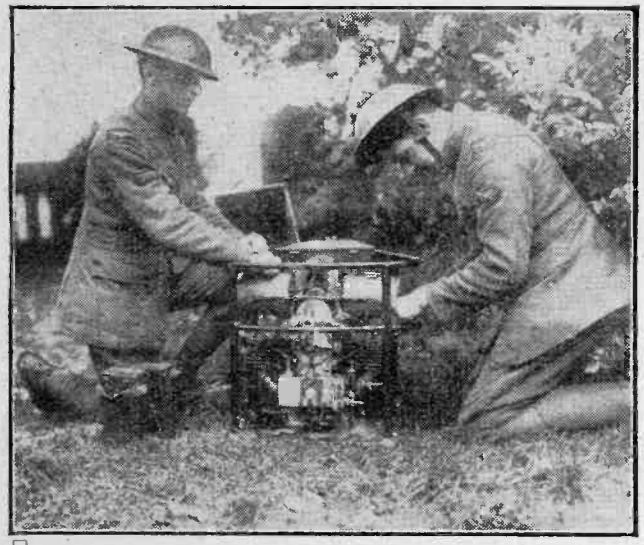
Edited by
JOHN SCOTT-TAGGART,
F.Inst.P., A.M.I.E.E.

October 7, Vol. 7, No. 3.

Wireless in the Army Manœuvres

By Major JAMES ROBINSON, D.Sc., Ph.D., F.Inst.P., Director of Research to Radio Press, Ltd.

In his article in our last week's issue on "Wireless in the Army Manœuvres" Dr. Robinson gave some general information relating to the organisation of and general methods employed by the wireless personnel of the R.A.F.



The twin-cylinder motor-cycle type of engine used for driving the generator for the transmitter used at a ground station.

Artillery Observation

ONE of the most important functions of wireless for modern war conditions is its use in spotting enemy guns or targets for our own guns. For this purpose there are special squadrons called Artillery Observation Squadrons. Each particular aeroplane is sent up to spot for a particular battery, and each Artillery Observation Squadron is given a special portion of the Front for this purpose. Depending on the density of the troops on both sides, there are more or less aeroplanes per mile of Front. Under certain circumstances the wireless receiving stations can be exceedingly close together, again depending on how close the batteries are together.

Reliable Information Essential

The information must be reliable, and if we have four aeroplanes on a mile of Front, it is obvious that there might be a considerable amount of jamming unless very special precautions are taken. Again, for a very wide Front, if the density of the batteries is very great, and if each battery has its observing aeroplane in action at the same time, there will be a tendency to considerable jamming, because each receiver will be able to hear not merely his own aeroplane but signals from aeroplanes some miles to his right and left.

Observation of Hostile Forces

On the other hand, it is absolutely essential to provide very reliable reception, because in case a particular aeroplane spots a target which should be immediately destroyed, such as a huge concentration of enemy troops, it is absolutely necessary that not only his own battery but every battery within gun range should hear him, and should thus be able to concentrate on this excellent target.

Importance of Selectivity

The problem thus becomes highly complicated. On the one hand there must be provided sufficient selectivity of some type so that each particular line of communication can be carried on—that is, that each battery can listen independently to its own aircraft—but, on the other hand, that there shall be so little selectivity that every battery within gun range of a good target should be able to hear any particular aeroplane.

Wireless in the Great War

In the last war this problem was solved, and exceptionally good results were obtained, so much so that the General Staff looked upon wireless as absolutely essential for artillery observation purposes. Spark transmission was made use of, with crystal reception on the ground. There was not a large range of wavelengths over the whole of the Front in France and Belgium, and, as there were many lines of communication required, it was necessary to employ the same wavelength for a flight of aeroplanes, and sometimes for two or more flights. Selectivity was obtained by using different notes on the same wavelength. This applied to neighbouring stations, so that each particular operator on the ground had to recognise the note of his own particular aeroplane, and to concentrate on this for ordinary shoots, but he had to be sufficiently wide awake to pick up any special call from any aeroplane within range.

Successful Methods

This was no easy matter, but our wireless operators on the ground became so good that an exceedingly small percentage of failures was recorded. The interesting fact emerged that it is possible for an operator

A small shelter tent is the only accommodation available for the wireless personnel under active service conditions.

In this concluding article will be found some interesting details concerning the apparatus used on aircraft and at ground stations, together with some indications of the problems involved in satisfactory communication in War.

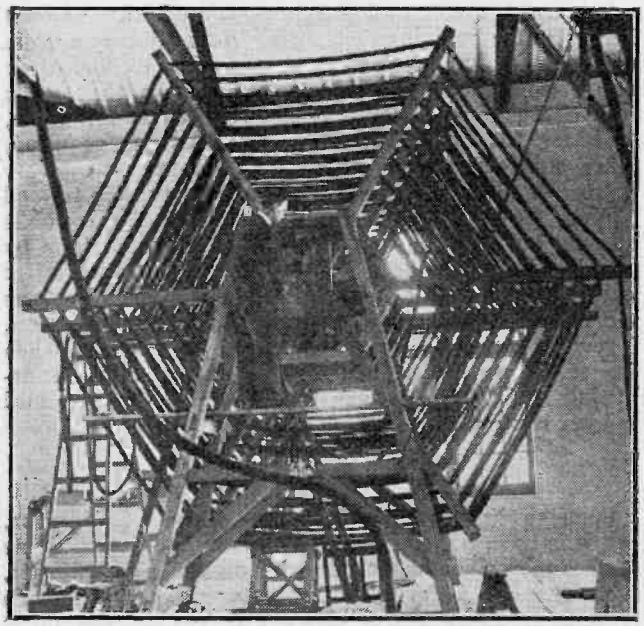
to concentrate on one particular signal when a number of signals can be heard, and to read this signal correctly.

Ground Stations

On the ground the organisation for reception is carried out by the Royal Air Force, and the operators are R.A.F. operators, the particular receiving stations naturally being attached to batteries of the Royal Artillery. In this respect the most important thing is that the receiving station on the ground should be self contained, and that it should not require replacements too often. In the last war crystal receivers were used, and these are ideal because they do not require replacements at frequent intervals.

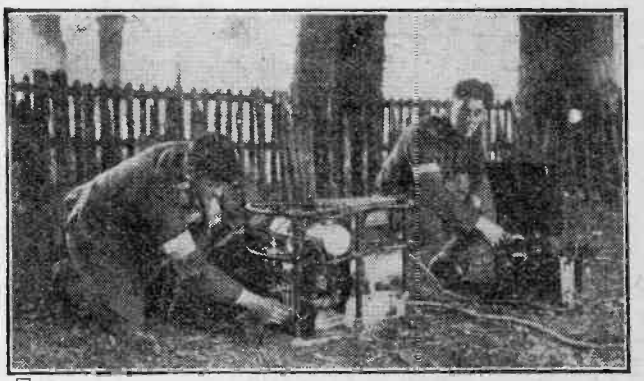
Valve Apparatus

The use of valve sets is not easy for such stations, as they are liable to be broken, and as accumulators need recharging and as the high-tension batteries need replacing frequently. Thus the use of valve receivers



Some idea of the dimensions of the main inductance coil at the Hillmorton wireless station may be gathered from this photograph.

at artillery observation reception stations is not an easy matter, but the Royal Air Force is trying out a system whereby the huge advantages of valve receivers are obtained, and whereby the disadvantages of the valve accessories have been overcome. The present



Another view of the engine and generator shown opposite, showing also the accumulator charging-board.

manœuvres will have given a severe test to this form of receiver.

Apparatus in Aeroplanes

As regards the special transmitters in the aeroplanes, the transmission is done by an observer who is not necessarily a wireless expert. For this purpose he must be trained in Morse to a reasonable speed, and, further, it is necessary to arrange special codes which are simple and reliable. The wireless duties are performed by the Squadron Signal Officer, who is responsible for the functioning of all the apparatus in all the aeroplanes and for their correct wavelengths being used, which is by no means an easy matter, as the wavelengths are so close together.

Wavelengths

The wavelengths used are around 400 and 500 metres (750 and 600 kc.), and a trailing aerial is used on each aeroplane. A valve transmitter is made use of, the power being supplied by a wind-driven generator on the wing of the aeroplane. A trailing aerial of about 150 ft. is used. This form of aerial produces directional effects, and it is found that transmission is best when the aeroplane is flying towards the receiving station; thus an aeroplane in observing flies away from his station to the distance required, which may be six to ten miles, makes his observation, and turns round to fly back towards his station, when he sends his message and again turns round towards the enemy territory for another observation. In this way the observer of the aeroplane can direct the fire of his particular battery on to his special target.

Bombing Aircraft

A very essential operation is the bombing of enemy territory. As is well known, this is carried out by the largest type of aeroplanes, which are capable of travelling some hundreds of miles. Their range is thus considerable, and may be up to six or seven hundred miles. During the last war the maximum range for efficient bombing was probably two hundred miles, but in the next war this range will be considerably increased.

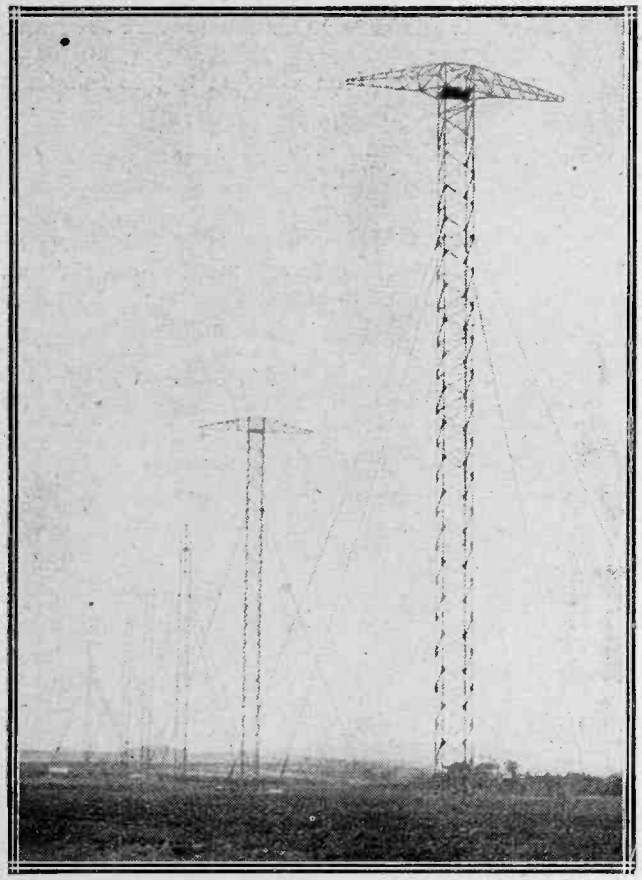
Essential Lines of Communication

On such operations it is obvious that aeroplanes should act in consort for protective purposes, and also

for obtaining more efficient results on any particular target. It is obvious that in such operations wireless must play a very important part. In the first place, such aircraft must be able to communicate with their base station. It is absolutely essential for them to be kept up to date with the latest information about the enemy, such as where defending enemy aircraft may be, etc.

Enemy Aircraft

Also it is of great importance that they should inform the base of any knowledge they obtain as regards the position of enemy aircraft. Thus it is essential to carry apparatus to operate over distances of a few hundred miles. For this purpose bombing



Six of the ten masts to be used for supporting the aerial system at the Beam station at Bodmin, Cornwall, now being constructed by the Marconi Co. for communication with Canada and South Africa.

aircraft are equipped with continuous wave transmission and reception apparatus such as that already described for reconnaissance aeroplanes.

Internal Communications

Another function necessary is intercommunication inside a squadron. Such squadrons must act in unison, and they should be comparatively close together. This is necessary for protection, and also that the squadron leader should be able to control the dropping of bombs of each of his aircraft. For this purpose very short distance wireless is required. It is obvious that the form of wireless must be such that pilots of each aeroplane will understand immediately any orders from their commanding officer, and thus it is preferable to use telephony. This should be of such short range that it cannot be heard by the enemy, though in actual practice it is not easy to satisfy this condition.

Bombing Raids

Bombing aircraft must operate at such long distances from the base that they are likely to be attacked, and thus deviated from their course. It is quite probable in certain cases that they may be so deflected from their course that they are not absolutely certain of their position. With aircraft it is vital to know one's position. Even though an aeroplane may have so lost its position as not to have succeeded in its bombing operation, it is vital for the machine to get back to its base. It is thus obvious that Wireless will be greatly utilised on aircraft in enabling them to know where they are.

Wireless Navigation

Certain methods of Wireless Navigation are fairly well known. One method which is being used is for the aeroplane to transmit, and for the ground station to plot bearings, and determine from the bearings of various stations the actual position of the aeroplane. When this is done the ground station informs the aeroplane of its actual position. On bombing operations, of course, this system has the disadvantage that the enemy can also determine by Wireless where the attacking aeroplanes are.

"Wing-Coil" Installations

It is much better to determine one's position without the aeroplane having to transmit. Actually it is usually sufficient for the aeroplanes to be able to find their own bearings on their Home Station, so that when their operation is completed they can head for home, the Base Station transmitting for them as required, either continuously or for 2 or 3 minutes in every quarter of an hour. Equipment of this type is termed "Wing Coil" installation, the direction-finding coils actually being fitted to the wings of the aeroplane by the Robinson method. This system consists of a maximum coil in the fore and aft line of the aeroplane and of a minimum coil at right angles to this direction, a reversing switch being employed to indicate when the aeroplane is heading directly towards the transmitting station. Thus the pilot turns his aeroplane until he gets it on to its correct course for home.

Wireless Operators

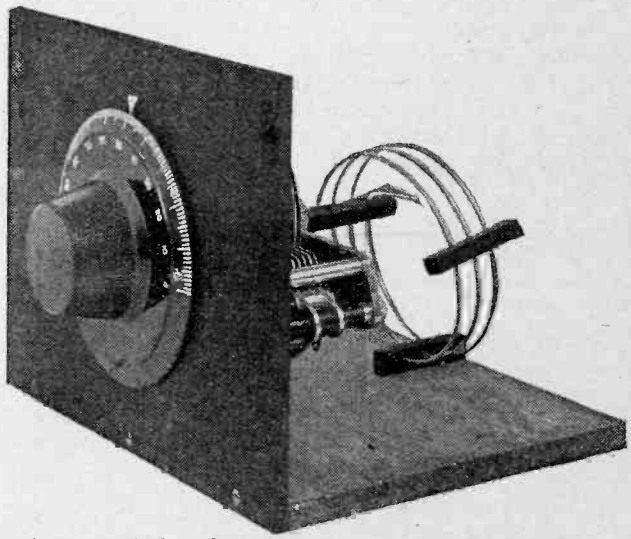
Such aircraft thus employ many forms of Wireless, and it is essential to carry a Wireless operator. Some of the operations must be done by the pilot himself, even though a Wireless operator is carried, such operations being the giving of orders to the other aeroplanes or receiving them, and also putting the machine on its correct course.

Some of the methods which have been tried out for Wireless communication during the manœuvres have been described. Sufficient examples have been given to show the complications of communication in the Services, and how efficient our Signal personnel must be. We can rest assured that out of the various systems tried, the best methods will be chosen by the senior officers who are in charge of the operations.

Calibrating a Short-Wave Absorption Wavemeter

By D. J. S. HARTT, B.Sc.

The accurate calibration of a wavemeter for wavelengths of 20 metres or less presents no great difficulty if the Lecher wire method of calibration is employed, as described in this article.



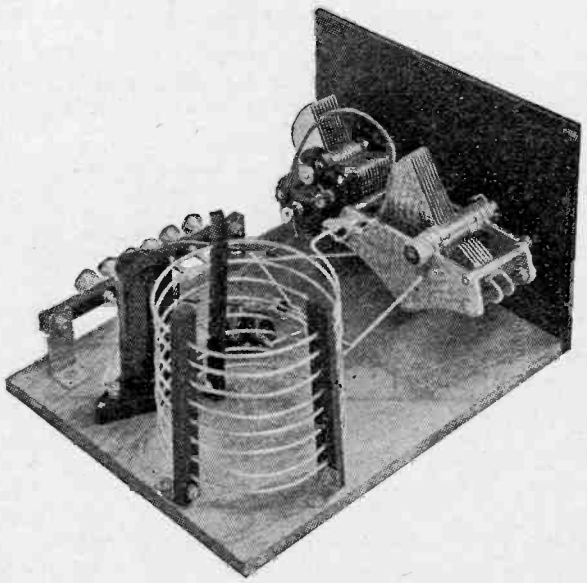
A view of the absorption wavemeter showing the method of mounting the bare wire coil.

AS our knowledge of the peculiarities of the short waves has increased, so it has become increasingly easy to construct and manipulate receivers to operate on these higher frequencies, and many an experimenter has proceeded so far and constructed a set which he has been able to make oscillate and at the same time control. Here, however, he encounters a difficulty; how is he to know on what wavelength he is operating?

On the broadcast and higher wavelengths it is a comparatively easy matter to determine the wavelength for any given adjustment of a receiver, and there are many accurate standards available for checking purposes. However the use of the ultra-high frequencies is modern practice, and experimental work has been largely confined to individual efforts, so that we do not find the same state of affairs existing here.

Working on Twenty Metres

We know that if a reliable design is *carefully* followed, say, for a 20-metre (14,991 kc.) receiver, and coils of a particular type and size with certain definite



The oscillator used in the experiment. The air-spaced coil is seen on the right with the R.F. choke on the left.

turn numbers are employed, we can be reasonably certain that the wavelength will be somewhere in the vicinity of 20 metres, but if one has not had any previous experience of operating on these frequencies nothing whatever may be tuned in until the degree of sharpness of tuning is appreciated.

I do not wish to convey the impression that there is anything very difficult in working on these high frequencies, for this is not so, and, provided certain reasonable precautions are observed, matters are perfectly simple.

Effects of High Frequencies

The essential thing to remember is that high-frequency effects, which are less apparent on the broadcast band, are very much more marked when we increase the frequency and come to wavelengths between 15 and 30 metres (19,988 and 9,994 kc.). In this connection I would refer readers to my article on the restriction of tuning ranges in *Wireless Weekly*, Vol. 6, No. 20, and an article on the same subject in Vol. 7, No. 2. It is very disappointing to construct a short-wave receiver designed, say, for 20 metres (14,991 kc.), and to find that the lower limit of its wavelength range is only about 25 or 30 metres (11,993 or 9,994 kc.), simply because certain essential precautions in reducing various stray capacities have been neglected.

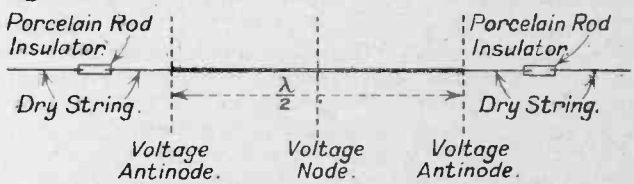
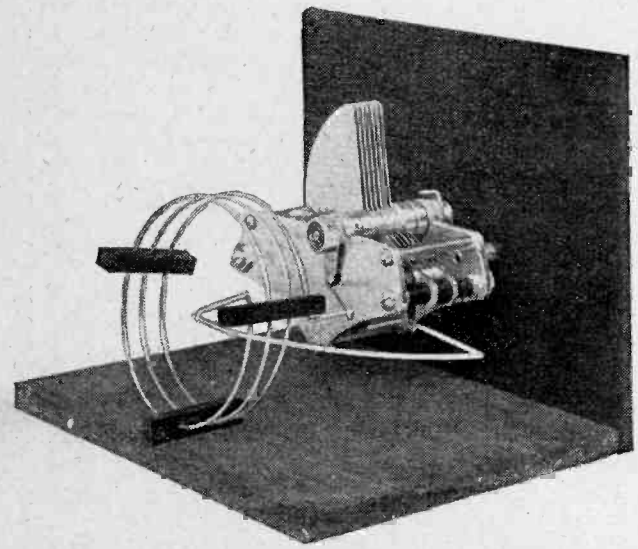


Fig. 1.—Illustrating the electrical characteristics of a single straight isolated wire oscillating electrically at the fundamental frequency.

Assuming, then, that such a receiver has been designed and made so that its tuning range does include, say, the 20-metre wavelength, what we want now is some *simple* and accurate means of calibrating it, or of calibrating a separate piece of apparatus (some form of wavemeter) which will enable us to tell with a fair degree of accuracy on what wavelength we are operating.

Assistance of NKF

Some great assistance to amateurs has been given in this direction by the United States Naval Station NKF, with whom *Wireless Weekly* are arranging a series of scheduled tests on various high frequencies, including the 20.8-metre wavelength. However, for those who are beginning this type of work, it is a somewhat haphazard way of calibrating one's set if the set has to be constructed and then one has to rely on picking up these signals on it for only one calibration point. An independent method, then, which can



This photograph shows clearly how the absorption wavemeter is constructed and wired up.

be employed at home and which demands no special or complicated apparatus is what is required.

