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The Broadcasting Committee's Report.

AFTER a delay which has seemed almost interminable, we have at last so definite news of the progress of the Report of the Postmaster-Gener Broadcasting Committee. At least we know now that the Report has b drawn up and submitted to the Postmaster-General. We are further promi that it will shortly be made public, and the full text published as a Government paper

There is no doubt whatever that this document will make extremely interesting readi and will set out all the problems arising out of broadcasting, with the special advanta of the assurance that each problem will have been treated after having heard evide from all interested parties. Thus far we may confidently look forward to a very interesti document, but yet we are inclined to believe that little will have been done to render t task of the Postmaster-General any easier in the matter of deciding upon a policy in rega to broadcasting and the problem of licences. At the best, the Committee's report cann be more than a review of the existing difficulties which have arisen as a result of t introduction of broadcasting, and recommendations made with a view to assisting t difficult task which will still devolve upon the Postmaster-General—that of making a decisions with regard to the future of this new wireless service.

It would appear, then, that we must not be too sanguine of any immediate results fro the Broadcasting Committee's Report. The very fact that this report has taken so long compile, and that it was hinted at one time that a minority report would also be presente goes to show how difficult a matter it has been to bring forward any recommendations all which could bring together with any sort of harmony the many conflicting interests a parties concerned.

When the time comes that the Postmaster-General is in a position to announce h policy and give decisions regarding the future conduct of broadcasting, and the issuing licences, it is to be sincerely hoped that all vestige of doubt and uncertainty will be remove and that the decisions (whatever they may be) will be definite and lasting, with no weak poin left which will require recommendation at a later date.

The service of broadcasting, and the industry which depends upon it, not to mentio the amateur situation, have already suffered sufficiently on account of the hopeles uncertainty which developed almost from the moment broadcasting was introduced.

The Artificial Aerial.

Not infrequently the persistent applicant for a transmitting licence has his efforts rewarde by the award to him of authority to use his transmitting apparatus with an artificial aeria We continually receive letters of indignation from experimenters who have secured suc facilities enquiring as to the extent to which their licence limits them. Such querists are of course, recommended to apply to the authority awarding the licence, though, in ou opinion, the use of an artificial aerial implies that the experimenter must use a non-radiatin system.

With the use of an artificial aerial the experimenter can learn a good deal with regar to transmitting apparatus, as in very few instances is it necessary to radiate in order t carry out investigations in the circuit principles of transmitting apparatus, and even thos experimenters who have full facilities with regard to transmission, could easily make us of an artificial aerial for many of their experiments. All the same we cannot see why experimenters should make application to use a non-radiating system at all. A non-radiating system cannot be used for the purpose of communicating, and therefore does not fall within the administration of the Post Office. Surely one may possess any kinc of gear which might possibly be employed for transmission without authority? The experimenter in high frequency work could, we should imagine install a 100 kW. generator with suitable oscillatory valves and circuits to handle this energy without seeking permission from anyone, provided it is connected up to a non-radiating artificial aerial circuit comprising resistance and capacity.

RECEIVER DESIGN.

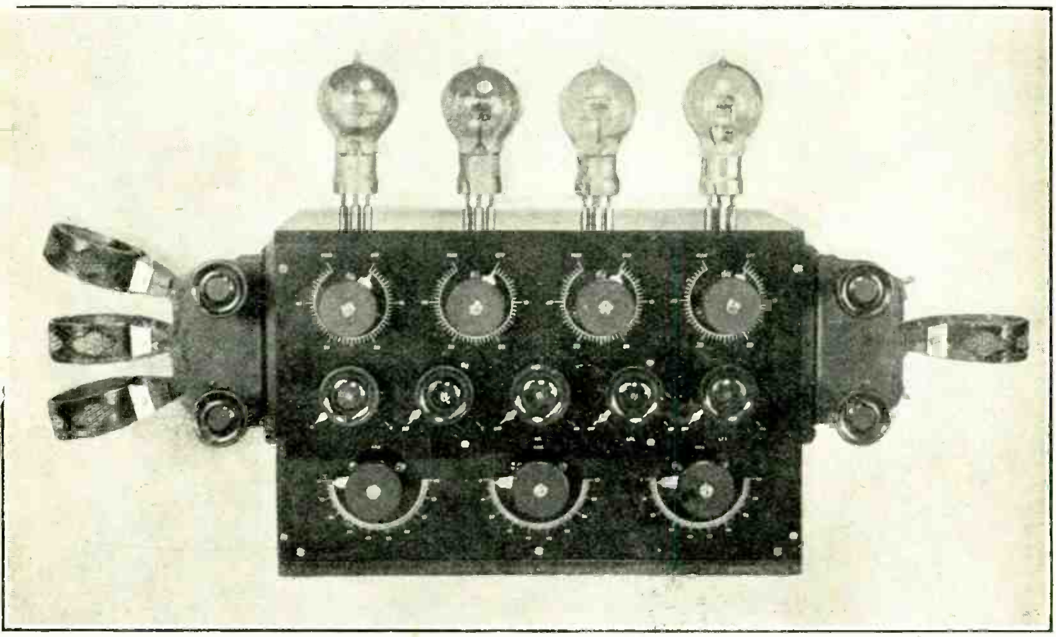
CONSTRUCTIONAL DETAILS OF A FOUR-VALVE SET.

The receiver described below has been specially designed to meet the constant demand for constructional details of a four-valve set embodying reliable circuit principles and arranged for home construction from component parts.

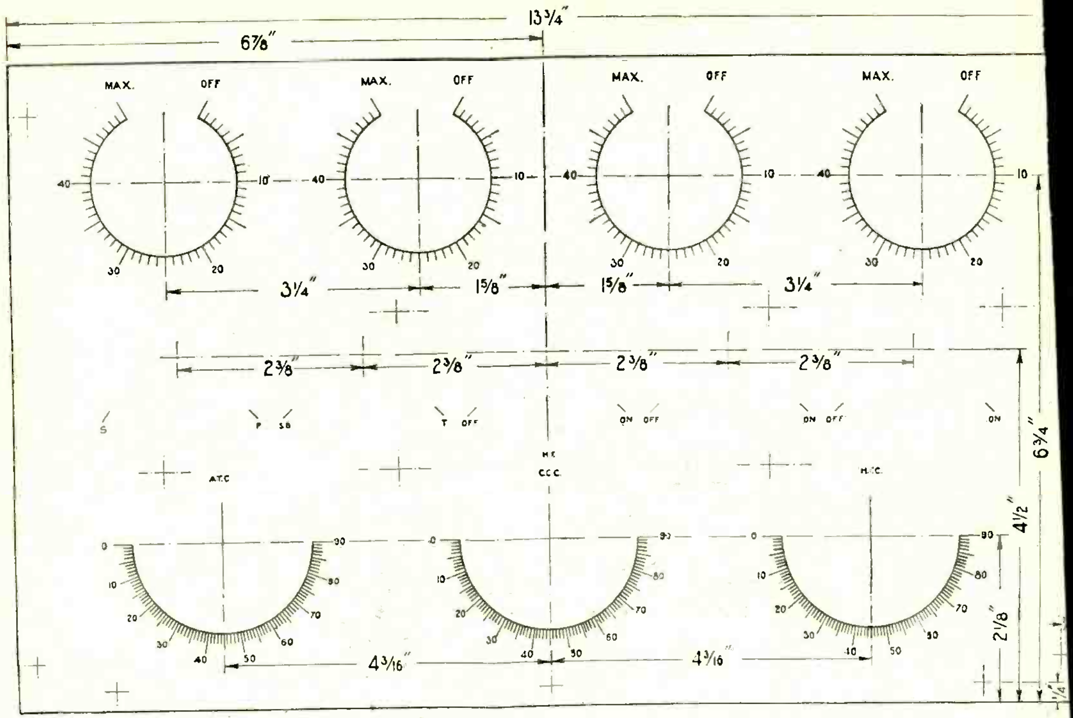
By F. H. HAYNES.

·lating to Design.

IT may be argued that a receiver is more suited to experimental requirements if it consists of the necessary component parts displayed on the bench and wired p, or a number of component instruments connected together. It is admitted that this arrangement does permit of making circuit changes, but unless fundamentally new circuit principles are to be tried out, it does not allow for rapidly changing from one receiving system to another. It is not possible to become adept in the skilful manipulation of the set which is laid out on the bench unless it remains wired almost permanently to one circuit. Efficient reception depends essentially upon critical and careful tuning, and unless the receiver takes a somewhat permanent shape one does not really "get the hang of it." There are so many minute adjustments to be made in order to get the utmost out of a set, that the writer is of opinion that every station should be equipped with a receiver of the boxed-up type which is stable and robust, and with which fine adjustments can be easily observed and noted. A few spare components can be set aside for original work. The locking up of valuable components in a permanent receiver is fully warranted because with the complete instrument the experimenter can make observations which would not be possible with temporarily wired units. True, one type of circuit will not be suited to every class of reception, and for this reason switches



The finished receiver, which can be inspected at the office of this Journal (12 *and* 13, *Henrietta Street, W.C.2*).


13¾"
6⅞"
MAX.
OFF
3¼"
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A.T.C.
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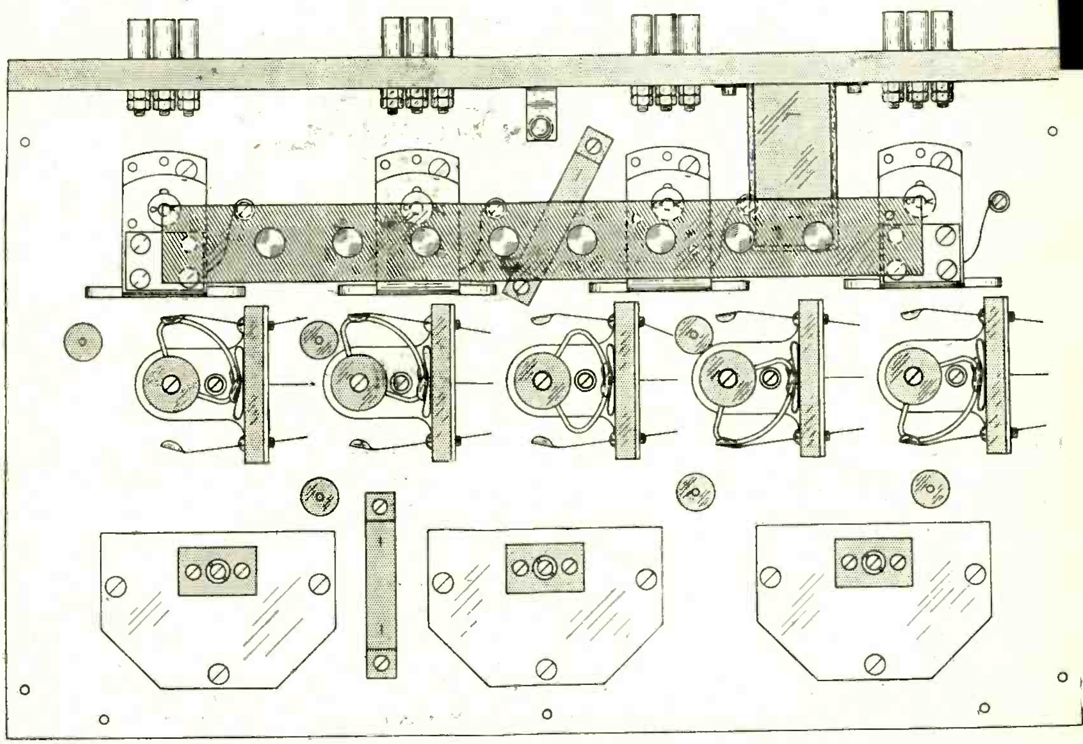
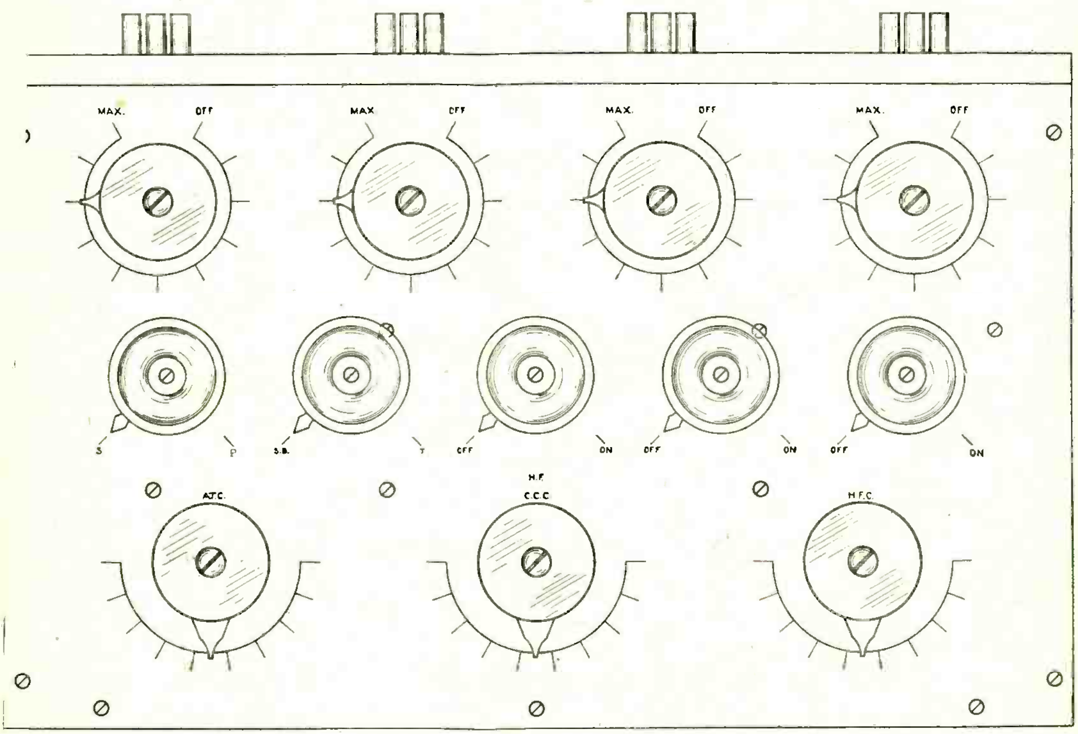
H.T.C.
4³⁄₁₆"
6¾"
4½"
2⅛"



iently arranged are liberally introduced ive various circuit combinations. Again, author has heard it said that the introtion of switches into multi-valve circuits es rise to losses, but whether or not this he case depends upon the type of switch ployed and *the method of wiring*.

'he instrument under description consists one high frequency amplifier, detector ve, and two note magnifiers. High quency amplification is an essential feature any receiver, though the manipulation more than one high frequency amplifier extremely difficult unless semi-aperiodic cuits which do not require critical adstments are adopted. In general, however, F. circuits designed for easy adjustment oduce a much lower degree of amplification an those which are precisely tuned. ie " tuned anode " method is incorporated preference to any other system of high equency amplification, as it functions well any wavelength. Transformers may be sed where the wavelength range is limited, and can even be wound to produce a step-up potential though they cannot be employed in an instrument designed for universal use, whilst the gain in amplification by their use is, perhaps, debatable. A valve is used as a detector in lieu of a crystal as reaction can be arranged between its plate circuit and the tuned anode. Although a crystal may be a very efficient rectifier, it often will not handle currents of big amplitude such as may be obtained from an oscillating high frequency amplifier, and, moreover, in itself cannot stimulate oscillation in oscillatory circuits to compensate for the high frequency resistance they may possess. Two note magnifiers are added for loud speaker work and will not, of course, bring in any signals which cannot be heard in telephones connected after the detector valve. More than two transformer coupled low frequency amplifiers are never required, because when they are correctly adjusted all the amplification ever likely to be required can be obtained and distortion kept to a minimum. Two



Front view with components attached. On the previous page is the setting out and engraving diagram (ivorine scales can be attached or the panel handed over to an engraver with the diagram) together with a view of the back of the panel.

position switches are introduced as follows:—

(1) A double-pole switch to connect aerial tuning condenser in series or parallel with the aerial tuning inductance.

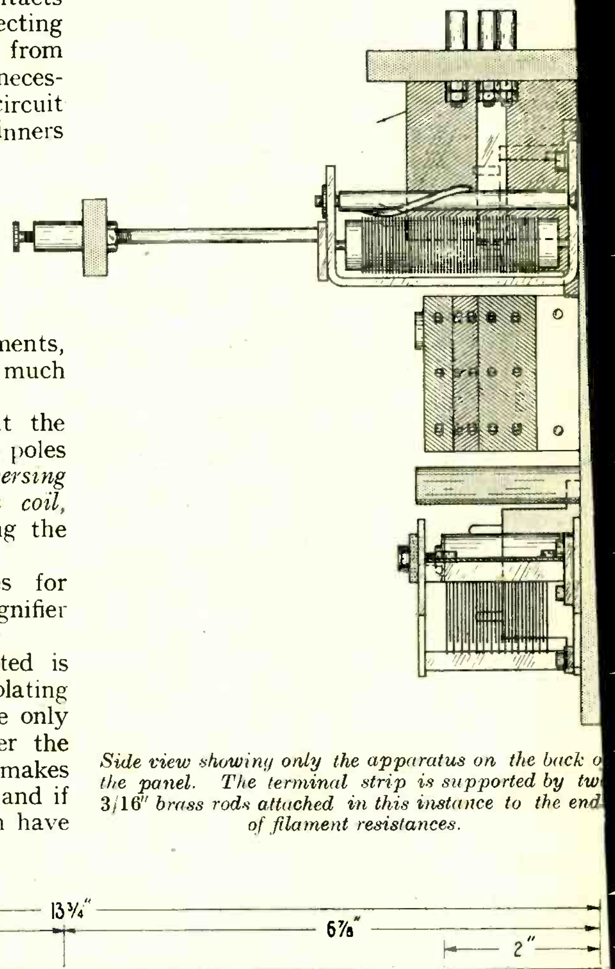
(2) A three-pole " stand-by " and " tune" switch for throwing the closed circuit in and out of use. One set of contacts on this switch is for disconnecting the closed circuit condenser from its inductance, which is a very necessary feature when the closed circuit inductance is idle. Many beginners hesitate to adopt closed circuit working, but it might be pointed out that the use of a closed circuit in front of a high frequency amplifier very considerably increases the degree of amplification and renders the tuning adjustments, with regard to self oscillation, much smoother.

(3) A four-pole switch to cut out the high frequency amplifier. Two poles of this switch are used for *reversing the connections to the reaction coil,* which is necessary when taking the amplifier out of circuit.

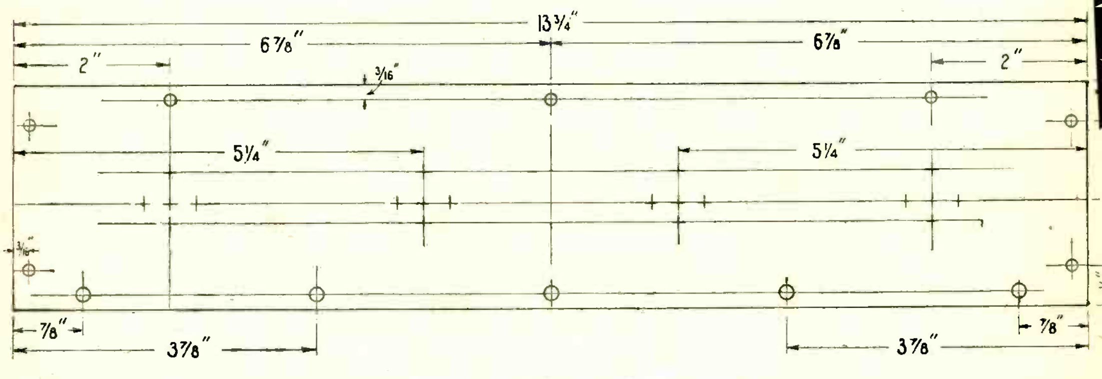
(4) and (5) Double-pole switches for disconnecting the two note magnifier circuits.

The system of tuning to be adopted is the controlling feature when contemplating the form and general dimensions. The only system with which one can tune over the entire wavelength range is that which makes use of the plug-in type of inductance, and if of a reliable type these coils may even have lower distributed self capacity (which i detrimental property most noticeable short wavelengths), than single layer ductances wound on ebonite.

The dimensions of the panel and contain cabinet are brought down to a minimum a



Side view showing only the apparatus on the back o the panel. The terminal strip is supported by tw 3/16" brass rods attached in this instance to the end of filament resistances.



Setting out of the valve-holder panel.

gardless of wiring difficulties. On the ınel there is just sufficient room to accommoıte the components which are manipulated y knobs on the face. A platform inside the ıstrument supports the transformers, whilst ıe top panel carries the four valve holders. : is considered that terminals disfigure the ıce of an instrument panel, particularly when connected to various kinds of leads. n this case a terminal strip is arranged at the ›ack of the instrument, and to allow of rigid viring is attached by supporting rods to the ›anel, whilst a slot in the back of the cabinet ıllows for the ebonite strip, on which the :erminals are assembled to come flush with the back of the instrument. The cramped arrangement of the components certainly does render the wiring up difficult, yet it can be accomplished by the beginner with care and patience, and precise details as to the method to employ will be dealt with subsequently. One often sees receivers having the components well spaced out for the purpose of reducing the capacity of the leads, but a brief consideration will reveal the fact that *short* leads comparatively near together will produce capacities just as low as longer leads spaced apart.

Components Required and their Selection.

One cannot draw up a detailed design giving all working dimensions without deciding to adopt the products of particular manufacturers. In this instance a great deal of modification is not required in order to substitute the components of makers other than those shown in the figures, and of a type favoured by the reader. It is not the aim of the author, however, to adhere to any special kind of product, and it is intended to deal pretty generally with the products of other reliable manufacturers in subsequent constructional articles. The following components are necessary :—

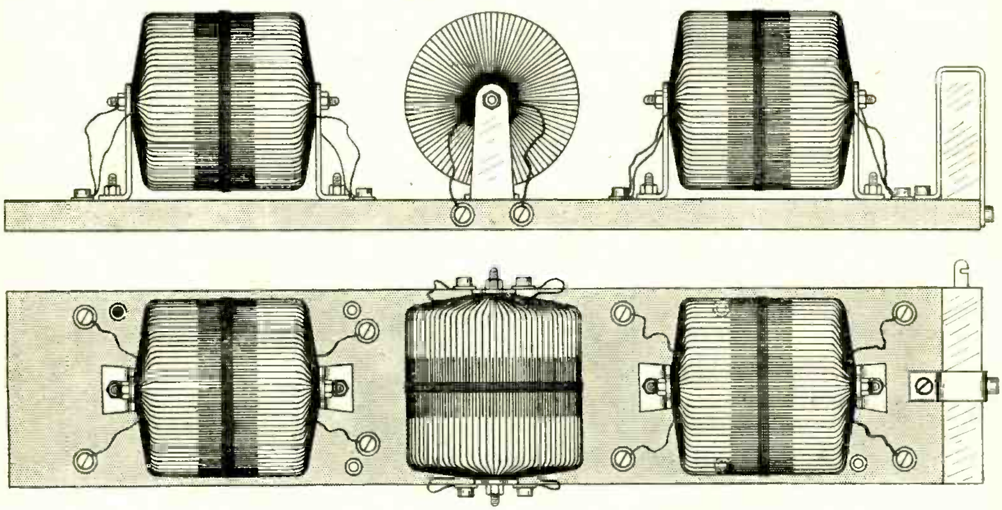
(1) Sufficient best grade $\frac{5}{16}''$ or $\frac{3}{8}''$ ebonite sheet to construct the front and top panels, terminal strip and transformer platform. $\frac{3}{8}$ in. ebonite rod for supporting transformer platform.

(2) Sixteen valve legs with nuts and washers.

(3) Four filament resistances.

(4) Five switches, *not* of the Dewar type but preferably of the pattern shown, or other specially designed multicontact key switch for use in high frequency circuits.

(5) Three intervalve transformers. In working out the dimensions sufficient depth has been allowed in the box for fitting any of the large types. When purchasing, one should *ascertain for certain* that the windings comprise 30,000, or more, turns. A turns ratio



The transformer platform. One transformer has its windings connected in series to form a choke, and is employed in conjunction with the condenser ($\frac{1}{2}$ mfd.) to feed the telephones or loud speaker.

of not more than 3 to 1 is required.*

(6) Air dielectric variable condensers of rigid construction, two having a value of 0·0002 mfds., and one of 0·0005 mfds. These values are specially suited to short wave reception and the low capacities will not necessitate the use of verniers. The capacities are sufficient, however, to not create gaps in tuning when interchanging coils.

(7) Two, three-coil coil holders and those which are operated through gearing are specially recommended.

(8) Two fixed condensers of approximately 2 and 0·3 mfds.

(9) Two condensers, one of 0·00025 mfds. for use in the grid circuit of the detector and another of 0·001 or 0·002 mfds.

(10) Eight terminals of good design.

(11) Grid leak of 2 megohms, with mountin[g] clips.

(12) One pound of No. 16 tinned coppe[r] wire.

(13) Some 3/16 in. brass rod for supporting terminal strip and about 2 sq. ins. o[f] $\frac{1}{8}$ in. brass sheet with six No. 4 B.A. by $\frac{1}{4}$ in. countersunk brass screws i[f] brackets are to be attached to the ends of the rheostats.

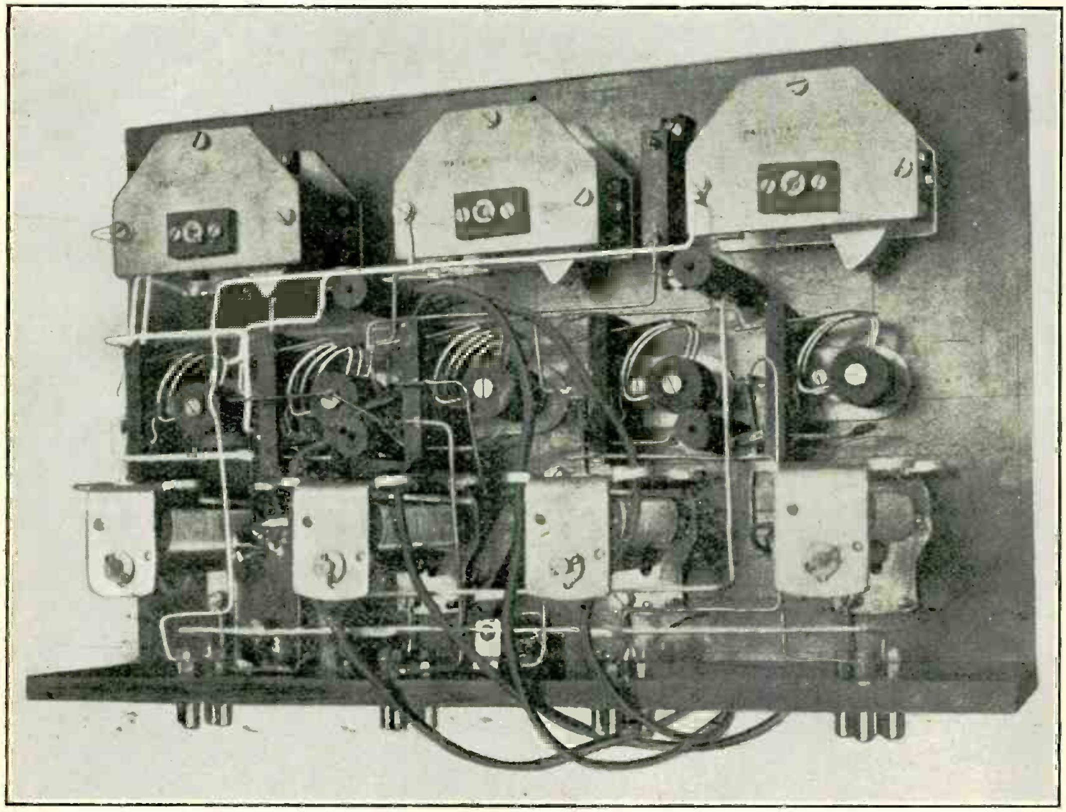
(14) Sufficient well seasoned mahogany, walnut, or teak, which when planed will measure 5/16 in. in thickness.