Calibration with Lecher Wire

It is a happy coincidence that, owing to the *shortness* of these waves, we are able to make use of the properties of stationary waves in stretched wires to help us over the difficulty we have been considering.

I refer here to the Lecher wire method of calibration. This, although striking for its simplicity, does not appear to be very widely used, but it is nevertheless capable of giving quite accurate results.

Erecting the Wire

The most simple arrangement is shown in Fig. 1. Here we have a tightly stretched single wire, well insulated with dry string, broken by two suitable porcelain insulators. When this is oscillating electrically at its fundamental frequency we have a voltage antinode at each end of the wire and a voltage node in the centre; the fundamental wavelength is then double that of the wire, or x (the length of the wire in metres)$=\frac{\lambda}{2}$

It is essential that the wire be well away from neighbouring objects, and for the purpose of these experiments it is best to arrange the wire out in the open air well above the ground, say, 5 or 6 feet.

The Absorption Wavemeter

I do not recommend you to calibrate the actual receiver. This may be convenient in some cases, but the receiver is somewhat susceptible to various changes which may render any such calibration inaccurate, and at the same time prevent any further experimental work being done on that particular receiver. It is much better to make use of a supplementary piece of apparatus, consisting simply of a suitable coil with a condenser connected across it, as shown in Fig. 3, which may be termed an absorption wavemeter. This may be made reasonably constant, calibrated and kept separately as a standard.

The method by means of which this calibration is carried out is as follows:—An oscillator, tuning over the calibration band, is required. This acts as a link between the Lecher wire and the absorption circuit, so that the final calibration of the latter is independent of any factors which may alter the constants of the oscillator.

The Oscillator

A suitable circuit for use as an oscillator is shown in Fig. 2. It uses the familiar circuit arrangement sometimes attributed to Reinartz, and a unit made up employing this circuit is shown in one of the accompanying photographs.

The coil is 4 in. in diameter, has eight turns of No. 14 S.W.G. bare copper wire spaced at $\frac{3}{8}$ in., and is supported on three ebonite strips, one end of each of which carries a small bracket to enable the coil to be secured to the baseboard. Several firms will make up coils of this description at a reasonable price to your specification. (The 8-turn coil shown was made by The Scientific Appliances, Ltd.)

Components

The other components used in the oscillator are one .0003 μF variable square-law condenser (Igranic), one .0003 μF do. (Collinson), one Burwood anti-capacity valve holder, one Lissen H.F. choke, six terminals, two Burndept clips, one 8 in. by 6 in. by $\frac{1}{4}$ in. panel, and a baseboard, 8 in. by 10 in. by $\frac{3}{8}$ in. The method of construction will be clear from the photographs.

Construction of Wavemeter

The absorption wavemeter consists of a .0003 μF variable square-law condenser (Igranic) and a three-turn, $3\frac{1}{2}$ in. diam. coil, with the turns of No. 14 bare

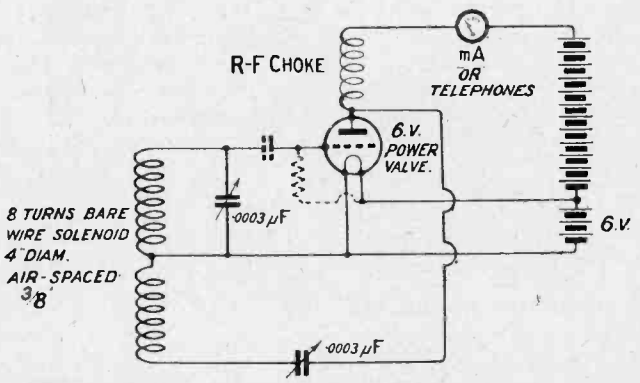


Fig. 2.—The inclusion of a grid condenser and leak, shown dotted in this diagram of the oscillator circuit, may in some cases be an advantage.

copper wire and air-spaced at $\frac{3}{8}$ in. This coil should be made as *rigid* as possible; this is best done by drilling the holes in the ebonite strips for a tight fit on the wire, but this procedure makes matters somewhat difficult when the strips are threaded on to the

wire, unless one is possessed of a fair measure of patience. The completed coil is secured to the baseboard by two small brass woodscrews through one of the strips, and thick rigid connections are made from its ends to the soldering tags on the condenser.

Valves to Use

So much, then, for the constructional part; the method of calibration will now be discussed. First be sure that the oscillator does oscillate; preferably take it out into the open air, for I find that no 20-metre oscillator will oscillate in my receiving room, which contains much other wireless apparatus. A 6-volt power valve such as the B4, D.E.8, D.F.A. or similar type, is to be recommended; a filament resistance can then be dispensed with and the full 6 volts of the accumulator put on.

Indicator for Oscillation

Adjust the H.T. voltage until the set oscillates evenly over the whole range of the grid condenser; (for the following experiments I used 4 turns in the grid circuit and 4 turns for reaction; one Burndept clip was connected by a short length of flex to the end of the tuning condenser remote from the grid and the other to the end of the reaction condenser remote from the plate); a milliammeter in the anode circuit gives the surest indication of oscillation, by a sudden change of anode current when oscillation sets in.

Now measure off a 10-metre length of, say, No. 20 bare copper wire, stretch it taut, and suspend it as indicated in Fig. 1, about 5 or 6 feet above the ground. Only the smallest possible loops should be made at the ends of the wire where the string is attached.

Calibration

The oscillator is then set into the oscillating condition and brought near to the centre of the wire, so that the turns of the oscillator coil and the wire are in one plane. This, I think, is most conveniently done by

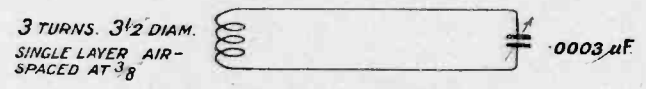


Fig. 3.—The circuit of the absorption wavemeter described.

having the oscillator, batteries, and milliammeter (if one is used) on a board, and lifting the whole into the desired position on some temporary support. Then rotate the grid condenser of the oscillator slowly, and note the position when oscillation stops. This will be shown by a sudden change in the anode current

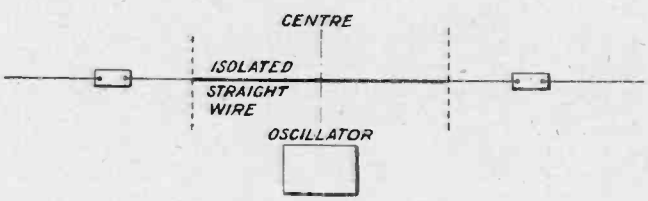


Fig. 4.—When the oscillator is brought near the centre of the isolated wire, it will stop oscillating at the fundamental frequency of the wire.

indicated on the milliammeter. If a sudden rise in anode current took place when oscillation started, the cessation of oscillation will be marked by a *sudden* decrease. Do not be misled here, for a slow change in anode current may take place as the grid condenser is rotated, on account of the varying intensity of the oscillations at different settings. On the higher range of the tuning condenser, for instance, the oscillations will generally be more feeble.

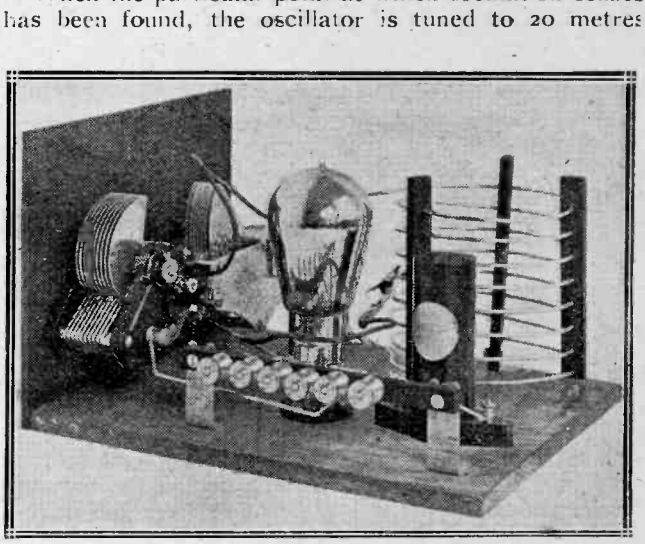
Telephones to Check Calibration

If a milliammeter is not available, a pair of telephones may be used in its place, and the point where oscillation ceases will be indicated by two clicks in the 'phones (if the condenser can be turned slowly enough), one when oscillation ceases and the other when it starts again after the point has been passed.

Usually, however, these clicks are only heard as one click as the point is passed, even when the condenser dial is carefully rotated. I need not emphasise the *necessity* for some form of extension handle in all this work, or some type of vernier dial on the condensers. Anyone who has experimented even on 50 or 60 metres (5,996 or 4,997 kc.) will have realised this.

Transferring to Wavemeter

When the particular point at which oscillation ceases has been found, the oscillator is tuned to 20 metres



The oscillator with valve inserted. All necessary connections are made to the terminals seen in the foreground.

(14,991 kc.) (*i.e.*, when a 10-metre wire is used as indicated). The oscillator is left at this adjustment and is then removed from the vicinity of the wire and the absorption wavemeter brought near to its coil. The condenser on the wavemeter is slowly rotated until the oscillator ceases to oscillate. This point is determined as before, either with a sensitive milliammeter or a pair of 'phones in the anode circuit of the oscillator. This then gives us one calibration point for the absorption wavemeter. Some form of indicator will be required for the latter, and the dial should be tightly secured to the spindle before any calibration is attempted.

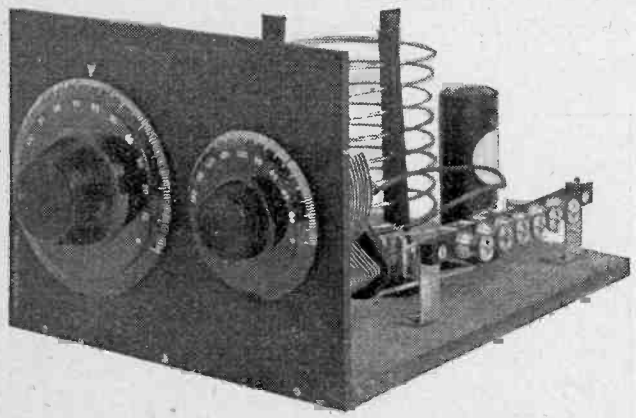
Calibration Curve

In a similar manner we can determine other points; a 7.5-metre wire will give us a 15-metre (19,988 kc.) point, a 12.5-metre wire a 25-metre (11,993 kc.) point, and so on. A complete calibration curve can therefore be plotted. The lowest point I actually plotted for the apparatus shown in the accompanying photographs was 15 metres (19,988 kc.); this occurred on 45 deg. of the wavemeter condenser (about 15 deg. on the oscillator); similarly the 20-metre (14,991 kc.) point was 56 deg. on the wavemeter and about 32 deg. on the oscillator.

Provided then that we use a good condenser and a rigid coil, we have a piece of calibrated apparatus which is not susceptible to any changes which will materially affect its calibration.

The Oscillator as a Receiver

By simply including a grid-leak and condenser of conventional values (shown dotted in Fig. 2) the oscillator can be used very successfully as an ultra-short-wave receiver. It may be desirable to experiment with different values of grid-leak to secure convenient control of oscillation, but the usual 2 megohms is satisfactory in most cases. An ordinary outdoor aerial may be used or a short vertical wire, loosely coupled to the oscillator inductance by means of a 2- or 3-turn coil connected between the aerial and the earth. This should be coupled just tightly enough to allow of free oscillation (if the coil is brought too near it may stop



The two variable condensers are the only components mounted upon the panel of the oscillator.

oscillation; a series condenser or loading coil in the earth lead is sometimes useful to detune the natural wavelength of the aerial system away from the wavelength on which it is desired to operate).

Receiving NKF

When this has been done it is interesting to listen to one of the special tests from NKF on 20.8 metres (14,414 kc.), and when this has been tuned in, to leave the receiver in the oscillating condition, and bring the absorption circuit near and determine the corresponding point of tune on its condenser. The 20.8 metre (14,414 kc.) wave from NKF is guaranteed to be correct to at least 0.1 per cent., so this will provide an independent check on the Lecher wire calibration.

If the latter has been carried out in a confined space, it is quite conceivable that some error in the calibration may result, but if the more ideal open-air conditions are possible there is no reason why the calibration should not check up exactly with that from NKF.

Conclusions

It is thus seen that the method is very simple to work and demands only an extra coil and condenser and a few odds and ends over the ordinary ultra-short wave equipment, so there is really no reason why anyone who has made such a set should complain that he does not know "where he is." The noises from motor ignition systems are a convenient guide for wavelengths "somewhere near" 20 metres (14,991 kc.), but in this class of work some more precise calibration such as the above is needed.

A SCREWDRIVER TIP

A SCREWDRIVER, when purchased, will usually be found to be ground down so as to have a fairly sharp edge to the blade. This type of "chisel" edge may give considerable trouble when the screwdriver is used for the insertion or withdrawal of small screws, especially if these latter are at all stiff to turn. The blade will tend to jump out of the slot in the screw-head, so that the slot will gradually be cut away and the screw may become difficult to turn at all.

A Remedy

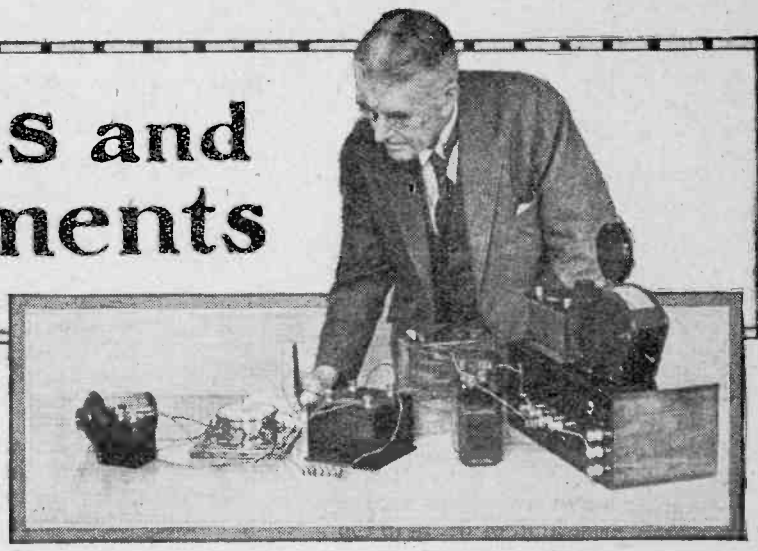
A suggested method of preventing the occurrence of this trouble is to alter the shape of the blade; this can usually be done with a file. The sharp edge of the blade is first filed down till it is quite blunt, about 1/32 in. of metal being removed. The edge should now be filed off quite square, particular care being taken to see that the corners are not burred over. The width of the edge of the blade should be such that it will just fit into the slot of a small screw.

It will often be found that, when a screw is to be inserted at an awkward point in a wireless receiver, it can be wedged on the blade of a screwdriver treated in this way, and in this way easily placed in the required position.

A. V. D. H.

Sir Hamilton Harty, who conducted the Wireless Symphony Orchestra when they broadcast recently from the London Station.

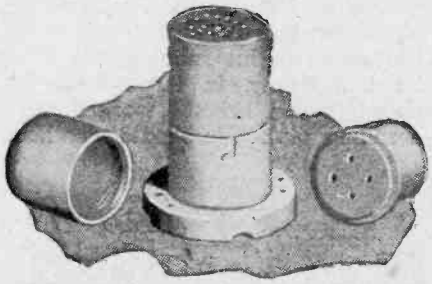
Inventions and Developments



UNDER THIS HEADING MR J.H.REYNER, B.Sc.(Hons), A.C.G.I., D.I.C., OF THE RADIO PRESS LABORATORIES, WILL REVIEW FROM TIME TO TIME THE LATEST DEVELOPMENTS IN THE RADIO WORLD.

A Valve without a Glass Bulb

RECENT developments which have been made in the matter of the construction of receiving valves have all been in the direction of improving existing patterns of thermionic valves. That is to say, the valve is still made with comparatively small electrodes



The valve inserted in an American type of valve holder.

and is enclosed in a glass bulb, from which as much gas as possible is exhausted.

Filament Construction

The biggest disadvantage of this system of construction lies in the fact that the filament, which is the most fragile portion of the whole unit, is not replaceable except at a cost very nearly as high as that of a new valve owing to the necessity for re-exhausting the bulb after the repair is effected. It is not surprising, therefore, that attempts have been made from time to time to depart from the existing type of construction, particularly in the case of transmitting valves, which cost several pounds each. If a satisfactory valve could be produced in which the filament were readily replaceable, then obviously the financial saving in a transmitting station would be considerable.

Little attention, however, appears to have been given to the question of receiving valves, and it would seem that we must continue to use the existing type of valve with its various defects. Certainly, the introduction of dull emitting filaments has rendered the life of a valve very considerably longer than of old, and this may have tended to discourage experimenters from producing any radically different pattern of valve.

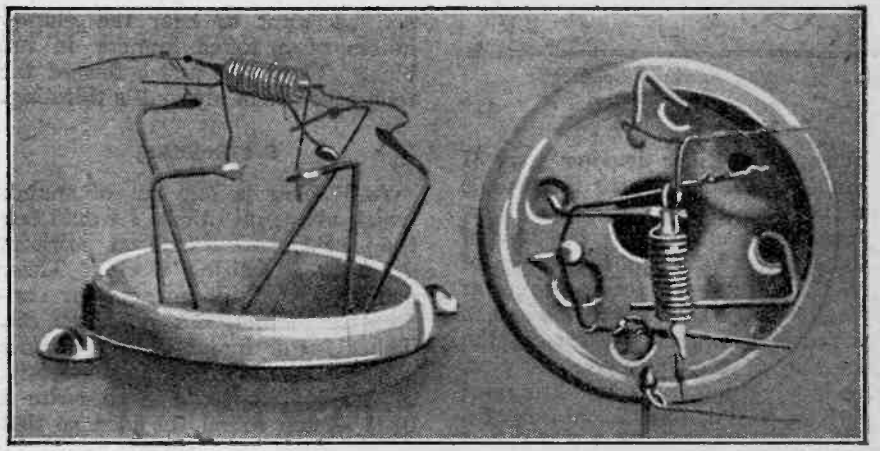
A Vacuumless Valve

Mr. E. V. Myers in America, however, has tackled the problem with a fair amount of success, and he has actually produced a valve in which all the electrodes are exposed to air, and are simply enclosed in an insulating chamber to protect them from mechanical damage and draughts.

Two views of the valve are shown in the larger photograph, from which it will be seen that it is essentially the same in construction as the ordinary type of thermionic valve, except for the fact that the glass bulb is missing. The principal point of difference lies in the filament, made of a particular substance which, of course, is the patent of the inventor. In the particular valve shown in the photograph, this filament measures .035 of an inch in diameter (about the thickness of the lead in a pencil), and is about five-eighths of an inch long. It has a fairly high resistance, and is operated from 110 volts lighting mains, at which voltage it takes a current of about half an ampere. It is understood to run at a temperature of about 800 degrees Centigrade.

Characteristics

Actual details of the characteristics are not at present available, although one would certainly expect the valve to be somewhat soft. This, however, depends upon the nature of the emission from this new filament, and without further details it is impossible to make any reliable comment. Some figures are given from which it appears that the parameters of the valve are somewhat similar to those of the existing

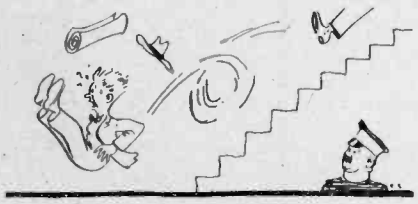


Showing the internal construction of the valve. The electrodes are arranged in the conventional manner.

(*Continued on page* 85)

Noises

EVERYONE has naturally his own views about the best kind of items in the broadcast programmes. Some adore sloppy songs, some those of the hale and hearty type; some bless entertainers, some cuss them; some delight in instrumental solos, some in orchestral pieces, some in news bulletins and some in topical talks. But my vote goes for none of these things. If there is one item in any programme that appeals to me more than all others it is one of those noise turns. We have had quite a number of them, as you will remember, but there can never be enough for me. We have had the



. . . *Being bumped down the back stairs* . . .

sounds of a liner leaving port (I would have liked to hear the sounds on the same liner a few hours later, when she was crossing the Bay of Biscay); we have had the noises of the Zoo and of feeding-time at Wembley; we have heard the splash of the waves upon the beach, the chanting of pierrots upon the pier, the jug-jugging of the nightingale; we have heard, too, the noises of a coal strike—or was it a coalpit? I really forget which; and we have had the sounds that occur upon the foot-plate of an express engine.

In a Newspaper Office

Only the other day we heard something of the clatter that goes on in a newspaper office—I say "something" advisedly, for, if you will believe me who know, there was quite a lot that we did not hear. To our ears, for example, there came nothing of the moaning of the reporter whose beautiful two-column article has been cut down to three lines by a ruthless sub-editor. We did not hear the would-be poets being bumped down the backstairs, the editor's telephone conversation with a star contributor once more late in sending in his copy, or the office boy explaining that something came to pieces in his hand.

Suggestions

There are simply heaps of other noises that I am longing to hear. I want the B.B.C. to arrange a butter slide on the pavement of Savoy Hill and to place a microphone close by. I want to hear the battle cry of the slipper-limpet (this is the noisy noise that annoys) as it attacks the oyster in his little bed. I want to hear an expert tracing a fault in his wireless receiving set. I want to hear the gluggy noises of a toffee foundry in full blast. These are just a few of the things for which my soul is thirsting.

Set Building

And there is one set of sounds which above all others I would beg the B.B.C. to broadcast without delay to a waiting world. These are the sounds of an amateur constructor building his receiving set. Think for a few blissful moments what it would mean. Somebody, of course, would have to write a little sketch round the idea so that quite a cast of actors could be worked in as well as the wireless orchestra.

"Noises Off"

The most important actor, though, would not be the constructor himself, but the fellow responsible for the "noises off." You see these would have to be magnified a little in order to come through properly and sound like the real thing. For example, you would simply never hear the sounds of the harried constructor running his hands through his hair as he strove to draw a full-sized wiring diagram, unless they were emphasised a little. The best way, I think, to reproduce them would be to draw a stiff brush across a sheet of glass-paper. We should hear the pencil travelling over the drawing paper (the studio gramophone turned on with the needle on the blank middle part of a record). Then would come the sound of his rubbing out what he had drawn (a large lump of dough being briskly worked with a rolling pin). We should also hear

. . . *Sausages frying over hot flame* . . .

him say "tut." The scream of pain as he endeavoured to extract a recalcitrant drawing pin might be produced in the natural way. Then would come the marking out of the panel with the scriber (one file drawn over another). The natural voice could be relied upon once more for the proper exclamations when the constructor pricked his finger with the scriber or allowed the set square to slip. The sounds of centre punching would be helped out with the big drum, the actor himself making at intervals a noise like a hammered thumb. It is a little difficult to suggest a good way of bringing out in emphasised form the sounds of the breast drill, though a mowing machine run over the carpet might answer fairly well. Whilst the working of ebonite was

in progress listeners would be requested to throw a piece of old motor tyre into the fire in order to get atmosphere.

Soldering

But the pièce de resistance of the whole show would, I think, be soldering. The constructor applies a dab of flux (an outsize in plaice is dropped on to a slab of slate). The flames of the gas ring are heard roaring (business with a knife machine); the constructor tests the heat of the iron by holding it to his cheek as he has seen professionals do (sausages fried over a hot flame; shrieks by the actor assisted by the clarionet and bassoon). He brings the point of the iron to the well-fluxed terminal (more sausages). Several lots of sausages will be required here, since the business of making the first joint always requires many minutes. Listeners will be requested to place more bits of motor tyre on the fire and to add to them some lard or gearbox grease.

Unstuck

The joint having been made, the triumphant cry of the constructor will be heard, changing rapidly into dismal woe as the wire comes away in his hands (sack of sheet-metal scrap thrown downstairs) when he pulls it. At about this point the expert friend enters and the constructor begs him to help. The expert friend does so at first in a verbal way only, and the constructor is heard tearing his hair (ripping of a sheet of American cloth), groaning (euphonium and bombardon), and saying "tut" (the actor himself) as he follows out the instructions. Presently the expert friend says, "Here, let me show you how to do it!" and now we hear the ill-suppressed cackles of the constructor and the still worse suppressed "tuts" of the expert

. . . Burnt-out valves hurtling through the air . . .

friend as he proceeds to give his practical demonstration. After prolonged frying, the expert friend says, "There now, I have shown you how to do it, and I am afraid that I must rush off to keep an urgent appointment."

Success

We next have a brief musical interlude by the orchestra, at the end of which the constructor sings—

"To work! to work! I must not linger
Until the job is done.
I've still got one good unburnt finger;
And who wants more than one?"

A few more sausages are fried, and then he announces that soldering is done and he is about to test out the fruits of his toil. We hear him attach the aerial, earth and battery leads (heavy ropes dragged across the floor of the studio, and business with ratchet brace).

Connecting Up

We also hear several piquant remarks about high-tension batteries, first of all when he endeavours to tighten down both H.T. leads at once with one hand on each terminal, and secondly, when he discovers by the well-known blue flash process that he has attached them inadvertently to the L.T. terminals. Next comes the sound of the burnt-out valves hurtling through the air and landing in the coal-scuttle (business with a sack of broken glass). At length he gets his connections as they should be and inserts four new valves into the holders. He switches on and moves the knobs of his condensers now this way, now that (a mincing machine filled with sand). This is all we hear. Otherwise there is a profound silence. At this moment his small son enters and suggests attaching the loud-speaker leads to the output terminals of the set. The lad is told not to be so silly and bustled out of the room. When he has gone the constructor adopts his advice.

Tuning In

Tuning now continues (squeaks, etc., provided by the violin, trombone and a battery of motor horns). The constructor says "tut" at frequent intervals. Meanwhile the wind is heard rising outside, and presently a loud crash tells us that the aerial has fallen through the greenhouse. We hear the constructor striding out into the night, disentangling the coils of wire, climbing a tree and refixing the free end. We also hear him descending the tree rather more quickly than he intended. He now comes within once more and gets down to it again. Presently an indistinct voice is heard coming from the loud-speaker. Prodigies of tuning are performed, half the instruments in the orchestra lending their aid to reproduce the screams, howls, roars, groans, chirps, yells and catcalls; and then clear and distinct we hear the announcer's voice whilst the constructor heaves a sigh of relief (balloon motor tyre punctured by skewer). "This is 2LO," says the voice, "We are now

. . . Striding out into the night . . .

closing down for the night. Good-night everybody. Good-night."

I Leave it to Them

Well, anyhow, I have done my bit. I have made to the B.B.C. a present of this beautiful idea, and have even gone so far as to show them just how to carry it out successfully. If they adopt it, joy will be brought into the homes, stately and otherwise, of England on that night. I omit Scotland, since in Northern homes signs of joy will probably not be apparent until about lunch time the next day. If the B.B.C. does not adopt it, then, at all events, you cannot blame me.

WIRELESS WAYFARER.

SHORT-WAVE TRANSMISSION.

Anyone picking up the following message on 25 metres (11,993 kc.) is asked to send a report on the signals heard:—CQ de G5DH.—QRA, G.P.O. Radio Research Station, Dollis Hill, London.

This station transmits from about 4.30 to 5 a.m., G.M.T., and also may be heard calling CA at 9 p.m., G.M.T., daily.

Reports are also asked for on transmissions by G2OC, which station may be heard working on 23 metres (12,304 kc.). These reports may be sent to Capt. D. Sinclair at the Air Ministry.

Some Practical Insulation Tests

By A. JOHNSON-RANDALL, Staff Editor.

The importance of good insulation as a factor in the efficient operation of wireless apparatus hardly needs emphasising, and in this article some simple methods of testing insulation are described.

GOOD insulation is one of the most important factors in serious experimental work. Unless the insulation of all of the components in a wireless receiver or transmitter is of a high order, it is an absolute impossibility to collect accurate data upon which to base calculations if they are to have any real value in future work. In the case of the broadcast listener, the efficient working of his set depends upon the insulating properties of certain important components, and hence it should be his object, provided he desires to obtain the best results, to make sure that these parts are up to standard in this respect.

Possible Methods of Testing

Let us consider the methods of insulation testing available to the experimenter. Now the usual commercial practice is to use some form of high voltage testing machine, such as the well-known "Megger," and to make rapid tests between the important points in a circuit.

The "Megger."

These machines are simply small D.C. generators, capable of an output of 100-500 volts, and in some cases 1,000 volts, according to the particular type chosen. Two flexible leads from the Megger are attached to the test piece, and the handle of the instrument is turned at a constant speed of usually about 100 revolutions per minute. In many cases the machine has a "slipping clutch" arrangement, by

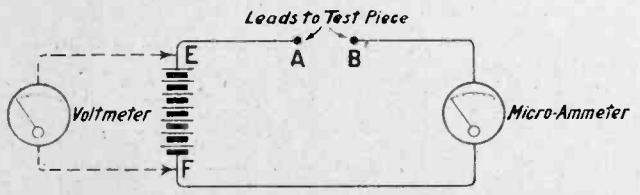


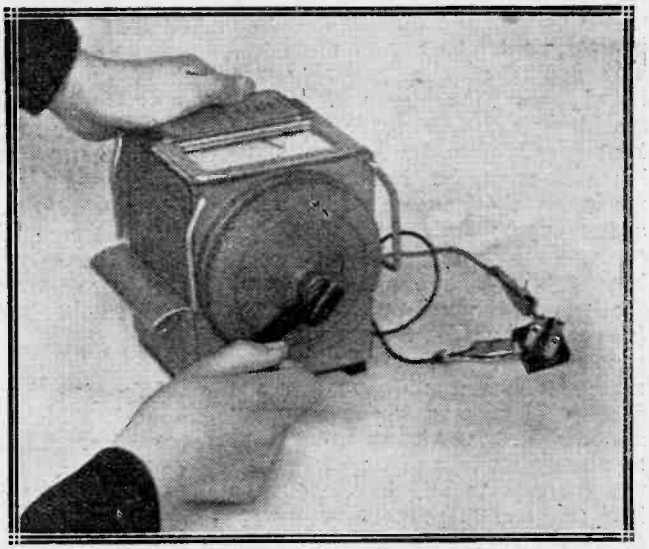
Fig. 1.—Leads from A and B are taken to the component whose leak resistance is to be tested, and a simple calculation from the readings on the meters will then give the value of this resistance.

means of which, when the speed of rotation of the handle is in excess of a certain figure, the clutch slips, so that the terminal voltage of the generator is maintained at a constant figure.

Indication of Resistance Value

This is very important in those cases where the circuit or component to be tested possesses large electrostatic capacity; for instance, in testing a large condenser it is essential that the terminal voltage of the generator should be absolutely constant.

The resistance of the article under test is indicated by a pointer and scale on the Megger, and should its resistance be too high to measure at that voltage the pointer will move across the scale to "Infinity," and the test piece may be assumed to be O.K.



The instrument used by the author in making some of the insulation tests described is of the "Meg" type shown here.

Another Form of "Megger."

Within the last few years there have been placed upon the market small portable insulation testers at a price within the reach of many amateurs, whilst at the same time there are also a number of these still to be obtained from those firms who sell Government disposal goods. For example, the well-known makers of the "Megger" now supply a number of smaller and cheaper testers under the trade-mark "Meg." They may be obtained both with and without clutches, the latter being somewhat lower in price. My own insulation tester is one of these latter. The serious experimenter would do well to consider the very many possible uses of the various testers of this type upon the market before dismissing them from his mind as being beyond his means.

Alternative Method of Testing

The second method of insulation testing is to place a micro-ammeter in series with the component to be tested and a battery such as an H.T. unit (Fig. 1).

The leak resistance of the test piece at any given voltage can be measured by reading the current flowing in micro-amps., and calculating the resistance by Ohms Law.

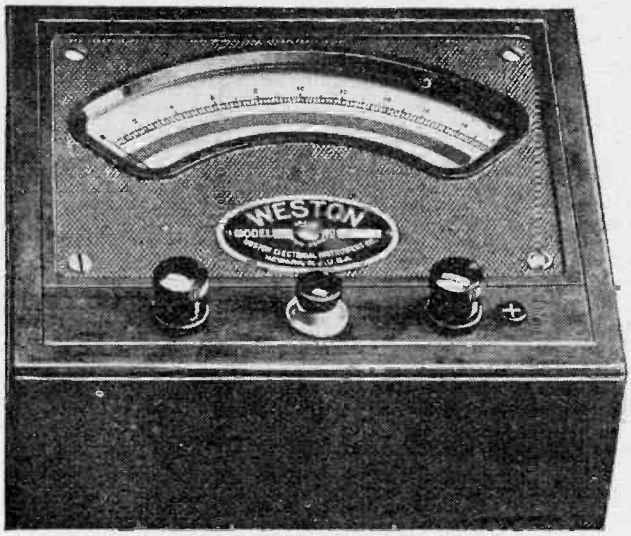
A Practical Example

For example, let us suppose that the particular test piece is a valve-holder, and that the flexible leads from A and B in Fig. 1 are joined to the grid leg and one of the filament legs.

Let the voltage between E and F be 100 and the current indicated by the micro-ammeter be 2 micro-amps. By Ohm's Law we have

$$R = \frac{E}{I} \text{ where}$$

R = resistance in ohms.
E = voltage across EF.
I = current in amps.



A typical micro-ammeter of well-known make, which may be used in conjunction with suitable apparatus for the accurate measurement of resistance values.

Then

$$R = \frac{100}{2 \times 10^{-6}} \text{ ohms} = \frac{100 \times 10^{6}}{2} = 50 M\Omega$$

Therefore if the applied voltage is 100, a deflection of 1 micro-ampere will be equal to 100 megohms. If no deflection takes place the resistance of the test piece may be taken as infinity. This method of testing can be applied to condensers large or small, and is also useful for measuring the resistances of grid-leaks.

Precautions

It is a good plan to insert a limiting resistance in the micro-ammeter circuit, to avoid injury to the instrument in cases where the resistance of the test piece might be low. With a small micro-ammeter reading up to 50 micro-amps., a 2-megohm grid-leak in series would prevent injury to the instrument with 100 volts applied. This could be subtracted from the calculated resistance of the test piece, or neglected altogether in many cases, according to the magnitude of the leak.

A Further Test Method

Another method would be to use the test piece as a grid-leak in an oscillating valve circuit, but I do not propose to deal with this in detail in this short article, since the method requires careful investigation, and may form the subject of a separate article at some future date.

In all insulation measurement the experimenter should view the matter in the proper perspective, and separate those portions of the circuit where the insulation should be of a high order from those in which a moderate degree of insulation is all that is necessary.

Testing Components

Low-frequency transformers, for instance, should give "Infinity" when tested:—

(1) between windings.
(2) from primary to core.
(3) from secondary to core.

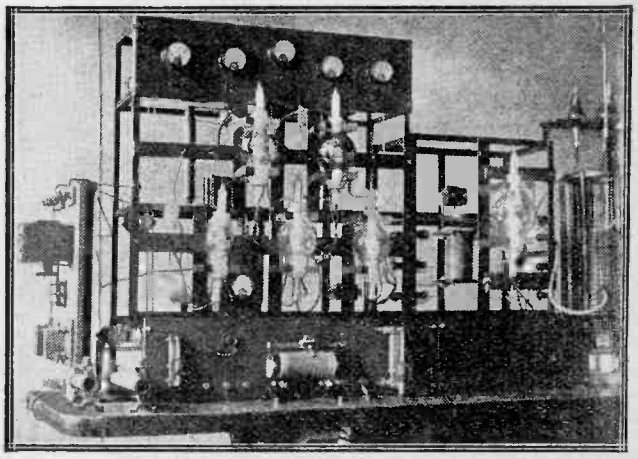
Infinity should also be obtained between the grid and filament legs of valve sockets, between the windings of H.F. transformers, the terminals of condensers and coil sockets, and also between any two points on an insulating panel, etc. On the other hand, it would be futile to aim at infinity in certain components which, when connected in circuit, are shunted by a comparatively low resistance.

A Point to Note

An adapter in my possession at the moment is made of an insulating material, which on test shows a resistance of about 50,000 ohms between the connecting lugs. In practice this adapter carries a resistance which is used to control filament current when a 6-volt accumulator is used with certain valves in place of another of 4 volts. This resistance, which has a value of a few ohms, is therefore connected across the two connecting lugs referred to, and a moment's thought will reveal the fact that a leak of 50,000 ohms in parallel with, say, 10 ohms is quite immaterial in practice.

Importance of Good Insulation

Going to the other extreme, however, I have also a 2 μF condenser, which on test shows an 80,000-ohm leak. The effect of employing this as an H.T. shunting condenser would be to draw from the H.T. battery a steady flow of current approximating to the load imposed on it by one valve, which would be a very undesirable state of affairs.



A view in the transmitting room at the Sheffield Broadcasting Station.

High-Tension Battery Voltmeters

The use of an unsuitable type of meter for checking the voltage of a high-tension battery may cause serious damage to the cells, and the desirable features of the correct form of instrument to employ for this purpose are indicated in these notes.

THE other day I was shown by a friend a voltmeter which he had purchased for the purpose of testing high-tension batteries. Being of an economical turn of mind he had bought a very cheap one reading up to 120 volts, and was not very satisfied with the results obtained with it. The instrument, which was of foreign make, was of the moving iron pattern. He suggested trying it across my own high-tension battery to demonstrate that its readings were inaccurate. This offer I firmly declined, but went round with him to his house, taking with me a milliammeter.

Heavy Current Taken

When the voltmeter was placed across the extreme terminals of a 100-volt high-tension battery, the needle, after wild movements, finally settled down for a moment at about 60 volts. It then began to drop quite steadily down the scale. I wired my milliammeter in series with it to ascertain what amount of current it was passing, and was not surprised to find that this was in the neighbourhood of a quarter of an ampere.

Damage to Battery

It cannot be too strongly insisted upon that voltmeters of this kind are absolutely useless for obtaining readings of the plate battery voltage. What happens when they are used is that the battery is practically short-circuited. An enormous load is put upon it which causes its cells to become polarised rapidly, so that the voltage at once drops considerably. The battery itself suffers greatly during the process, and the application of such a voltmeter to it for even the few seconds necessary to allow its pointer to come to rest may take more out of it than weeks of actual working in connection with the receiving set.

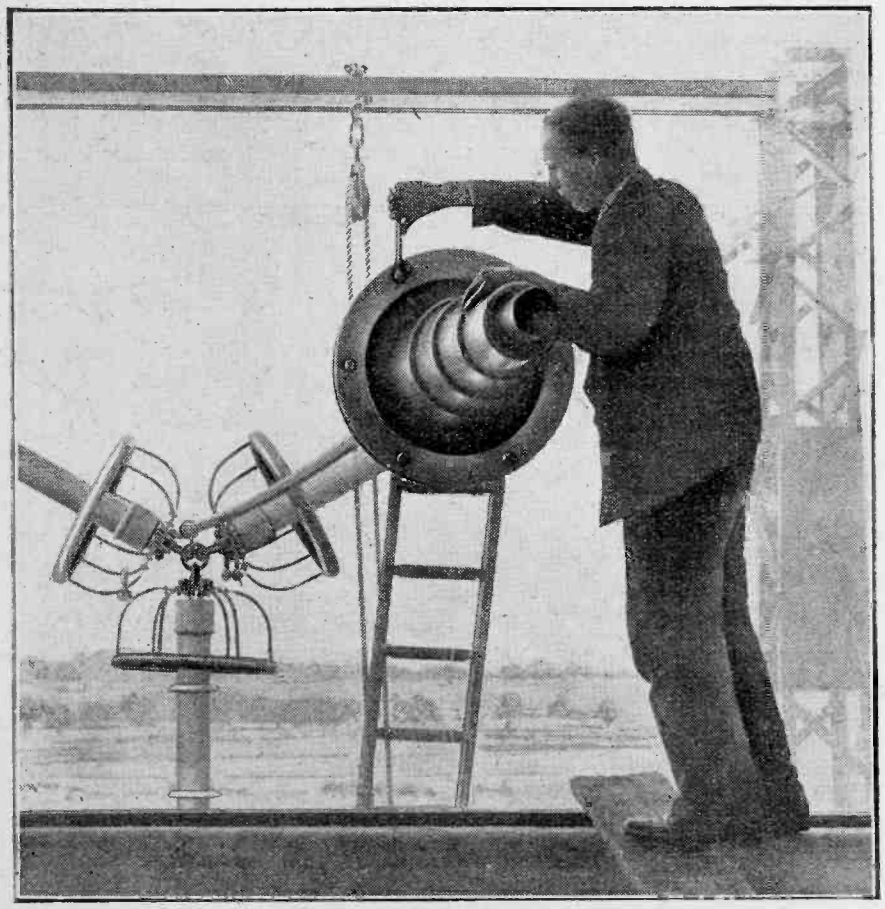
Instruments to Use

The only voltmeter suitable for use with high-tension batteries is a moving coil instrument of high resistance—the resistance should certainly not be less than 100 ohms per volt. These instruments are more expensive than those of the moving iron type, but the extra expenditure is well worth while since, besides giving accurate readings, they inflict no injury upon one's high-tension battery.

A Suitable Meter

A type which I have found very satisfactory for use with the wireless set is the double range pattern which gives readings from 0 to 6 and from 0 to 120 volts. My own instrument has a resistance of 900 ohms on the lower scale and 18,000 ohms on the higher. It thus passes a maximum of about 7 milliamperes of current, whether the accumulator or the high-tension battery is being tested. This load can certainly do no harm to the filament battery and it is not excessive even for a plate battery composed of small cells, since, owing to the deadbeat action of the pointer, readings can be taken almost instantaneously.

R. W. H.



Adjusting the aerial lead-in and insulator at the Government wireless station at Hillmorton, near Rugby, claimed to be the world's largest wireless station.