(15) Solder, preferably cored with resin, "Fluxite," glue, lacquer, and small quantities of good quality enamel in four colours, preferably white, blue, red and green.

(16) Miscellaneous wood and brass screws will be required, as shown in the drawing and depending upon the style of components.

Constructional details and manipulating instructions will be given in the next issue.

* Reference can with advantage be made to an article in which data concerning various transformers is given (*Wireless World*, page 669, August 15th, 1923).



Back view of panel with components assembled and wired prior to placing the transformer platform in position.

A LOW VOLTAGE CATHODE RAY OSCILLOGRAPH.

The development of the oscillograph in which a heated filament is used for electron emission is a recent advance, and provides the radio experimenter with apparatus which is convenient to manipulate, and suitable for making wave form investigations.

By N. V. Kipping.

A TYPE of cathode ray oscillograph tube, more usually known as the Braun tube, has long been used as a means of studying igh frequency electromagnetic phenomena, here being particular properties of such device which rendered it useful when other ypes of oscillograph, such as the vibrating trip type, were unsuitable. Its particular itility lies in the fact that the moving part consists of a beam of electrons which, being practically without inertia, is capable of dealing with frequencies at least equal to those of the upper radio frequencies.

The difficulties and cost of operating the Braun tube have prevented a most useful device from becoming more generally used, but the gap has been filled by the Western Electric Co.'s new Cathode Ray Oscillograph, a tube working on the same principle but at low cost and with simple auxiliary apparatus.

Before proceeding to describe first the Braun tubes, and then the new type oscillographs, it will be well to form a clear picture of how the latter operates as an oscillograph.

The beam of electrons may be deflected in any direction by applying an electric or magnetic field across the beam near its source. Deflection occurs in the same direction as the electric field, and at right angles to the direction of the magnetic field.

If two fields are applied in two directions at right angles, then the path traced by the end of the beam is the curve in rectangular co-ordinates of the relation between the two fields at any time. Two fields which are cyclic and synchronous, result in the ray tracing out the same pattern repeatedly, with the result that a stationary curve is obtained. If one of the two interdependent variables is time, special arrangements, in which one of the synchronous deflections is made proportional with time, enable a stationary pattern to be obtained in this case also.

Like the galvanometer forms of oscillograph, the Braun types are best suited for studying cyclic or recurring phenomena, though the approximate form of transient phenomena may also be indicated, if the frequency is low enough to enable a single sweep of the ray across the screen to be seen.

The principles set out above apply both to the original Braun tubes and to the new cathode ray tubes.

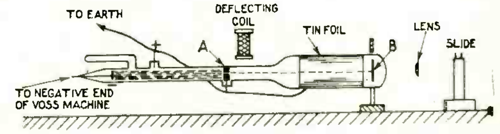
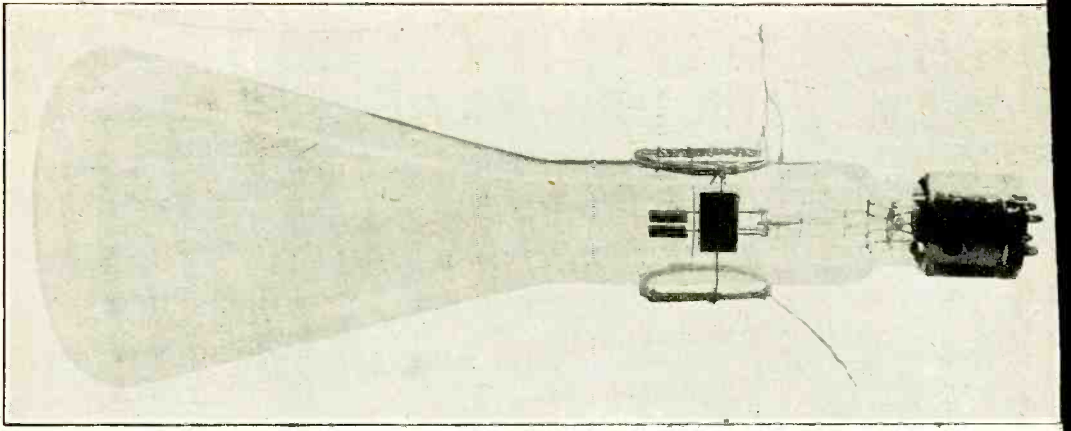


Fig. 1. Diagrammatic arrangement of the early gas discharge oscillograph.
A. Baffle screens. B. Fluorescent screen.

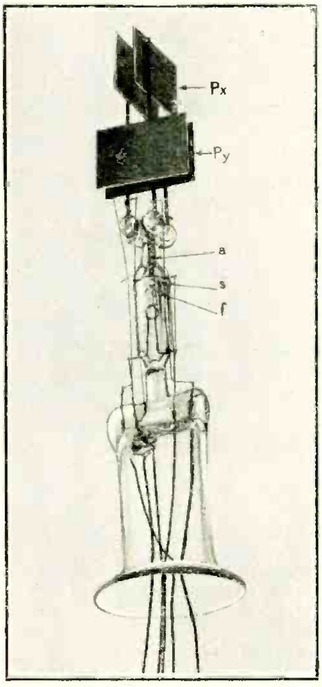
The former derives its electron beam from a high voltage gas discharge. Fig. 1 shows diagrammatically the arrangement of the gas discharge type, which is a form of high vacuum tube having at one end a cathode from which the cathode beam is projected. Two baffle screens A are provided with small holes in them, and on an enlarged end, a screen B of fluorescent material. The projection of cathode particles was brought about by the unidirectional and continuous discharge from some electrostatical electrical machine, such as a Voss or Wimshurst. The ray showed as a bright spot on the fluorescent screen. Deflection was obtained by placing on either side of the neck of the tube a pair of coils traversed by an electrical oscillatory current. The line of light so produced was examined with some such device as a rotating mirror. The tube required constant voltage from 10,000 to 50,000 resulting in an expensive, cumbersome, and somewhat dangerous



[By courtesy of the Western Electric Co., Ltd.

Fig. 2. Cathode ray oscillograph tube.

installation, which placed it beyond the means of most experimenters. The focussing of the ray was brought about



[By courtesy of the Western Electric Co., Ltd.

Fig. 3. Internal construction.

by the use of "striction" coils, or some other producer of a powerful field.

The Cathode Ray Oscillograph to be described here differs from the original form of Braun tube in that the source of electrons is a hot filament instead of a gas discharge. This makes it possible to operate the tube on a comparatively low anode potential of 250 to 400 volts, the sensitiveness being correspondingly greater, and the auxiliary apparatus very simple.

A general idea of the appearance of the tube may be obtained from Fig. 2, and the internal construction is shown more clearly in Fig. 3. The small internal glass tube seen in Fig. 3 contains a length of oxide-coated filament *f*, heated when in use, by a 4 or 6 volt accumulator. From 1·2 to 1·5 amperes are consumed by the filament when the beam of electrons is correctly adjusted, and the current to the tube anode *a* from which the beam issues, is about half a milliampere. A shield *s* is

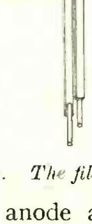


Fig. 4. The filament.

inserted between anode and filament, and has a small hole in the centre. The end of the filament is bent round into a nearly complete circle, of diameter just greater than that of the hole in the screen. The back bombardment on to the filament of positive electrons is thus largely overcome and the filament has a correspondingly longer life—about 200 hours. A detailed drawing of the filament is shown in Fig. 4. Above the anode, two pairs of deflecting plates Px and Py are mounted at right angles to each other, and one plate from each pair is connected to the anode. The potentials to be studied are connected between the anode and the other plate of each pair.

The large end of the tube is coated on the inside with a fluorescent substance, which becomes luminous at the spot where the electrons strike it. The coating is a mixture in equal parts of calcium tungstate and zinc silicate, which results in a spot sufficiently bright for visual observations, yet containing enough blueness to be fairly active photographically. The tube contains

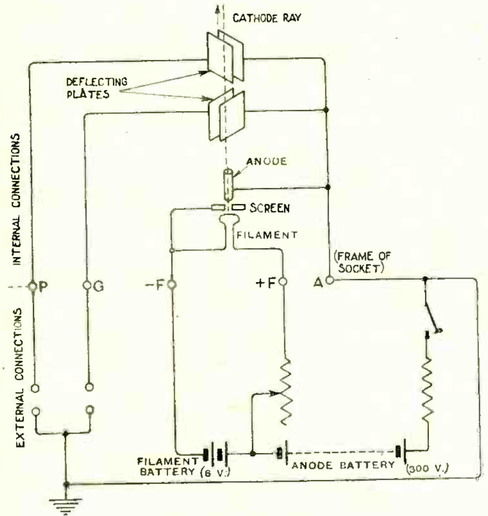


Fig. 5. Connections for the operation of the oscillograph.

a small amount of gas, which prevents charges from accumulating on the walls of the tube, and also assists in the focussing of the ray as will be explained later. The tube is based to fit into an ordinary bayonet socket, four lugs and the frame giving connection to the filament, anode, and deflecting plates.

A diagram of the connections for the operation of the oscillograph are shown in Fig. 5. The internal deflecting plates are connected conductively to the anode in order to avoid a charge collecting on them, which would cause the spot to drift.

The brightness of the spot increases rapidly as the anode voltage is raised, but a certain amount of sensitivity is lost. The anode voltage should therefore be governed by the nature of the experiment—whether sensitivity or quick visibility is of greater importance—but 300 volts is generally the best value.

When current deflection rather than voltage deflection is required, the current is passed through a pair of small coils of wire placed outside the tube, such as those in Fig. 2. The beam is deflected by the magnetic field from the coils, which are usually connected in series, and set of course, in a plane parallel to the plane of one of the pairs of deflecting plates.

The deflecting plates are made of a high resistance non-magnetic material, so as not to cause distortion when using the magnetic field. A bar magnet is sometimes necessary to compensate for the deflection of the ray by the earth's field, but apart from this and the circuit of Fig. 5, nothing more is required.

The focussing of the rays to a spot on the fluorescent screen, one of the most important steps in the designing of this type of oscillograph was, as mentioned above, brought about by the introduction into the tube of a small amount of gas. The suggestion was due to Dr. H. J. van der Bijl, who, with J. B. Johnson, was responsible for most of the work on the tube's development.

The part which the gas plays depends upon the difference in the mobilities of electrons and positive ions.

Some of the electrons in the stream forming the "cathode ray" in passing through the gas in the tube, collide with gas molecules and ionize them. Both the colliding electrons and the secondary electrons leave the beam, but the heavy positive ions receive very little velocity, as a result of the impact, and drift out of the beam with only their comparatively low thermal velocity. It therefore happens that positive ions accumulate down the length of the stream, so that there is a field surrounding the "cathode ray" which tends to pull the electrons inwards. There is, however, a mutual repulsion between the electrons constituting the beam, which has to be overcome before the ray is properly focussed. If there were only the mutual repulsion between the electrons to overcome, this would be done when the number of positive ions in the stream equals the number of electrons. If the original divergence in the beam is taken to be one degree from the axis, and the electron current 2×10^{-5} amp., then a simple calculation shows that the radial field required to pull the beam to a focus at a distance equal to the length of the stream in the tube is about one volt per cm. This field strength is produced, with beams of ordinary intensity, if there are four positive ions for each electron in the stream.

When the current is increased, the total positive ionization of the beam increases, the field around the beam becomes stronger, and the electrons are brought to a focus in a shorter distance. This has been proved to be true by using a moveable fluorescent screen with the tube.

The focussing of the beam therefore is brought about merely by adjustment of the filament current. In general, visual examination of the curves, etc., obtained is all that is required, though stationary curves may be photographed.

A difference of potential of 1 volt across a pair of deflecting plates, with 300 volts anode potential, results in a deflection of the luminous spot of about 1 mm. The deflection due to one ampere turn in the external coils of Fig. 2 is about 1 mm.

Articles to be published shortly in this Journal will describe experiments of the author relating to valves and valve circuits, in which visual results obtained with the cathode ray oscillograph will be described and explained. Amongst experiments to be described will be :—

Measuring modulation of high frequency currents.

Obtaining resonance curve of a reactive circuit.

Use as a frequency meter.

Characteristics of valves.

Investigation of oscillatory circuits.

Wave forms of rectifiers.

Study of transformers, etc.

EXPERIMENTAL STATION 2XP.

THE receiving portion of this installation is arranged in three separate sets of panels on a large vertical switchboard.

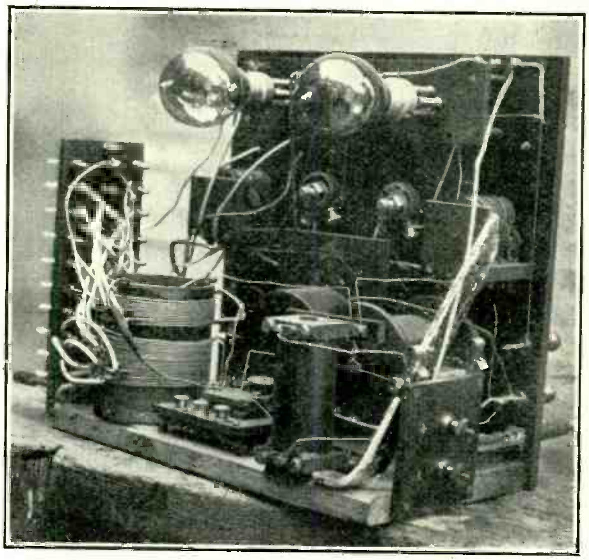
Six valves are employed, and the switching arrangements provide for any combination of valves or circuits to be used, from a single detector valve to two high frequency, detector, and three low frequency valves. The wavelength range of the tuner is from 140 to 25,000 metres.

A back view of the transmitter panel is shown in the photograph. Either grid or choke control may be employed for telephony transmission, and the valves may be connected in parallel for C.W. or grid modulation.

Three meters are provided on the front of the panel, which indicate respectively the anode, filament and aerial currents.

The H.T. supply is derived from the 240 volt D.C. lighting mains, and an aerial current of over 0·4 amperes is obtained when using two power valves.

The aerial consists of a 50-foot inverted L twin, used in conjunction with a four-wire counterpoise, no direct earth connection being employed.



Back view of the transmitter panel.

DRILLS AND DRILLING.

By Richard Twelvetrees, A.M.I.Mech.E.

In passing a critical eye over many of their earliest attempts at constructional work, most amateurs will recognise blemishes due to defects in drilling. Panels that were marked out accurately enough are marred by irregularly spaced holes; studs which ought to be upright, incline towards each other affectionately, and numerous other points indicate that something has gone wrong with the drilling.

There are so many patterns of drilling machine, ranging from the primitive bow pattern, still used for certain purposes, to the expensive pillar machine for repetition precision work, that the amateur may be excused if he gets somewhat confused when making the choice of tools for his workshop.

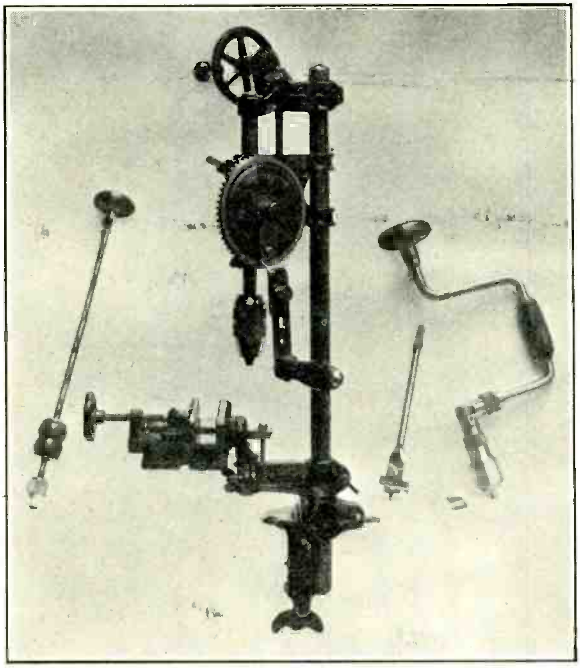


Fig. 1. A collection of drilling appliances.

The Use of Archimedean Drills.

For really light work there is nothing quite so handy as the simple form of archimedean drill, which in its modern form is sometimes known under the more elaborate title of the Reciprocating Automatic Drill. One of these is shown in the group of drilling appliances in Fig. 1, and consists of a double grooved shank with a chuck at one end and a ball-bearing head at the other. The motion is provided by working a central driver up and down the shank, and by virtue of the double groove the direction of rotation, permits of the use of ordinary twist drills. This little machine is capable of drilling holes up to ¼ in. in diameter with comparative ease, and is very useful in places where there is no room to swing a brace or gear driven drill. Furthermore, it is very desirable for using in a horizontal position, as the spindle is easier to keep perfectly level than that of the gear-driven type, and for this reason is sometimes preferred by amateurs. Its price, too, is an attractive feature as for the sum of six shillings a first-class type can be purchased.

Swing Braces and Expanding Bits.

The swing brace usually associated with the woodworker's kit is extremely useful in the wireless amateur's workshop, quite apart from its application to wood cutting. For example, in countersinking a drilled hole in metal the speed of the geared hand brace spindle is so rapid that there is a danger of running right through the hole with the countersink drill, but this objection disappears when the swing brace is used for the purpose.

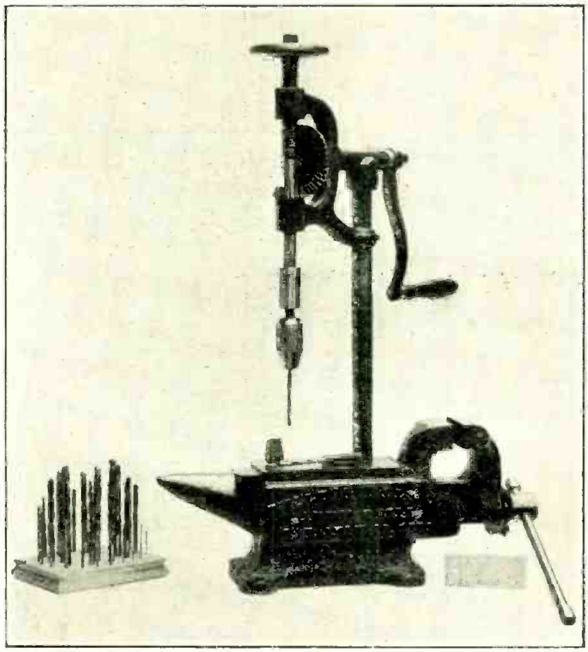
Apart from its uses on wireless work, the swing brace and a set of bits will often be required in adding to the general convenience of the shop itself, and is invaluable as a powerful screwdriver when a suitably shaped bit is fixed in the chuck.

Adjustable fly cutters can also be used in the swing brace for making large holes up to 4 in. in diameter in vulcanite or wooden panels; whilst special expansive bits, opening out from $\frac{7}{8}$ in. to 5 in. in diameter, enable one to complete jobs that would otherwise involve a good deal of work.

When it is desired to counterbore a hole in a block of ebonite, the job can be done better with a swing brace than any other hand-operated tool, especially if the cutter made for the job is left with the edges rather on the blunt side. Jobs of this kind tend to make the cutter "draw through" just in the same way as when drills are used to countersink holes when used in a geared brace.

Hand Drills.

The small wheel brace, shown in the group of tools in Fig. 1, can be used by itself or else can be mounted in the drill press also illustrated. The value of the latter will be readily appreciated by those who have experienced difficulties in drilling holes square through various kinds of work. The drill press makes an effective compromise between using the hand drill in the ordinary way and purchasing a more expensive machine than the character of the work to be done in the shop justifies. The press consists of a metal base provided with a screw clamp, and this permits of its being fixed securely to the work bench. The base is suitably enlarged to form a sort of table upon which the work to be drilled can be supported, and if necessary, clamped in position. By a simple sliding arrangement the press can be fixed at any desired height from the base with a single thumb nut, and the upward and downward movement of the drill is obtained by a very convenient and sensitive compound lever. When at its highest point, the distance between the chuck and the table is $7\frac{1}{2}$ in., which permits of a very useful range of work being done in this handy little contrivance. As the price of the stand itself is only 6s. 9d. the addition is not a very costly one.



(a) (b) (c)

Fig. 3. (a) Set of twist drills in stand. (b) Combination tool incorporating a drilling machine. (c) A drill gauge-plate.

Combination Drill, Anvil and Vice.

Those amateurs who from considerations of space favour various forms of combination tool, may be attracted by the appliance illustrated in Fig. 2, which has the virtue of permitting a large range of operations to be performed whilst occupying but very little room in the shop. From these points of view, the combination tool possesses distinct advantages, and therefore its claims ought not to be dismissed by the amateur constructor without due consideration.

There are few more necessary tools than the vice, the drill and the anvil, and in this case the three are combined into one appliance costing £4 10s.

It will be noticed that in this instance the drilling portion of the combination tool is far more solid in construction than any hand-operated brace, indeed it is made so substantially that there would be no objection to removing the handle and fitting a belt pulley in its place, thus converting it to a power-driven machine of a very inexpensive form. At times when the drill itself is not required, the entire pillar can be removed from its base by releasing two set screws ıd the combination of the vice with this ally substantial anvil, removes the objection mentioned in the previous article on ɔol Equipment.

The steel-faced anvil measures 8 in. long y 4 in. wide, and has a square hole into which vage blocks can be fitted, as well as a second ole, into which a drift for removing these wage blocks can be introduced. The latter oint alone indicates that the tool originates rom the brain of a practical man and thereɔre adds to the appeal made to the discriminating amateur. Somehow or other makeshift tools lead to makeshift methods ; and contrariwise, it is almost impossible to revert into slipshod ways when one is surrounded by a set of workmanlike tools. As manners maketh man, so tools often make the mechanic.

Twist Drills.

Until one becomes skilled in the use of hand braces, twist drills, especially those of the smaller sizes, suffer from breakages, and one is forced by bitter experience to learn how such breakages are avoided. If the drills are kept loose in a box or drawer, a considerable amount of time will be taken in searching for one of the required size, therefore it is much better to invest in a proper stand in which the drills are kept according to their size. Thus every drill can be found at once, or failing that, one can discover the place a given size of drill occupied before it was broken, which is a minor kind of consolation. The set shown in the photograph herewith includes drills from 1/16 in. to ½ in. in diameter advancing by sixty-fourths of an inch, thus including all sizes likely to be required by the amateur. Shown in this group also is a standard and tapping gauge for BA threads, which will enable the user to select the correct size of drill to use for holes that have to be tapped out.

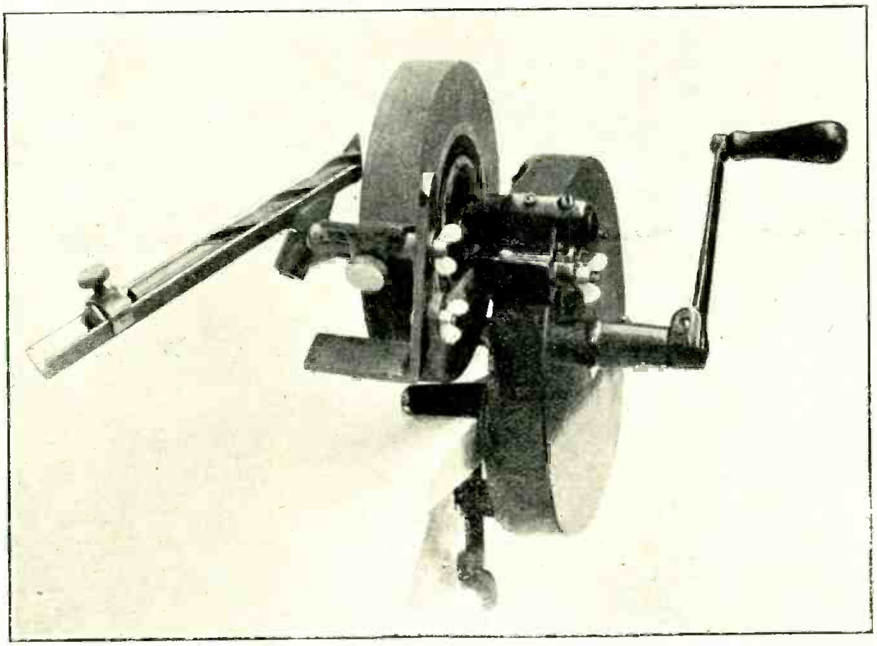


Fig. 3. A hand-operated grinder, with special attachment for correctly sharpening twist drills.

Drill Grinding.

If a small grinding wheel had no other use in the amateur's shop, it would justify its existence in keeping the drills sharpened, because the surest way to get inaccurate results with either a hand or machine operated drill is to use blunt or improperly ground drills. If drills are ground unequally nothing will induce them to run true, and so the holes are bound to be crooked and there are various other ill effects too numerous to mention here.

The best kind of grinder to use is one similar to that shown in Fig. 3. There are one or two points to be observed in selecting this kind of tool, as there are so many inferior models on the market. The worst thing is to choose one with cast gears for these are apt to chip and finally strip all the teeth on the very slightest provocation. Purchasers should insist on cut gears, machined from solid blanks, as these alone can be relied upon to give continued service. The gears and their bearings should be enclosed in an oil bath and the clamping arrangement must permit of a solid fixture on the work bench.

Unless one has had some practical e perience in grinding twist drills, the grind should have a special attachment where this operation can be performed very easil The attachment consists of a device f holding the drill to be ground at the corre angle with the surface of the grinding whee and by one simple movement of a hinge portion, the drill is made to follow the prop movement necessary to grind it accuratel

Amongst other uses, this high-spee grinder can be adapted to take a cotto polishing buff, which is useful in securin a high finish to fittings of sets designed t be ornamental as well as efficient.

Wireless Club Reports.

Felixstowe and Ipswich Radio Societies.*

A joint meeting took place on Saturday, August 18th, when, at the invitation of the Felixstowe Society, members of the Ipswich and District Radio Society visited Felixstowe.

The proceedings opened with a visit to the transmitting station of the Ship Salvage Co., the operator-in-charge, Mr. Barter, describing the various operations in considerable detail. After tea at the Pier Hotel, the visitors proceeded to the Old Walton Martello Tower, where a three-valve portable set was experimented with.

Despite the unsettled weather, culminating in a rainstorm, the afternoon was thoroughly enjoyed.

Hon. Sec., (Felixstowe), E. Cork, 3, Highfield Road, Felixstowe. Hon. Sec. (Ipswich), H. E. Barbrook, 46, Foundation Street, Ipswich.

The Wireless Society of Hull and District.*

The second of a series of visits to places of interest took place on Saturday, August 11th, when the members spent a very enjoyable and instructive afternoon at the Hull Corporation Electricity Works, Sculcoates Lane. Every detail of the machinery was carefully explained by capable guides.

On August 17th an excellent paper was read by Mr. G. E. Steel on an important subject to experimenters, viz., "Magnetism."

The annual Field Day was held at Anlaby on Saturday, August 18th, when, despite the very showery weather, there was a good attendance and excellent results were obtained with an outside receiving station, twelve pairs of telephones being connected at one time. Some experiments were also carried out with a kite aerial.

The syllabus for the winter is now being arranged, and the Hon. Sec. will be pleased to hear from anyone who would care to read a paper or give a demonstration. New members will also receive a hearty welcome.

Hon. Sec., H. Nightscales, 47, Wenlock Street, Hull.