THINK IN KILOCYCLES

In a recent issue of "Wireless Weekly" it was notified that frequency equivalents in kilocycles would in future be given together with wavelengths in metres. It has now been decided to adopt the practice of referring to kilocycles in preference to metres, and the reasons for this development are given in the accompanying article.

A SHORT time ago it was pointed out in these columns (*Wireless Weekly*, Vol. 6, No. 17) that the use of frequencies rather than wavelengths was very much more scientific, and had much to recommend it. In view of these advantages, it was decided that the frequency nomenclature should be adopted generally by the Radio Press publications in order that a lead should be given to the radio world in general on this important subject.

Difficulties Involved

The change, however, from wavelength to frequency, although desirable, is one which will demand a certain diligent application in the early stages. We must become accustomed to thinking in terms of kilocycles rather than metres, referring (for instance) to 2LO as working on 838 kilocycles rather than 357 metres.

Accuracy

For the last few weeks we have been giving the kilocycles equivalent after wavelength figures, in order to prepare the ground for this change in nomenclature. These frequency figures, however, have been somewhat difficult to deal with for two reasons. In the first place, a round number in metres very often does not convert into an equally round figure in kilocycles. In the second place, the conversion tables which have been used are worked out on the accurate basis, assuming the velocity of propagation of the wave to be 2.9982×10^8 metres per second.

A Slight Alteration

The difference, however, between the kilocycles figures already stated and those on the basis of the more readily remembered 3×10^8 is only about 0.1 per cent., and in the majority of cases the frequencies employed are not accurate to this percentage. Hence the conversion of wavelengths to frequencies on such an accurate basis is both unnecessary and, in the present state of affairs, undesirable.

Convenience

The use of the approximate figure is in many ways more convenient. For example, 600 metres will be found to be 500 kilocycles, 300 metres is 1,000 kilocycles. In order, therefore, to assist our readers still further in this matter of speaking in frequencies, we shall in future give the frequency figure worked out on the approximate basis, and for a time we shall give the wavelength also in brackets. By this means we hope to familiarise our readers with the frequency nomenclature, and it will become common practice to speak of the 500 to 1,000 kilocycle band rather than the 300 to 600-metre band. It will readily be seen that the two terms are equally convenient.

A Possible Objection

It may be suggested that this action in adopting the approximate conversion is unscientific and undesirable. But the kilocycle nomenclature is bound to come, and the leading authorities in this country, in Europe and in America are all tending towards the adoption of the frequency basis. When this basis is finally adopted, then stations will be rated in terms of kilocycles, and the frequency will be adjusted to a round number of kilocycles.

Changes to be Expected

There is little to be gained by continuing to convert metres to kilocycles on the accurate basis in ordinary conversation, because when the change actually does come all the kilocycle figures will be rounded off into more or less integral values, so that we might just as well adopt these reasonable values at this stage of the proceedings. Many readers may find this change a little inconvenient at first. We have pointed out, however, that there are many advantages to be gained from the use of frequency, and, secondly, that the use of frequency is bound to come. A short table is appended giving the frequencies of the main British and Continental broadcasting stations. In the case of the British stations, the frequencies given are the actual frequencies as measured at our Elstree laboratories, and not those corresponding to the published wavelengths of the British Broadcasting Co., Ltd.

Frequencies of Broadcasting Stations.

The figures are given to the nearest kilocycle, and are arranged in order of frequency.

Station.	Call Sign.	Frequency kc.	Station.	Call Sign.	Frequency kc.
Eiffel Tower	FL	113 / 136	Newcastle	5NO	747
Amsterdam	PCFF	153	Madrid	EAJ7	765
Radio-Paris	SFR	168	Bournemouth	6BM	782
Daventry	5XX	187	Schenectady	WGY	789
Konigswusterhausen	LP	231	Manchester	2ZY	806
Geneva	HB1	273	London	2LO	838
The Hague	PCGG	280	Cardiff	5WA	852
Hilversum	HDO	283	Leeds	2LS	867
Lausanne	HB2	353	Petit-Parisien	—	869
Prague	PRG	540	Plymouth	5PY	887
Berlin	—	594	Hull	6KH	895
Aberdeen	2BD	606	Dundee	2DE	906
Swansea	5SX	620	Edinburgh	2EH	914
Birmingham	5IT	628	Nottingham	5NG	920
Ecole Superieure	PTT	655	Liverpool	6LV	952
Leipzig	—	660	Bradford	2LS	967
Belfast	2BE	683	Schenectady	WGY	970
Stockholm	SASA	702	Stoke-on-Trent	6ST	981
Rome	IRO	705	Sheffield	6FL	996
Glasgow	5SC	706	Radio-Toulouse	—	1,001
Munster	—	732	Brussels	SBR	1,131
			East Pittsburgh	KDKA	4,410

Ship and shore stations on 375, 500 and 666 kc. (spark).

A Use for Discharged Dry Batteries

Dry cells which have run down after giving good service are often thrown away as useless, since of course they cannot be recharged in the same manner as secondary cells. A method of giving a new and almost indefinite life to such cells is described in the accompanying article.

MANY ideas have been published from time to time for the utilisation of discharged dry cells. Most of these are found on trial to be unsatisfactory on account of the very temporary service rendered by the treated cells, the trouble taken to rejuvenate them usually not being worth while. Also, the current output is too small and dwindles too rapidly to be of any practical use for filament heating.

Low Cost

The treated cell here described does not suffer from any of these defects, and can be recharged as often as desired at a cost of less than 2d. each time. The voltage is just under 1.5, and the cell will deliver a steady current for hours at a stretch.

Causes of Failure

The chief reason for the failure of a treated cell is usually to be attributed not only to the method of treatment, but also to the construction of the cell itself. In the ordinary type of dry cell the centre carbon element is considerably smaller than its zinc container, to allow for the surrounding layer of impregnated plaster of Paris, as shown in Fig. 1. This results in a small current output, which is further reduced by the high resistance of the plaster layer, choked with the semi-insoluble waste product of the original charge.

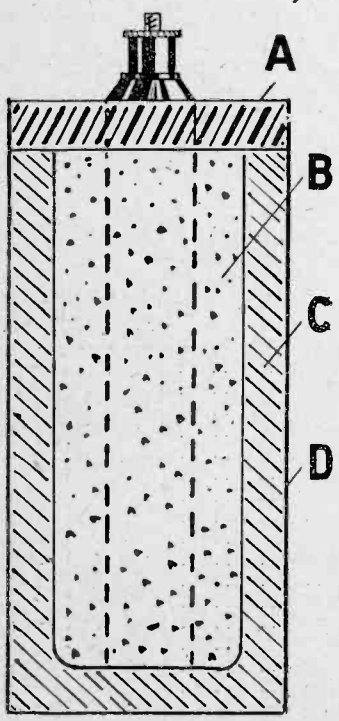
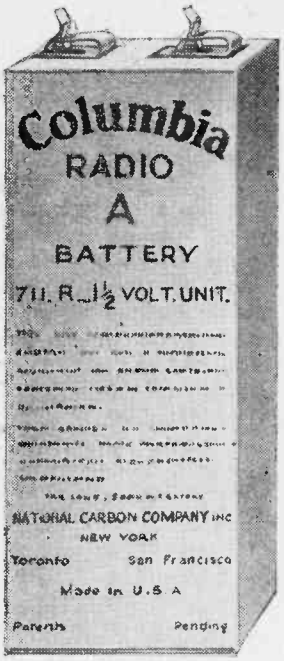


Fig. 1.—Here A is the sealing, B the carbon compound, C plaster of Paris, and D the zinc container.



A cell of the type described by the author as suitable for the treatment recommended.

Construction of Cell

Owing to the extensive use of dry batteries for filament heating, dry cells have been developed especially for this purpose. These are designed with regard to the necessity for a comparatively large and steady current output. This is achieved by constructing the cell on the lines indicated in Fig. 2. The zinc container is fairly large to commence with, and is entirely filled with the carbon compound, except for a thin layer of porous paper lining the case. The thickness of this layer has been exaggerated in the illustration for the sake of clearness; actually it will be found to be very little thicker than the zinc container.

Dismantling

This type of cell is particularly suitable for conversion into a wet battery, and as such it will give far superior results to the more conventional and old-fashioned porous pot Leclanche battery. Very little work is entailed in the process of conversion; the old zinc container, the sealing compound, and the paper must first be removed, taking care not to break the carbon compound block in so doing. Then soak the latter in cold water for a few hours, finally tying it round with a piece of rag or cloth, as illustrated in Fig. 3. A thin sock tied or sewn at the ankle, with the lower part cut off, makes a good sack for this purpose.

Re-assembly

A solution is now made up consisting of 3 or 4 ozs. of sal ammoniac to a pint of water. The sack is placed in a

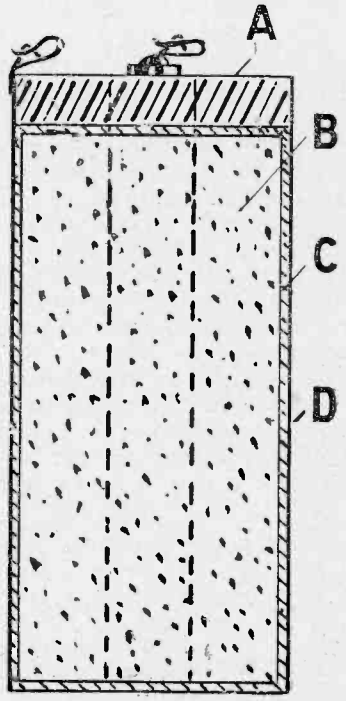


Fig. 2.—A similar type of cell to that shown in Fig. 1, in which C is a wrapping of porous paper.

large jam jar and enough solution poured in to cover it, leaving the carbon rod and terminal projecting. A piece of zinc will also need to be placed in the solution to form the negative element of the cell. For this purpose the old zinc may be

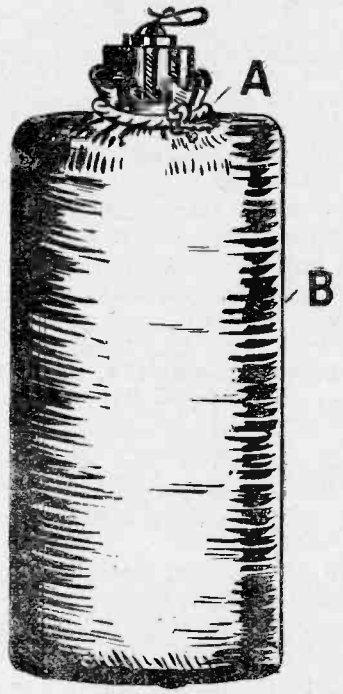


Fig. 3.—Showing how the carbon compound block may be tied up in a piece of cloth.

opened out and placed round the sack. This, though effective, is not, however, entirely satisfactory.

Local Action on Zinc

When the zinc is placed in the solution, what is known as "local action" takes place. Particles of impurities in the zinc set up minute electric currents, and it is thus eaten away by the same process as when the cell is actually in use. A better plan is to obtain a new zinc battery rod for a few pence and amalgamate it. After this, no action will take place except when the cell is working.

Amalgamation

When the rod has been in the solution for a few hours it will be found to be clean and bright. If it is now placed in contact with a globule of mercury the mercury will unite with it, and may be spread in an even coating all over the rod.

Advantages

This cell with an amalgamated zinc rod has an advantage over all other batteries and accumulators in the fact that it may be left unused for any length of time without deteriorating, and will immediately give its full voltage and current, with only the addition of sufficient water to make up for that lost by evaporation.

Suitable Cells

For the benefit of those who like to know the actual articles used in experiments, of which descriptions are given, it may be mentioned that the cells used by the writer were those known as "Columbia Radio A Batteries," but any cell of the new type will do for the purpose.

Discharge Current

One converted battery will supply current for a valve of the one-volt 0.25 amp. class for several weeks of average use. Two in series will light a valve of the .06 type for about two months at each charge.

INVENTIONS AND DEVELOPMENTS

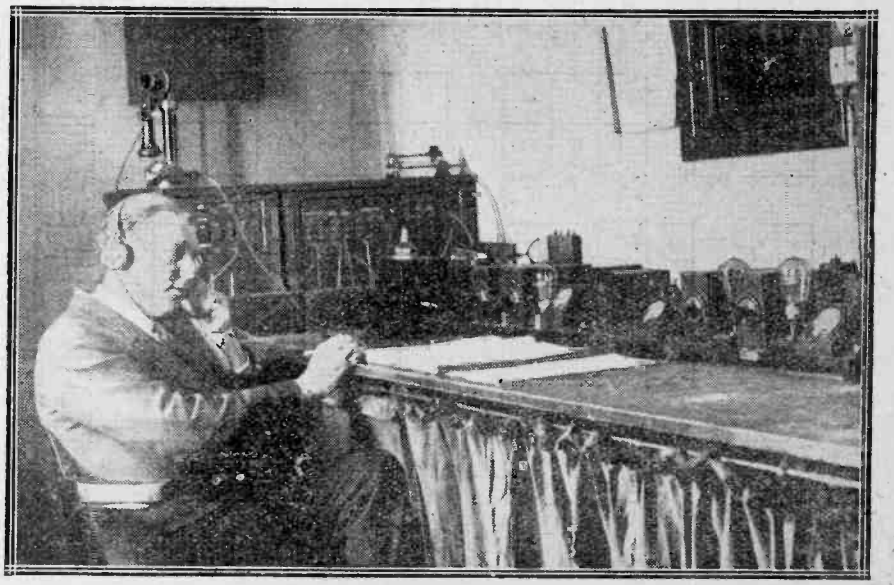
(*Continued from page 77*)

types. The anode to filament impedance is given as 65,000 ohms, and the amplification factor as 14. The grid to filament impedance is given as 4,000 ohms only. If this is correct it is, of course, a radical departure from the existing type of valve, in which the grid to filament impedance is nearer 400,000 ohms.

Reduced Cost

If this type of valve proves satisfactory in actual use (and it has certainly given every indication that it may do so), it will result in the complete elimination of the exhausting process in valve manufacture. Since the exhaustion of the ordinary type of valve accounts for something like 50 per cent. of the actual cost of manufacture, it will be seen that a very considerable reduction in the price of valves would result if this invention became generally used. The filament is reasonably robust, but even if it should be broken, it can easily be replaced by undoing two screws and inserting a fresh length.

The whole valve is mounted on a four-pin socket, which is made to fit the American valve holder, and is provided with a cover to shield it from draughts. The assembly of the complete valve in a valve-holder of the American type is shown in the smaller photograph.



In the control room of the Sheffield Broadcasting Station.

THE WIRELESS EXHIBITION

We give below a list of Exhibitors and Stand Nos. at the Wireless Exhibition being held at the Horticultural Hall from October 10 to 16, and a general plan of the hall showing the arrangement of the stands.

BERTRAM DAY & Co., LTD., 9, Charing Cross, S.W.1. (69).

BRANDES, LTD., 296, Regent Street, W.1. (34.)

BRETWOOD, LTD., 12–18, London Mews, Caple Street, W. (63),

BRIT. ENGIN. PRODUCTS Co., Windsor House, Victoria Street, S.W.1. (51).

BROWN, LTD., S. G., Victoria Road, North Acton, W. (9, 10, 11).

BULLER, W., 28, Holywell Lane, E.C.3. (13).

C. A. C., LTD., 10, Rangoon Street, E.C.3. (48, 49).

CASSELL & Co., LTD., La Belle Sauvage Yard, Ludgate Hill, E.C.4. (30).

CLEARTRON RADIO, LTD., 1, Charing Cross, S.W. (44).

COLLINSON PRECISION SCREW Co., LTD., Provost Works, Macdonald Road, Walthamstow, E.17. (62).

CURTIS, LTD., PETER, 75, Camden Road, N.W.1. (27, 28, 29).

ENERGO PRODUCTS, LTD., 2, Olivers Yard, E.C.1. (25, 26).

ENGINEERING WORKS, Thurlow Park Road, W. Dulwich, S.E. (70).

FELLOWS MAGNETO Co., LTD., Cumberland Place, N.W.10. (12, 17, 18, 23).

FINSTON MFG. Co., LTD., 2, Finsbury Ave., E.C.2. (61).

FORMO Co., Crown Works, Cricklewood, N.W.2. (71).

GRAHAM & Co., R. F., Norbiton Engineering Works, Kingston-on-Thames. (58).

HINDERLICH, A., 1, Lechmere Road, N.W.2. (3).

IGRANIC ELECTRIC Co., LTD., 149, Queen Victoria Street, E.C. (32, 33).

J. R. WIRELESS Co., 6–8, Rosebery Avenue, Clerkenwell, E.C. (7).

J. W. B. WIRELESS, LTD., 320a, Euston Road, N.W.1. (65, 66).

LOVELAND BROS. & SONS, Crescent Place Works, Norbury, S.W.16. (52).

LOWENADLER, F. W., Ely Place, Holborn Circus, E.C. (1).

MICROHM ENGIN. Co., 1a, College Street, E.9. (57).

MOTORISTS PURCHAS. ASSN., 62, Conduit Street, W.1. (15, 16).

NEW LONDON ELEC. WORKS, LTD., East Ham, E.6. (40-41).

NEW TIMES SALES Co., 61, Leather Lane, E.C.3. (14).

ORMSBY & Co., L., 28, Page Street, Westminster, S.W.1. (75).

PENTON ENGIN. Co., 15, Cromer Street, W.C.1. (73.)

PETTIGREW & MERRIMAN, LTD., 122, Tooley Street, S.E.1. (67, 68).

PORTABLE UTILITIES Co., LTD., Fisher Street, Southampton Row, W.C.1. (42, 43).

RADIARC ELEC. Co., LTD., Bennett Street, Chiswick, W.4. (22).

RADIO PRESS, LTD., Bush House, W.C.2. (45.)

RADIO RECEPTION Co., 110, Wilton Road, Victoria, S.W. (56).

RAPINIT, LTD., 39, Gretin Road, Earlsfield. (31).

READ & MORRIS, 31, Eastcastle Street, Oxford Street, W.1. (72).

REFLEX RADIO Co., 45, Stamford Hill, N.16. (4).

REIGATE RADIO Co., Leigh, Reigate, Surrey. (6).

ROTAX, LTD., Willesden Junction, N.W.10. (35, 36).

SCLERINE CRYSTAL Co., 4a, Aubery Road, Walthamstow, E.17. (5).

SEAGULL, LTD., 5a, Newcastle Place, Edgware Road, W.2. (24).

SEL-EZI WIRELESS SUPPLY Co., LTD., 6, Greek Street, Soho, W.1. (20, 21).

SERENADO MFG. Co., LTD., 22, Paper Street, E.C. (19).

SEXTON-BARNES, LTD., 61, Borough Road, S.E.1. (53).

SILVERTOWN Co., Silvertown, E.16. (46, 47).

SIMON BROS., LTD., 21, Panton Street, Haymarket, S.W. (2).

SPARKS RADIO SUPPLIES, 43, Gt. Portland Street, W.1. (55).

STELLA PRODUCTS, LTD., 31, Wybert Street, N.W.1. (8).

TRADER PUBLISHING Co., LTD., 139, Fleet Street, E.C. (50).

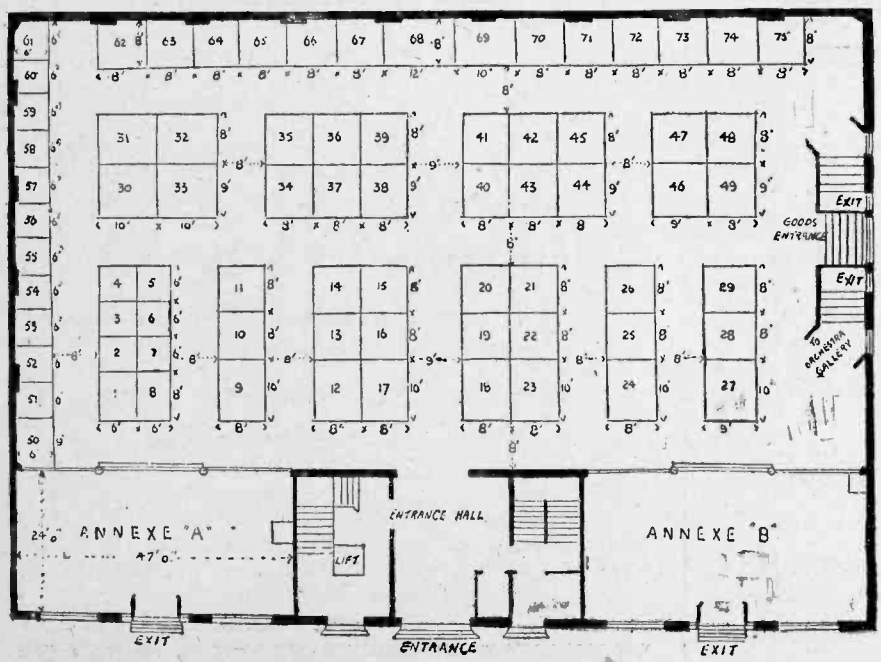
WATMEL WIRELESS Co., 332, Goswell Road, E.C. (54).