Tottenham Wireless Society.*

"Workshop Practice" was dealt with in a lecture delivered on Wednesday, August 22nd, by Mr. L. Tracy. The lecturer carefully explained the fitting out of an experimenter's workshop, giving details of the tools to be used, and practical hints as to the best methods of doing those jobs which look easy until they are tackled. Mr. Tracy also suggested many admirable adaptations of tools for special purposes.

Hon. Sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

Midhurst and District Radio Society.

At the monthly meeting held on August 21st, under the Chairmanship of Major-General Sir J. F. Daniell, K.C.M.G., Mr. H. C. Naldrett was elected representative to the Radio Society of Great Britain. An informal discussion on "Reaction" was opened by the Hon. Secretary, who explained his remarks with blackboard diagrams. The discussion was keenly pursued by the President, the Chairman, and Messrs. S. F. Broadway and A. Haseltine, and it became evident that amateurs in the district are in favour of very little reaction and of taking great care in tuning.

An interesting winter programme is being arranged.

Particulars of membership will be gladly furnished by the Hon. Sec. H. J. Dyer Cossins, Hunsdon, Midhurst.

Barnet and District Radio Society.

A small attendance, due to the holidays, was noticeable at the Society's meeting on August 22nd. After the Morse class, one of the members exhibited a single-valve tuner, its circuit being discussed by means of blackboard sketches.

There is still room for new members, and prospective members will be gladly furnished with particulars by the Hon. Sec., J. Nokes, "Sunnyside," Stapylton Road, Barnet.

INSTRUCTIONAL ARTICLE FOR THE LISTENER-IN AND EXPERIMENTER.

WIRELESS THEORY—XXIII.

The series has been specially arranged so that the reader who follows each section as it appears will have obtained a complete wireless education with a minimum of time and trouble, and he will be in a position to successfully design his own wireless equipment.

Recent sections deal with series and parallel circuits, damping, choke coils, and transformers.

By W. James.

6.—Mechanical Analogy.

WHEN studying the properties of coupled circuits, it is helpful to consider the motion of coupled pendulums. Suppose we have two pendulums (Fig. 112), which may consist of two equal lengths of cord, each fastened with masses of equal weights tied to a supporting cord at A and B. Call

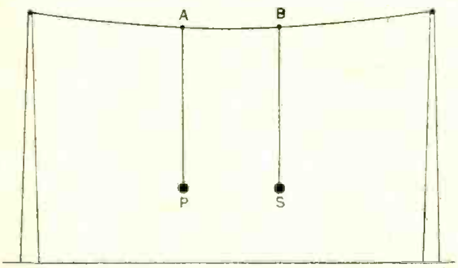


Fig. 112. *An arrangement consisting of two pendulums, P and S, fastened at points A and B to the supporting cord, used to show the effects of coupled circuits.*

the pendulums P and S, P corresponding with the primary circuit and S with the secondary circuit. If their lengths and weights are equal, their natural frequencies are the same. The greater the distance between the points of support A and B, or the tighter the supporting cord, the smaller or weaker the coupling, so that the coupling may be altered by changing one of these factors. With these factors held constant, increasing the length of the pendulums reduces the coupling. The damping is affected by the size of the masses, and is due to air displacement and losses in the cord between A and B. The damping may be increased by fixing vanes to the masses.

If pendulum P is pulled to one side and then released, it swings two and fro, and energy is transferred *via* the cord A B to pendulum S. The amplitude of the swing of P becomes smaller and smaller as energy is transferred to S, and lost through damping, and finally reaches zero. At the same time, as pendulum S receives more energy from P, the greater will be the amplitude of its swing until P has parted with all its energy. At this moment, the amplitude of P is zero, and that of S is at its maximum. The amplitude of the swing of S at this instant is nearly equal to the initial amplitude of P (the masses and lengths of P and S being similar). Since S continues to swing, energy is transferred back to P, which commences to swing again, its amplitude building up as energy is transferred, while the amplitude of S falls off. When the whole of the energy

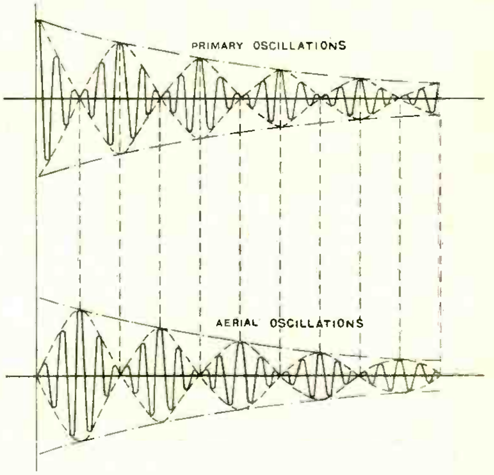


Fig. 113. *The upper curve shows the amplitude of the oscillation in the primary circuit, and the lower curve those in the secondary or aerial circuit. Notice the amplitude of the primary oscillations is a minimum, when that of the secondary is a maximum. The oscillations are not symmetrical as shown by the dotted outline. The amplitude of the maximum values decrease as indicated by the dotted lines.*

c

has been transferred from S, the amplitude of P is a maximum, and that of S a minimum (practically zero). The maximum swing of P is, however, a little less than the last maximum value of S. The cycle of events goes on; while the amplitude of P is increasing that of S is decreasing and *vice versa*, the maximum amplitude each time being smaller through damping losses, until the whole of the energy originally applied to P is expended.

The frequency of the swings is constant except when either pendulum passes through its minimum swing, when there is a phase reversal.

The motion is represented in Fig. 113. The rise and fall in the amplitude of the pendulums occurs at regular intervals. The tighter the coupling (*i.e.*, the closer points A and B), the less is the number of oscillations between successive minimum values.

Since each pendulum has a similar natural frequency, it follows from the nature of the oscillations that the frequency of the oscillations or swings is not that of the natural frequency of the pendulums themselves; in fact from the curves showing the motion of the pendulums it may be seen the beats [illegible] produced through the operation of t[illegible] frequencies. The beat frequency $N = f_1 -$[illegible] where f_1 and f_2 are the two frequencies, s[illegible] Figs. 114 and 115. Here, curves A and [illegible] represent the two frequencies f_1 and [illegible] The resultant curve is the full line, and [illegible] shown again in Fig. 115.

Suppose now after pendulum P h[illegible] given the whole of its energy to S, that [illegible] when the pendulum S has reached its fir[illegible] maximum value, pendulum P is prevente[illegible] from swinging again (by holding it, or cuttin[illegible] it off). S will oscillate at its own natural frequency. Instead of its swings being damped down quickly through transferring energy back to pendulum P, it will continue to swing with slowly diminishing amplitude, the reduction in amplitude being only due to its own damping.

The swinging of the pendulum will then be as shown in Fig. 116. This case is important in practice, and is analogous to the condition obtained when a *quenched spark gap* is employed in the primary circuit. During the time the primary pendulum is swinging, the secondary pendulum is increasing in

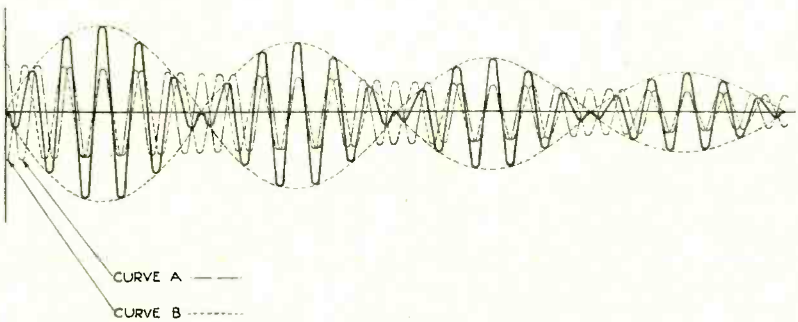


Fig. 114. *Curves A and B, represent currents with frequencies of f_1 and f_2. Each circuit, primary and secondary, have flowing in them at the same time two currents with frequencies f_1 and f_2. The resultant current obtained by adding curves A and B is shown by the full line, and again in Fig.* 115 *below.*

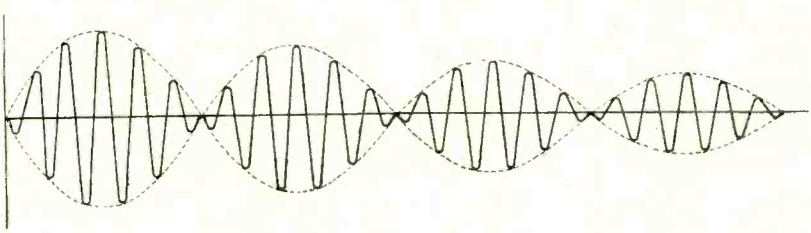
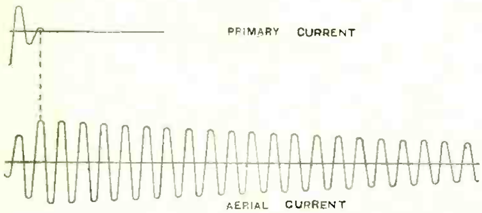


Fig. 115. *Refer to Fig.* 114.

plitude, and as before, two resultant freencies are present, but when the primary cuit is opened, the secondary oscillations determined solely by the constants the secondary. It swings at its own natural quency, and the reduction in the amplide of the oscillations is due to its own mping.



ig. 116. If the primary circuit is broken at the id of the first few oscillations (i.e., when the current as reached its first maximum value), the secondary rcuit will oscillate at its own natural frequency, the urrent only gradually falling in amplitude because f the small damping. At the beginning of the scillations in the secondary circuit, while the oscillations are building up, two currents, with two frequencies are produced as before.

7.—Effect of Coupled Circuits on Frequency.

Let us now see what happens when the condenser C, Fig. 71*, is charged. If the aerial circuit were removed, the circuit consisting of coil L, condenser C and spark-gap G, would oscillate (during the time a spark discharge was passing across the gap), the frequency and damping being determined solely by the constants of the circuit. When the aerial circuit, consisting of the aerial coil and the condenser formed between the aerial wires and the earth is coupled with the primary circuit, energy is induced into the aerial circuit. Consequently a forced oscillation commences in the aerial circuit, which then oscillates at its natural frequency. At the same time, when energy is oscillating in the aerial circuit, energy is induced back into the primary circuit. Clearly, the tighter the coupling, the greater will be the effect of each circuit upon the other, so that the resultant oscillations are different from those generated when the two circuits are not coupled; further, the energy in the aerial circuit will be quickly damped out, owing to the losses caused by the primary.

The effect of tight coupling upon the damping is shown in Fig. 117. The primary oscillations induce secondary oscillations, and because of the transfer of energy, the primary oscillations quickly die down. Then energy is transferred from the aerial circuit back to the primary, consequently the aerial oscillations die down quickly, and oscillations are built up again in the primary circuit. This transfer of energy from one circuit to the other takes place until the whole of the energy is expended. It will be noticed that when the current in one circuit is at its maximum value, that in the other circuit is at its minimum value.

When the coupling is loose, the reaction between the aerial and primary circuits is less, consequently the energy is slowly transferred from the primary to the aerial circuits and *vice versa*, as shown in Fig. 113. If the initial primary energy is the same in this as in the previous case, the number of wave trains will be less; also the peak value of the voltage induced in the aerial circuit is less than in the former case.

We have shown that when two circuits are coupled together, the effect of mutual inductance is to change the effective inductance of each circuit. In the case of

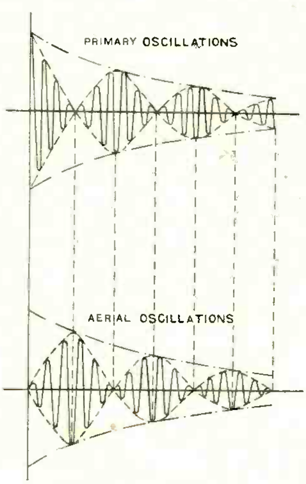


Fig. 117. When the circuits are tightly coupled, the oscillations are more quickly damped out.

Fig. 71, if the inductance of the primary circuit is $L\mu H$, and that of the aerial circuit $L_A\mu H$, and each are separately tuned to the same natural frequency, f, f is proportional to

$$\frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{L_AC_A}},$$ C and C_A being the capacities of the closed and aerial circuits.

* Wireless Theory, July 7th.

When the circuits are oscillating, the frequency of the oscillations will not be f, but will be different because now the effective inductance values of the aerial circuit will be $L_A\ (I-k)$ and $L_A\ (I+k)$, and that of the primary $L\ (I-k)$ and $L\ (I+k)$, resulting in frequencies proportional to

$$\frac{1}{\sqrt{L(1-k)C}} \text{ and } \frac{1}{\sqrt{L(1+k)C}}$$

Two frequencies are generated, f_1 and f_2, the mean frequency being f, that for which the circuits were tuned. One frequency is higher and the other less than f. In Fig. 114, curve A represents the higher and curve B the lower frequency. By adding the two curves we obtain the total aerial current. At one instant, the two currents are in phase, and the total current therefore high. A little later they are in opposition, giving zero resultant aerial current. The resultant current curve is shown again in Fig. 115, and it is seen the current rises and falls at intervals. It will be noticed that there is a phase reversal when the currents reach their minimum value. The frequency with which the current falls to zero is called the beat frequency, and is equal to f_1-f_2 per second.

N, the beat frequency

$$= f_1 - f_2 = f\left(\frac{1}{\sqrt{1-k}} - \frac{1}{\sqrt{1+k}}\right)$$

When k is small, $N = fk$.

The two frequencies or wavelengths may be observed with a wavemeter. If they are λ_1 and λ_2, we may find the co-efficient of coupling k, from the relationship

$$k = \frac{\lambda_1 - \lambda_2}{\lambda} \times 100$$

which is sufficiently accurate for most purposes. Thus, if the observed wavelengths are $\lambda_1 = 420$ metres, $\lambda_2 = 380$ metres, the natural wavelength of the circuit $\lambda = 400$.

$$k = \frac{420 - 380}{400} \times 100 = 10 \text{ per cent.}$$

The effect of close coupling is therefore to cause the energy to be transmitted, not with a single frequency or wavelength, but a band of wavelengths is occupied, the amplitude of the aerial current being a maximum at two points. A resonance curve showing the effect of close coupling is given in Fig. 118. It will be noticed there are two peaks, corresponding with the two wavelengths.

As the coupling is made very loo the resonance curve is altered and approac curve A, Fig. 119. Weakening the coupl still further reduces the amplitude of aerial current as at B.

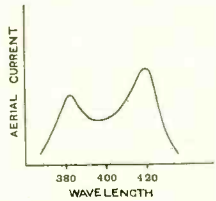


Fig. 118. If we couple a wavemeter near the secondary circuit and measure the current (or watts) induced in the wavemeter circuit when it is adjusted to various frequencies, a curve as above may be plotted. When the primary and secondary circuits are tightly coupled, a wide band of frequencies may be occupied. The curve is not flat, but has two peaks which correspond with the two frequencies produced.

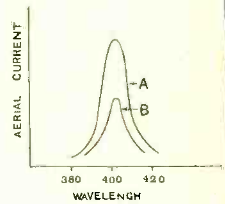


Fig. 119. When the cou ling is loosened or ma weaker, the energy in t secondary circuit a proaches that represent by curve A. Tuning in this case is fair sharp, the energy osci lating in a narrow ban of frequencies with th resonance point well de fined. If the coupling made still weaker, th resonance curve is sharp but there is a loss energy, represented b curve B.

The disadvantage of coupling too closel is obvious. Through the band of wavelength occupied for a single transmission, interference is produced; further, the aeria voltage rises to a higher value than when looser coupling is employed, giving greate risk of insulation breakdown, as well as tending to excite other aerials. If the energy sent out is highly damped, aerials may be excited by shock, that is, forced into oscillation, the aerial circuit then oscillating at whatever wavelength it happens to be tuned.

In next Issue :—

How to make
A PORTABLE FLEWELLING RECEIVER

Distortion in
DETECTOR VALVE CIRCUITS

Some Laboratory Experiments with the
ARMSTRONG SUPER

Theory of
INDUCTANCE COIL DESIGN

HINTS FOR BETTER RECEPTION.

By W. JAMES.

A GOOD deal of the noise present while listening to a concert is due to the high tension battery, and sometimes to the accumulator. ıe internal resistance of the battery :reases during its life, resulting in a drop voltage across the battery itself, the drop, course, being equal to the current multi-ied by the resistance. If the resistance anges during reception, the voltage across e battery changes in proportion, and e anode filament current changes on this :count instead of only varying according the signal. The variations are amplified, ıd produce noise in the telephones. In ldition the battery resistance acts as coupling between each valve, variations anode current due to the signal producing orresponding variations in anode voltage hich is communicated to each valve. he result is often that the receiver howls. ccasionally oscillations with frequency bove audibility are produced, seriously educing the signal strength. The remedy s to connect a large capacity condenser, uch as 2 μF, across the battery, to act s a reservoir, and as a low-impedance ath between the common anode connec-ions and the filament. Results are often urther improved by connecting a resistance of the order of 25,000 ohms across the battery, but this resistance will take an appreciable current if a high anode voltage is used (4 MA with 100 volts). Nevertheless, when the battery is old and very noisy, it is worth while adding this resistance (Fig. 1).

When the accumulator is almost discharged, and sometimes when it is freshly charged, noises may be produced by it. The remedy is to shunt it with a condenser and resistance. A 2 μF condenser and a 500 ohm resistance generally suffice to prevent the noise due to the accumulator. If a potentiometer is used there is no need for this resistance.

Noises are sometimes produced through poor insulation. The skin of ebonite should be removed before parts such as valve sockets are mounted. Very often it is as well to scratch lines around all terminals, valve sockets, etc. Valve holders constructed of composition instead of ebonite should be avoided.

A faulty grid leak causes, as a rule, a very bad noise. All transformers and condensers, such as those used to couple the anode circuit with the next grid circuit, should be very carefully insulated. In the case of transformers, low insulation causes

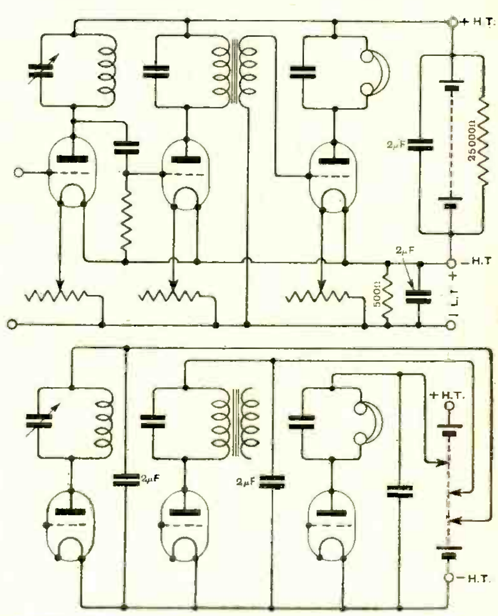


Fig. 1. The upper figure shows the method of connecting a condenser and resistances across the H.T. battery and the accumulator to help in the reduction of noise. In the lower figure a separate voltage tap is provided for each anode circuit.

a marked reduction in amplification, as well as noise.

Of course no one would expect a receiver to work well if there were any intermittent disconnections in the wiring, or in the wire of any of the components.

When designing a multi-stage amplifier, it is important to make sure that each valve works within the limits imposed by its characteristic curve.

The nature of the apparatus joined in the output (anode) circuit determines to a large extent whether the working or dynamic characteristic curve is straight or not. The curve will have a considerable straight portion when, in the case of a resistance connected in the anode circuit, the ohmic value is about twice the normal impedance of the valve. In the case of an " R " type valve, the normal impedance is about 40,000 ohms; the " V 24 " type valve, 15,000 ohms. When a choke is used, its inductance, under working conditions, should be 50 henries or more if possible. It will be clear that if the characteristic curve is not straight over the portion used, the output cannot be a faithful copy of the input, and the harmonics produced may be objectionable. When a tuned anode circuit is used, its impedance will be generally sufficient to give a straight characteristic.

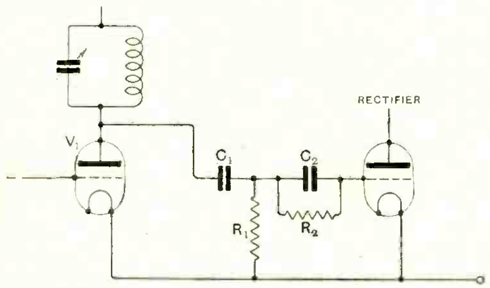


Fig. 2. Condenser C_1 is the coupling condenser, C_2 and R_2 the grid condenser and leak resistance. Resistance R_1 fixes the potential of the point joining C_1 and C_2.

In general, when fairly large capacity valves, such as the " R " type are employed for high frequency amplification, there will be no need to provide the second stage with higher anode volts and a higher filament temperature than the first, but it is as well to use plenty of anode voltage and to control the length of the characteristic curve by variation of the filament resistance.

When the tuned anode method of high frequency amplification is employed, it is of course essential to provide a coupling condenser. It has been found desirable, both from the point of view of signal strength and quality, to employ two grid condensers and grid leaks as shown in Fig. 2. Here condenser C_1 is employed to couple the anode V_1 with the grid circuit of the rectifier, and the resistance R_1 prevents it obtaining an unsuitable potential. The secondary C_2 and resistance R_2 are the ordinary grid condenser and leak. The condensers and resistances may be adjusted to give v fine results.

A good deal of distortion is due to properly designed note magnifiers. rule should be not to use more than tl stages when the signals are to operate ordinary loud speaker. When transforr coupling is employed, it is highly import: to use only the best type of transform

There are, unfortunately, many manuf tured which ruin quality. There are a f good ones, only, which are expensi They have a large number of turns, a a low ratio. It is much easier to build low ratio transformer—such as two to one which will be satisfactory, than a four one, which is generally not satisfactor Poor quality due to bad transformers m: be improved at some expense in amplific tion by connecting a resistance across t secondary winding, although it should l emphasised *there is no need to connect resistance for this purpose when the tran former is well designed.* Sometimes, howeve a high resistance of the order of 0·5 megohı is connected for the purpose of reducin noise produced by strays or stati Another method is to provide *an air ga in the iron core.* One may easily find whethe

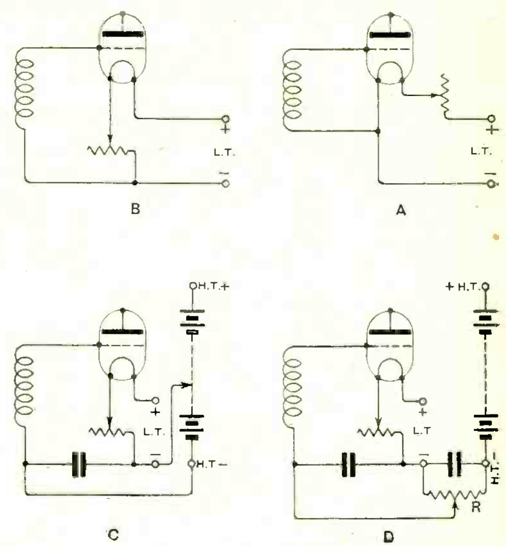


Fig. 3. Methods of connecting the grid circuit to obtain a suitable operating potential. In (A), the normal grid voltage is the same as the negative side of the filament. In (B), the grid is negative by the voltage drop in the filament resistance. Diagram (C) shows how the potential is obtained by tapping the H.T. battery. The scheme shown at (D) is probably the best of all.

proved quality results by gradually parating the two parts of the core while tening. The air gap is particularly necesry when the transformer carries a relatively gh anode current.

It is, of course, necessary to use some eans for providing the grid circuits with e requisite normal potential. Grid current ill flow when the grid becomes positive d produces distortion. Cells may be is required. Two special transformers are required, with a centre tap taken from the secondary of T_1 and from the primary of T_2. Alternatively, two transformers may be used in place of T_1, the two primary windings being connected in series, and the two secondaries in series with the inner terminals connected to the grid battery. In the case of transformer T_2, the two transformers may be connected in series as

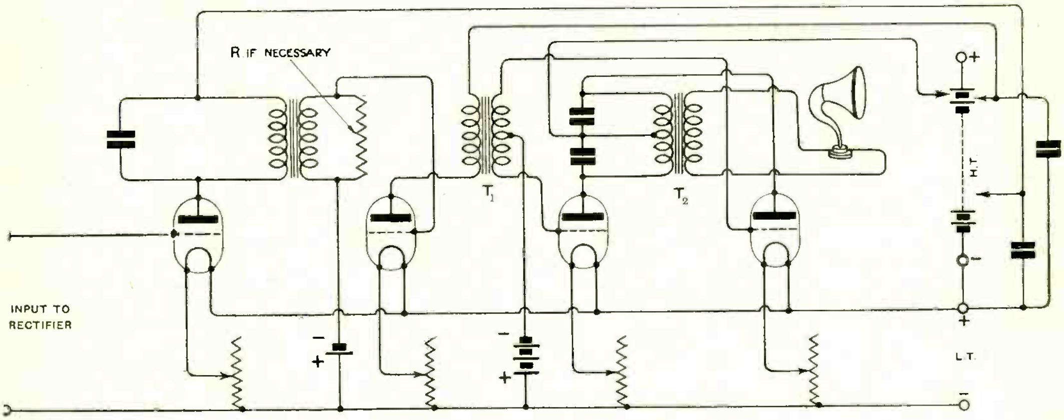


Fig. 4. Connections of the push-bell amplifier.

used in the grid circuit, or a resistance may be employed as shown in Fig. 3D. The anode current flowing through resistance R produces a voltage drop across it; —H.T. is negative by this amount with respect to —L.T. If the anode current is 5 MA and the resistance 1,000 ohms, the voltage drop is of course 5 volts, so that —H.T. is 5 volts negative with respect to —L.T. A suitable potential may be tapped off, and further, if the H.T. volts are increased, the anode current increases, giving a corresponding increase in the voltage drop across the resistance. The grid is therefore automatically made more negative. A 2 μF condenser should be connected across the resistance.

There is some danger that with strong signals the last valves of the low frequency portion of an amplifier may be over-loaded in spite of using extra high tension volts, and a suitable grid potential. Special valves are expensive, and extra high tension and filament current are required. The circuit given in Fig. 4, which is known as a push-bell amplifier, may be used with every success when extra strength of signals before, and the connection from positive H.T. taken to the inner primary terminals.

This method is very useful when extra power is required using ordinary receiving valves, such as the "R" type, and enables one to use transformers which, when used in an ordinary circuit, produce distorted signals.

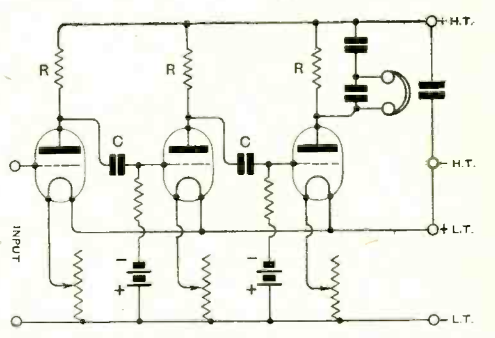


Fig. 5. Resistance amplifier. The telephones only carry the varying current; the steady anode current is carried by the resistance R. Suitable values are $R = 70{,}000 - 100{,}000$ ohms, coupling condensers $C = 0{\cdot}005\mu F$ to $0{\cdot}05\mu F$. Grid leaks $0{\cdot}5 - 2M.\Omega$.

There is a good deal to be said for the ordinary resistance coupled amplifier, on account of it being entirely aperiodic, that is, untuned. The connections are given in Fig. 5. The anode resistances R may have a resistance of 70,000 to 100,000 ohms, and the anode voltage should be raised accordingly. The grid leaks should preferably have a high resistance such as 2 megohms, but provided the cells are used as shown, this value may sometimes be reduced with improved results. The coupling condensers C have a value of 0·005 0·05 μF. The H.T. voltage required necessarily high—120 volts is suitable. will be noticed the last valve has a resistan in its anode circuit, connected across whic is the loud speaker in series with a larg capacity condenser. A well insulate 1 μF condenser is recommended. In this wa only the signal current, which is a varyin current, passes through the loud speake The remainder of the anode current passe through the anode resistance.