WESTERN ELECTRIC Co., LTD., Connaught House, Aldwych, W.C.2. (37, 38, 39).

WOODS, H. W., 15–16, Railway Approach, London Bridge, S.E.1. (64).

ZEITLIN & SONS, 41, High Holborn, W.C.1. (74).

Plan of the ROYAL HORTICULTURAL HALL.



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THE VICTORIA VERNIER DIAL

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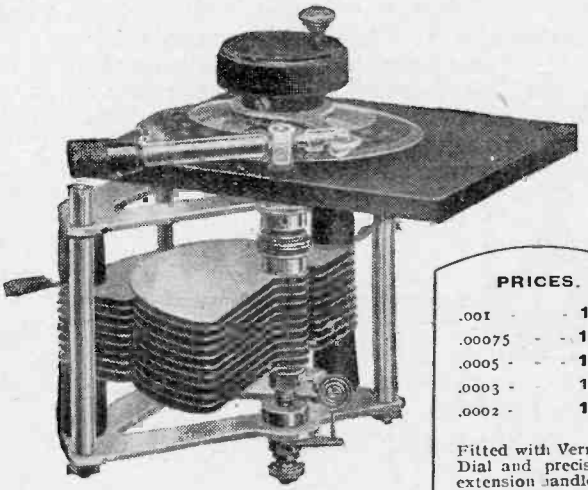

For purposes of illustration, section of panel is not shown in correct position.

WE said: "Whenever a better condenser is produced the 'Victoria' will make it." Here is one.

PRICES.

.001	16/-
.00075	15/6
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.0003	14/-
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Fitted with Vernier Dial and precision extension handle as illustrated, 2/6 extra on prices quoted above.

From your Dealer.

VICTORIA ELECTRICAL (Manchester) LTD.

Victoria Works, Oakfield Road, Altrincham, Cheshire.

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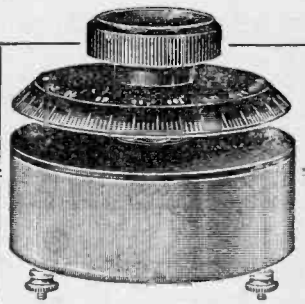

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.00025 „ - - „ 6/8
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.001 mfd - - each 8/4
.0005 „ - - „ 7/6
.00025 „ - - „ 7/6

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OCTOBER 10th to 16th

Royal Horticultural Hall

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Wireless News in Brief.

Mr. Ford and the Post Office. Having defied the postal authorities to enter his house under the provisions of the Wireless Telegraph Act, Mr. R. M. Ford, of Park Row, Albert Gate, W., wrote to the Postmaster-General offering—

"to keep any appointment you may see fit to make at this address, when I shall be ready to give your spies a fitting and hearty reception to an Englishman's home."

As a result, two representatives of the Post Office went to the house.

Answering one of the officials, who asked if Mr. Ford declined to allow them to examine any wireless apparatus the premises might contain, Mr. Ford said he did not admit that he had any wireless apparatus, but he would not allow a search to be made.

The officials then withdrew. A further visit has now been made by a Post Office official and a policeman. On this occasion they found nothing but an aerial, of which they took possession.

* * *

The New Wavelength Tests. In a short talk broadcast recently, Capt. Eckersley stated that as a result of the tests carried out by European broadcasting stations on wavelengths especially allotted for the purpose of these tests, it has been provisionally decided at the subsequent Conference at Geneva to make the necessary changes in the allotment of wavelengths in November or December of this year. Capt. Eckersley laid some stress on the fact that the European countries represented at Geneva have in mind an ideal of the internationalisation of wireless broadcasting, while the B.B.C. in particular are equally anxious to give the utmost service to the crystal user. It seems probable, therefore, that the general tendency in the future of broadcasting in Europe will be towards the establishment of a small number of comparatively high-power stations.

* * *

More Broadcasting. An extension of broadcasting hours for the benefit of night workers, hospital patients, and others who are debarred from listening during the evening, is being made by the B.B.C.

As an experiment, the B.B.C. are transmitting from Daventry additional programmes from 11 a.m. to 2 p.m. daily, except on Saturdays and Sundays. Programmes consist of studio performances relayed from London, and of outside broadcasts taken from London restaurants and places of entertainment. No gramophone records are included.

* * *

Broadcasting in Italy. Messrs. Marconi's Wireless Telegraph Company, Ltd., have received an order for a broadcasting station in Rome of a larger power than the one which was erected by them there some time ago, and which is now working. As soon as the larger station, which is a 12 kw. station, is in operation, the smaller, a 6 kw. station, will, we understand, be removed to Naples. Naples will thus be added to the foreign stations available for British long-distance listeners.

* * *

Wireless in Greenland. The new wireless station at Julianehaab, in South Greenland, recently established direct connection with the Lyngby Station, in Denmark, for the first time. Julianehaab Station is the largest of the four wireless installations which Denmark has been erecting during the past twelve months; it is intended for direct communication between Copenhagen and the Faroe Islands.

The broadcasting station at Angmagssalik, on the south-east coast of Greenland, was opened in July, and will be used for the transmission of official messages via Iceland, Godhavn and Godthaab; the other two wireless stations in Greenland, are intended for communication with Julianehaab. That at Godhavn is already open, and that at Godthaab is expected to be completed very soon.

* * *

Mr. Guy Burney, late Managing Director of the Sterling Telephone & Electric Co., Ltd., has opened offices at Morning Post Building, 346, Strand, London, W.C.2 (telephone: City 2373). Mr. Burney proposes to interest himself in the development of patented articles—mechanical, electrical, and other kinds—and he will be pleased to hear from his old friends in the industrial world, and others desirous of placing any new invention before him.

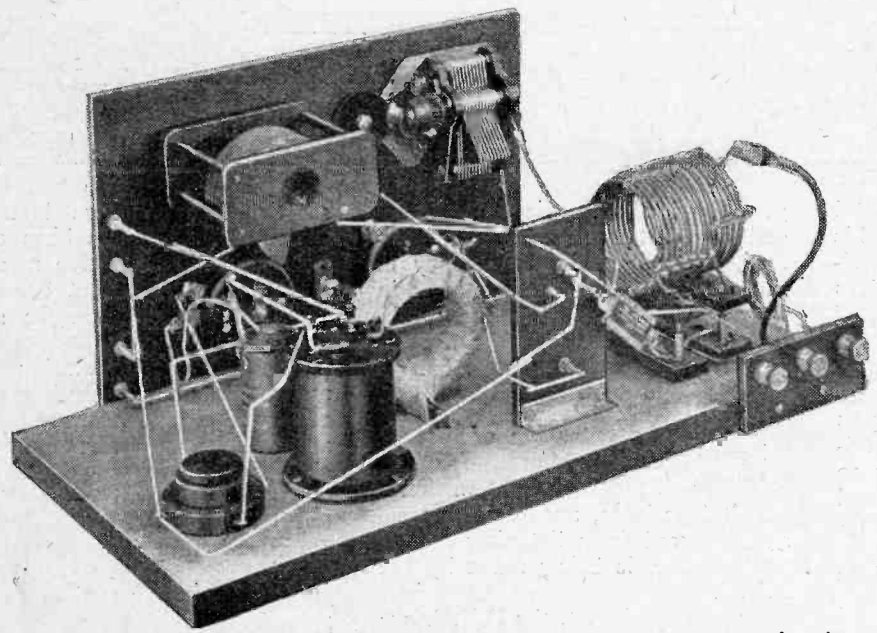
* * *

Wireless and Farmers. According to a recent survey by the United States Department of Agriculture, the increase in the number of farms using wireless sets, from 365,000 in 1924 to over 550,000 in the present year, is due to the need for prompt market information in merchandising farm products, the educational value of wireless and its entertainment features. The growth in the use of broadcasting by the agricultural population of America is a notable point in the phenomenal development of wireless communication of the last few years.

A SIMPLE SHORT-

By C. P. ALLINS

With the approach of longer eve
improvement to be expected in
many people will be turning th
struction of a short-wave receiu
The receiver described here has
in its simplicity of constructio



This view shows clearly the connections to the valve holder and how the air-core choke coil is mounted.

THE following article describes a short-wave receiver with interchangeable coils. Capacity reaction is used, thus doing away with swinging coils and their disadvantages as regards obtaining fine adjustments, and also the marked effects they produce on tuning.

This time last year saw the amateur who was interested in short-wave reception intent on the design of a receiver that should go down to 50 metres (5,996 kc.), so that he might receive the transmissions from KDKA which were being sent out on a wavelength in the neighbourhood of 60 metres (4,997 kc.).

Shorter Waves

This year, with the amazing developments of the last few months with regard to long-distance daylight communication on 20 metres (14,991 kc.), sees old sets being redesigned. If we examine the sets used last year for 50-metre work, we find in many cases that they are unsuitable for 20 metres. Either the tuning inductances are fixed, giving only a limited tuning range, or else undesirable self-capacity is found to be present, setting a limit to the lowest wavelength that can be received, or both. How serious this problem of self-capacity can be is shown by a receiver that the writer had used with great success down to 60 metres, American amateurs, for instance, on the 75-80-metre (3,998-3,748 kc.) band being received at great strength.

Stray Capacities

On attempting to get down really low, it was found impossible to get below 20 metres, even with a two-turn coil, and, further, it was found that with this coil a .0003 μF tuning condenser only gave a tuning range of from 20-26 metres (14,991 to 11,532 kc.). A rough consideration of the components in use led to the conclusion that the stray capacities present in the circuit due to the minimum capacity of the tuning condenser, the valve-holder and valve, the coil mounts and wiring, amounted to about 100 $\mu\mu$F, and on calculating the effect of this on the tuning range it was found to tally approximately with the figures obtained.

Design of Receiver

It was therefore decided entirely to re-design the receiver and to rebuild it on improved lines. No cabinet was to be employed, as, at the very high frequencies involved, it is better to have the field of the inductances as free as possible. The size of the panel, too, was to be kept down, and though this possibly might have been drilled out with some slight advantage as regards reducing the amount of solid dielectric present, and also perhaps reducing the capacity between component and component, it was decided that the effect would be so small as hardly to warrant the extra work involved.

Special Features

The completed receiver is shown in the photographs, and reference to these will help to make clear

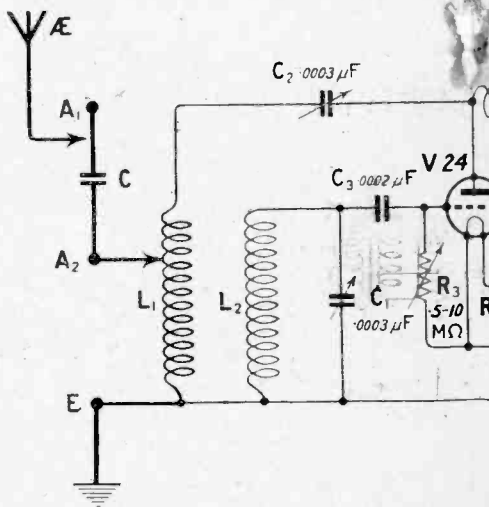


Fig. 1.—In this circuit diagram L3 is an ai
controlled by means of the v

WAVE RECEIVER

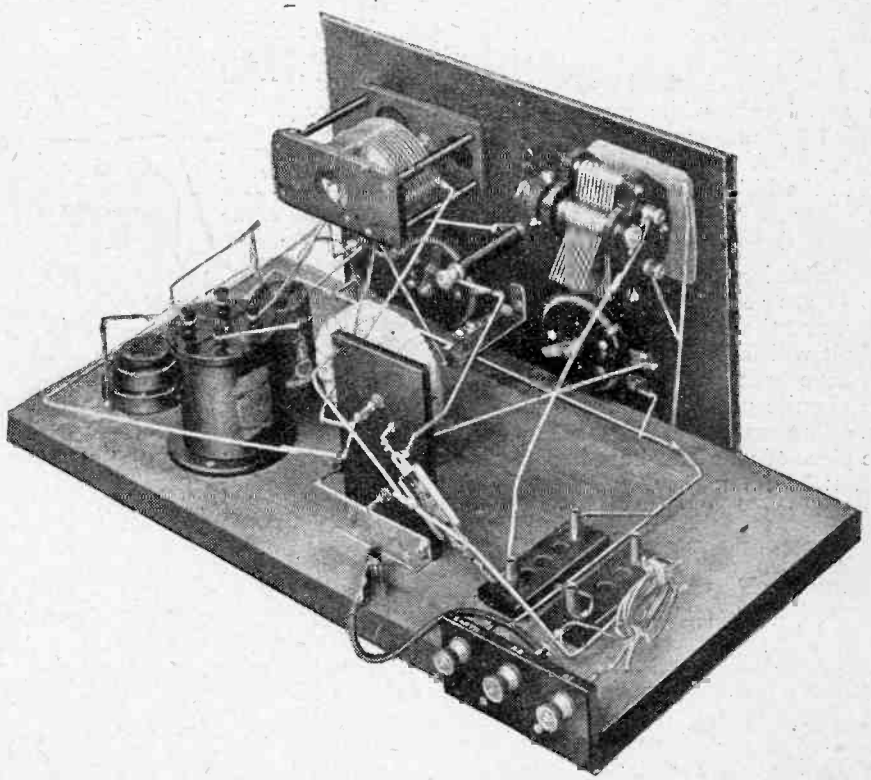
SON (6YF).

nings and the consequent long-distance reception, eir attention to the con- er for the coming winter. s much to recommend it n and ease of operation.

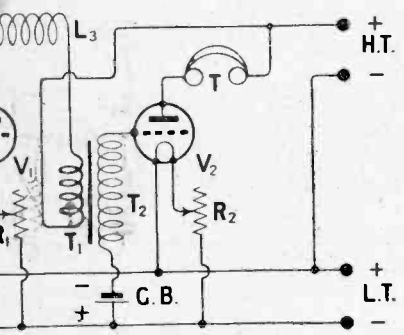
some of the points in its design which may here be discussed. Viewing the receiver from the front, the chief point to note is that only the H.T. and L.T. terminals are carried on the panel. The telephones are placed in circuit by means of a plug and jack, the jack being conveniently placed in the centre of the panel. The left-hand dial is that of C1, the tuning condenser, and has a 20-1 reduction gear incorporated. Even with this, tuning is found to be somewhat critical below the 40-metre (7,496 kc.) mark. The right-hand dial controls C2, the reaction condenser, which is also a geared type with insulated spindle. The variable grid-leak, which is adjusted by the knob in the centre, is found of great use in enabling a perfectly smooth reaction control to be obtained.

Terminals

Looking at the receiver from the back, it will be seen that the aerial and earth terminals are carried on a small strip of ebonite on the right-hand side. This enables the aerial and earth leads to be kept well out of the way, so that (in the case of the aerial lead, and perhaps also the earth lead if a long one) they will not be so near to the body as to cause the introduction of variations in tuning whenever the experimenter moves nearer to or further from the set. It will be noted that two aerial terminals are provided, and the odd-looking object connected between them is a small series condenser, the construction of which will be dealt with later in the article. The two coils L1 and L2 are mounted close together, and the clip shown is used to connect the aerial to tappings on L1, small pieces of copper wire being soldered to the coil for this purpose. The short connection between one side of L2 and the grid of the detector is clearly shown. This could not have been made shorter without bringing the valve mounting too close to the field of the coils. As will be seen, a V24 valve is used, this type being particularly suited to the reception of very short waves.



In order that the receiver may operate satisfactorily on short wavelengths the wiring must be well spaced out.



r-core choke coil, and reaction is ariable condenser C2.

Hand Capacity

In constructing this receiver, the scheme of wiring should be closely followed, as it has been spaced out as widely as possible without making connections unduly long. The shielding of the tuning condenser is found of great use in helping to eliminate hand-capacity effects, and this is also helped by the position of the earth and L.T. leads close to the bottom of the panel. Filament rheostats of the dual type are used, so that either bright- or dull-emitter valves may be used, while a single dry cell is permanently connected in the grid circuit of the L.F. amplifying valve,

though with some valves two or three may be used with advantage.

Turning to Fig. 1, the circuit diagram, those who have read the article on the "Novel Three-Valve" receiver, described by the writer in *Modern Wireless* for May, 1925, will see that the circuit used is very similar to that used in this receiver. Instead, however, of a swinging coil being used for L1, this is fixed, and a variation of aerial coupling is obtained by means of an aerial tap, while reaction is controlled by means of a variable condenser. A choke coil is connected in the H.T. + lead, as shown at L3.

Components

The following components and materials are required to build this receiver, and those who wish exactly to copy it will find that the makers' names have been given :—

One ebonite panel, 12 in. x 8 in. x ¼ in. (Paragon).

One piece of wood for base-board, 17½ in. x 8¾ in. x ¾ in.

One .0003 μF variable square-law geared type condenser (Collinson).

One .0003 μF variable square-law geared type condenser (Success).

One .0002 μF fixed condenser (Therla).

One low-frequency transformer (Success).

One radio choke coil, or ¼-lb. No. 24 d.c.c. copper wire.

One V24 valve and holder (Marconi Scientific Instrument Co.).

One antiphonic valve - holder (Burndept Wireless, Ltd.).

Two dual type filament resistances (Burndept Wireless, Ltd.).

One variable grid-leak (Bretwood).

One single-circuit jack (Elwell).

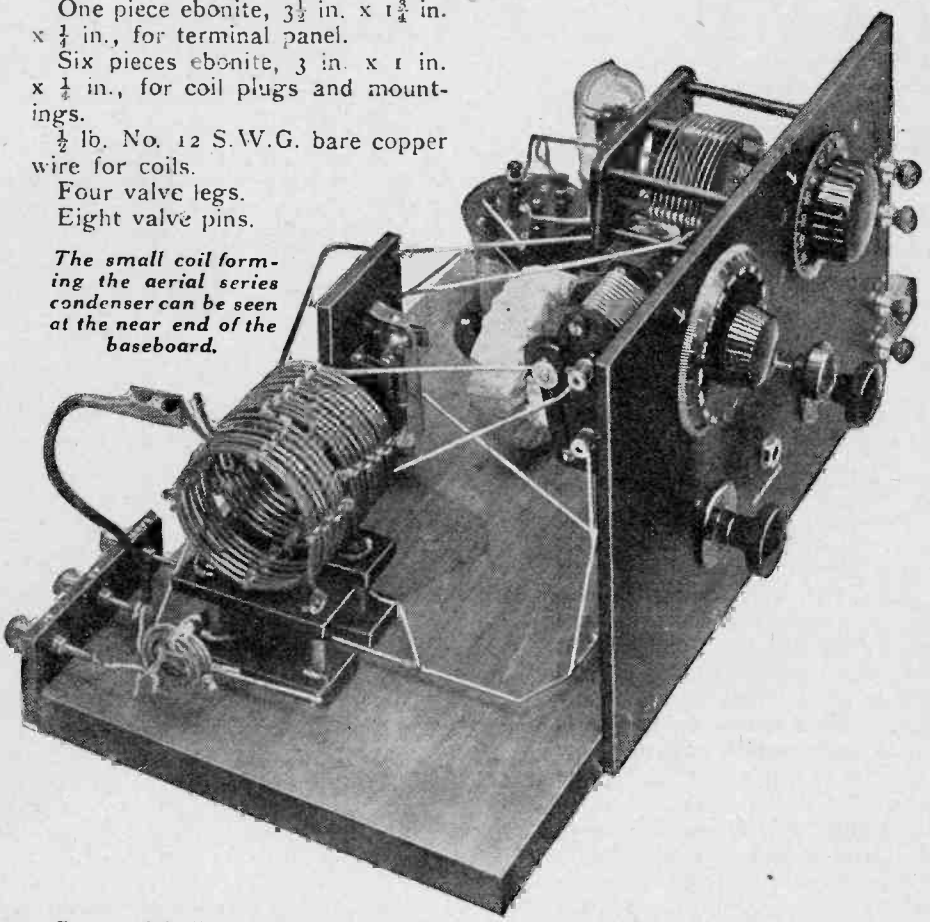
One piece ebonite, 3½ in. x 1¾ in. x ¼ in., for terminal panel.

Six pieces ebonite, 3 in. x 1 in. x ¼ in., for coil plugs and mountings.

½ lb. No. 12 S.W.G. bare copper wire for coils.

Four valve legs.

Eight valve pins.



The small coil forming the aerial series condenser can be seen at the near end of the baseboard.

Seven nickelled W.O. type terminals.

One spring clip (Burndept Wireless, Ltd.).

One dry cell for grid bias and quantity of square tinned copper wire for connections.

One set Radio Press panel transfers.