CORRESPONDENCE

CONSTITUTION OF THE COMMITTEE OF THE RADIO SOCIETY OF GREAT BRITAIN

Much comment has been aroused by the publication, in the August 22nd issue of this Journal, of a letter from Lieut. H. C. H. Burbury, protesting against the composition of the Committee of the Radio Society of Great Britain. The question is one which we feel should be open for discussion from all points of view and therefore we publish the following representative letters recently received.

To the Editor of The Wireless World and Radio Review.

Sir,—I should be grateful if you would permit me, as President of the Radio Society of Great Britain, to make a few comments upon Lieutenant Burbury's letter appearing in your current issue, wherein he discusses the Society's efforts to promote national unity in amateur wireless matters.

First, I should like to remind you that when the need for an amateur society of national scope became apparent some years ago, the Wireless Society of London initiated a scheme of annual conferences. At these meetings the organisation of a national amateur Parliament was discussed. The conferences were all well attended, and each of them enabled the Wireless Society of London to take a further step towards national accord. As a consequence the present position is as follows :—

(1) The Radio Society of Great Britain has been formed from the Wireless Society of London and its affiliated Societies.

(2) The Radio Society has received the honour of the patronage of H.R.H. the Prince of Wales.

(3) The Memorandum and Articles of Association defining the constitution of the Radio Society are now approaching completion.

(4) Meanwhile the affiliated Societies are being kept in touch by letter from the Hon. Secretary of the Radio Society, and by memoranda circulated as required.

During the transition period the Committee of the Society is studying how to ensure adequate representation of the affiliated Societies on the Central Committee. In order to get the best advice on this matter the Committee decided to invite four provincial amateurs to join them. In view of the urgency of the matter the Committee themselves chose four provincial members instead of trying to organise a special election. This is the step which has called forth the letter of your correspondent. But I can assure him that neither the method of augmenting the Committee, nor the proportion of provincial to London members, is intended as a permanent arrangement or as a precedent. Arrangements for the future will be made with an open mind by the augmented Committee.

Finally, as a practical step towards helping the Radio Society to obtain complete representation of every view, I suggest that those amateurs who sympathise with your correspondent should communicate with him and then elect a representative; after which I would do all I could to get their representative appointed to the Committee immediately.

Yours faithfully,

W. Eccles.

To the Editor of The Wireless World and Radio Review.

Sir,—I have read in your last issue a letter from Lieutenant H. H. Burbury, and I would like to state that I am in sympathy with him as regards his suggestion that there is now too much trade element on the Committee of the Radio Society of Great Britain.

This Society (until recently the Wireless Society of London) was originally formed to look after the interests of the wireless experimenter. It is officially recognised by the Postmaster-General, and in this, and other connections, has done most excellent work. It is only to be expected that owing to the growth of the wireless industry in this country, a number of the members of the Committee, being very clever wireless experimenters, should turn their knowledge to commercial advantage, and so enter the wireless trade.

The Radio Society of Great Britain has now been constituted the parent body of wireless experimenters and their local associations, so that it would seem to me to be correct that its operation should not be controlled by a Committee, consisting mainly of members connected with the wireless trade, either commercially or professionally, but that a new Committee should be elected, on which there is only quite a small proportion of the trade.

I also think that, in view of the importance of ıe Society, and its anticipated growth, that a paid ecretary should be employed, as I am sure there ill be a very great deal of work and detail involved ı the future, which it would be unfair to expect gentleman in an honorary capacity to execute.

I suggest that you throw your columns open for orrespondence on this matter, which I am sure will e of great interest to the members of the Radio ociety of Great Britain and its affiliated Clubs nd Societies.

W. W. Burnham, Fellow I.R.E.

London, W.C.2, *August 28th*, 1923.

To the Editor of The Wireless World and Radio Review.

Sir,—With reference to Mr. H. C. Burbury's letter in your issue of the 22nd inst., we wish to say that we heartily endorse his remarks with regard to the position of the Radio Society of Great Britain.

It has long been evident to our Society that the R.S.G.B. function only as a debating and lecture society and our affiliation to them means nothing more to us than support for this side of their activities.

As one of the oldest wireless societies in the country may we appeal to the other societies to give publication to their views on this subject, as the inactivity of the R.S.G.B. during and since the formation of the B.B.C. is a galling fact which calls for immediate consideration.

Unity of action is essential. The experimenters of the country to-day are evident in such numbers that they can claim their individuality if they act together, and they require a live representation by a Committee of Amateurs free from any trade influences.

It is presumably admitted that the R.S.G.B. require full trade support for their lecture programme, but if they are to maintain their position as the representatives of the amateur movement, they have yet to offer facilities for a Committee of Amateurs free to deal exclusively with the P.M.G. and with amateur organisation.

The alternative, which seems to us the happier solution, would be achieved if all the Experimental Societies rallied behind the British Wireless Relay League, which is already a purely amateur organisation, and worked to give it a status similar to that enjoyed by the American Radio Relay League in the U.S.A. We are aware that criticism has been raised in London on account of the fact that the B.W.R.L. is run from Manchester, and that there is no room for relay work in this country. There is no apparent reason, however, why the B.W.R.L should not transfer headquarters to London if they were fully supported and still work in harmony with the R.S.G.B., and one has but to listen-in on amateur wavelengths any night to realise the vast amount of practical work going on within our boundaries, which, if developed in the spirit of the "freemasonry of the ether" by a central office of reference, would react to the benefit of all.

It is singularly fitting, we must remark, that we should be called to action by Mr. Burbury who is, we believe, universally acknowledged one of the foremost amateurs of the day.

W. G. Dixon,

(Chairman, Newcastle-on-Tyne Radio Society).
Rowlands Gill, Co. Durham, *24th August*, 1923.

To the Editor of The Wireless World and Radio Review.

Sir,—I have read with interest your editorial of August 1st on "Politics in Wireless."

It seems to me that the trouble is that the genuine amateur has no national society to look after his interests, that is, no genuinely constituted national society.

It must be evident to everyone that the so-called Radio Society of Great Britain is simply the old Wireless Society of London under a new name, and even the addition of carefully selected provincial members of the Committee suggested by the Committee itself, does little to improve matters.

A society calling itself the Radio Society of Great Britain should be constituted of the whole of the amateur societies of Great Britain on an equal footing, without any dominant or outstanding society, each society sending delegates to a yearly conference in the proportion of say one delegate to every 50 of its membership, and each society paying its quota on membership to the central funds, as decided by such Conference. The Conference thus constituted would then proceed to elect its Executive Committee to meet and conduct the general business of the society.

I am, of course, aware that the "Shilling a head" idea was dropped at the last so-called Conference, but was mainly opposed because the provincial societies had no representation, and object to government entirely by London. The best brains are not all in London even if the biggest hats are there.

The danger to the amateur to-day is not through any lack of insight into the future on his part, nor on account of any petty jealousies between individuals and societies. I do not believe in going round corners, and I say in all seriousness that the amateur (the genuine amateur) has no say in any national society. I have before me, as I write, the letter heading of the so-called Radio Society of Great Britain, and much as I admire the strings of letters after the names of the various officers, I can find very few names of men who are purely amateurs.

That is the danger to the amateur. His interests are in the hands of men who are not solely in the radio science for hobby and scientific interest from pure love of it, but who have made radio their profession, and in many cases their livelihood. They naturally look on radio from a purely professional and business standpoint, and whatever legislation arises with respect to radio they will eventually adapt themselves to it in such a way that their financial interests are not unduly disturbed, whatever may happen to the amateur.

I may be wrong; I hope I am, but I do think that if these gentlemen are elected to office in the Radio Society of Great Britain they ought to be so elected (with a leavening of the pure amateur) by general vote of the whole of the affiliated wireless amateurs of the country, and not by the comparatively few members of the Wireless Society of

London, which is as much in existence as ever it was.

You, Sir, are the editor of a journal which is the official organ of the Radio Society of Great Britain. You are not the editor of the official organ of the amateur, but you would be were the Radio Society of Great Britain properly constituted and conducted to run the country instead of the Metropolis.

LOUIS J. WOOD, Hon. Sec. Halifax Wireless Club.
Member, Radio Society of Great Britain.
Halifax, *August 3rd*, 1923.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—With reference to the letter (published in *The Wireless World and Radio Review*, August 8th), giving details of a new scheme for representation on the National Committee, at our meeting last evening it was unanimously decided—

"That in the matter of representation on the Committee of the Radio Society of Great Britain, London should be treated as a separate group entirely and under no circumstances should any member of an affiliated society of the London group represent the provincial societies on the National Committee."

As this seems to be a matter of easy adjustment we trust that the Committee of the Radio Society of Great Britain will give it immediate attention.

P. SAWYER,
Hon. Sec. Southampton and District Radio Society.
Southampton, *August 11th*, 1923.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I welcome Lieut. Burbury's recent letter and the correspondence to which it has given rise as evidence of awakening interest in Radio Society politics and a desire on the part of the Provinces to take a more active part in them.

In the conduct of each of the four annual Conferences every effort was made to induce the delegates to suggest means of effective representation and even of executive power. Having failed to do so the Committee now invite some leading amateurs in the Provinces to attend their meetings with a view to formulating means whereby at the next Conference they can elect their own representatives.

The Committee of the Radio Society of Great Britain is continuously listening in to catch the views of the Provincial Societies, who so abl represent the average amateur throughout th country. It has been well said that London always the purse, sometimes the brain, but never th heart of England. It is doubtless because w realise this, that the vast majority of the Provincia Societies have accepted our recent announcemen as an evidence of our persistency in tuning i and have welcomed it accordingly.

Now as to the charge of professionalism. A few years ago the profession did not exist. It was created by such men as those whose names appea on the letter heading of the Radio Society of Grea Britain, *every one of whom was an amateur or a professor.* Many have since been forced into the profession by their achievements, and I am confident that they are as good representatives of the amateur as they ever were, but I realise that some readjustment will be necessary as the younger men don't know their history and some of the older ones forget it. At every annual meeting of the R.S.G.B., the floor members have been urged to take advantage of their democratic constitution and to initiate election of new members.

Owing to the holidays I have had no opportunity of conferring with my colleagues. but I can say with confidence that our wish is to encourage "a large and liberal discontent" and to give the fullest opportunities for the expression of opinion.

F. HOPE-JONES,
Chairman, Radio Society of Great Britain.
London, E.C.1, *August 29th*, 1923.

ON JOINING A WIRELESS SOCIETY.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—With reference to the Editorial in your issue dated August 15th, entitled "On Joining a Wireless Society," I should like to see wider publicity given to this excellent article.

If every Hon. Secretary of a wireless society would take the trouble of sending a copy of the article to the editor of his local paper, together with a few items of information relating to his own society, it is quite probable that he would soon make the acquaintance of many of "those who should be members, but who stand aloof."

H. HYAMS.

Crouch End, N.8.
August 17th, 1923.

Notes and News

For the benefit of ratepayers a wireless set has been installed at the Shoreditch Council Library.

* * * *

The Brazilian Wireless Telegraph Company has begun the construction of a high power station at Rio de Janeiro.

* * * *

A wireless car is being constructed for the use of Scotland Yard. It will be capable of both transmission and reception of messages.

* * * *

Wireless on Lifeboats.

The adventurous voyage of the *Trevessa* survivors in a ship's lifeboat has raised the question of equipping such boats with wireless apparatus. In this connection, Mr. Havelock Wilson. Chairman of the Seafarers' Joint Council. recently stated that, "in his opinion, the installation of such apparatus is an absolute impossibility at present, for there is no machinery yet invented that would make it possible to install wireless in a small boat."

This somewhat sweeping assertion is hardly in accordance with facts, for special lifeboat sets have been in existence for several years. A new type of wireless installation for ships' lifeboats is at present on view at the Olympia Shipping Exhibition, constructed by the Marconi International Marine Communication Company. The set, which is easily carried between the afterthwarts of a lifeboat, embodies a direction finder, an almost indispensable adjunct to such an installation. The transmitting range on a 600 metres wavelength is 50 miles.

Continental Broadcasting Reception.

It would be interesting to know whether any other listeners-in have "logged" so many foreign broadcasting stations as Mr. Kenneth M. Langdale, of Petersfield, Hants. The following have been heard quite distinctly with a three-valve set (H.F., detector and L.F.):—Eiffel Tower, Radiola, Ecole Supérieure des Postes and Telegraphes, The Hague (PCGG and PCUU), Koenigswusterhausen and Prague.

The Birmingham Broadcasting Station.

The aerial of 5 IT at Summer Lane, illustrated on page 710 of our issue of August 22nd was specially constructed for the British Broadcasting Company by Messrs. Reynolds and Bradwell, the well-known Birmingham electrical engineers.

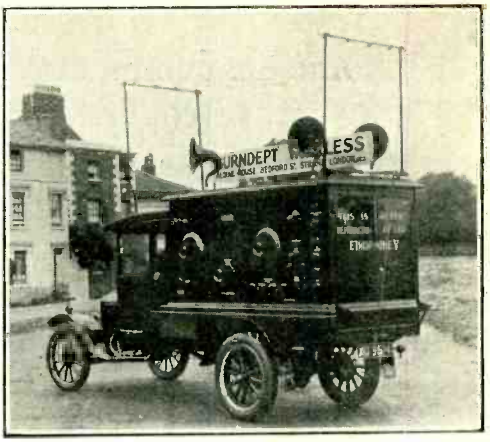
New Beyrouth Station, FFD.

On August 20th the "Radio-Orient" Company opened a new coast station at Beyrouth (Syria). The station operates on wavelengths of 450, 600 and 800 metres, and the provisional daily times of transmission are:—6 a.m. to 10 a.m. (G.M.T.), 12 noon to 4 p.m. (G.M.T.).

Erratum.

Owing to a misprint, the number of the Dubilier Condenser patent appearing on page 689 of the August 22nd issue of this Journal was given as 197536. This should be corrected to No. 197556.

A well-equipped radio demonstration van now in the service of Messrs. McMichael, Ltd.



Our photo shows the unique delivery van recently put on the road by Messrs. Burndept, Ltd.

The New Broadcasting Stations.

Readers will be interested to learn that the Aberdeen station is to be opened on October 2nd, and the Bournemouth station on the 17th of the same month.

Books and Catalogues Received.

G. Davenport (Wireless), Ltd. (99, 101, 103, 105, Clerkenwell Road, E.C.1.). "Wireless Bulletin," the Monthly House Organ and Catalogue of the Company.

The "Ready" Method of Memorising Morse. Utilising an original system for committing the Morse characters to memory. (Distributed by G. W. I., Ltd., Imperial Works, Shanklin Road, London, N.8. Post free, 6d.).

FORTHCOMING EVENTS.

THURSDAY, SEPTEMBER 6th.

Dewsbury and District Wireless Society. Opening Meeting of Session.

Stoke-on-Trent Wireless Experimental Society. At the Y.M.C.A., Hanley. Ordinary Meeting.

Newcastle and District Amateur Wireless Association. At 7.30 p.m. Annual General Meeting.

Ilford and District Radio Society. Lantern Lecture: "Post Office Telegraphs." By Mr. G. F. Hearn.

FRIDAY, SEPTEMBER 7th.

Gorton and District Wireless Society. Ordinary Meeting.

Calls Heard.

Margate.
2 BN, 2 BO, 2 BS, 2 CO, 2 DC, 2 DO, 2 FQ, 2 FS, 2 FU, 2 IF, 2 MS, 2 MT, 2 OM, 2 QN, 2 RH, 2 SX, 2 SZ, 2 WS, 2 XZ, 2 ZZ, 5 BV, 5 CG, 5 FY, 5 JP, 5 KP, 5 QV, 5 SV, 5 VR, 5 WR, 8 AA, 8 AB, WJZ (N.J.).
(Arthur O. Milne).

Lavender Gardens, London, S.W.
2 MK, 2 OM, 2 XL, 2 XR(?), **5 IO, 5 PU, 5 SU, 5 XR, 6 IM, 6 KR.**
(A. F. C. Boyd and L. M. T. Bell) **(5 XZ).**

"Strandhuset," Faxe Ladeplads, Denmark.
2 AO, 2 DF, 2 NA, 2 TB, 5 BV, 5 GS, 5 JX, 5 LG, 6 NI, 8 AQ, 8 AW, 8 BV.
(James Steffensen).

Ilkley.
2 AW, 2 CK, 2 DF, 2 FZ, 2 GJ, 2 GT, 2 GU, 2 ID, 2 JF, 2 JP, 2 JZ, 2 KD, 2 LA, 2 NK, 2 PZ, 2 QK, 2 ST, 2 SU, 2 TC, 2 VO, 2 WV, 5 BG, 5 CK, 5 CL, 5 CU, 5 CX, 5 DC, 5 FS, 5 ID, 5 KO, 5 NN, 5 OD, 5 PK, 5 SZ, 5 TR, 5 UF, 5 US, 5 UQ, 5 YY, 6 BR, 8 BM.
(E. S. Dobson).

Some Experiments Illustrating the Electrical Properties of Neon Lamps.

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

(*Continued from page* 704, *August 22nd issue.*)

DISCUSSION.

Mr. Eric Cuddon.

Mr. Coursey has mentioned that a decrease in current produces an increase in voltage. Therefore, if you are operating a detector valve at the saturation point of the characteristic curve, so that rectification is due to an average decrease in anode current, could not the tube be used as a voltage amplifier.

Mr. T. Hesketh.

I should like to draw the attention of the audience to one little peculiarity of the ordinary commercial types of lamps, in connection with the negative characteristic of the vacuum. With the ordinary lamps, with a view to preventing them being damaged, I believe it is customary to introduce a resistance in the cap of the lamp, so as to neutralise it.

Mr. F. L. Hogg.

With reference to the rectification effect of a neon lamp, it has often been the wish of many experimenters that we could rectify A.C. for H.T. supply for transmitters more easily. A friend of mine thought out an easy method of using neon lamps instead of valves on the Army T.V.T. apparatus. If two of these lamps are connected in series, it will be found that the small wave formed on the reverse direction of the contact breaker will be entirely suppressed, and the current from the T.V.T. unit can be smoothed out and used for telephony, thus doing away with rectifying valves. This is a thing worth further experiment, as it saves a good deal of expense.

Mr. Coursey, replying to the questions raised, said :—

The actual characteristic one obtains with each lamp differs according to the shape and size of the electrodes put in. Some lamps, used, I believe, for night-light purposes, or designed mainly for that purpose, and for lighting corridors, cupboards, etc., have electrodes of approximately equal area, in which case one gets practically no difference of effect when the voltage is applied in opposite directions. In order to get that difference, it is necessary to have the size of the electrodes as different as possible. The actual amplification obtainable with the valve differs, of course, with where one is working on the characteristic of the valve, and in the demonstration with the relays, I was adjusting it as a rectifier to work right down at the bottom end of the valve characteristic. If you want to work it as an amplifier, it must be operated higher up the characteristic, and in fact, quite good telephone reproduction can be obtained with one of these arrangements if the grid potential of the valve is put at the right value. Further, in reply to Mr. Cuddon's query, the same effect—*viz.*, a decrease of anode current on receipt of a signal—is obtained when a grid condenser and leak are used. This effect was referred to in the lecture.

I should have mentioned about the resistance which is mounted in series with the lamps as sold, and I thank Mr. Hesketh for having mentioned it. The ordinary lamps, as sold, have a resistance in their caps, and for some purposes it is desirable to remove that resistance. That has been done in the case of one of the lamps on the table used for the experiments (Figs. 6 and 7), but for some experiments it does not matter whether the resistance is in or not, and, for safety's sake, it is better in such cases to keep it in. But where you want to use the negative characteristic and the interruption phenomena to best advantage, the resistance must be removed.

I am certainly glad to hear of their use in series in lieu of a rectifying valve for transmission purposes, and I think it is by such experiments that one can possibly find out some more quite interesting uses for these lamps; and before concluding, I should like to thank members for the interest that has been shown in the experiments.

Mr. Hugh S. Pocock. (*Contributed*).

The use of the neon tube as an oscillator in the Armstrong Super circuit occurred to me several months ago, and I have devoted a good deal of experimental work to the development of its application in this direction.

Although more or less satisfactory results have been obtained, they in no way compare with the results given when a three-electrode valve is used as a damping oscillator. The reasons for this are, I think :—

(1) The amplitude of the oscillations obtained when using the usual type of neon lamp (with the resistance removed) as an oscillator, is insufficient to bring about the necessary degree of damping.

(2) The wave form of the oscillations produced by the neon lamp is unsuitable as it does not permit of rapid building up of oscillations in the collector circuit to high amplitude such as is essential for obtaining good results when using the Armstrong super-regenerative principle.

A number of circuits have been tried in which one source of high tension voltage is applied both to valve and neon tube oscillators, and the damping is produced by connecting the neon tube in series with a condenser which is used to tune the plate circuit of the valve oscillator. By this means the capacity of the condenser is thrown on to the valve oscillatory circuit whenever the resistance across the electrodes of the neon tube falls, and onsequently periodic damping at the frequency to which the neon tube oscillator is adjusted, results.

I have temporarily abandoned my investigation in this matter pending the production of specially designed neon tubes.

Mr. W. J. Joughin. (*Contributed*).

These experiments are particularly interesting to me as I have been working on some of these lines for a considerable period. The first time I saw these put to practical use was on the R.A.F. type 57 transmitter. A glass tube about three inches long with a tinfoil covering at each end was placed on the top of the instrument, and one tinfoil only connected to the aerial terminal. This was sufficient to produce a definite glow in the tube when the transmitter was oscillating.

More recently I was present at a lecture where the production of high frequency currents by means of a neon tube was demonstrated. Although the circuit at that time did not interest me, it appeared an easy matter to adapt the phenomenon to the Armstrong super-regenerative circuit. This should be by no means difficult in the light of Mr. Coursey's last experiment and those to whom the circuit appeals, have a really useful application at their service.

The item which particularly interests me is the use of neon tubes as rectifiers. Being worried with that ever growing demand for more H.T. on the transmitter, and having two different patterns of T.V.T. units, I should be interested to know whether the rectification efficiency is at least comparable with modern valve rectification, and whether in common with the latter it would be necessary to run several lamps in series to divide up the voltage on each.

Soon after the experiment had been conducted some months ago, I heard that a neon tube had been used to produce H.F. currents for transmission on 200 metres. In common with many, I decided to wait and see before I could believe such an achievement possible, as I realised that it could not be done by means of the series resistance and condenser as shown this evening.

As soon as it was mentioned that a neon tube in the plate circuit of an oscillating valve was satisfactory as a relay, I had a clue as to one possible means of producing short waves, by utilising the three-electrode valve merely as a driver and the neon tube as the power oscillator. It is not obvious yet how the three-electrode valve may be eliminated, desirable as it may be.

Following the reading of the paper, a demonstration of the apparatus was given by M. Marrec,* the signals being received from the Long Island (New York) station.

At the conclusion of the meeting, the President announced that this was the last this session, and that the next meeting will be held on September 26th.

* *The Wireless World and Radio Review*, pp. 634–635, *August 8th*, 1923.

BROADCASTING.

REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS*:

GREAT BRITAIN.

LONDON 2 LO, 369 metres; **MANCHESTER, 2 ZY,** 385 metres; **BIRMINGHAM, 5 IT,** 420 metres; **CARDIFF, 5 WA,** 353 metres; **NEWCASTLE, 5 NO,** 400 metres; **GLASGOW, 5 SC,** 415 metres. Regular morning and evening programmes, particulars of which appear in the daily press, are conducted from these stations by the British Broadcasting Company. The usual times of transmission are:—Weekdays, 11.30 a.m. to 12.30 p.m. (**2 LO** only), 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 p.m. (**2 LO** only), 8.30 to 10.30 p.m.

FRANCE.

PARIS (Eiffel Tower), **FL,** 2,600 metres. Daily, 7.40 a.m., Meteorological Forecast; 12.15 p.m., Meteorological Report and Forecast; 3.30 p.m., Financial Bulletin (Paris Bourse); 6.10 p.m., Concert; 7.20 p.m., Meteorological Forecast; 11.15 p.m., Meteorological Report and Forecast. Sundays, 6.10 p.m., Concert and Meteorological Report.

PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), 1,780 metres. Daily, 12.30 p.m. Exchange News, 12.45 p.m. News and Concert, 4.45 p.m. Commercial Intelligence, 5 p.m. Concert, 8.30 p.m. News, 9 p.m. Concert, Tuesday and Friday, 5 to 6 p.m., Dance Music. Thursday and Sunday, 10 to 10.45 p.m., Dance Music.

ECOLE SUPERIEURE des Postes et Telegraphes, 450 metres, Tuesday and Thursday, 8.30 p.m., Concert. Saturday, 2.30 to 7.30 p.m., Concert.

LYONS, YN, 3,100 metres. Weekdays, 10.45 to 11.15 a.m., Gramophone records.

DENMARK.

LYNGBY OXE, 2,400 metres. 10.30, 4.40 p.m., and 9.45 p.m. Meteorological Report in Danish. 8.30 p.m. to 9.45 p.m., Concert (Sundays excepted).

HOLLAND.

THE HAGUE, PCGG, 1,050 metres. Sunday, 3 to 5 p.m., Concert. Monday and Thursday, 8.40 to 9.40 p.m., Concert.

THE HAGUE (Heussen Laboratory), PCUU, 1,050 metres, Tuesday, 7.45 to 10 p.m., Concert. Sunday, 9.40 to 10.40 a.m., Concert.

THE HAGUE (Velthuyzen), PCKK, 1,050 metres. Friday, 8.40 to 9.40 p.m. Miscellaneous.

IJMUIDEN, PCMM, 1,050 metres. Saturday, 8.40 to 9.40 p.m., Concert.

AMSTERDAM, PA 5, 1.050 metres. Wednesday, 8.10 to 9.10 p.m., Concert and News.

BELGIUM.

BRUSSELS, BAV, 1,100 metres. Working days, 1 p.m., Meteorological Bulletin. Daily, 5.50 p.m., Meteorological Bulletin; Tuesday and Thursday, 10 p.m., Concert. Sunday, 7 p.m., Concert.

GERMANY.

BERLIN (Koenigswusterhausen), LP, Sunday, 4,000 metres, 11 a.m. to 12 noon, music and speech; 2,700 metres, 12 noon to 1 p.m., music and speech; Daily, 4,000 metres, 7 to 8 a.m., 12 to 1.30 p.m., 5 to 6.30 p.m., Financial and other news.

EBERSWALDE (2,930 metres), Daily, 1 to 2 p.m., 8 to 9 p.m. Tuesday and Saturday, 6.30 to 7.30 p.m., Concert.

CZECHO-SLOVAKIA.

PRAGUE, PRG, 1,800 metres, 8 a.m., 12 noon and 4 p.m., Meteorological Bulletin and News. 4,500 metres, 10 a.m., 3 p.m and 10 p.m., Concert.

KBEL ((near Prague), 1,000 metres. Daily, 7.20 p.m. Concert Meteorological Report and News.

SWITZERLAND.

GENEVA, HB 1, 900 metres. Daily, 6 to 8.30 p.m., Concert ("Utilitas").

LAUSANNE, HB 2, 1,350 metres. Daily, 6 to 8.30 p.m., Concert "Utilitas").

* British Summer Time is given in each case.

QUESTIONS AND ANSWERS

"H.C." (Bromley) *submits particulars of a switch he proposes to use for changing over from transmitting to receiving. He asks will the proposed arrangements be satisfactory.*

The switch will be quite satisfactory for the purpose without alteration.