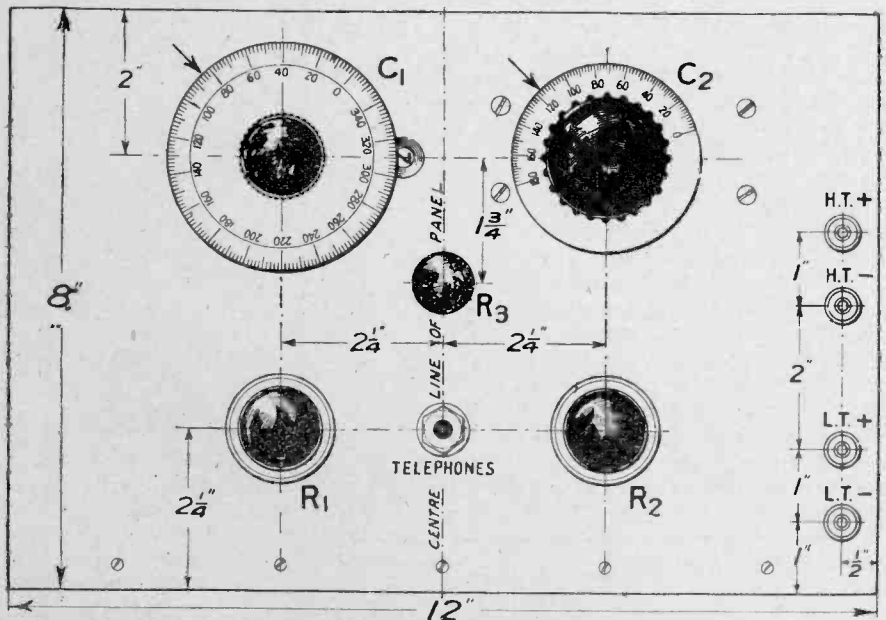


Fig. 2.—The dimensions given above for marking out the panel may be used to obtain the layout of the actual set described.

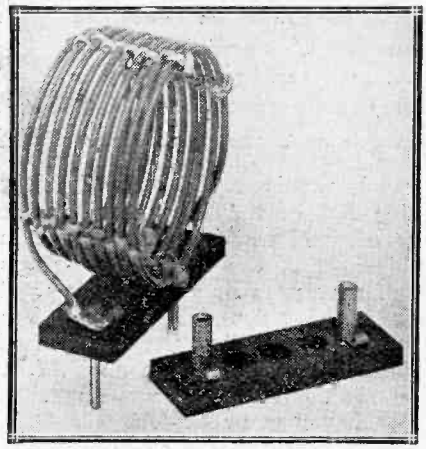
Ebonite Panel

A dimensioned panel lay-out is shown in Fig. 2, and this will assist in determining the position of the components on the panel. The holes for fixing the components having been drilled, the panel transfers should be applied next, after which, if necessary, the panel may be wiped over with a slightly oily rag to give it a rich black surface, taking care to wipe off any excess of oil, otherwise dust will collect on the panel, to the detriment of its appearance and insulation. This having been done, the components and terminals which go on the panel may be mounted.

Coils and Mounting

The construction of the coils should next be undertaken. Those shown were wound on a former about 2½ in. diameter and sprung off. They were then made self-supporting by binding the turns together with string, the string

having previously been soaked in paraffin wax so as to render it immune from damp. The coil mounts or plugs are pieces of ebonite, 3 in. x 1 in. x ¼ in., in which two valve legs are fastened



Holes may be drilled between the sockets, if desired, to reduce the amount of solid dielectric present.

2 in. apart with a soldering lug under each lock-nut. The ends of the coil go through two holes outside the valve legs and 2½ in. apart, and a short length of wire is soldered on to the lug and the coil, thus making connection with the valve legs. The coil-holders are made from similar pieces of ebonite with valve sockets into which the legs are inserted. Connections are again made by the use of lugs. The valve sockets may either be tapped into the ebonite strips or else fastened by means of lock-nuts. In the latter case the strip must be carried clear of the base-board when mounting it, by means of washers.

Holes to Reduce Capacity

The strips have three ⅜-in. holes drilled in them, as shown in the above photograph, so as to reduce the amount of dielectric between the pins or sockets, thus not only reducing the capacity of the mounting but also reducing losses to a certain extent.

Coil Sizes

Four coils are required to cover the wavebands between 70 and 15 metres (4,283 and 19,988 kc.), and with the former of the size given the numbers of turns required are 10, 7, 5, and 4. For wavelengths above the topmost range of the 10-turn coil, other coils would need to be constructed. In order that the aerial may be connected as desired, small pieces of copper wire are soldered to the coil at a couple of points in the case of the larger coils, and in one place only (not at the centre) with the smaller ones. By reversing the coil in the holder the proportion of the coil that is included in the aerial-earth circuit may be varied, thus avoiding the need for more than one tap.

Next mount the V24 valve-holder on a small piece of angle brass by means of two 6 B.A. screws passed through the corners, two holes being drilled in the angle so as to allow these to come through. Two other holes allow of wood screws fixing the whole on the base-board.

The Choke Coil

The radio choke coil employed was made by winding 150 turns of No. 24 d.c.c. copper wire honeycomb fashion on a former of the spoke type. The coil was then dipped in molten paraffin wax and the surplus wax carefully shaken out. When cold the whole was wound over with empire tape and fixed to a small strip of ebonite, and mounted on the base by means of two ½-in. wood screws. It should be mounted as shown with its axis at right angles to the axis of the tuning coils, so as to prevent interaction between their fields.

Aerial Series Condenser

Lastly, the small terminal panel carrying the two aerial terminals and the earth terminal may be constructed and mounted in position. The series condenser mounted between terminals A1 and A2 consists of about 18 in. of No. 18 gauge d.c.c. copper wire (previously waxed to exclude moisture) twisted together, the end of one wire being soldered to A1 and the end of the other to A2. If the aerial is such that it is difficult to make the set oscillate, it may possibly be found necessary to reduce the length of the two wires forming this condenser, while if oscillation is readily obtainable a little more may be used. The chief point is that when using it in the aerial circuit the set should oscillate over the whole waveband covered by the smallest coil.

Wiring

All the components that go on the base-board may now be mounted and the panel fixed thereto. The wiring diagram shown in Fig. 3 shows the relative positions they should occupy, and also gives the wiring scheme, which should be carefully followed. All leads should be spaced well apart, especially any that have to run parallel for any distance. The wiring is all perfectly straightforward, and the only point that requires mention in any way is the lead from the reaction con-

(*Continued on page 99.*)

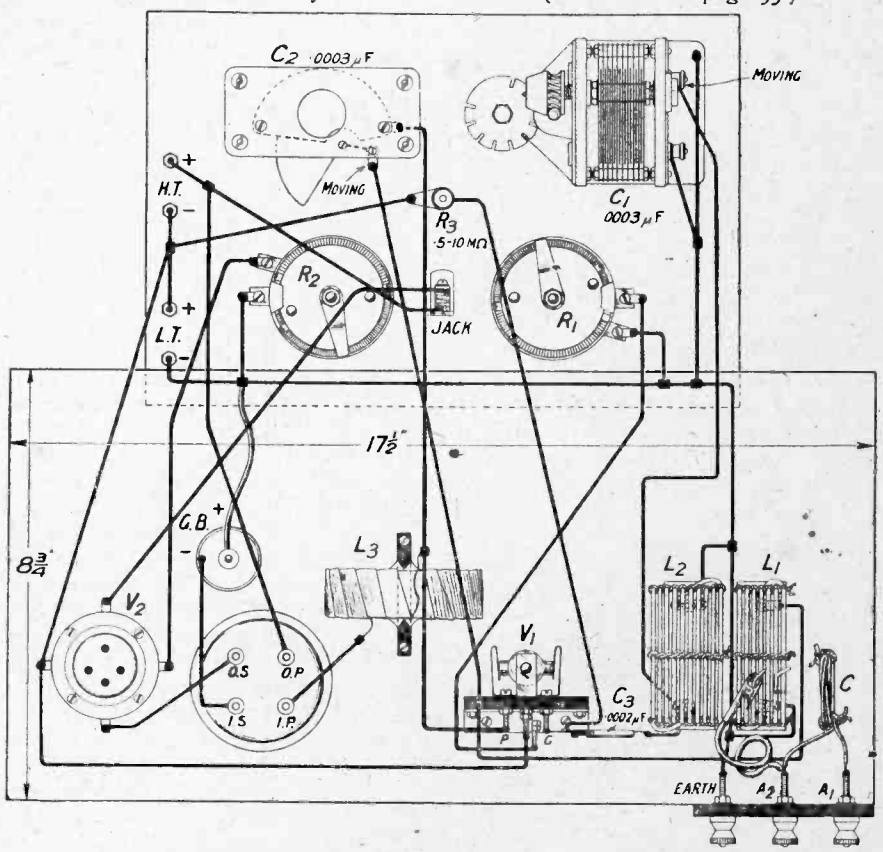
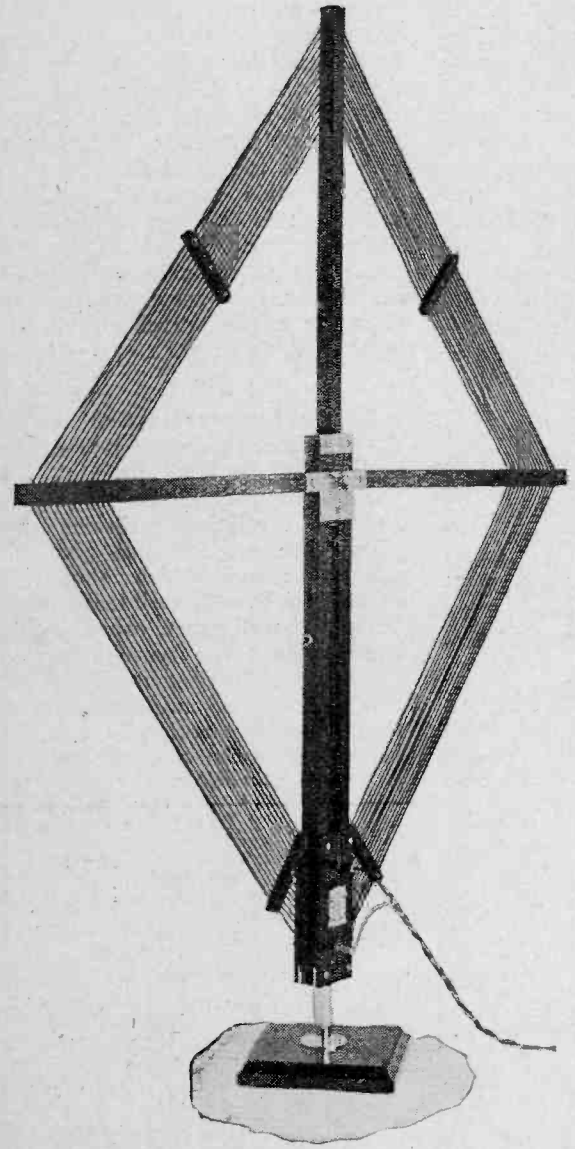


Fig. 3.—The components on the baseboard are well spaced, and the choke coil, L3, is mounted at right angles to L1 and L2.

SOME NOTES ON FRAME AERIALS

By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., Staff Editor.

Users of frame aerials who have been at a loss to account for the lack of directional properties often exhibited by this form of aerial will find that these notes will go some way to explain the reason for the phenomena encountered.



A frame aerial of a type commonly used for the broadcast frequencies.

WITH the increasing use of super-heterodyne receivers and other forms of portable sets, frame aerials have recently come into prominence for amateur receiving equipment. One of the advantages which is claimed for the use of the frame aerial is that the directional effect may be utilised in reducing interference from unwanted stations.

Lack of Directional Effect

It is often found, however, in practice, that this directional effect, although present, is not sufficiently marked to enable the full advantage to be obtained. The rotation of the frame certainly produces a variation in the signal strength, but it is very often impossible to reduce the signal strength actually to zero. If any undesired station is to be eliminated it is, of course, essential that there should be some position of the frame at which the signal strength is zero, so that unless the frame is operating satisfactorily it will not counteract the interference.

Response of a Frame to a Wireless Wave

Now there are reasons for this state of affairs, which will readily become apparent if the action of the frame is considered in a little more detail. A frame aerial is often spoken of as responding to the magnetic field of the wireless waves. Although this is perfectly correct, a frame aerial may be considered from the same point of view as an ordinary aerial, that is to say, as responding to the electrostatic field. The electric and magnetic fields are merely different manifestations of the same phenomenon, so that, for the sake of consistency, many people prefer to regard a frame from the electric point of view rather than the magnetic.

Effect of Incoming Wave

Let us take first of all a simple loop aerial such as is shown in Fig. 1. Here an electric wave passing this aerial will affect the side AB of the loop as a simple aerial, and will induce voltages in this side of the loop. The waves will now pass over the frame, and since the sides AC and BD are parallel to the direction of travel of the wave, there will be no E.M.F. induced. When the wave reaches CD, however, an E.M.F. will again be induced in this leg of the frame, acting as a simple aerial.

Difference of Phase

These two E.M.F.'s which have been induced in the frame will produce currents in opposite directions round the frame, and will thus tend to cancel each other. When the frame is in the position shown, however, the electric wave reaches the side AB before it reaches the side CD. There is thus a slight phase difference between the two E.M.F.'s, so that they do not completely cancel each other, and a small resulting E.M.F. is left. If the frame is turned at right angles to the direction of the wave, then the waves will affect the sides AB and CD simultaneously, so that

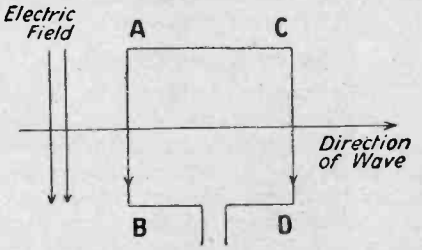


Fig. 1.—When the frame is in the plane of the wave there is a maximum phase difference between the E.M.F.'s in AB and CD.

there will be no phase difference, and the two E.M.F.'s will actually cancel each other. In this position, therefore, the reception on the frame will be a minimum.

Loop and Frame Aerials

If now instead of having a simple loop of wire we have a frame consisting of several turns of wire, then each individual turn will act in the manner just described, and the resulting E.M.F. will therefore be several times as great as it would

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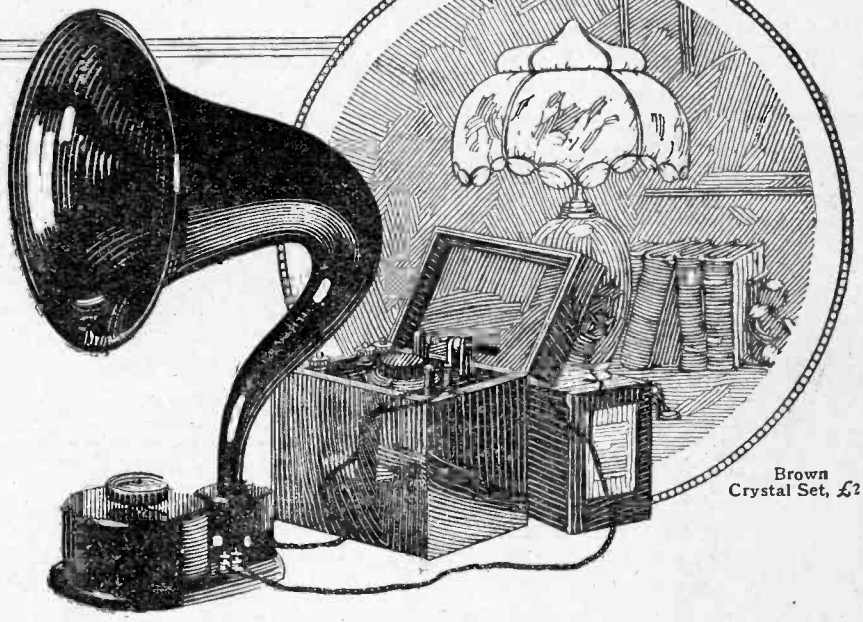

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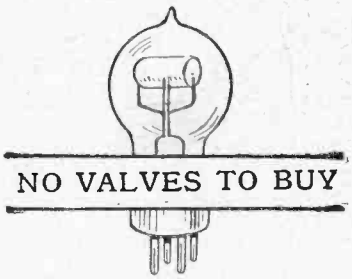

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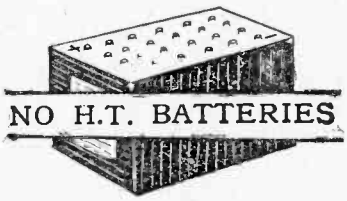

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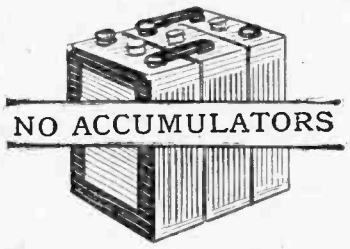

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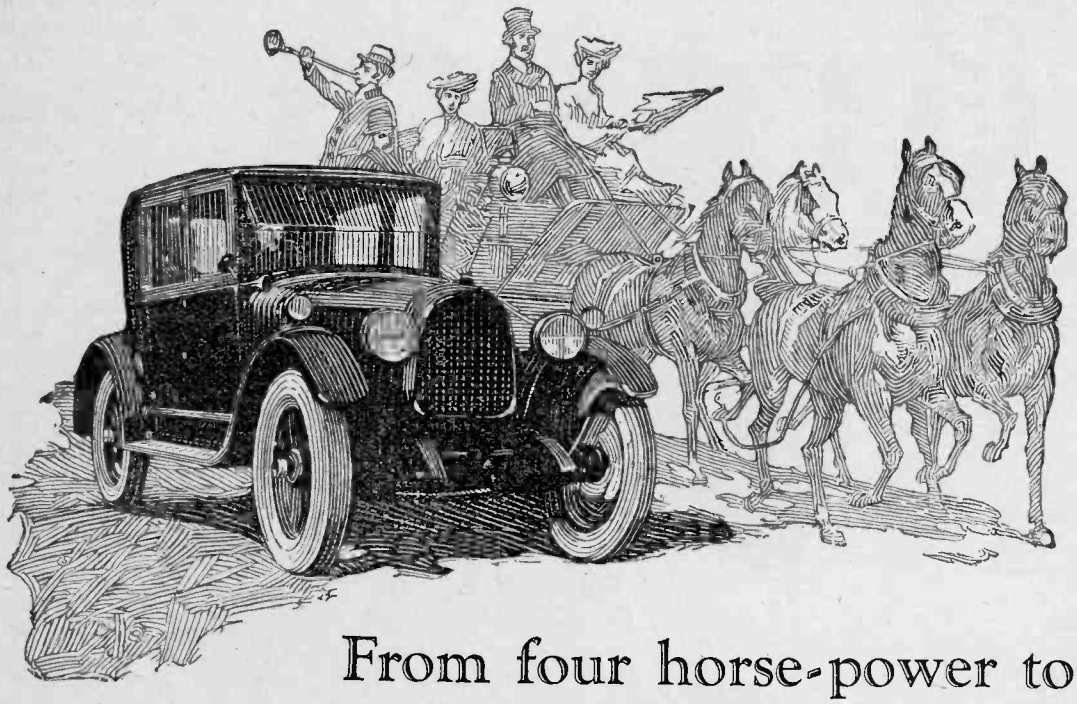

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The Wuncell puts life first and current consumption second. In spite of this, its wattage is still less than one-sixth of any bright emitter valve. That is to say, any six-volt accumulator which might, for example, have given 20 hours at a charge with bright emitters would give 120 hours using Wuncells.

The abnormally long life of the Wuncell Valve is due to its special filament, manufactured under a patent process known only to Cossor. Instead of being whittled down, as in most dull emitters, it is actually built up layer upon layer until it is as stout as that used in any standard bright emitter, and when in use it merely glows at a temperature not exceeding the embers of a dying match.

Its prolific output of electrons—harnessed to the well-known Cossor principles of construction—ensures a sensitivity which has no counterpart in any make of valve. For the first time since the Dull Emitter appeared on the market, users are saying that here at last is a perfect match in performance for the best bright emitter valve ever made.

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Gilbert Ad. 365

be for a simple loop. The question of the best size of frame and the best number of turns, etc., is outside the scope of this article, but may possibly be discussed at some future date.

From the point of view of the action of a frame, however, it may be considered as a simple loop, such as is shown in Fig. 1.

"Aerial" Effect

The E.M.F.'s set up in the sides AB and CD of the simple loop have been seen to combine to produce a resultant current round the loop itself, this being the ordinary loop effect, which is directional.

The various parts of the loop or frame, however, have a certain capacity to earth, and the E.M.F.'s set up by the action of the wave

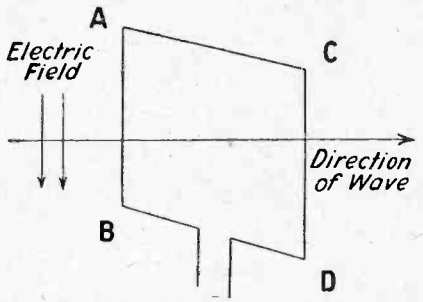


Fig. 2.—When the frame is at right angles to the plane of the wave, E.M.F.'s in AB and CD are in phase and reception is zero.

will produce currents through this capacity. The arrangement thus behaves as an aerial connected to earth through a small series condenser.