"SERVICE" (H.M.S. "Centurion") *asks for details of the construction of a microphone amplifier.*

We regret that the space at our disposal will not allow of the proper treatment of the subject, but we would refer you to page 130, October 28th issue, 1922.

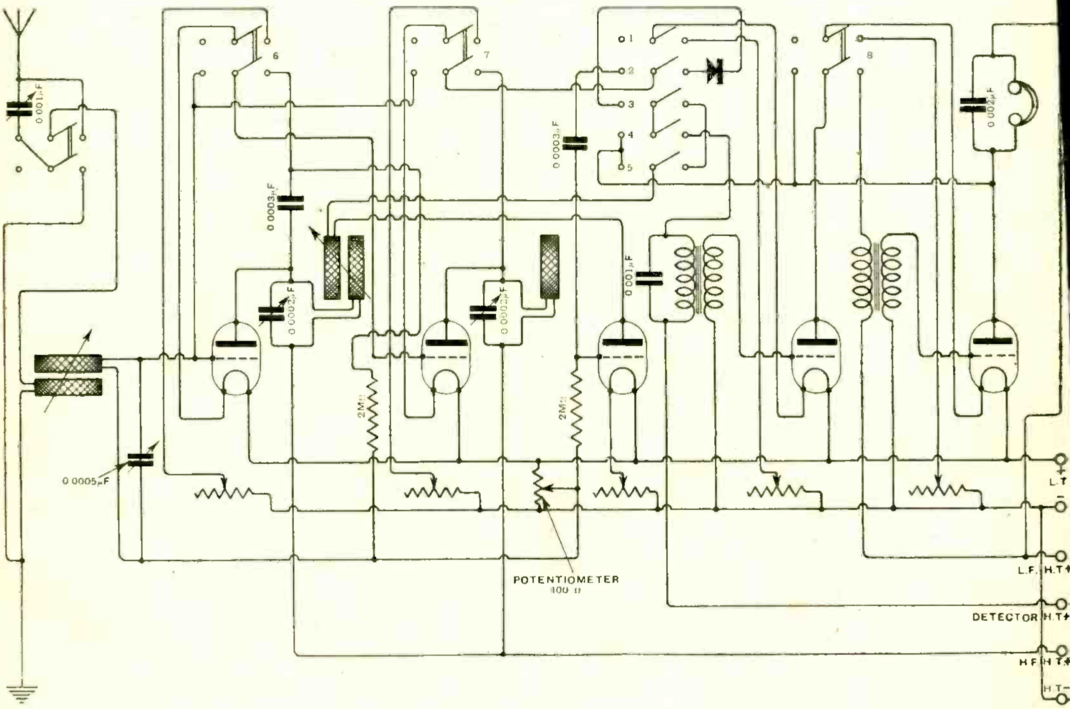


Fig. 1. **"Bomcutta" (Streatham, S.W.16).** *Receiver with two stages of H.F., tuned anode amplification, rectifier and two note magnifiers. Switches are provided to vary the number of valves in circuit. The reaction coil is coupled with the anode coil. Switches 6 and 7 are connected in the H.F. valve circuits; 8 switches the last note magnifier. To employ the valve as rectifier, switch* **2** *left,* **1, 3, 4** *and* **5** *right. To employ crystal rectifier, switches* **1, 2,** *4, 5 to right,* **3** *to left.*

"BOMCUTTA" (Streatham, S.W.16) *asks* (1) *For a diagram of a five-valve receiver employing two H.F. valves, tuned anode coupled, valve or crystal rectifier, and two L.F. valves, with switches to cut out all valves. Potentiometer control of the grids of the H.F. valves is desired, and separate H.T. positive leads for the H.F., detector and L.F. valves.*

(1) *The diagram is given in Fig.* 1.

"D.H." (Nottingham) *asks* (1) *and* (2) *For particulars of certain components comprising a service receiving set.*

(1) and (2) We regret we have no information concerning the receiver referred to.

"C.B." (Eastcote) *submits details of his four-valve receiver, and asks* (1) *How is it possible to make the receiver more selective.* (2) *Why reception from the British broadcast stations, other than* **2 LO**, *is now impossible, although most of these stations were formerly picked up easily.*

(1) We advise you to employ separate anode coils of the basket or honeycomb plug-in type, each covering a short wavelength band, and to be tuned with a 0·0002 μF variable condenser. (2) We do not think it likely that the trees are responsible for the difference in reception. Make a careful inspection of the whole aerial and earth arrangements. The whole of the fault does not lie with the broadcast transmissions.

" S.B. " (Midhurst) *asks* (1) *With reference to Fig.* 61 *in " The Amateur's Book of Wireless Circuits," would we give this circuit with the following alterations: Reactance to first H.F. valve, and switch to cut out second valve if required.* (2) *To which terminal of the L.T. battery should the grids of the L.F. and H.F. valves be connected. Also would it be preferable to use a potentiometer for the H.F. valves, and grid cells for the L.F. valves.* (3) *Is it possible to use a variable grid condenser in conjunction with a variable grid leak.* (4) *Is the switching of the H.F. valves correct, or should the grid leak and condenser be disconnected when switching out a H.F. valve.*

(1) The diagram is given in Fig. 2. (2) Join them with negative L.T. A potentiometer and cells should generally be used. (3) Both a variable grid condenser and a variable grid leak may be used with advantage when employing different types of valves. (4) The switching is given in Fig. 3.

" W.D. " (Chesterfield) *submits a diagram of a detector unit, and asks* (1) *For diagrams of H.F. and L.F. units to be used in conjunction with it.* (2) *What are the dimensions of suitable anode and reaction coils for the H.F. unit, for wavelengths up to 500 metres, and for wavelengths from 500 to 2,000 metres to fit the receiver panel.*

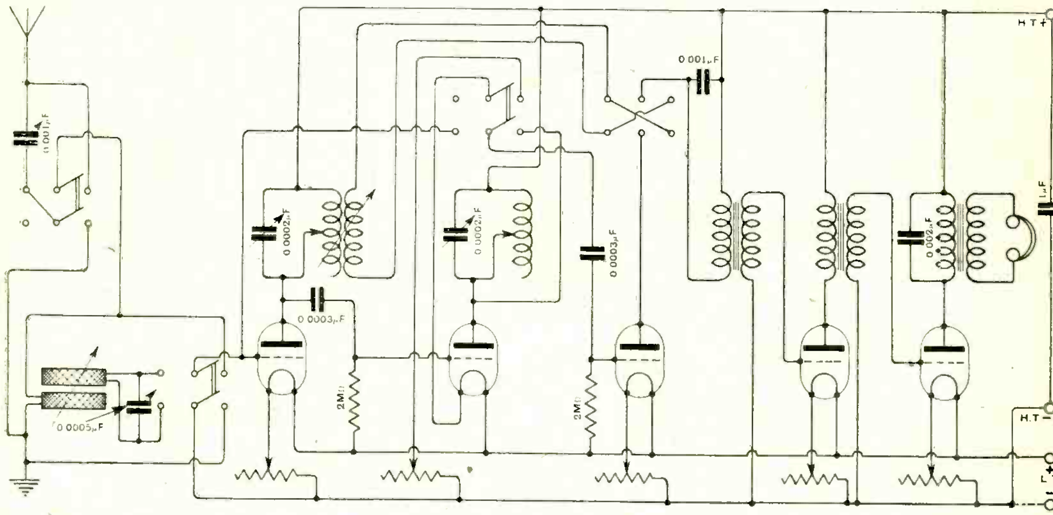


Fig. 2. **" S.B." (Midhurst).** *Receiver with two H.F., rectifier and two note magnifiers. The reaction coil is coupled with the first anode circuit, and a reversing switch is fitted.*

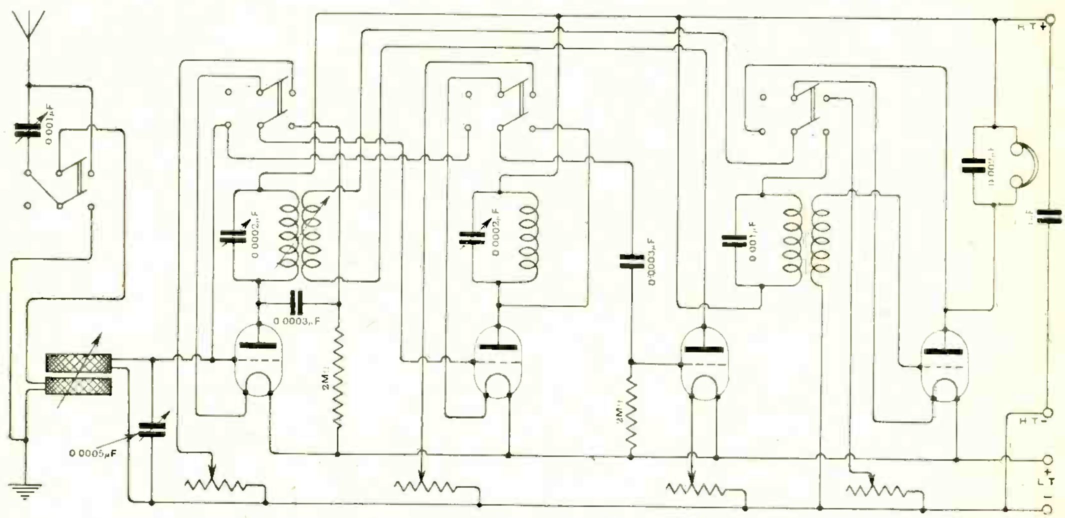


Fig. 3. **" S.B. " (Midhurst).** *This is the diagram of a receiver with two H.F., rectifier and a note magnifier with switches to vary the valves in circuit.*

(1) The diagrams are given in Fig. 4. (2) For wavelengths up to 500 metres we suggest you wind a layer of No. 30 S.S.C. wire on a former 2½″ in diameter and 3″ long. Five tappings should be taken, the first at the 20th turn, and the rest equally spaced along the coil. For the range of 500 to 2,000 metres, the anode coil may consist of 2 layers of No. 30 S.S.C. wire on a former 2½″ in diameter and 6″ long. Fifteen tappings should be taken, the first from the 80th turn and the rest equally spaced along the coil. The reaction coil for both may consist of a winding of the same wire on a former 2″ in diameter and 4″ long.

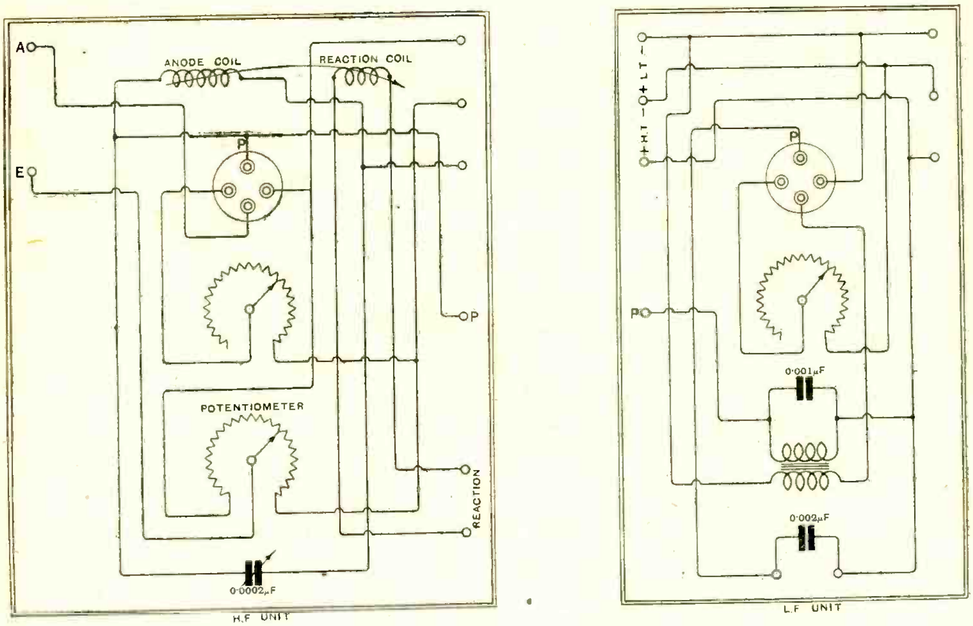


Fig. 4. **"W.D." (Chesterfield).** *Connections of H.F. and note magnifier units.*

"C.F.W." (Bedford) *asks* (1) *How is it possible to get rid of an earth buzz.* (2) *Why does a receiver "howl" when three L.F. valves are used, although with two L.F. valves reception is good.*

(1) We suggest you use a counterpoise earth, consisting of wires running parallel to the aerial, at a distance of 5 or 6 ft. above the ground. (2) The howl is due to the design of the low frequency amplifier, especially the transformers. We would refer you to "Wireless Theory," August 8th issue. The amplifier will probably not howl if a resistance of the order of 100,000 ohms. is connected across the secondary windings of the transformers.

"E.C." (Petworth) *asks* (1) *Can the wavelength range of a variometer tuner be increased from 900 metres to 2,000 metres by the addition of a loading coil.* (2) *What is the cause of certain noises in the loud speaker.*

The wavelength range of the tuner may be increased in the manner indicated, also by adding a small fixed condenser in parallel with the variometer. (2) The noises referred to may be due to a near-by generator, or electric power cables.

NOTE.—*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:*—(1) *Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor,* **The Wireless World and Radio Review,** 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

THE WIRELESS WORLD AND RADIO REVIEW

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

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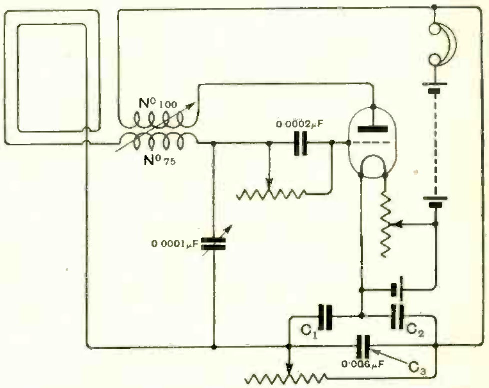
A COMPACT FLEWELLING RECEIVER.

The Flewelling Circuit lends itself to the construction of a compact and sensitive receiver. The design given in this article embodies simple construction from typical component parts, requiring neither elaborate tools or exceptional skill. With this outfit the experimenter can gain acquaintance with the operation of the Flewelling arrangement.

By 5 HZ.

THE increasing popularity of wireless for out-of-doors use has intensified the necessity for the production of a small, compact and efficient long range receiver which will work anywhere and under widely varying conditions.

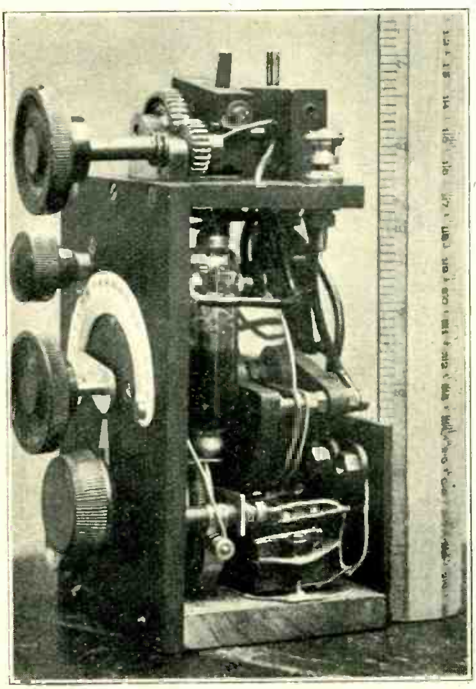
A light weight portable valve set has not hitherto been possible owing to the necessity for using a heavy accumulator and a fairly bulky H.T. battery, with more than one valve for efficient reception on frame aerials, etc. The last named difficulty was removed with the introduction of the Armstrong super-regenerative circuit, the remarkable amplification obtainable when using one valve with this circuit enabling a one-valve portable set to be constructed. The bulky coils associated with it, however, operated against the production of a really small light weight portable receiver. The Flewelling circuit with its group of small condensers replacing the bulky coils of the Armstrong circuit offers a way out, and, combined with the recent development of reliable dull emitter valves which will work with dry cells or a small flash lamp accumulator for heating the filament, makes the problem of the design of a pocket set less difficult.



Flewelling Circuit with suitable inductance and capacity values.

The writer has demonstrated that a dull emitter valve will function well as an oscillator on low plate volts, and has found no difficulty in operating a Flewelling circuit with two of the very small type of Eveready flash lamp batteries in series for the H.T. supply, that is, using 9 volts, and a small non-spillable accumulator for filament heating. The employment of the tubular D.E.V. type valve further reduces the space occupied by the components and the manner of their assembly to form a pocket set is illustrated in the accompanying drawings, diagrams and photographs.

The theoretical circuit is well known, but is reproduced here for reference and for convenience in following the connections and indicating the values used.

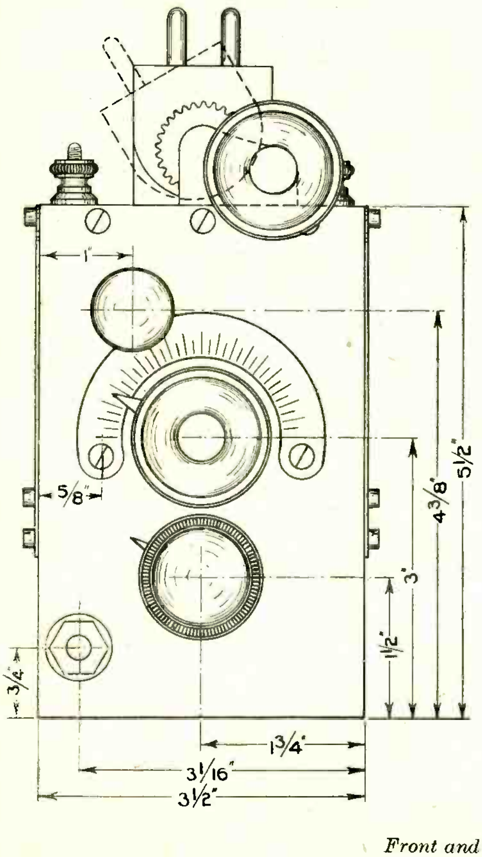


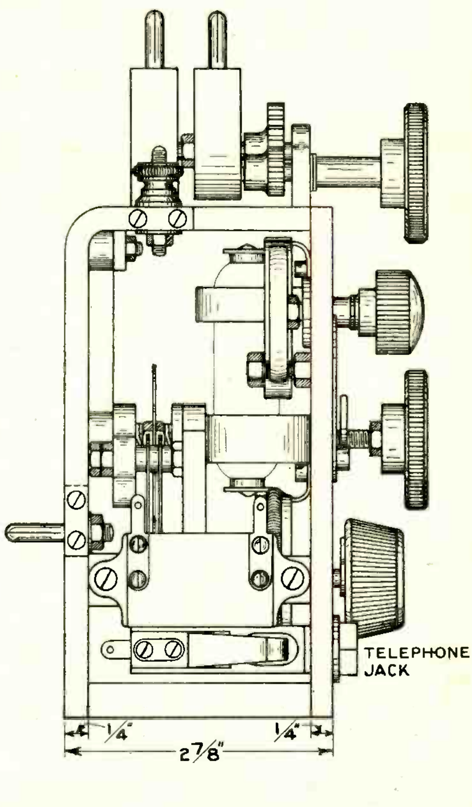
The complete Flewelling set of simple construction.

A list of the materials required is given below :—

Ebonite $5\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{1}{4}''$.
Ebonite $3\frac{1}{2}'' \times 2\frac{1}{4}'' \times \frac{1}{4}''$.
Ebonite $3\frac{1}{2}'' \times 2\frac{5}{8}'' \times \frac{1}{8}''$.
2 coil holders (one with rounded base).
2 coils Nos. 75 and 100.
2 terminals.
2 Meccano gear wheels.
12″ brass rod, 3/16″, 6″ screwed 2 BA.
2″ brass tube to slip over 3/16″ rod.
$\frac{1}{4}''$ brass mount for gear wheels.
1 condenser variable 0·0001 μF.
2 2 BA knobs and 1 pointer.
1 filament rheostat.
1 piece wood $3\frac{1}{2}'' \times 2\frac{5}{8}'' \times 7/16''$.
$1\frac{1}{2}''$ diameter disc ebonite $\frac{1}{4}''$ thick.
12 5 BA screws, nuts and washers.
6 2 BA nuts and washers.
2 feet brass strip.
1 telephone jack and plug.
4″ $\frac{1}{8}''$ diameter brass rod.
3 spring washers.
2 brass bushes.
4 special coil plugs and sockets (for battery connections).
2 pieces ebonite, $1\frac{1}{4}'' \times 2'' \times \frac{1}{2}''$.
3 0·006 μF condensers.
1 D.E.V. valve.
Short lengths of bare tinned copper wire, Systoflex, and single flex.
Odd screws, etc.

The usual practice was followed of building up the set on the table, and it was found that the value of the two condensers C_1 and C_2 were not critical; in fact 0·001 μF condensers have been used in these positions with good results. A variable "plate leak" is an advantage, but does not appear to be necessary if some value, say of 2 megohms or above, is used, and in the set described the actual leak was a graphite pencil line which has proved very effective. A variable leak is almost essential in the grid circuit, and consists in this receiver, of a pencil line drawn on the periphery of a rotatable ebonite disc. Connection is made from the graphite to one side of the condenser *via* the washer, screw, and spindle. The other





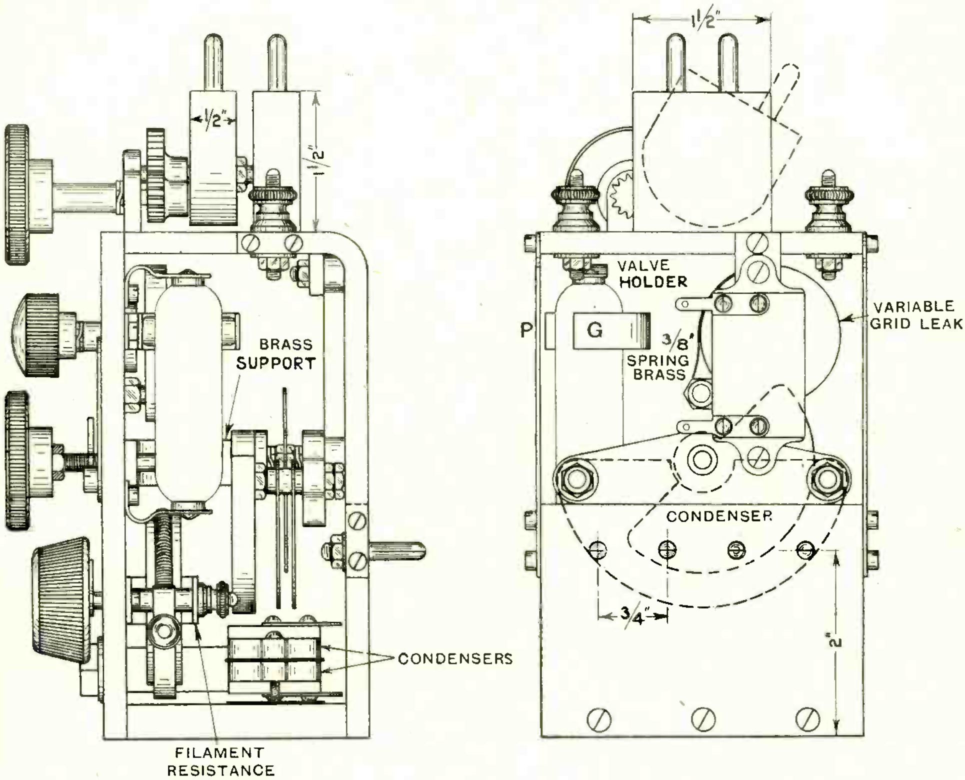
Front and side views.

end of the leak is connected to a brass strip bent to the curvature of the disc, and bearing on the graphite pencil line.

Both the plate and grid leaks are in positions readily accessible for removal or alteration if required, and can be distinctly seen in the photographs.

The method adopted to make the circuit function was as follows :—

An ordinary Dubilier grid leak of 2 megohms value was placed in position across the bank of condensers, and a variable grid leak was placed across the grid condenser. This was adjusted until a high-pitched whistle was obtained and signals received. These were adjusted to maximum intensity on fairly low H.T. volts with close reaction coupling. The grid leak was left in position, and the plate leak taken out, this being substituted by a pencil line in a groove cut across the 0·006 μF condenser C_3. The pencil line was thickened or thinned until a whistle of the same pitch as that previously obtained with the standard 2 megohm leak was heard in the phones. The variable grid leak was then taken out and substituted by a pencil line cut across the 0·0002 μF grid condenser, the pencil line being adjusted until best results were obtained. This substitution method can be employed to make leaks of any value from standard makes with sufficient accuracy for this purpose.

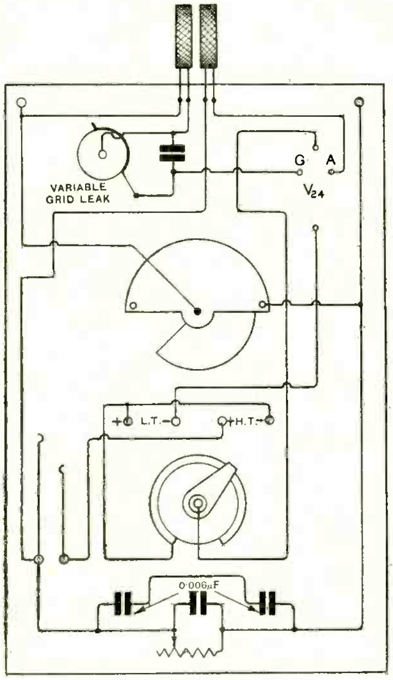


Side and back views.

Unfortunately on each of the occasions referred to I omitted to take measurements, and in the attempt to get better results the leak values were altered and the opportunity passed by.

The objectionable whistle can be varied in pitch in the Flewelling circuit by a careful adjustment of the values of the two H.R. leaks, and it will be found that as the pitch of the note gets higher and higher, received signals are not so strong, but are clarified. Stronger signals are obtained with a comparatively low whistle.

On two occasions, whilst experimenting, with the leaks on this set, I have obtained clear speech signals on short waves with no accompanying audible whistle, and I presumed the frequency of the whistle at these times must have been beyond the audible limit.



Practical wiring diagram.

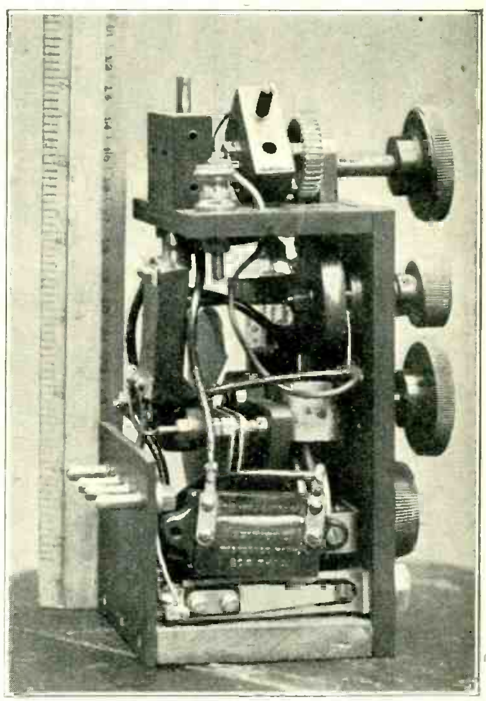
The constructional details given can, of course, be readily modified to suit components slightly varying from those shown in the accompanying diagrams. For instance, pinion wheels can be obtained for the coil holder occupying less space than those shown, or the pinion drive may be abandoned entirely if the experimenter is unable to rig up a suitable mounting bracket. The spacing between the centres of the two coil holders is only about $\frac{3}{4}''$ in the diagram in order that simple basket coils may be employed, but if the reader wishes to make use of standard plug-in type coils, this distance will need to be $1\frac{1}{8}''$.

For investigation purposes I would suggest the use of a wavemeter or a local oscillator capable of tuning up to say 15,000 metres wavelength, in order to ascertain whether the Flewelling circuit is vibrating at super-audible frequencies or not. Without some such means it is not possible to say precisely whether the set is functioning properly super-audible frequencies.

The first words heard on testing the circuit on a frame aerial were "Hullo! Cardiff calling." This is good testimony to the efficiency of the receiver as Cardiff is approximately 150 miles away. All the B.B.C. stations except **5 SC** were heard the same evening. Spark stations come in very strongly, **BVN** (the particular bugbear to listeners-in on the **5 IT** wavelength in this area) being particularly loud.

Correct tuning is effected by a proper simultaneous manipulation of the reaction coil and variable condenser, best signals being obtained when the circuit is only just oscillating, the filament rheostat helping to achieve this. Hand capacity effects are noticeable, and as long extension handles are not practicable for a pocket receiver, an improvement could no doubt be effected by lining the box with copper or tinfoil.

The plugs on the battery terminal panel are joined to the batteries by means of a four-wire cord of the ex-army pattern. This lead has standard coil sockets fitted

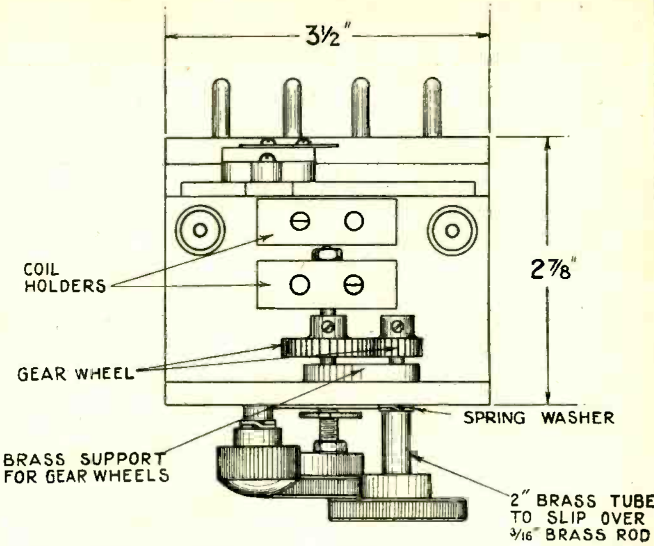


The arrangement of the components assembled behind the panel.

into ebonite mounts, the spacing being arranged so that the L.T. and H.T. sockets can only be connected to the correct plugs on the panel.

The coil holders on top of the set may be dispensed with and basket coils substituted inside with very little addition to the size of the set.

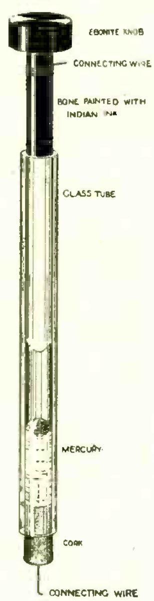
The receiver is almost entirely home-made, and the writer wishes to express his indebtedness to a fellow experimenter, Mr. J.C.Hibberd, for his valuable services in this connection.



The spacing between the coil holders shown is suitable for basket coils. For the usual type of plug-in coil 1⅛" between coil centres is necessary.

VARIABLE HIGH RESISTANCE.

THE need of variable resistances for use in the Flewelling circuit resulted in the trial of the following method of construction. The resistance is critically variable, costs little to make, gives very satisfactory results, and can be put together in a very short time.



The difficulty was to make good contact, and this was overcome by using a small amount of mercury. For the resistance itself a bone knitting needle 6 ins. long was given a coat of indian ink, and a connecting wire twisted tightly round one end. A glass tube was chosen so that its inside diameter was slightly larger than that of the resistance, and a piece 5 ins. long cut off. A cork to plug one end was obtained by boring a cork with a cork borer such as is used in laboratories, and carefully pushing out the boring and using that. A connecting wire was soldered to the eye end of a small sewing needle, and the latter was pushed through the cork and the cork plugged into one end of the tube. About ¼ in. of the pointed end of the needle was now projecting inside the tube.

The tube was now mounted vertically and enough mercury poured in so that when the resistance was placed as far as it would go in the tube the mercury was about ¼ in. from the top. The surface tension of the mercury was sufficient to retain the resistance in any position in the tube. In this way more or less of the resistance could be put in circuit by simply moving it up or down in the tube, the mercury shorting the part immersed. Very critical adjustments could be made, and two such "leaks" gave good results when used in the Flewelling circuit.

A.H.

DISTORTION IN VALVE RECEIVING CIRCUITS

The extent of distortion may depend upon the method of detection employed and its adjustment. This is discussed in the following article, and a correct understanding of the subject is essential in the design of apparatus for telephony reception.

By S. O. PEARSON, B.Sc.

(2) Valve Detectors.

A THERMIONIC triode can be made to act as a rectifier of high frequency oscillations in two different ways: (1) by operation at one of the bends in the anode current and grid potential characteristic, known as anode rectification, or (2) by making use of the unilateral conductivity of the grid to filament circuit inside the valve, known as grid rectification. It is intended here to discuss and compare these two methods with special regard to the distortion of speech which may occur when receiving telephony. Although the former system is used quite extensively in receiving circuits, the latter is the more usual on account of its greater sensitivity on weak signals.

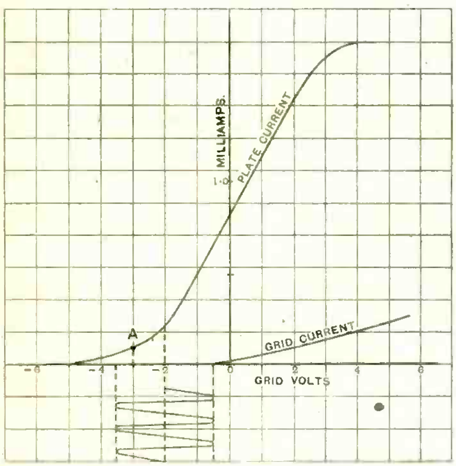


Fig. 1. Typical characteristic curve of a receiving valve showing plate and grid current values for various grid potentials.

In an ideal rectifier or detector for reception of telephony the change of plate current from the normal value would be directly proportional to the amplitude of the received high frequency oscillations, but no such perfect rectifier has yet been discovered. These ideal conditions are only approximately approached in valve detectors when the circumstances are favourable. Some tests were carried out on an ordinary "R" valve with a view to finding out to what degree the ideal conditions are approximated to in both methods of rectification, and the results serve to show that each method has its advantages under certain conditions.

ANODE RECTIFICATION.

In Fig. 1 is given a D.C. characteristic curve of an ordinary receiving valve, and also the grid current to grid potential characteristic. For anode rectification to be most efficient the normal value of the grid potential should be adjusted by means of a potentiometer or grid battery so that the valve will operate at the point where curvature of the anode characteristic is greatest, *viz.*, at the point A in the figure.

In order to test the rectifying properties various values of *alternating* voltage at low frequency were impressed on the grid and the corresponding mean values of the plate current were measured. In the ordinary way it is not very easy to measure low values of alternating voltage so in this case a straight-wire potentiometer or "slide wire" was used, a known value of A.C. voltage being applied across the ends. The voltage to be applied to the grid was taken between one end of the wire and a "jockey,"

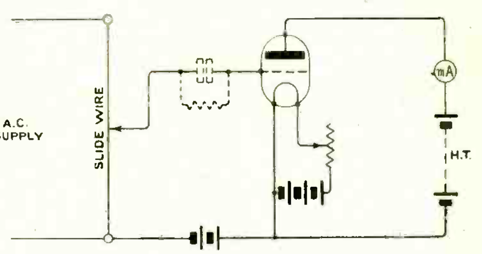


Fig. 2. Method of providing suitable values of alternating grid potential.

by means of which contact could be made with any part of the wire, the voltage being proportional to the length of wire intercepted between these two points. The circuit is shown in Fig. 2.

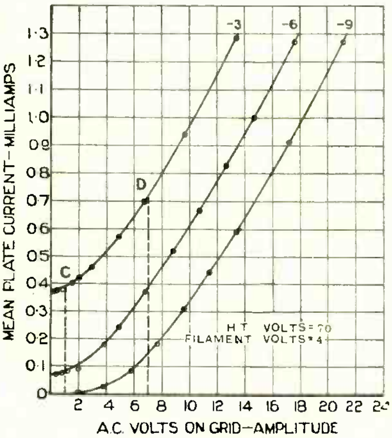


Fig. 3. The curves show plate current values obtained with various applied and fluctuating grid potentials.

In this way the series of curves shown in Fig. 3 was obtained. The curves show the relation between the *maximum value* or amplitude of the A.C. voltage applied to the grid and the mean plate current. Each curve corresponds to a definite value of normal or mean grid potential applied by means of the grid battery, as indicated by the appended numbers. It must be remembered that when an A.C. potential is applied to the grid, the plate current has an oscillating component, but the moving-coil milliammeter in the plate circuit indicates the *average* value of the anode current.

It will be seen that none of these curves obeys a straight line law, so that the change of mean plate current is not proportional to the applied oscillation. In fact each curve approximates very closely to a parabola in shape, especially at the lower bends, so that the change of mean plate current is approximately proportional to the *square* of the amplitude of the impressed oscillation. This is what is meant by the common statement that the "efficiency" of a rectifier is proportional to the square of the signal strength. Thus we see that for very weak signals or low amplitudes of oscillation on the grid there will be practically no rectification at all and this explains why the addition of a high frequency amplifier makes such a tremendous difference to the ran of a receiving station.

We now come to consider the effect of th non-uniform rectification in the receptio of telephony as regards the distortion speech. Suppose first of all that we ar receiving from a transmitting station wher the modulation is nearly 100 per cent., tha is to say, the ratio of change in amplitude t maximum amplitude of the high frequenc carrier wave is nearly unity, as indicated b the curves (a) and (b) of Fig. 4. Then at th times when the amplitude is at its minimun value there will be practically no rectificatio at all, whereas at times when the amplitud is greatest the valve will rectify quit efficiently. If the low frequency wave obeyed a sine law as in Fig. 4 (a), not very much distortion would be noticeable; but the wave shapes corresponding to speech are very complex and if good speech is to be received in the telephones, the oscillations on the output side of the valve must be a faithful reproduction of the wave-form of the modulation.

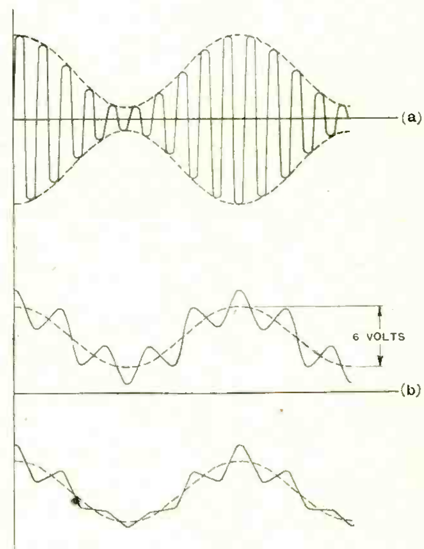


Fig. 4. Modulated oscillation trains.

In order to see clearly how a complex wave is distorted by the non-uniform rectification, consider as a simple example a carrier wave which is modulated in the manner shown by the curve of Fig. 4 (b) which represents the *amplitude* of the carrier wave at all times, the high frequency component not being ıown for the sake of clearness. The wave ırm consists of a fundamental sine wave ith a fifth harmonic superimposed, the ındamental being represented by the dotted ne. Neglecting for the moment the fifth armonic or "ripple," assume that this ındamental sine wave represents a maximum hange of 6 volts in amplitude, of the ıigh frequency oscillations, *viz.*, from 1 volt ıp to 7 volts. Suppose the normal grid potential to be adjusted at − 3 volts so that he valve operates on the top curve of Fig. 6. Then during one complete period the valve would operate at all points along the curve from C to D. Now the rectification is best at those parts of the curve where the change in plate current is greatest for a given *small* change in amplitude of the applied oscillations on the grid, that is, on the steepest parts of the curve. On the horizontal portion there is no rectification at all. The fundamental wave of current on the plate side of the valve will thus have its lower peaks slightly flattened, as shown by the dotted curve of Fig. 4 (c).

Consider now the actual wave represented by the full line curve of Fig. 4 (b). When the fundamental wave is passing through its maximum value, the valve will be operating at the point D on the A.C. characteristic (Fig. 3) where the curve is fairly steep and straight, and the ripple will thus be rectified quite efficiently, being more or less faithfully reproduced on the plate side of the valve. However, when the fundamental is passing through its minimum value and the valve is operating at the point C (Fig. 3) where the curve is nearly horizontal, there will be practically no rectification of the ripple at all, with the result that, to all intents and purposes, the fifth harmonic will be absent in the plate current at the time when the fundamental passes through its minimum value. Thus the amplitude of the harmonic is seen to vary periodically at the same frequency as the fundamental, and the resulting plate current is given by the full line curve of Fig. 4 (c). This simple illustration serves to show how seriously a complex wave-form can be distorted on account of the square law of rectification obeyed by the valve, when the percentage modulation of the carrier wave is large.

Distortion of this nature depends almost entirely on the degree of modulation at the transmitting station. If the percentage modulation is small, say 10 to 20 per cent., the rectifying valve would operate over quite a small portion of the A.C. characteristic and practically no distortion would occur. Just sufficient H.F. amplification should be employed to enable the rectifying valve to be operated over the steeper parts of the A.C. characteristic. It is interesting to note that the British Broadcasting Company employs quite a small degree of modulation so that no trouble of the nature described above should be experienced when receiving broadcast programmes.

GRID RECTIFICATION.

The principles of this method of rectification, sometimes called the leaky grid-condenser method, are well known to most experimenters. A small condenser is connected in the grid lead, and the oscillations are applied to the grid through this condenser. Owing to the fact that current can flow from the grid to the filament and not in the reverse direction, a charge of negative electricity is accumulated on the grid side of the condenser when an oscillating voltage is applied between the other side of the condenser and the filament, thus reducing the value of the plate current. It is necessary for this charge to leak away as soon as possible when the applied oscillation ceases, bringing the plate current back to its normal value. For this purpose a high resistance leak is connected directly across the condenser or from the grid side of the condenser to one leg of the filament.

A test similar to that described above for anode rectification was carried out on the grid condenser method, the circuit being the same as that of Fig. 2, except that a grid condenser was connected in series between the jockey and the grid, this condenser being shunted by a 1-megohm reistance. Since the test frequency was only 50 cycles per second, it was found that the grid condenser should have a capacity of at least 0·05 mfd. Larger values of capacity made no difference.

The results of the test are shown by the curves of Fig. 5, where, as before, the plate current is plotted against the *amplitude* of the applied oscillations. Each curve corresponds to a definite value of voltage applied by means of the grid battery, not on to the grid itself, but on to that end of the leak resistance which is not connected to the grid. It will be noted that the two top curves, where the applied volts are +2 and zero respectively, slope *downwards* right from the start so that no matter what the value of the applied oscillation,

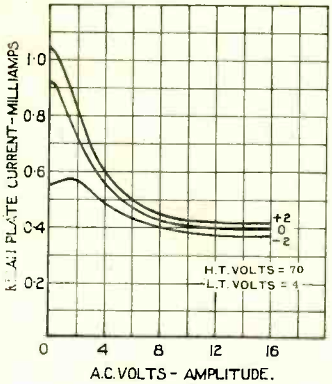


Fig. 5. Curves obtained by plotting plate current against oscillation amplitude.

the plate current is always less than the normal. But the bottom curve slopes upward at first, becomes horizontal when the applied oscillation is about 1·5 volts, and then begins to slope downwards again as the A.C. voltage is further increased. This may appear rather peculiar at first, but on reference to Fig. 4 again the reason should be obvious. The mean value of the grid potential is −2 volts and grid current does not commence to flow until the grid voltage has been raised to about −0·5 volt, so that no grid rectification can possibly take place until the applied oscillation has reached 1·5 volts. From this it would appear that the curve should be horizontal all the way from zero to 1·5 volts; but on noting that −2 volts corresponds to a point well round the lower bend of the *anode characteristic*, we see at once that for amplitudes less than 1·5 volts the valve is acting as a rectifier on the anode side. For higher amplitudes of oscillation the anode rectification does not cease, but grid rectification commences and predominates, causing the curve to slope downwards. At the point where the curve is horizontal the anode rectification is exactly neutralised by the grid rectification, and any small change in the amplitude of the applied oscillations at this point would not be copied at all on the plate side of the valve. This bottom curve represents a really bad state of affairs which should be avoided; it is usual to connect the oscillatory circuit to the negative leg of the filament, in which case the valv operates on the middle curve of Fig. 5.

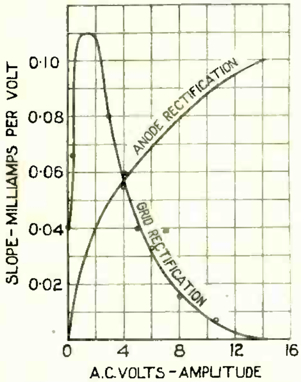
The two upper curves are fairly straigh between half a volt and 4 volts on the gric so that for operation over this range dis tortion will be a minimum. For greate amplitudes, say up to 10 volts, the bend in the curve will introduce distortion similar to that described for anode rectification. Since there is practically no bend at the start, the degree of modulation of the carrier wave will have very little effect as regards distortion; and since the curves are fairly steep at the start the valve will rectify quite efficiently even when the signals are very weak.

There is yet another cause of distortion to be mentioned which is inherent in the grid-condenser method of rectification, this being of the nature of a time lag similar to that described in connection with H.F. circuits in a previous article. When an oscillation is suddenly applied, the negative charge on the grid side of the condenser must be accumulated gradually because it represents a certain amount of stored energy. Similarly when the applied oscillation is suddenly cut off the charge cannot leak away instantaneously. The smaller the capacity of the grid condenser the smaller will be the time lag in direct proportion. But the grid condenser must not be too small or its impedance will be so high that the oscillating voltage will not be efficiently passed on to the grid and the received signal will be reduced in strength. The impedance of the grid condenser must be fairly small compared to that of the grid to filament circuit inside the valve and in practice it is found that this condenser should have a capacity not less than 0·0002 mfd. The grid leak must have a fairly high resistance, or when a signal is being received, sufficient charge will not be accumulated in the condenser owing to its leaking away as fast as it is being collected. Thus we see that it is impossible to do away with this time lag altogether and the leaky grid-condenser method of rectification can never give results quite free from distortion.

Comparison of the Two Methods.

A brief comparison of the two methods of rectification discussed above should prove useful and will serve to show under what conditions each has its advantages. The two chief considerations are sensitivity and distortion.

The sensitivity in either case is represented the slopes of the respective A.C. characterics (Figs. 3 and 5), for a given amplitude impressed oscillation. The values of



ig. 6. The comparative sensitivity of grid and anode rectification with various oscillation amplitudes.

hese slopes have been worked out in milli-.mperes per volt for various amplitudes of he applied oscillation, for the top curve of Fig. 3 and the middle curve of Fig. 5 res-ectively, and plotted as curves in Fig. 6. We see at once from these curves that for grid rectification the sensitivity is greatest for amplitudes of oscillation ranging between zero and 4 volts, whereas for anode rectification the valve does not become efficient as a rectifier until the amplitude of the applied oscillations has reached at least 4 volts and that the efficiency goes on increasing with signal strength. It is evident then that for weak signals or for circuits where no H.F. amplification is used, the grid method of rectification should be employed, whereas for very strong signals or where considerable H.F. amplification is used, the anode method has the greater advantage.

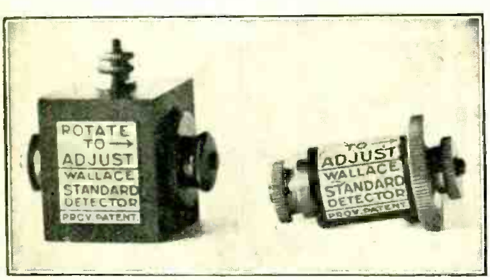
In both cases the least distortion occurs when the valves are operated at amplitudes giving greatest efficiency of rectification since the A.C. characteristics are straightest where they are steepest.

Since the time element inherent in the grid rectification cannot be eliminated, it will be found that far better results as regards clearness are obtained by using a high frequency amplifier in conjunction with anode rectification. It is a great advantage to be able to use either method at will according to the strength of the signals to be received. This can be done by having a grid condenser and leak in the circuit in the ordinary way with a switch across the condenser for short circuiting it when anode rectification is desired. Means should also be provided for putting a negative potential on the grid if necessary.

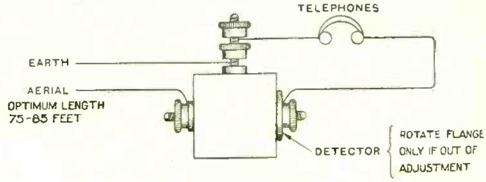
When the tuned anode method of amplification is employed before the detector, one has no choice but to use the grid-condenser method of rectification unless an extra H.T. battery is available. The writer has found it an advantage to replace the grid condenser by a separate H.T. battery with its negative pole connected to the grid of the detector and its positive pole to the plate of the preceding valve, when the signals have been amplified sufficiently to warrant anode rectification. The voltage of this battery should be just sufficient to hold the potential of the grid at the requisite negative value to give good rectification.

THE SMALLEST RECEIVER?

Many so-called "smallest receivers" have appeared from time to time, made up in match boxes, cigarette cases and similar receptacles, but most of these are fragile, and reports are wanting as to their efficiency. The producer of the set illustrated claims that very definite and satisfactory results can be obtained. Its construction is rendered possible by a new patented detector known as the "Ideal" permanent detector, introduced by Messrs. Gamage. The inductance, which is wound with 47 S.W.G., is fixed to give maximum strength on broadcasting wavelengths with an average aerial of 75 ft.



Complete receiver. *The detector taken out.*



The circuit diagram.

INSTRUCTIONAL ARTICLE FOR THE LISTENER-IN AND EXPERIMENTER.

WIRELESS THEORY—XXIV.

The series has been specially arranged so that the reader who follows each section as it appears will have obtained a complete wireless education with a minimum of time and trouble, and he will be in a position to successfully design his own wireless equipment.

Recent sections deal with series and parallel circuits, damping, choke coils, and transformers.

By W. JAMES.

48.—Inductance Coils.

THE aim in inductance coil design is to produce a coil with low losses with a minimum of expense. A coil ideally possesses inductance only, but *actually has resistance and capacity*, and these factors act to modify the behaviour at high frequencies.

The high frequency resistance of conductors is considerably greater than the resistance for direct or low-frequency alternating currents, and the reason may be explained as follows. If the circle (Fig. 120) represents the cross section of a conductor, and a continuous current is flowing, the current is uniformly carried by each portion of the cross section. Magnetic lines of force are generated around the conductor, as shown by the circles. If the current varies, the number of lines of force vary. Suppose an alternating current is flowing through the wire. When the current has zero value there is no magnetic field; as the current increases the magnetic field increases.

One may think of the lines of force growing outward from the centre of the wire. In so doing, an induced pressure is generated in the wire, in the same way that an induced pressure is generated in an inductance coil. When the current has reached its maximum value, part of the lines of force have grown from inside the conductor to the space around as shown in the figure. Consequently, an element of the wire, such as A, is affected by more lines of force than an element such as B. Thus the induced pressure is greater in those portions of the wire situated close to the centre than in those portions near the surface; further, the pressure is a back pressure, as explained in section 15. Consequently the current will not be carried equally by each element, but will tend to flow near the surface, because although the same pressure is applied t each element of the conductor, those element near the surface offer resistance and a sma back pressure to the current flow, whi those nearer the centre offer the sam resistance but a greater back pressure.

The distribution of current, however, is sti *symmetrical*, provided the wire is no influenced by other conditions, *i.e.*, th current distribution is symmetrical in th

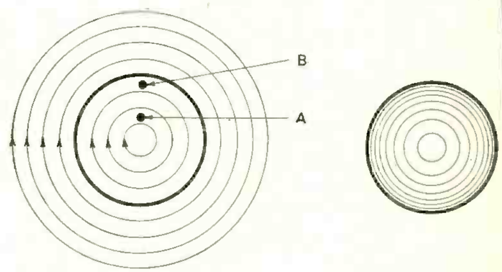


Fig. 120. The heavy circle represents the surface of a conductor. When current flows, an element situated at A is linked with more lines of force than another at B. Consequently the back pressure developed is not equal over the cross-section. The current distribution is similar to the arrangement of the circles in the small figure, the current density near the surface being greatest.

case of a straight wire, but will be modified when the wire is wound, say, in the form of a coil.

It will be noticed the phase of the current near the centre is different from that close to the surface on account of the back pressure.

The effects described are called *skin effects*. The skin effect is greater the larger the cross section (S) of the conductor, the higher the frequency (f) of the alternating currents, and the better the permeability (μ). It is lower for conductors with high specific resistance (p). Thus the skin effect is proportional to $S \times \frac{\mu f}{p}$.

Round Wires.

In the case of round wires, the resistance at high frequency may be determined accurately. Referring to Table 1, the ratio of the resistance at the desired frequency (R_H) to the direct current resistance (R) is given with corresponding values of x. The quantity x *in the case of copper wires, is equal to* $10da$, where d = the wire diameter in cms., and the quantity a is taken from Table 2.

TABLE 1.

Table giving quantity $\frac{R_H}{R}$ for various values of x obtained from the formula above.

x	$\frac{R_H}{R}$	x	$\frac{R_H}{R}$
0·5	1·0003	9·0	3·446
1·0	1·005	10·0	3·799
1·5	1·026	15·0	5·562
2·0	1·078	20·0	7·328
3·0	1·318	25·0	9·094
4·0	1·678	30·0	10·86
5·0	2·043	50	17·93
6·0	2·394	70	25·0
7·0	2·743	100	35·6
8·0	3·094		

TABLE 2.

Table giving the quantity a for various frequencies.

a	Frequency.
13·12	1,500,000
10·17	1,000,000
9·579	800,000
8·296	600,000
5·866	300,000
4·79	200,000
3·387	100,000

Thus, to determine the high-frequency resistance of a copper wire, the values of a, corresponding to the frequency of the current, is taken from Table 2. This value of a is put in the formula $x = 10\,da$, and the quantity x obtained. In Table 1, corresponding to this value of x, is read off the ratio $\frac{R_H}{R}$. Multiplying this quantity by the known direct current resistance gives the resistance of the wire at the frequency required.

Suppose the wire is 0·2 cm. in diameter, what is the ratio of its high frequency resistance to its low frequency resistance at 1,000,000 frequency.

From Table 2, corresponding with 1,000,000 frequency is the value $a = 10·17$. Then $x = 10\,da = 10 \times 0·2 \times 10·17 = 20·34$. Corresponding with the value of $x = 20·34$ in Table 1 we find $\frac{R_H}{R} = 7·4$ nearly. That is, the resistance of a copper wire 0·2 cms. diameter at 1,000,000 frequency is 7·4 times its direct current resistance.

B. Consequences of Skin Effect.

In consequence of skin effect, attempts have been made to construct conductors which have a small ratio $\frac{R_H}{R}$. It is clear the skin effect is less the smaller the diameter of the wire. In Table 3 is given data, determined by L. W. Austin, showing the largest diameter wire in milli-metres which at various frequencies has a resistance only 1 per cent. greater than the direct current resistance.

TABLE 3.