This aerial is not tuned to the frequency of the wave, so that this capacity current is normally quite small. It is, however, independent of the direction of the signal, so that as the frame is rotated towards the zero position, the legitimate "frame" current grows smaller and smaller while the "aerial" current remains constant.

Thus signals will still be heard when the frame is in the zero position, and, instead of a crisp zero, a more or less flat minimum will result.

Reduction of "Aerial" Effect

The currents set up by this aerial effect produce voltage variations between the grid and filament of the first valve of the receiver, as illustrated in Fig. 3. In order to neutralise this effect, the middle point of the frame is connected direct to earth. The capacities of the two ends of the frame to earth are then approximately equal, so that the grid and filament of the first valve are at practically the same potential as far as these capacity currents are concerned. Fig. 4 illustrates such a circuit.

Filament Battery Not Earthed

With a set operating directly from a frame, as in Fig. 4, the

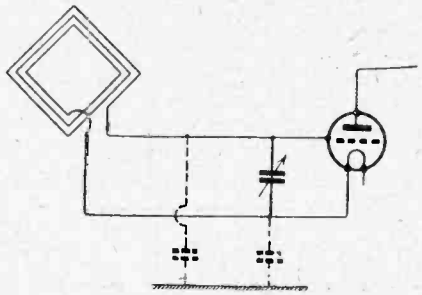


Fig. 3.—The E.M.F.'s in the frame also produce currents through the capacity to earth.

negative of the filament should not be earthed. This would stabilise one end of the frame, but there would still be a capacity between the other end and the earth, and since this other end is connected direct to the grid of the valve, the full aerial effect would be noticeable.

Effect of Size of Frame

We have seen that this aerial effect is normally only troublesome near the zero position of the frame. It is, in fact, a serious trouble in direction-finding equipment, and special care has to be taken to eliminate it before the apparatus is brought into use.

Except at the minimum region, however, the aerial effect is usually negligible with a fairly large frame.

The frames employed for broadcast receivers, however, are not large, and the actual E.M.F. induced therein is comparatively small.

The aerial effect is not reduced to anything like the same extent, so that it is not uncommon for the aerial E.M.F. to be greater than

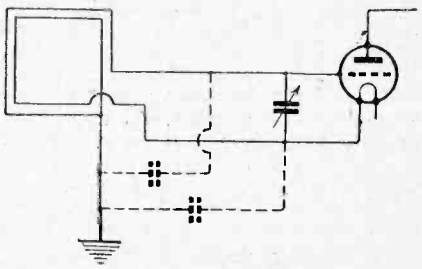


Fig. 4.—Earthing the middle point of the frame eliminates the aerial effect.

the maximum E.M.F. produced by the frame.

A Remedy

Under such conditions the set will obviously exhibit very poor directional properties, and this is often found to be the case in practice. The earthing of the middle point of the frame will usually cure the trouble and result in reasonably sharp zeros being possible.

Other Forms of Circuit

The circuits so far shown have been direct-coupled, but it may be desired to use a frame loosely coupled to the receiver, as illustrated in Fig. 5.

In such a case the aerial effect is still obtained, but in this case the capacity currents induce voltages on to the grid of the valve through the coupling.

To remedy the defect in this case the middle point of the coupling coil is earthed. The currents in the two sides of the frame then flow through the two halves of the coupling coil in opposite directions, and so produce no effect in the secondary.

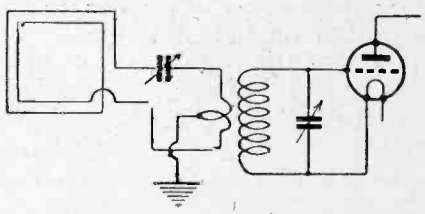


Fig. 5.—In the case of a coupled circuit the middle point of the coupling coil is connected to earth.

Night Effects

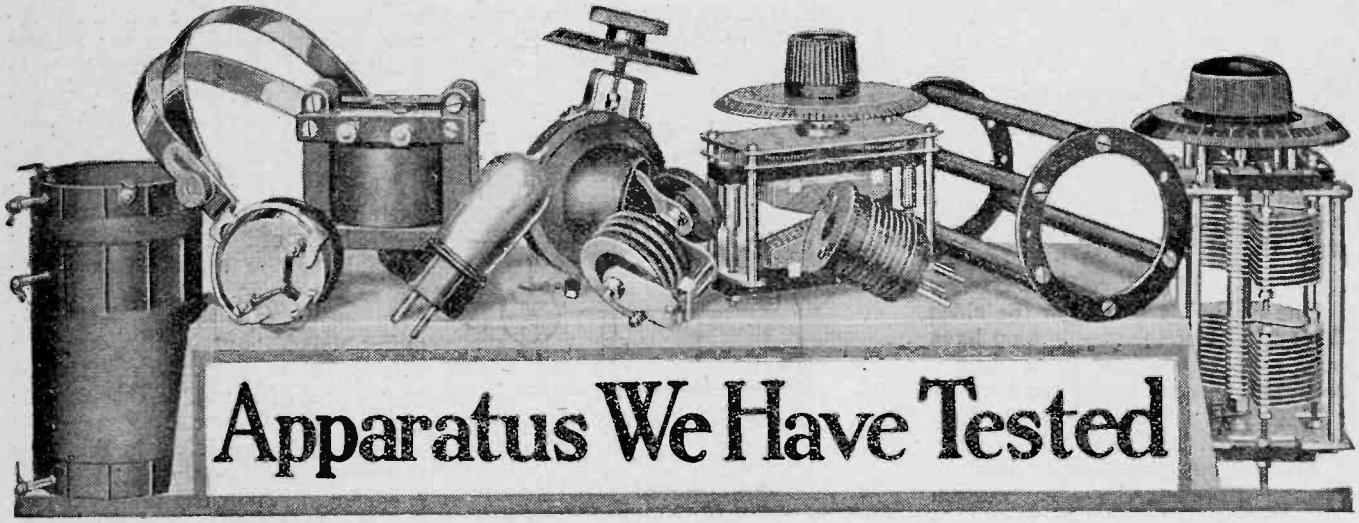
It should not be forgotten, however, that there are secondary effects which may also produce peculiar behaviour in a frame aerial.

The electric field in the "direct" wireless wave is substantially vertical, as illustrated in Figs. 1 and 2. There is also, however, a reflected wave which arrives from the upper atmosphere, and as has been explained in previous articles, this wave may arrive from a slightly different direction, or it may be horizontally polarised.

Fading

These effects give rise to the night variations which are so common on direction-finding work, in addition to which there are the fading effects, due to interference between the direct and reflected waves.

The remarks given above concerning aerial effect thus deal with one aspect of frame reception only. The question is an important one, and a distinct improvement may be expected from the earthing of the middle point, as described, but it should be emphasised that the method is not a cure for night effect and fading.



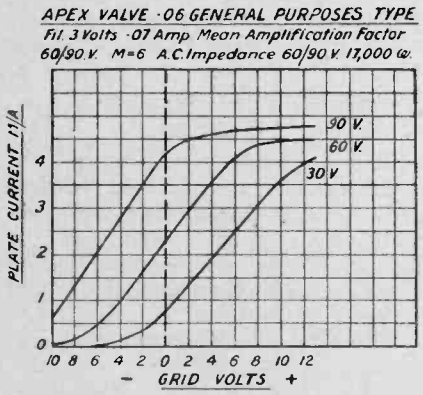
Apparatus We Have Tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

Apex Valves

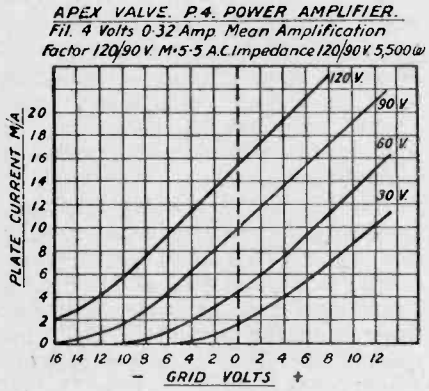
Messrs. the Apex Valve Co. have submitted samples of their .06 type of general-purpose valve, and of types P4 and P6 low-frequency power amplifying valves.

The .06 type is rated at 3-3.5 filament volts, and .05 to .07 ampere, with 20-60 volts H.T. for detector or H.F. amplifier, or 50-100 volts as L.F. amplifier. At 3 volts the valve tested showed a maximum plate-current of around 5 milliamperes with high H.T. and positive grid-bias; at this rating the filament demand was 0.07 amperes. It is a small valve, with a small diameter anode of normal shape but more open below than usual. The filament is straight, and the grid is of the usual spiral form. On test, the mean amplification factor between 60 and 90 volts H.T. came out at about 6, whilst the A.C. impedance was of the order of 17,000 ohms in this region. The valve showed a similar behaviour to others of this .06 G.P. class of



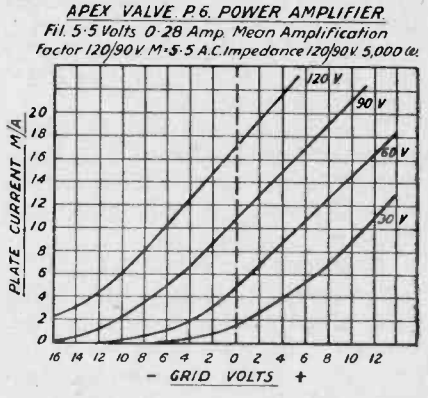
moderate amplification factor; as a detector for local loud transmissions 50 volts H.T. and a 2 megohm leak appeared suitable, whilst for distant transmissions 30 volts and a 4-megohm leak gave good results and smooth reaction; the grid current, under ordinary working conditions, increased rapidly above 0.6 volts positive potential. For a moderate degree of loud-speaking, 120 volts H.T. and up to 10 volts negative grid-bias were demanded, but the valve would not, of course, handle much power without blasting.

The Apex P_4 power amplifier is rated at 3.5-4 volts and 0.3-0.32 amperes, with 10-50 volts H.T. as



detector and 50-120 volts H.T. for L.F. amplification. This is a low-impedance power-valve of the modern type, designed to handle a great deal of signal energy without giving rise to the distortion which results from over-running the characteristic of the valve. It has a large oval box-like anode, with a V filament and a grid of fine wire wound on a frame. It was tested at 4 volts and 0.32 amperes in the filament; the saturation current was not reached at all under these circumstances. The characteristics showed a large available sweep of grid-voltage in a straight portion of the 120-volt curve to the left of the zero grid-volts line; on trial with loud signals and with 120 volts H.T. and 6-9 volts negative grid-bias this was confirmed, powerful loud-speaking resulting without distortion. As a rectifying valve, a much smaller reaction coil than usual was required; for smooth operation but 30 volts H.T. and a 2-megohm leak were suitable on the local transmission, or some 15 volts H.T. and a high value of leak for long-distance work. The grid current was small (under usual conditions) up to some 0.8 volts positive.

The P6 power valve is rated at 5.5-6 volts and 0.25-0.27 amperes, with H.T. values as for the P_4; also the bulb is pipless. The characteristics proved to be very similar, the amplification factor being the same reasonable figure (for a power amplifier) of 5.5 and the A.C. impedance slightly lower than that of the P_4. The filament emission was very large. At first some anomalies were noticed in the grid current; these were finally traced to a small H.T. leakage across the base of the valve. On carefully cleaning this the grid current approached the same characteristics as observed with the P_4 valve. As a result of this small leak the valve operated as a detector quite well without external leak; with 50 volts H.T. and a moderate additional leak, local strong signals were well received, or without a leak and but 15 volts H.T.



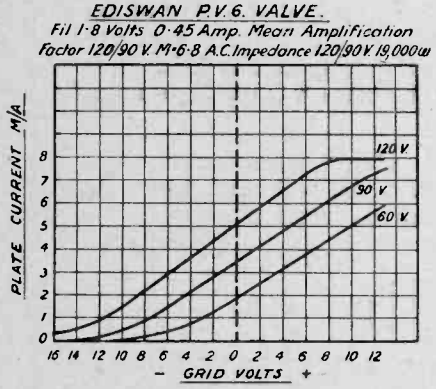
long-distance reception resulted, a very small reaction coil being used. Even 4 volts H.T. gave good results in distant reception. For handling a large amount of power in L.F. amplification the valve proved excellent with 120 volts H.T. and up to 9 volts negative grid-bias. For real loud-speaking on

the local transmission, or in a second or third stage of L.F. amplification in general, the P.6 was able to handle even more signal energy than the average 5-volt .25 amp. power-valve, without a trace of distortion; for this purpose it can certainly be recommended.

Ediswan Power Valves

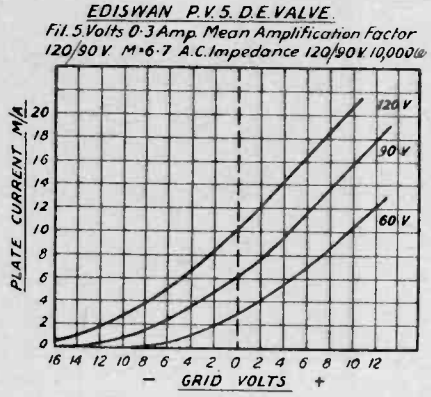
Messrs. Edison Swan Electric Co., Ltd., have sent for our trial samples of their small power valves for L.F. power amplification: the P.V.6 and the P.V.5 D.E.

The P.V.6 is a valve of moderate size, the internal elements of which closely resemble those in the A.R.D.E., L.F. valve of the same make, but with a cylindrical anode of rather larger diameter. It is rated at 1.8-2 volts and 0.4 amperes, and 60-120 volts respectively. A saturation current of over 8 milliamperes was reached under working conditions with 1.8 volts and 0.45 amperes in the filament, under which conditions the characteristics were determined. A mean amplification factor of M=6.8 was recorded with 90-120 volts H.T. and an



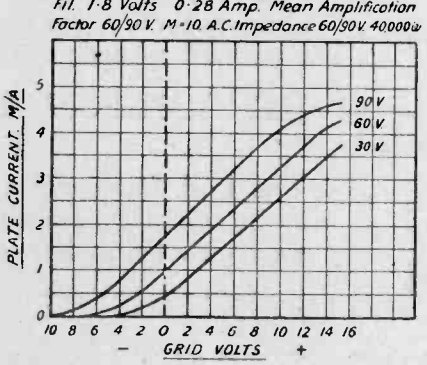
A.C. impedance in this region of about 19,000 ohms. An available swing of a total of 10 or 12 volts in the 120-volt curve, below the zero-volts line, appeared to promise a fair measure of distortionless loud-speaking; on trial, with 6 volts negative grid-bias, this was confirmed, though full power could not be handled without some rectification occurring on the local station's transmissions. For moderate loud-speaking in a small room the valve proved excellent, and could be operated conveniently in conjunction with the A.R.D.E. types with a common 2-volt L.T. accumulator. As a rectifier, the valve operated well in long-distance work with 20 to 30 volts H.T. and a high leak, 4-8 megohms.

The P.V.5 D.E. is a rather larger valve, with large oval box anode and V filament, with a fine grid wound on a frame over the filament. It is rated at 5 volts and 0.25 amperes in the filament, with 50 to 150 anode volts. The specimen tested showed a consumption close enough to this: 0.3 amperes at 5 volts, at which rating saturation was not reached with 25 milliamperes plate current. The amplification factor was about what might be expected in a low-impedance power amplifying valve, around 6.7, whilst the A.C. impedance in the same 90/120 volt region was rather higher than that expected, being about 10,000 ohms. Accordingly, good loud-speaking was to be expected with 120 volts H.T. and a grid-bias, from the curves,



of around 6-8 volts; but not of the order implied by the use of two stages of efficient L.F. amplification on local transmissions. Practical trial showed this to be the case, as a large volume of sound was obtainable without distortion except when quite hard pressed and nearing the practical limit of a large loud-speaker. For the loudest transmissions an extra supply of H.T. up to 250 volts, with correspondingly increased grid-bias, proved necessary. As a detector the valve operated well under similar conditions to those given for the P.V.6.

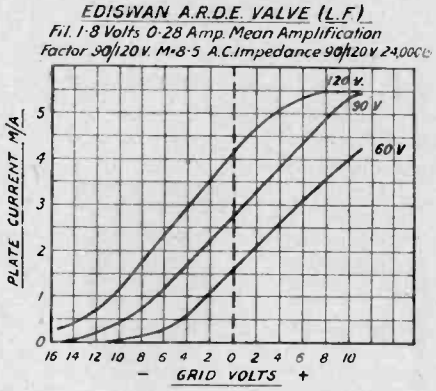
For distortionless loud-speaker reproduction under ordinary domestic conditions of reception these small power valves can be well recommended, the P.V.5 D.E. in particular, in conjunction with a 6-volt L.T. battery. The performance of the samples was noticeably uniform.



Ediswan A.R.D.E. Valves

Two samples each of the new L.F. and H.F. patterns respectively of the familiar 2-volt .3 ampere D.E. valve have been sent for our test by Messrs. Edison Swan Electric Co., Ltd., and have been submitted to extensive tests. These have the usual vertical cylindrical anode and straight axial filament, with a spiral grid; the anode of the H.F. (red line) pattern is larger in diameter, and the grid appears to be a little more open than in the L.F. (green line) valve. The rating is the same in both cases—1.8-2 volts and 0.3 amperes, with 20 to 100 plate volts.

On test, the H.F. valve showed straight characteristics and a moderate available grid-volts swing on 60 volts H.T., at which voltage practical trial showed that it functioned well as an H.F. amplifier. The voltage-amplification factor came out at the satisfactory figure of M=10 in the 60-90 volt region, the valve being operated at the convenient figure of 1.8 volts and 0.28 amperes in the filament. The maximum emission under ordinary working conditions was around 5 milliamperes at this filament heat; grid current was noticeable above 0.5 volts negative, and was quite large at zero grid volts. For detection a high grid-leak and 30 volts H.T. appeared suitable except for strong signals, when 50 volts H.T. and as low as 1 megohm leak were best. In L.F. amplification, for which the valve was not designed, but moderate power could be handled with 120 volts H.T. and 4 volts negative grid-bias.



The impedance was fairly high—40,000 ohms at 60-90 volts.

The L.F. pattern showed, on test, a more modest amplification factor, around 8.5 in the 90-120 volt region, and a much lower impedance of 24,000 ohms here. The maximum plate current was well over 5 milliamperes; the characteristics showed a large available swing of grid volts on the 120-volt curve, with 4-6 volts negative grid-bias. On practical trial, moderate loud-speaking resulted under these conditions on a local transmission. As a rectifying valve this valve was better than the H.F. type; with 22 volts H.T. and a 4 megohm leak, or with 30 volts and an 8 megohm leak, excellent long-distance reception resulted and smooth reaction; or for local loud transmissions with full H.T. and a low-value leak. The valve oscillated with ease. Grid current was small below the zero grid-volts point, but increased rapidly above this point.

It was noticeable with both L.F. and H.F. valves how very uniform in their characteristics the two samples of each submitted proved to be. For their specific purposes these valves should give every satisfaction.

ENVELOPE NO. 3

SIR,—I feel I should like to tell you of the results I have had from the "Three-Valve Simplicity" set as described by G. P. Kendall, B.Sc., in Radio Press Envelope No. 3. May I tender my thanks for the extremely simple way in which every detail is described. This was especially beneficial to me, as that was the first set I had ever constructed, and I am only sixteen. Birmingham and Daventry come in with tremendous strength, and have to be considerably de-tuned to be at all comfortable to listen to. I have a room at the top of the house at the back from which 80 ft. of Electron wire laid double runs to the front room and the loud-speaker. One evening, a few days ago, while Birmingham, our local station, 3½ miles away, was on, I received London (100 miles) at excellent loud-speaker strength; in fact, it could be heard all over the house. Manchester comes in just as well, and Bournemouth almost as well. These stations are free from interference from Birmingham except for a faint background absolutely inaudible when music is on from the station being received. Cardiff, which I believe comes in very badly round here, we have received about as well as Bournemouth, with a more appreciable background from Birmingham, but not enough to prevent any enjoyment of the programme. Aberdeen, Glasgow and Newcastle are loud on the 'phones, while Belfast comes through as well as Bournemouth on the loud-speaker. Of the relay stations, Nottingham is the best, being as good as Manchester, although with more interference from Birmingham. Stoke-on-Trent and Leeds-Bradford are good loud-speaker strength, while Liverpool is audible twenty feet away from the loud-speaker. Swansea, Dundee, Edinburgh, Plymouth and Sheffield are received at loud 'phone strength while Birmingham is not broadcasting.