Wavelength.	*Copper.*	*Manganin*	*Constantin.*
100	0·006	0·29	0·30
300	0·09	0·50	0·57
400	0·10	0·60	0·66
600	0·15	0·75	0·83
1,000	0·21	0·99	1·10
2,000	0·30	1·38	1·52
3,000	0·33	1·62	1·82

The effect of a higher value of specific resistance is clearly seen. Resistances for use in high frequency circuits should therefore be built with a wire possessing a high specific resistance, such as constantin or manganin.

A copper tube has practically the same high frequency resistance as a solid copper wire of the same diameter; and tubes are often employed in the construction of inductances for large power transmitters.

It is common practice in America to employ aerial wires which consist of steel wires with a copper coating, the advantage being that the great strength of the steel is utilised, while the resistance is not greater than that of a solid copper wire of similar size.

This point should be borne in mind in connection with the use of tinned copper wires. Tin is a poor conductor compared with copper. As the tin carries practically the whole of the current, the resistance may be very high, especially if the tin coating is poor.

The resistance of square section wire is practically the same as that of round wire of equal cross section.

Flat strip conductors are often employed in transmitters, partly from mechanical as well as electrical considerations. The resistance ratio increases with the width of the strip. It is better to use thin strips. The ratio $\frac{R_H}{R}$ is less than that of an equal cross section of circular conductor.

C. Litzendraht.

It must be clear that if a wire of small diameter is chosen such that the ratio $\frac{R_H}{R}$ is small at the frequency which will be employed, and a number of these wires *suitably insulated,* are woven so that each appears on the outside of the cable and the inside of the cable the same number of times, then the current will be carried equally by each strand, because each strand is subjected to the same strength of magnetic field per unit length.

It is of no use simply twisting together a number of small diameter conductors. The ratio $\frac{R_H}{R}$ for such a cable is higher than that of a solid wire of similar area.

It is better still to weave the small wires round a core, so as to produce in effect a tube, the wall of which is woven wire. Sometimes a non-conductor core is used. Such cables are frequently used in wireless apparatus; also as aerial wire. For transmitters, where heavy currents are carried, a number of cables may be twisted up to form one large conductor. The conductor need not be circular; they are often made up into flat strips. The insulation is often enamel, perhaps with a single covering of silk.

The ratio of the resistance of strand cable to an equivalent cross section solid wire at a given frequency depen upon that frequency, but may be one quar to one half.

Not all stranded cable is good, howev Losses due to faulty construction and po insulation, with may-be broken strand make it doubtful, from the point of vie of receiver construction, whether the ga is worth the extra expense.

The above remarks refer to single straig conductors which are only affected by the own magnetic field. When conductors a wound into coils, the coil losses vary greatl with a number of factors, treated below.

D. Resistance of Coils.

If a coil is wound as shown in Fig. 121 the flux produced by an alternating curren links with the conductors, so that an elemen situated at B is cut by more lines of force

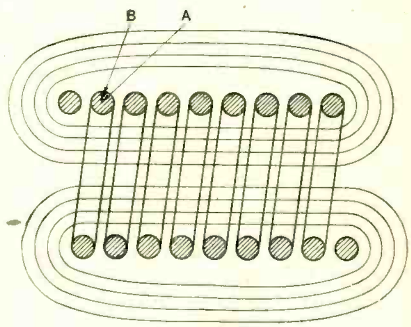


Fig. 121. When the wire is wound in the form of a coil, the current distribution is again changed. The current density is greatest in the portion of the wire on the inside of the coil.

than an element at A. Consequently, as explained above, there will be a redistribution of current, and in fact the elements of the conductor on the inside of the coil carry a larger current than those situated near the outside, resulting in the effective resistance being greater than that of the conductor laid out straight; perhaps three or four times as great.

There are other losses, equivalent to resistance losses, due to;—ends which are not in use but which are influenced by the magnetic field generated by the remainder of the coil (*dead end losses*); losses due to insulation (*dielectric hysteresis*), and the capacity between turns of the coil (*self-capacity*).

It will be realised that since when a coil rries current there is a difference of potenıl between adjacent turns (and in the case multilayer coils between layers as well), small charging current may flow from turn › turn through the dielectric, the adjacent ires with their insulation operating as nall capacity condensers (Fig. 122). Thereɔre, while the inductance of the coil is ıbstantially a fixed quantity, we cannot all its impedance $\sqrt{R_H+(\omega L)^2}$ ohms, where R_H is its resistance and L its inductance .t the frequency considered ($\omega=2\pi f$). The ffects of the capacity must be considered.

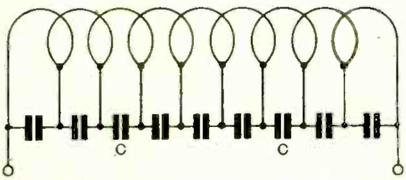


Fig. 122. The coil possesses capacity as well as inductance. The capacity is represented by condensers between turns.

At low frequencies, the reactance may be considered as positive, but beyond a certain frequency the impedance will be negative; that is, in the first place the coil is reactive, but at higher frequencies the coil is operating as a condenser.

This effect is specially noticeable when the coil consists of a number of layers wound on without regard to capacity; for example, a multilayer winding, or the windings of a low frequency transformer. In the case of the coil, Fig. 122, its self-capacity is such that together with its inductance it will have a natural frequency, so that we may represent the coil by a pure inductance (L) with resistance (R), in parallel with a condenser C (Fig. oo). If the E.M.F. is connected to the ends of the coil, and the frequency happens to equal the natural frequency of the coil, then the effective resistance is very high, because here we have parallel resonance—a rejector circuit.

Further, on account of dielectric hysteresis (and perhaps turn to turn *leakage*), the condenser action is imperfect; that is, there is an energy loss in the dielectric which is manifest as increased apparent coil resistance.

Other losses may be due to the capacity between the coil and earth or earthed bodies, other coils, etc.

When, as is often the case, only part of the coil is connected in circuit (Fig. 124), the end of the coil not in use is nevertheless energised by the magnetic field produced through the current carried by L_1. Thus, eddy currents may flow in the unused ends (in the case of large conductors) and oscillating currents in the circuit formed by $L_2 C_2$. As explained in section 45, losses in this circuit, due to any cause whatever, are equivalent to coil resistance.

It may possibly happen that $L_2 C_2$ is in resonance with the fundamental or a harmonic of $L_1 C$, when the effective resistance is greatly increased. Another ill effect arises through the coil end acting as a coupled circuit in this, that circuit $L_1 C$ may possess not a single resonance frequency, but two, (see section 47).

E. Change in Inductance.

If the inductance of the coil is measured at low frequency, and then the coil is placed in a high frequency circuit, its apparent inductance is now, on account of its self-capacity, different, and varies with change in the frequency. For frequencies below the natural frequency of the coil, the apparent inductance increases with the frequency.

The capacity of coils ordinarily used cannot be accurately predicted, though it can be measured.

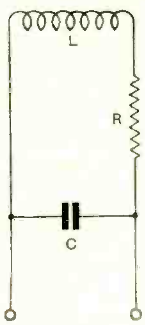


Fig. 123. Here the ideal coil is represented by L, its resistance by R, and its self-capacity by C.

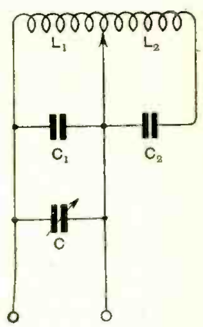


Fig. 124. When part of the coil only is used, the end not used acts to modify the behaviour of the circuit with which the coil is connected.

F. Coils Wound with Stranded Wire.

In the case of coils built to operate in large transmitters, it is customary to employ either stranded cable, strip or tube.

Of special interest is the case of coils for use in small power transmitters and receivers. It may be thought desirable to employ stranded wire (Litzendraht), but this is sometimes not so, for the following reasons.

It has been found that a coil of perfect litzendraht has a little lower resistance than an equivalent coil of solid wire for a range of frequencies, but that for very high frequencies, such as 1,000,000 cycles (wavelength 300 metres) the coil of solid wire is preferable. This assumes perfect litzendraht; that is, the insulation of each strand is good, each strand is continuous, and the connections at the ends of the coil make good contact with each strand. But it is found that after use, some strands may break, and other imperfections appear. Consequently the effective resistance increases, and the distributed capacity may be several times larger. Thus the constants of the coil may change with age, which is a serious disadvantage. All things considered, the superiority of coils wound with litzendraht for medium frequencies is hardly sufficient to warrant the extra expense. *It is definitely better to wind coils of solid wire when the frequency is high.*

Curves of interest are given in Fig. 125. Curve A refers to a coil of perfect litzendraht, and curve B to that coil with one strand broken. Curve C refers to a solid wire coil. It will be noticed frequency is plotted against *apparent resistance.* The natural frequencies of the coils A and C is 300,000 cycles (wavelength 1,000 metres); therefore the apparent resistance here is very high. While coil A is superior to coil B, coil C is definitely inferior at all frequencies to coil B; its apparent resistance is considerably greater and its natural frequency has lowered, indicating an increase in its self-capacity.

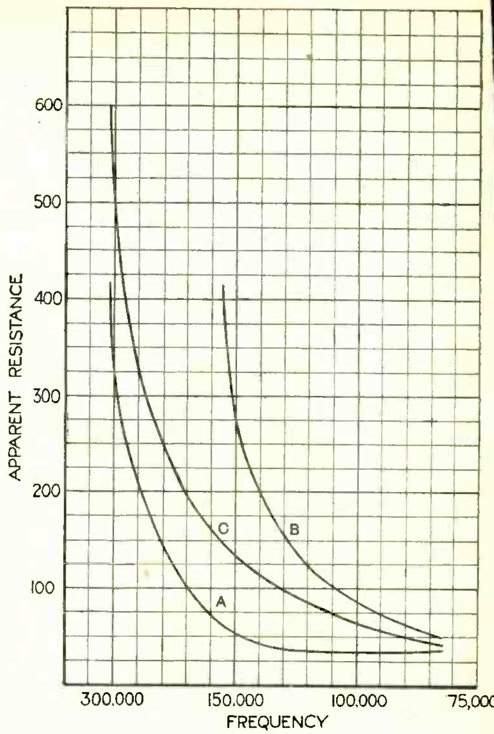


Fig. 125. Curves giving the apparent resistance of coils wound with stranded cable (A and B) and solid wire (C) at various frequencies.

G. Forms of Inductance Windings.

The variety of coils available at the present time is the result of attempts to prevent the losses, with the ill effects, outlined above, and is treated in the next section.

Wireless Club Reports.

Contributions to this section are welcomed. Reports should be as concise as possible and should record the most interesting features of each meeting. The Editor reserves the right to edit the reports when necessary. **Papers read before Societies will receive special consideration with a view to publication.**

An Asterisk denotes affiliation with the Radio Society of Great Britain.

Clapham Park Wireless Society.*

At a recent meeting of the Society, Mr. Harold Boucher entertained and instructed the members with a demonstration of the "Chakophone" unit system. The first unit was a tuner with loose coupling and no reaction, to which could be added any number of H.F. panels, employing tuned anode coupling. L.F. valves up to three for practical purposes, could also be added. The lecturer concluded with a demonstration of reception from **2 LO** and an interesting discussion ensued.

Hon. Sec., J. C. Elvy, A.M.I.E.E., 12, Tavistock Street, W.C.2.

Belvedere and District Radio and Scientific Society.*

A proposal with respect to new accommodation was considered at an extraordinary general meeting held on August 29th. A special committee had made the necessary preliminary arrangements for the renting and ultimate purchase of a new building, to be erected to the Society's own specification. The plans were unanimously agreed to, it being decided that the building should be erected as quickly as possible. It will be designed to form comfortable rendezvous and a convenient boratory for carrying out experimental work.

An attractive programme for the winter is eing arranged.

Hon. Sec., S. G. Meadows, 110, Bexley Road, :rith, Kent.

Cirencester Radio Society.*

On Saturday, August 25th, a party of fifteen notored to Leafield Wireless Station, permission naving been granted by the G.P.O. The officer n charge himself kindly took half the party round, and his assistant steered the others. The boiler-house, the steam turbine (running at 6,000 revolutions per minute) geared down to 1,000 revolutions to work the alternator, the arc, set in a magnetic field that all but tore a spanner out of one's hand, and the air-driven signalling keys, worked by a relay from the transmitting office at Banbury, were all shown and clearly explained, besides the many supplementary machines and "gadgets." Everything being in duplicate, the idle set could be closely examined, while alongside the very much alive twin was hurling into the huge aerial system 230 kilowatts of energy, sending a series of test messages to Halifax, Nova Scotia. A walk round the nearest masts (the furthest were half a mile away), and a keen discussion on "harmonics" and the plans of the O.I.C. for reducing them, brought an exceedingly interesting visit to a close, and the party returned to "The Highway" Tea Rooms, Burford, where they found most excellent fare awaiting them. A short meeting was held after tea, at which the Secretary, the Rev. B. R. Keir Moilliet, in view of his coming departure from the district, tendered his resignation, and Mr. A. J. Carter, of X-Ray Department, Cirencester Memorial Hospital, was elected honorary secretary in his place.

Honor Oak Park Radio Society.

Another successful meeting was held by the Honor Oak Park Radio Society on Wednesday, August 22nd. A member, Mr. J. McVey, gave a graphic account of the damage done by an electrical discharge from the sky, through his wireless set during the storm of Saturday morning, August 18th. He also exhibited several parts of the damaged apparatus for inspection of the Club members.

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

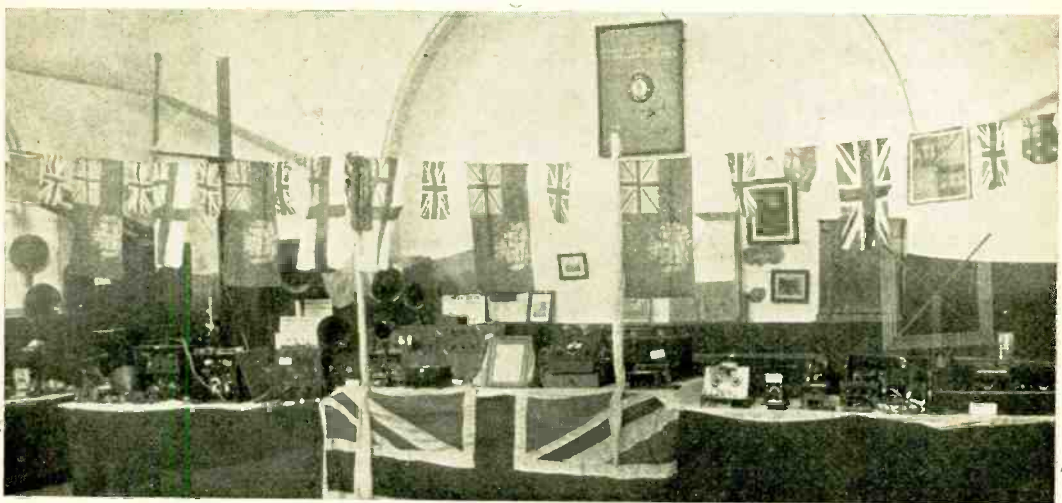
South Dorset Radio Club.

The Hon. Secretary has forwarded to us a list of suggested rules for this new Society. These are very comprehensive, and should be of material help in the proper conduct of the Society's affairs.

Hon. Sec., E. B. Cartwright, 18, Newbury Terrace, Weymouth.

Tunbridge Wells and District Wireless Society.

On Saturday, August 25th, a party of about forty members and friends journeyed by charabanc and private cars to Gills Lap, on Ashdown Forest, where a temporary aerial was erected and some interesting experiments were carried out.



The Stratford-on-Avon and District Radio Society held a wireless exhibition on July 22nd. Above is seen a portion of the display.

Mr. G. Mortley's portable transmitting station **(2 PQ)** was erected and communication established by wireless telephony between this and Mr. Featherstone's experimental transmitting station at Tunbridge Wells **(5 IF)**.

The replies from Tunbridge Wells were made audible to all present by means of a Burndept receiver and power amplifier, and three loud speakers.

After a picnic tea, wireless telephony and music were listened to from the English broadcasting stations, and from the Eiffel Tower, Paris, the latter station transmitting a particularly good musical programme.

Although the weather was not so warm as might have been desired, all agreed that an interesting and enjoyable afternoon had been spent.

Those interested in the science of wireless telephony and telegraphy are invited to join the Society, full particulars being obtainable from the Hon. Sec., H. Featherstone, A.M.I.E.E., 3, Cumberland Gardens, Tunbridge Wells.

Constructional Details of a Four-Valve Set.

(*Continued from page* 758, *September 5th.*)

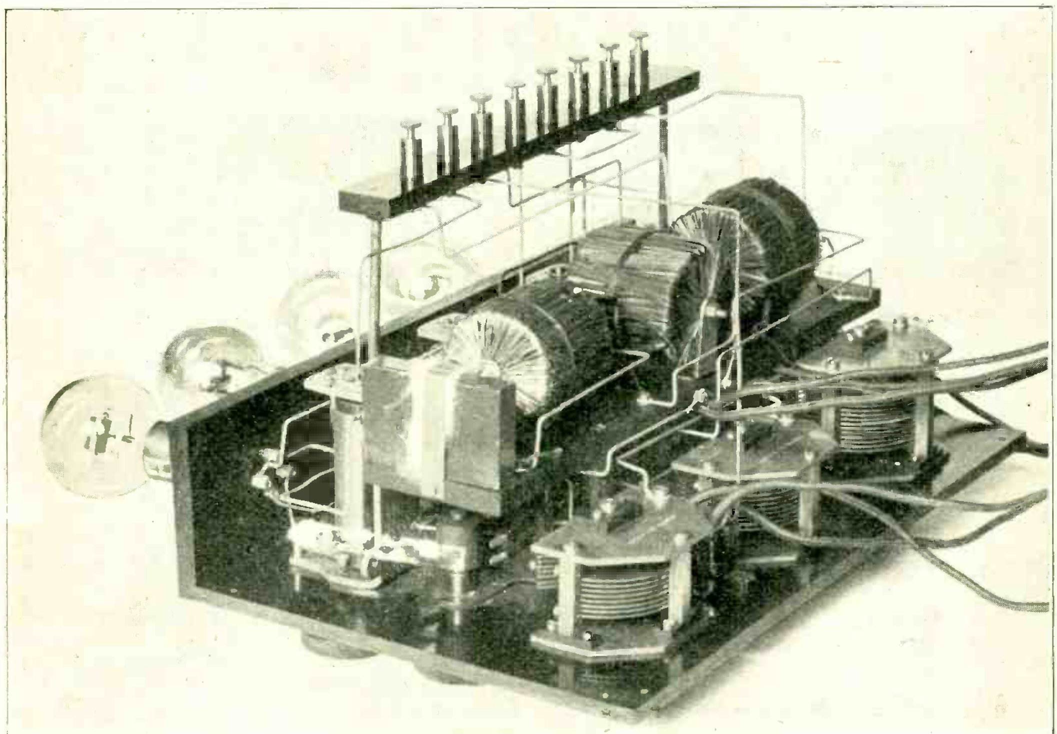
By F. H. HAYNES.

Construction.

THE general principles have been dealt with and some advice is offered with regard to construction. It is not proposed to deal with the methods of working ebonite, brass and wood, as it is presumed that the reader has a certain amount of experience in this direction and detailed descriptions of simple workshop processes as applied to the construction of this set were given earlier in the volume.*

The ebonite work comprises four panels 5/16 or $\frac{3}{8}$ in. in thickness. The former dimension can be used for economy, but if portability is required, $\frac{3}{8}$ in. ebonite is recommended. The dimensions for the front panel are given on page 754, as well as the location of all holes. These can be employed without amendment with the majority of components on the market. The valve-holder panel must be made a good fit on to the front panel as the joint is in a conspicuous position. A well-made fit, finished matt should be practically invisible, and the seam must be wiped clean from all traces of oil which might otherwise subsequently creep and reveal the join. Five screws are employed to secure the panels together to give strength, but it should be noted that the valve panel is entirely supported by the boxwork when in position. An endeavour is made to avoid the presence of screw heads on the face of the front panel and with the style of components shown only six countersunk heads appear, being those employed for attaching the supporting pillars of the transformer platform. The

* *Wireless World and Radio Review*, p. 42, April 14th; p. 268, June 2nd; p. 340, June 16th, 1923.

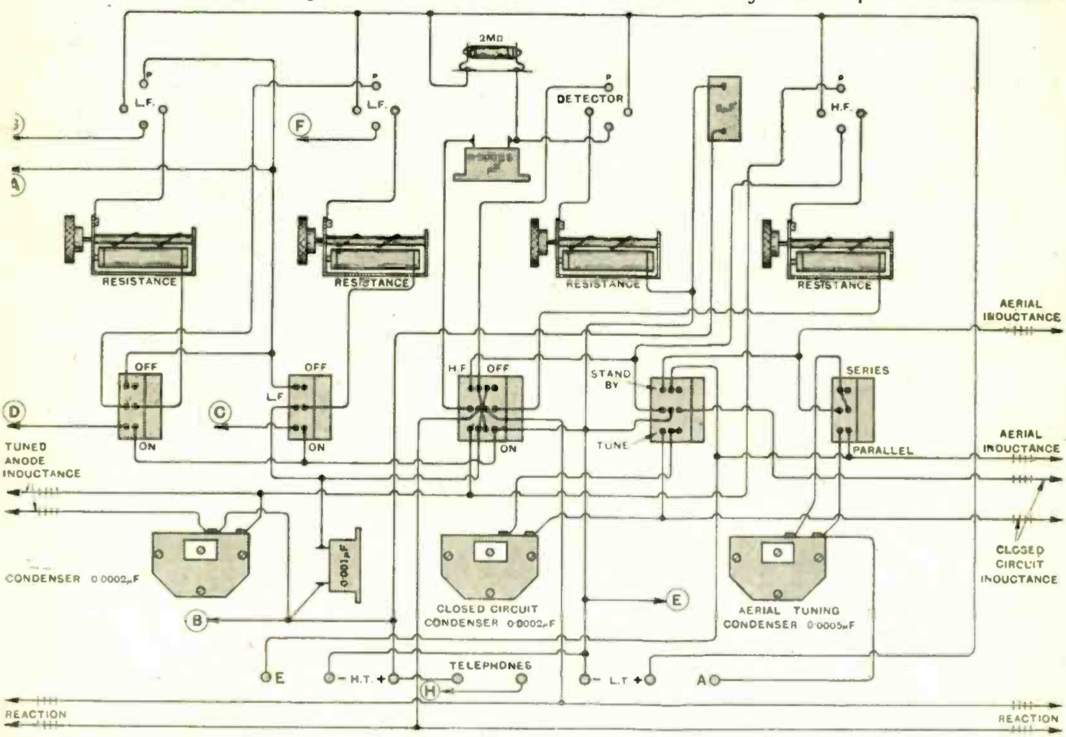


Interior view with transformer panel in position and wiring up completed.

ads may be slightly reduced in diameter order to render them less conspicuous. he two small condensers attached to the ack of the panel are held by screws in lind holes. In good instrument designs it ould be the aim to avoid the appearance f screwheads in conspicuous positions, and lso the employment of short blind holes, ut it is not always possible without inreasing the amount of labour to achieve hese ideals.

Before any assembling or fitting up is ommenced the engraving must be carried out. A suggested layout for engraving is shown in the dimensional drawing, and the positions for the various scales and lettering should be marked in pencil on the roughened face of the panel in their precise places. The centres for the various letters and figures must be marked and their sizes indicated as being ⅓, ¼, ⅙, ⅛, or 1/10 of an inch. ¼, ⅛ and ⅙ in. are convenient sizes. Machine engraving can be entirely avoided by employing variable condensers having rotating dials and for which sufficient space is allowed on the panel, while if dials are desired for the resistances also, suitable ones are available on the market, made of white celluloid, engraved and filled in black.

Assembling is quite straightforward, and every part should be correctly fitted up, including the transformer panel and terminal strip, before wiring is commenced. The latter is secured to the panel or resistances by means of two 3/16 in. brass rods tapped 2 BA. One end of each rod fits into a blind hole on the terminal strip, and is held secure by a lock nut, whilst the other end is tapped and soldered flush into a small brass plate which is held by three 4 BA countersunk screws. The two large capacity condensers are attached by means of thin brass straps.

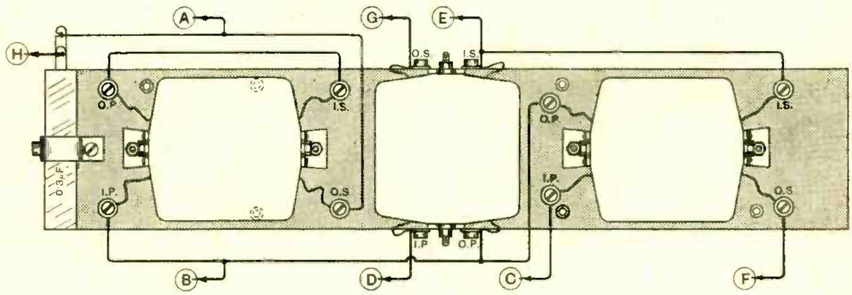


Practical wiring diagram. Leads can be marked off as they are fitted. Flexibles are indicated by cross lines.

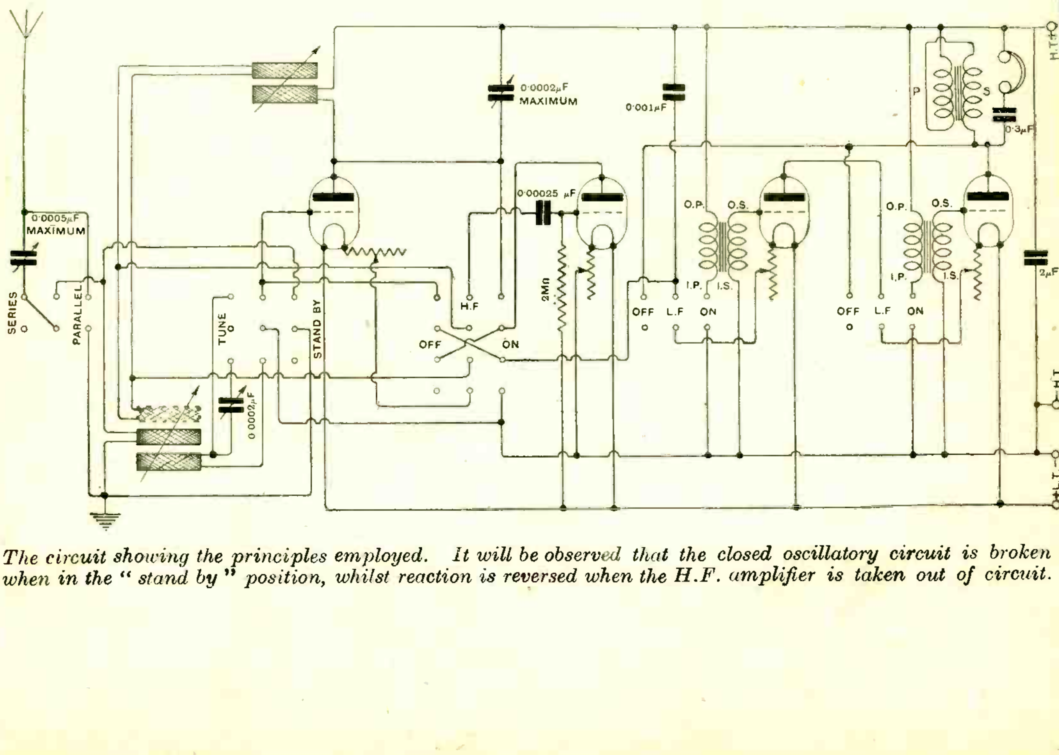
Wiring.