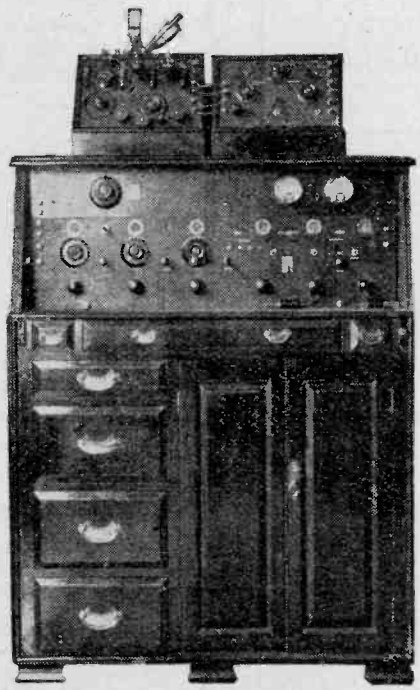
Of foreign stations, I have received Madrid, Barcelona, Radio-Paris and Radio-Toulouse at excellent loud-speaker strength. I have also heard on the 'phones Hamburg, Zurich, Brussels and Rome, and numerous other stations which I have been unable to identify. I think these results speak for themselves as to the undoubted efficiency of the set. In fact, a friend with a much more complicated three-valve set cannot get nearly such good results. Thanking you for the description of the set and wishing your periodicals every success in the future. Yours faithfully,

W. G. JOHNSON.

West Smethwick.

THE ANGLO-AMERICAN SIX AND TRANSATLANTIC V

SIR,—The enclosed photograph of my Anglo-American Six (*The Wireless Constructor*, January and February issues, by Percy W. Harris, M.I.R.E.) with the original Transatlantic V (*Modern Wireless*, November, 1923, by



Mr. Marlow's handsome Anglo-American Six receiver with his Transatlantic V set above.

Percy W. Harris, M.I.R.E.) may interest you. You will note that the panel of the A.A. Six has been extended to take an ammeter, milliammeter and the special A.A. Six wavetrap. The set slides out when required. As the panel is set back 6in., this makes the operation of the set comfortable, and provides space for 'phones, coils, etc. The top lifts back on hinges for changing coils, etc. The cupboard is divided into two, the top half taking the H.T. batteries and the bottom the L.T. battery, the leads from which are all out of sight. There is ample room in the drawers for coils, H.F. transformers, etc., which are to hand when wanted. I am very pleased with the set, and find the milliammeter very useful in tuning. I have fitted C.A.T. and find it an improvement.—Yours faithfully, FRANK MARLOW.

Didsbury.

THE ANGLO-AMERICAN SIX IN SWITZERLAND

SIR,—It may interest you to hear that one of your "Anglo-American Six" receivers (described by Percy W. Harris, M.I.R.E., in the January and February issues of *The Wireless Constructor*) has been constructed and is now in service on the highest observatory of the earth. Jungfrauyoch is at 11,000 ft. above sea level, in the Swiss-Bernese Alps. Continuous snowstorms sweep the place, and even in the finest weather the temperature stays far below zero.

The set has been in operation now for four months, and gives excellent results. On some occasions receiving conditions are astounding, and as many as 25 stations are heard on the loud-speaker. On other occasions only a few stations come in clearly. Local static discharges are sometimes very strong, and on one occasion destroyed part of the set. The antenna consists of nearly 300 ft. steel wire, which runs between two rocks along an ice slope, and which is continuously covered arm-thick with ice, so proper insulation is an absolute impossibility. On the high-power stations, such as Daventry, Paris, etc., the second low-frequency stage gives practically too much power for the small loud-speaker. Nearly all other stations come in at full loud-speaker volume.

On a station of the Jungfraubahn Railway (at 7,200 ft.), a first-class American super-het. is installed. It seems as if this kind of apparatus does not suit our receiving conditions. Atmospheric noises are amplified so much that no speech or music can be followed. Your "A.A." set is giving great service to the station, as weather reports are received daily from Rome, Zurich, Paris, London, and at midnight from Norddeich; time signals from London, Paris and Berlin.—Yours faithfully, ALFREDO KOLLIKER,

Observer.

Astronomical Observatory,
Jungfrauyoch.

A SIMPLE SHORT-WAVE RECEIVER

(*Continued from page 91*).

denser to one side of L1. This passes through a hole drilled in the corner of the detector valve mounting, so as to support it and prevent vibration on account of its length.

Connecting Up

Having completed the wiring and checked it over, the two valves should be inserted in their holders and two coils into their mounts, say, the 7-turn coil for L1 and the 10-turn for L2. Connect the L.T. battery first, and see that the valves are correctly controlled by means of the filament resistances. Next connect the H.T. battery, and, with C2 set at zero, plug the 'phones in. Increasing the value of C2 should result in a soft plop being heard in the 'phones as the set goes into oscillation, and, provided that the coils have been wound in the same direction, this will occur unless the H.T. and L.T. values are too low.

Operation

If everything is all right, connect the aerial and earth to A2 and Earth respectively, and see if the set will oscillate over the whole range of the tuning condenser. If not, the aerial should be transferred to A1, and in nine cases out of ten this will be the right terminal for the aerial to be connected to. A very short aerial, such as an indoor aerial, should preferably be used for the reception of stations working on less than 40 metres (7,496 kc.), as it will probably be found that there is very little diminution of signal strength as compared with a large or outside aerial, while any atmospherics that may be present will be greatly reduced.

On wavelengths above 40 metres it will be found that the setting of the reaction condenser C2 will have but little effect on the tuning; below this, however, it may be found that, as C2 is decreased (so as to get the set just on the oscillating point), C1 needs to be increased, and *vice vêrsa*.

Wavelength Ranges

With the four coils of the sizes given, the writer's receiver will tune approximately as follows:—L1 7-turn, L2 10-turn, from 88 metres to 24 metres (3,407 to 12,496 kc.); L1 4-turn, L2 5-turn from 45 to 15 metres (6,663 to 19,988 kc.). If a 3-turn coil is constructed for use as L1 and the 4-turn coil used in the grid circuit, the minimum wavelength on which the receiver is capable of receiving is in the neighbourhood of 12 metres (24,985 kc.).

Test Report

The receiver has been given a pretty thorough test, and has been found to be most efficient. Swedish, Belgian, Dutch, German and French amateurs have been received at excellent strength on an indoor aerial about 15 ft. long on the 40-80-metre bands. On 20 metres Canadian 1AR has been received comfortably readable at 2255 G.M.T. American 1IF was strong on the same aerial on 20 metres at 2323 G.M.T., the latter reporting an input of only 90 watts. Many telephony transmissions have been heard on the short waves, but their exact origin was not an easy matter to establish.

The writer would be glad to receive reports as to this receiver's action under varying conditions, as he is inclined to be of the opinion that reception conditions in his particular neighbourhood are none too good.

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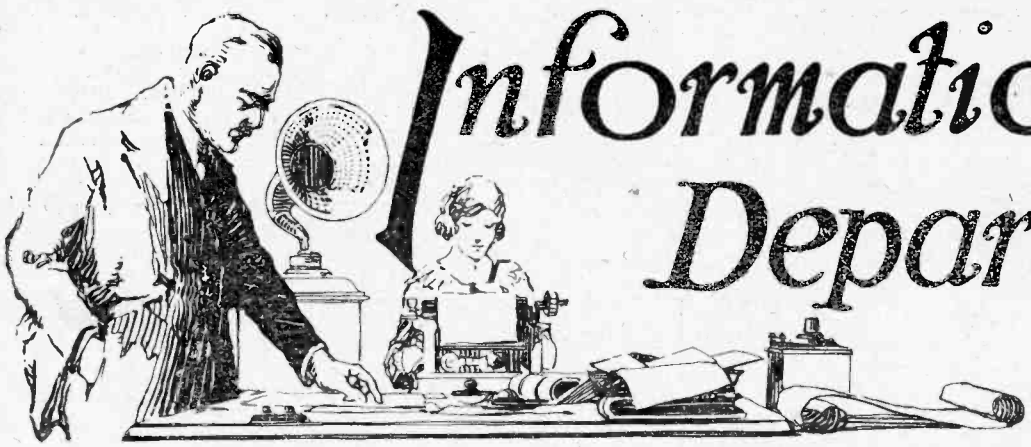
Western Electric Head Receivers



Information Department.

L.E.S. (FOLKESTONE) asks us for a theoretical circuit diagram of a selective four-valve receiver, employing a high-frequency stage with Neutrodyne control, a valve detector and two transformer-coupled low-frequency amplifiers. A separate H.T. tapping is required for each valve, and a switch to cut the last completely out of circuit if required. The set is only required for the reception of stations on the lower broadcast band.

In Fig. 1 we give a circuit of a four-valve receiver, which should adequately meet our reader's requirements, whilst still being simple to operate. In order to obtain good selectivity without the further control necessitated by a normal loosely coupled arrangement, a low-loss coil has been shown for the aerial circuit, tapped suitably to obtain a semi-aperiodic aerial system. The coil may be wound on a Collinson type low-loss former 3in. diameter and 6in. long, and should consist of 80 turns of 22 s.w.g. enamelled wire wound in the slots provided to give suitable spacing. One end of the coil should be taken to the grid of the high-frequency valve and the other to the earth terminal, whilst the aerial tapping is made between 15 and 25 turns from the earth end. With most aerials it is not advisable to reduce the number of turns between the earth connection and the aerial tapping below 15, since although selectivity is improved, signal strength may suffer. A coil of this type with a parallel condenser of .0005 μF should adequately cover a range from below 300 metres (1,000 kc.) to somewhat above 500 metres (600 kc.).

For the H.F. coupling, either a neutrodyne unit or two plug-in coils of low self-capacity may be used, the anode coil L3 being tuned by a parallel condenser of .0003 μF. Where plug-in coils are used, L2 and L3 should be of the same size, mounted close together so as to be separated only by a small distance, such as $\frac{1}{8}$in., and should be of such a size as to cover the same wavelength range as the grid coil L1. NC is an ordinary type neutrodyne condenser. Magnetic reaction has not been introduced by the usual method of

a coil in the plate circuit of the detector valve coupled to the grid coil L1, since reaction effects may readily be obtained by slightly upsetting the balance of the neutrodyne condenser.

To cut the last valve in and out of circuit, whilst at the same time permitting the two amplifying valves to have separate high-tension tappings, a 3-pole 2-way switch is necessary. The connections to this are fairly straightforward, and it will be seen that with the switch in the upward position four valves are employed, whilst in the lower the last valve is cut out of circuit, the loud-speaker then being inserted into the plate circuit of V_3, and V_4 extinguished. Separate grid bias tappings have been indicated for both L.F. valves, being shown as G.B.–1 and–2 respectively.

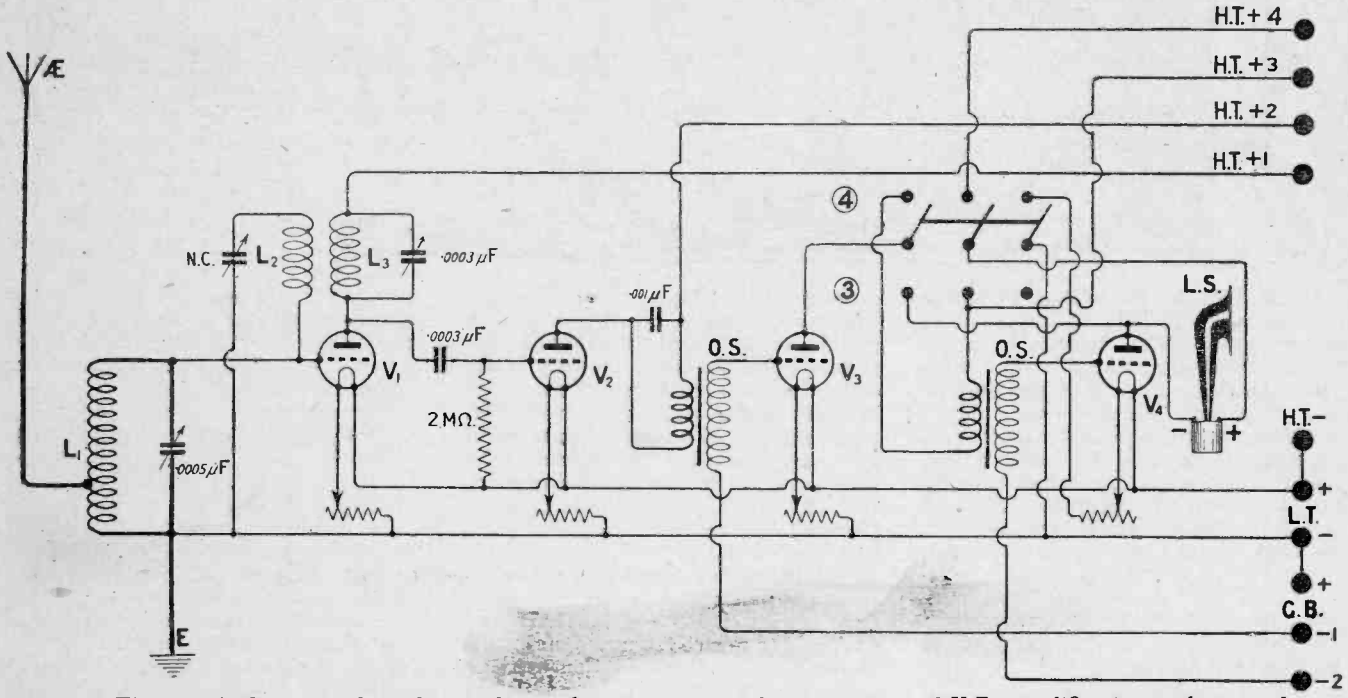


Fig. 1.—The circuit diagram of a selective four-valve receiver, employing a stage of H.F. amplification with neutrodyne control and a switch for providing one or two stages of L.F. amplification. (*L. E. S., FOLKESTONE.*)

We Ask for Your Criticism

In our endeavour to improve "Wireless Weekly" at every appearance, we are particularly desirous of ascertaining which features our readers find most acceptable and what further features they most desire. If they will answer the questions printed on this page, tear out the page and return it to us, they will help us materially in our efforts to produce just the periodical they want.

1. Which features in *Wireless Weekly* do you like best?

2. Would you like *Wireless Weekly* to give more designs for receiving sets, or do you think that these should be left to the other Radio Press publications which cater more particularly for the constructor?

3. Have you any suggestions for regular features?

4. Is the type used in *Wireless Weekly* too big, too small, or satisfactory?

5. Do you think we neglect any aspect of wireless which you regard as suitable for treatment in *Wireless Weekly?*

6. Do you like articles on transmission?

7. Would you like more attention given to reception on other wavelengths than the normal broadcast bands?

8. Would you like more or less attention given to short-wave subjects?

9. Do you want more theoretical or practical research articles?

10. Do you desire the humorous feature to be continued?

11. Do you wish the feature "Information Department" to be continued? It is to be understood that this feature does not provide a means of answering any individual reader's queries, since these are all dealt with by post. The queries published, with their answers, are only selected as a matter of general interest.

12. Place in the order of your preference the names of the more regular contributors to *Wireless Weekly.*

13. Do you wish to have more articles dealing with the theory of the Super-Heterodyne?

14. Do you wish for series of articles of an instructional type?

15. Which articles appearing during the last few months do you consider the most valuable?

16. What general criticism have you to make? The more outspoken your remarks, the better.

Wireless Weekly Small Advertisements.

Radio Press Information Dept.

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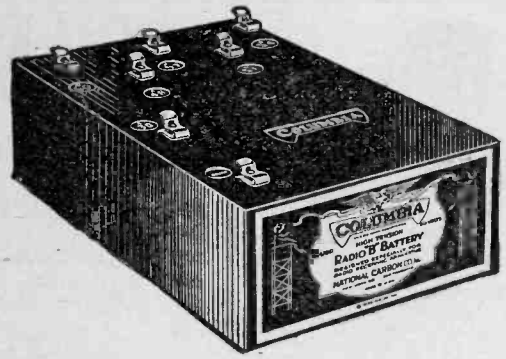

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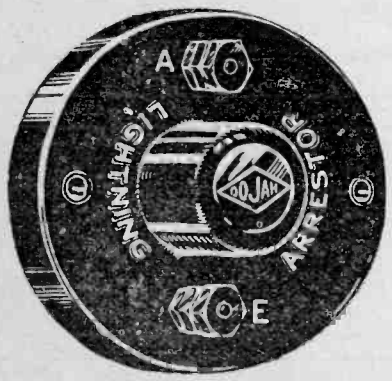

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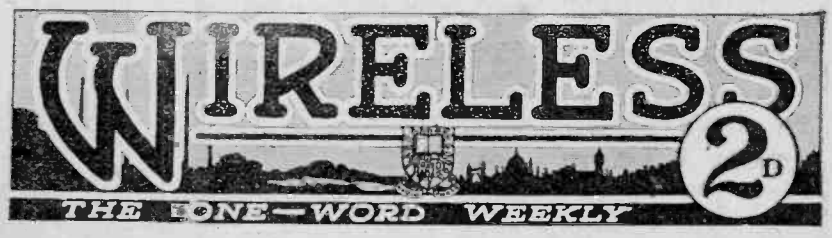

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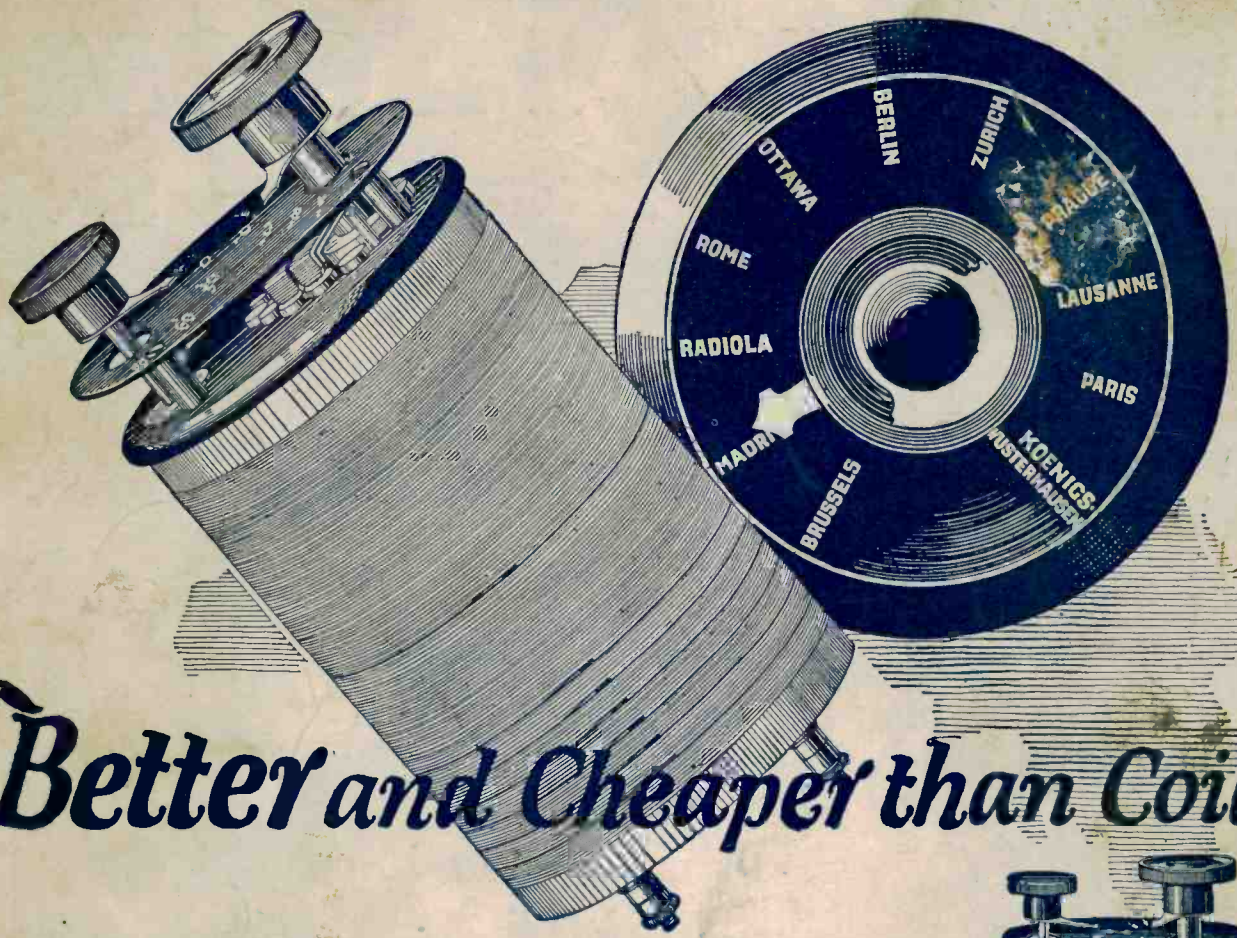

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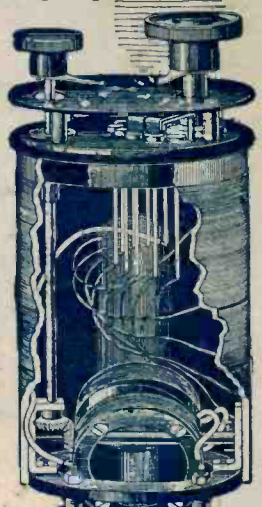

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