The bigger portion of the wiring is put in with the transformer panel removed, which, when replaced, obscures most of the complicated switch connections. No. 16 S.W.G. tinned copper wire is employed. This is a very rigid wire, and retains its bends. Unfortunately, when purchased, it is usually wound upon small diameter reels and must be straightened before use. This may be done in short pieces by hammering on a flat surface with a wooden mallet. Do not use a steel hammer or the wire will become bruised and flattened. Another method is to unwind a good length of wire and with one end held securely, pull on the wire until it can just be felt to stretch, after which the slight curvature may be taken out by passing round a wooden tool handle.

Advice on soldering may be a little out of place here, yet good clean connections are of first importance. In brief, clean with a trace of "Fluxite," and tin separately surfaces to be soldered, using a clean, well-tinned iron. Use a good hot iron, taking care not to get it red hot, and do not leave it in the flame when not required, as it will become oxidised. Using the practical wiring diagram as a guide, which shows the actual points between which connecti must be made, each connection is taken a considered in turn and the shortest a most direct route decided upon before t lead is prepared. Leads must only be ru parallel to the edges, and consequently a bends are right angle ones. As the hig frequency tuning circuits must be of lo capacity and must not present appreciab stray capacity into adjoining leads, the should be put in first. In particular, the grid leads of the high frequency and detector valves must be short and direct. The more obscured contacts of the switches must be watched with a view to making connection before they become inaccessible, and in particular attention is drawn to the flexible lead joined to the lower middle



Practical wiring of transformer panel.



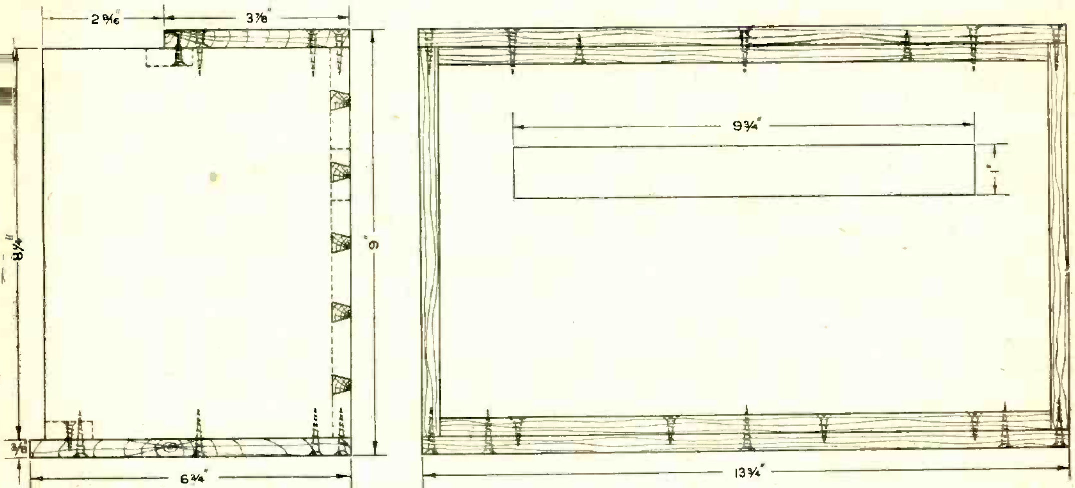
The circuit showing the principles employed. It will be observed that the closed oscillatory circuit is broken when in the "stand by" position, whilst reaction is reversed when the H.F. amplifier is taken out of circuit.

ntact of the "stand-by" and "tune" ritch. Most of the other flexible leads hich are marked with four short dashes ear the arrow point can be attached when e stiff wire is in position.

Do not hurry over the wiring. It will robably take you longer than the whole the fitting up of the instrument. Small ound-nosed and end-cutting pliers are ndispensable for bending the wire and either end of a lead should be attached ntil it has been shaped to fit. As each lead s completed it should be marked off from he wiring diagram, and a good method s to run over it with a fine red ink line at he same time verifying the points between which connection has been made. Those leads which are marked with letters A to H one of them a right angle bend so that it lies along the other for about ½ in. The flexibles will need to be about 2 ft. long in the first instance, and can be shortened where necessary afterwards. Their ends should be bound with cotton to prevent fraying, and if four different colours are employed they can be recognised for connecting to the coil holders.

Woodwork.

The dimensions of the containing box are given in the accompanying diagram. It is made from ⅜ in. to ½ in. teak, mahogany or walnut. Softer wood may be employed, in which case it should not be less than ½ in. in thickness. The corners may be screwed and glued instead of dovetailed. The hole



Dimensional drawing of the box work. The location of the slot for the terminal strip must be carefully set out.

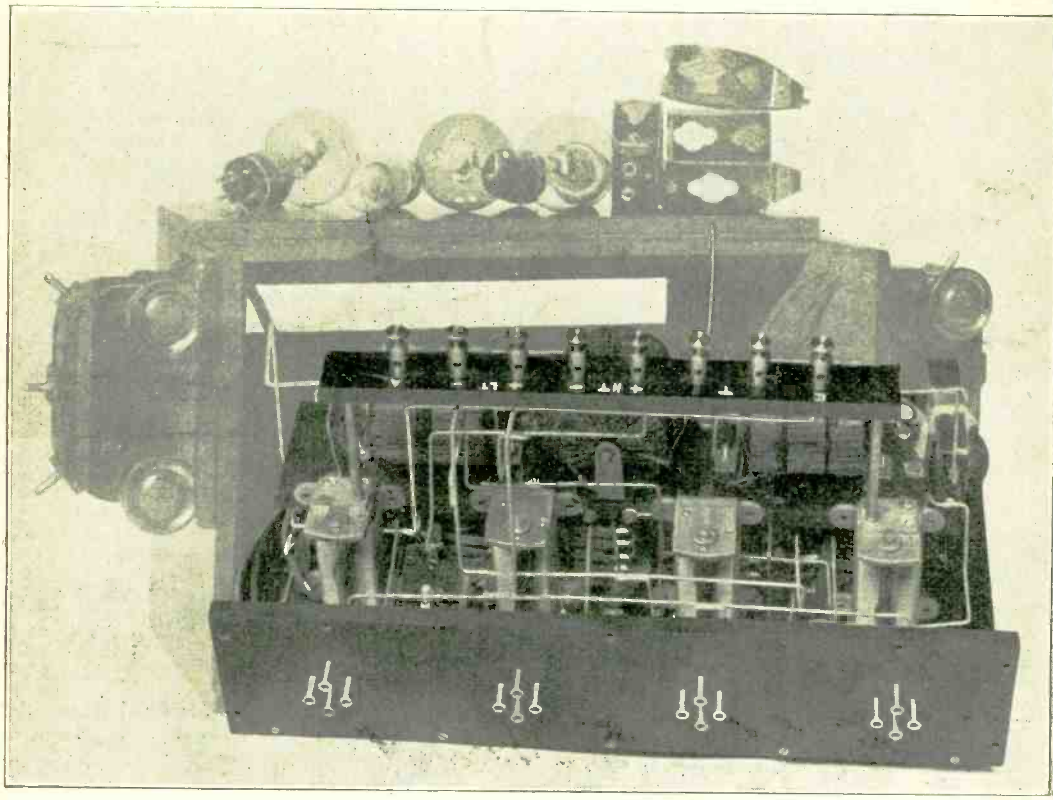
are those which are carried on the main panel to the transformer platform. It will be necessary to attach C and D to the switches before fixing the platform. The soldered connections must be thoroughly washed with methylated spirits, applied by means of a camel hair brush before they are obscured. Every trace of "Fluxite" can thus be removed, the ebonite left clean and dry, and high insulation maintained. For ready identification it is useful to enamel the leads various colours and this must be commenced whilst the transformer panel is removed. The aerial and closed circuit tuning leads may be enamelled white, grid leads red, leads in the H.T. circuit green, and L.T. leads blue. Where one lead makes connection with another, strong union is effected by giving

at the back to give clearance for the terminal strip requires very careful setting out, and its position should be confirmed by making measurements from all edges to allow for the panel or woodwork being slightly out of square. It may be finished with shellac varnish and rubbed down with a trace of boiled linseed oil. The coil holders are attached as shown in the photograph of the complete instrument, and holes drilled through to pass the leads. The aerial inductance is the centre one on the left-hand side in order that reaction may be obtained with the switch in the stand-by position. The closed circuit is the outer coil and the reaction inductance the lower one. The tuned anode inductance is in the centre on the right-hand side, whilst the lower holder is paralleled across with the reaction coil holder on the left. The upper holder on the right-hand side is also paralleled into this circuit, but the leads are crossed over so that by transferring the reaction coil from the lower to the upper position the direction of reaction coupling is reversed.

Operation.

The various switching arrangements not only increase the utility of the receiver, but

perience shows that it is frequently possib to obtain a higher degree of amplification b reacting on to the tuned anode inductanc instead of the aerial circuit. High frequenc amplifiers are only efficient when they ten to self-oscillate, and for this reason it doe not greatly matter whether reaction i arranged on to the tuned anode or aeria circuit when considering the interferenc likely to be caused if receiving on broadcas



Another view of the complete set showing the interior.

simplify tuning. The aerial circuit can be adjusted to bring in the required signal with the switch in the "stand-by" position. On changing over to "tune" the closed circuit can be adjusted, and on switching in the high frequency circuit this can be tuned separately, slight adjustments being made to the tuning of all circuits and degree of coupling afterwards. The aerial tuning condenser should, as a rule, be used in series for wavelengths below 600 metres. Ex-

wavelengths. For telephony reception, self-oscillation may introduce distortion and reaction may be so coupled to damp out the tendency to oscillate. For reception on wavelengths of 600 and below, coils numbers 25, 35, 50, 75, 100 and 150 are needed, duplicate coils being inserted in the closed and tuned anode circuits. It is possible to receive all the well-known European telephony transmissions on a loud speaker if desired with this receiver.

SOME LABORATORY EXPERIMENTS WITH THE ARMSTRONG CIRCUIT.

With the increasing interest that is being taken in receivers embodying the Armstrong principle, the following experimental investigations of the conditions prevailing during the operation of this type of receiver, and the conclusions arrived at, should be of special value.

By H. Andrews, B.Sc.

THE following article is an endeavour to put before the amateur fraternity some actual data and figures obtained in the laboratory concerning the now famous Armstrong circuit.

It is intended here only to give the results and conclusions of a series of experiments on the single valve, or "flivver" circuit, which were carried out with a view to finding out exactly how this circuit worked, the best conditions in practice, and the actual amplification obtainable under the best conditions.

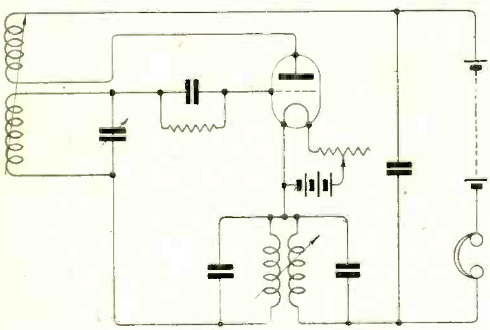


Fig. 1. Typical Armstrong Super Circuit.

As a preliminary the one and two valve circuits were tested on local broadcasting from **2 LO**, and it was decided that the one-valve circuit (Fig. 1) was easier to operate, and gave slightly better results. So much having been written on the subject, it is assumed that the reader is conversant with the ordinary Armstrong circuits. It was noticed at the start that very poor amplification was obtained. Throughout this article amplification is used to mean the increase in signal strength obtained with the Armstrong over the ordinary single valve circuit.

The current change in the anode circuit was measured on tuning in the signal by inserting a micro-ammeter and balancing out the steady anode current. This arrangement is shown in Fig. 2, and is a very useful method of measuring the change in anode current produced by a signal E.M.F. on the grid of a valve. In this way the increase in anode current change due to the L.F.

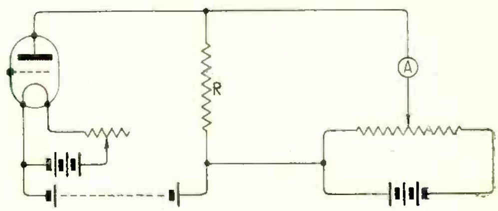


Fig. 2. Method of determining current change in the anode circuit.

oscillations of the valve was measured, and hence the amplification determined. The maximum amplification obtained using local broadcasting was only from 3 to 5, but this, of course, corresponded with a loud signal.

One of the difficulties experienced in working with this circuit is that we have so many variables, such as the anode voltage, the H.F. coupling between the grid and anode circuits, the low frequency coupling, and hence the low frequency grid swing voltage, the mean grid potential, and lastly the received signal strength.

Now, to obtain any numerical results a all it is essential to make all these variable constant except one, and then find the best conditions for the latter. Even this method does not necessarily give the best conditions, but still serves as a plan of operation.

The anode voltage and mean grid potentia were first settled fairly easily by taking several anode current-grid volts curves for the valve to be used, and then adjusting the anode voltage so that with a mean grid potential of approximately zero, the anode current was half the saturation current.

Leaky grid condenser rectification was used, and hence the valve was working under the best conditions for rectification and amplification. The anode voltage for the valve used, a M-O type "R," was about 160 volts.

These variables were then left. As far as could be determined the best results were always obtained with the H.F. coupling as large as possible without the valve howling.

The low frequency grid swing was next investigated. The value of this could of course be varied by altering the coupling between the large inductances in the grid and anode circuits.

To measure the actual voltage (peak), an H.F. voltmeter was set. This arrangement is shown in Fig. 3. It consists of an electrostatic voltmeter fed through a rectifying valve which charged a condenser connected across the voltmeter. This arrangement was connected across the grid coil of the L.F. circuit. Measurements were then taken, finding the increased change in the anode current for different grid swing voltages.

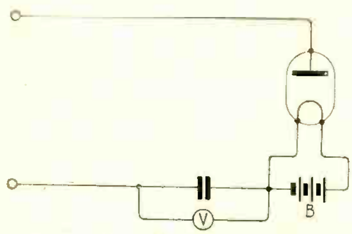


Fig. 3. Showing how the peak value of the voltage is determined.

The best value for this was found to be about 60 volts, but on investigating very carefully it was found that this voltage was very critical, and was really the deciding factor of the amplification of the circuit.

In these experiments it was necessary, of course, to set up a local source of signals.

This was done by employing a valve oscillator near the receiving circuit and dispensing altogether with the frame. In order to take a reading, the procedure was as follows. The anode micro-ammeter was balanced to zero by means of the potentio meter, then the signal was switched on and a reading obtained. This process was repeated with and without the L.F. grid swing, and hence the amplification for any given conditions obtained.

Finally the question of signal strength was investigated. The H.F. current flowing through the tuning condenser of the oscillator

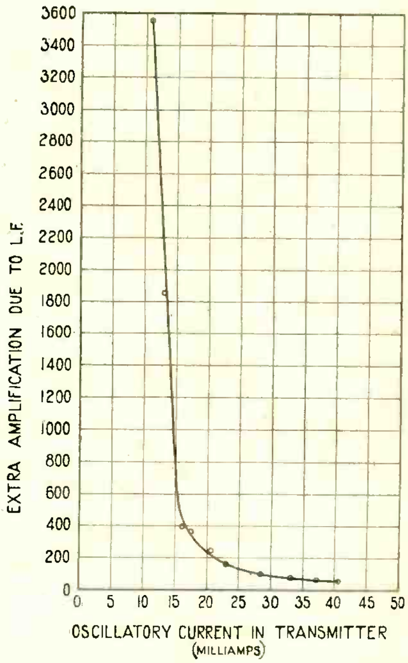


Fig. 4. Graph indicating the relationship between the signal strength and the amplification obtained.

Readings for Curve Fig. 4.

I	Change in Anode Current.		Ratio.
	With L.F.	Without L.F.	
43·7	450	10·5	42·8
40·5	430	8·0	53·75
37	430	7·2	59·80
33	430	6·2	69·40
28·4	422	3·9	108·1
23	410	2·6	157·9
20·5	410	1·2	348
17·6	400	1·1	374
16·2	395	1·0	395
14·7	385	·4	962·5
13	370	·2	1850
10·8	355	·1	3550

as measured by means of a thermo-couple ıd micro-voltmeter, and it was assumed ıat the energy radiated was proportional to ıe square of this current.

Readings were then taken between the scillator current and the change in anode urrent with and without the L.F. grid wing.

At first the oscillator and the receiver vere placed about 20 feet apart, and with he smallest oscillator current only an .mplification of about 8 was obtained.

To observe the effect of very small signals t was necessary to reduce the signal strength still further. This sounds simple, but unless one has actually worked with such a circuit, and with very delicate instruments, it is not easy perhaps to realise how difficult it is to get a really small and yet measurable signal.

Finally, the oscillator was placed in a large zinc box about 50 feet or more from the receiver, and in this way the curve shown in Fig. 4 was obtained. These results are really very striking as they show that *the amplification of the Armstrong circuit increases as the signal strength decreases.* This is a very remarkable property of the Armstrong circuit, and as far as the writer knows it is the only circuit which has this property. As mentioned above, these results could only be obtained with a very critical adjustment of the grid swing voltage.

Below are given some data of the constants, etc., when the curve shown was taken. The complete circuit is shown in Fig. 5.

L_1 = 300 mhys. λ = 300 m (approx.)
C_1 = 0.03 mfds.
H.T. volts = 160 volts.
Resistance in anode circuit = 760 ohms.
Grid swing (L.F.) = 58 volts.
L_2 = 1500 duolateral coil
L_3 = 1250 duolateral coil.
C_2 = 0·005 mfds.
C_3 = 0·001 mfds.
C_4 (grid condenser) = 0·0005 mfds.
R_2 (grid leak) = 1 megohm.
Max mutual inductance between anode and grid (H.F.) = 37 microhys.

Note.—Without L.F. grid swing the coupling was adjusted to give greatest change without valve oscillating; a very difficult adjustment.

In the column of readings for the curve Fig. 4, I is, of course, the oscillator current in milliamps.

In the two columns showing the change in anode current 0·2 divs. represents 1 microvolt, hence 1 division represents a change in anode current of $\frac{5 \times 10^{-6}}{760}$ amps. or 0·00658 micro-amp.

Hence we see that the method of measuring the change in anode current was very sensitive and the signals very small indeed.

From the results of these experiments we may, I think, draw the following conclusions: *Firstly,* that in spite of the many statements made to the effect that any average amateur may learn to work this circuit in half-an-hour or so, it is a very difficult circuit to manipulate and the greatest care is required to obtain good results. It might be mentioned here that the above experiments took nearly a month (six hours a day) to complete.

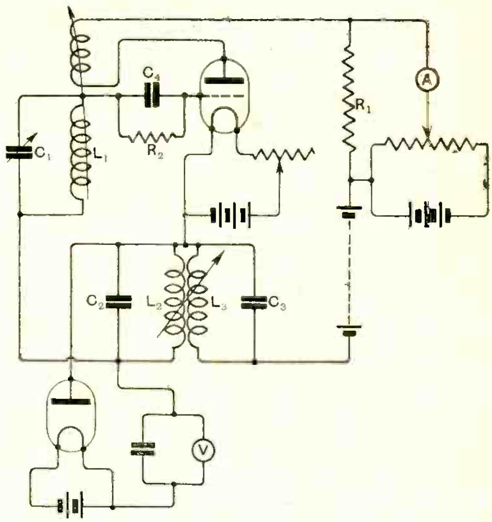


Fig. 5. Circuit employed to obtain the readings for the curve shown in Fig. 4.

Secondly, that the circuit requires very careful arranging and proportioning, and that to get satisfactory results one must at least know the saturation current of the valve to be used. *Thirdly,* that only great amplification can be obtained on very faint signals. On fairly loud signals, we see that, at the best, the addition of the low frequency grid swing is only equivalent to about one low frequency valve.

When the circuit was working at its best, some very curious results were observed which might perhaps be recorded. Firstly, it was found that it was possible to control the L.F. oscillations of the valve by means of the H.F., as well as *vice versa*. This indicates, I think, that the theory at any rate of the one valve circuit is not so simple as the usual theory given, but is a complex phenomena due to the valve oscillating at two frequencies simultaneously. It was also noted that in the sensitive condition, when the signal was switched on, not only did the anode current change, but also the grid swing voltage (L.F.) altered from 59 to about 40 volts with no change of coupling.

The following circuit (Fig. 6) is suggeste[d] as a good one for general reception. I[t] would, of course, require very carefu[l] manipulation, but the interference cause[d] by this type of circuit is very muc[h] exaggerated. A rejector is provided to prevent the L.F. whistle being radiated, and the coupling is of course kept very loose between the primary and secondary circuits.

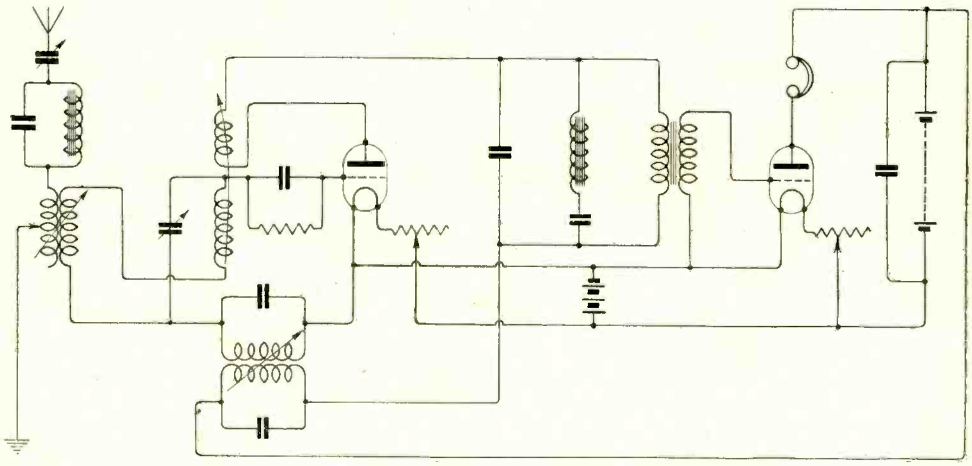


Fig. 6. A suggested circuit diagram for a two-valve receiver embodying the Armstrong principle.

In conclusion, the author wishes to express his indebtedness to E. T. A. Rapson for his able co-operation in these experiments.

CORRESPONDENCE

To the Editor of The Wireless World and Radio Review.

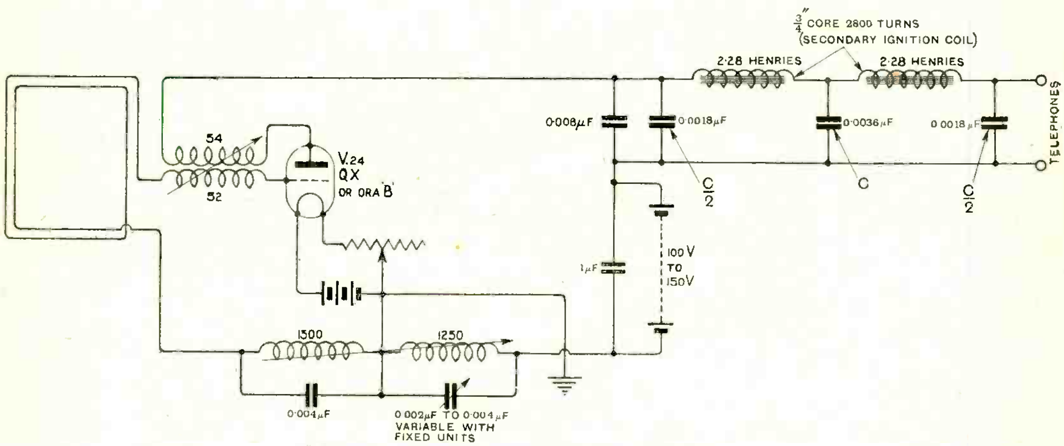
Sir,—I have read with interest the article "Fading, a New Aspect," published in the July 21st issue of this journal, and possibly some experience I have had in this direction may be of interest. The receiver used consisted, in the main, of a two-valve panel receiver, using one H.F. and detector valves, with the addition of H.F. or L.F. panels as required. The combination usually comprised one H.F., detector and one L.F., but frequently the L.F. was omitted. The H.F. valve was coupled by tuned anode, in variometer form, a great help in obtaining selectivity. Inductive coupling was used, secondary tuning within primary (A.T.I.), the reaction coil being coupled to the anode variometer. The A.T.I. was wound with heavy wire of about 20 D.C.C. gauge, this making a marked improvement in signals. The secondary was of No. 30 S.S.C.; it would no doubt be an improvement to use heavier wire, but for considerations of space. The secondary tuning condenser is of 0·0003 mfd. capacity, and the aerial tuning condenser 0·001 mfd., with vernier. The valves used giving best results were H.F., M.O. "R," detector, Ediswan "A.R.," and L.F., French "R."

The following observations were made on a single wire 40-ft. "L" aerial, 23 ft. high, surrounded by trees and houses and directional to S.E.

WJZ has been listened to several times, and I have noticed a swinging effect in fading as described in the article referred to. First, on tuning in, the carrier wave was weakly heard, but after a short time the strength would increase appreciably and remain at this strength for 60 to 80 seconds. Then it would again begin to fade for about the same time, on several occasions being accompanied y a drop in wavelength of about 1 or 2 metres, sing as the strength rose. The swings were also ound to be more prolonged in fine weather, although he strength was not so great. A semi-fading effect as found on **1 CMK**, whose strength after remaining steady for about 80 seconds would fade o practically R 1 for no longer than 4 seconds, fter which it would rise and become steady for nother 80 seconds. With regard to southern and eastern stations, although the direction of he aerial is favourable and the distance not to be compared with that of the above-named stations, **FL** telephony is nearly always poor. This weakness of signal strength is not apparent with other stations in this direction, as **SFR**, **PCGG** and Ecole Supérieure are always R 7. It would be interesting to know whether bad fading or temporary blindness has been experienced by others on **FL**. In conclusion I may add that his Spark and C.W. are R 9.

A. RICHARDSON.

Brixton Hill, London, S.W.2.
August 1st, 1923.



The diagram referred to by Mr. Devine.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I have much pleasure in forwarding an account of some of my experiences with the single valve Armstrong Super.

I find that the points to concentrate on are (*a*) The correct amplitude of the low frequency oscillations, and (*b*) The correct adjustment of the grid potential.

With the single valve, filter circuit, and using headphones, I have received Newcastle, Manchester, London, Glasgow and Cardiff. The addition of a single note magnifying valve enables satisfactory reception to be obtained with a large Brown loud speaker.

I employ a frame aerial 2 feet square, wound with 10 turns of No. 22 S.W.G. enamelled wire, spaced 3/16 in. apart.

The constants for the components of the circuit are indicated on the accompanying diagram.

The filter circuit is very efficient, and has many advantages over the resonant type of filter. The instructions for making it were obtained from an American publication advertised in *The Wireless World and Radio Review*, entitled "The Armstrong Super-Regenerative Circuit," by George Eltze, Jr., E.E., A.I.E.E.

For the benefit of those who may not have the above in their possession, I will quote the formulæ employed for the necessary calculations.

Z = impedance (25 per cent. error permissible).
L = inductance of the coil.
C = Capacity of the condenser.
(The outside condensers are equal to one half of this capacity.)
F = cut off frequency.
LC = 4 (L.C. for cut off frequency.)

(i) $Z = \sqrt{\frac{L}{C}}$ (ii) L.C. for cut off frequency $= \frac{1}{(2\pi F)^2}$

The results are obtained in henries and farads. Trusting that the above information may be of some help to your readers, and hoping that much more practical information will be forthcoming from other British experimenters.

I am, Sir, yours faithfully,
EDWARD A. DEVINE.

Wooler, Northumberland.
August 21st, 1923.

In next issue :—

NEW METHODS OF HIGH-FREQUENCY AMPLIFICATION for 200 metre reception.

NEW FEATURE IN APPARATUS CONSTRUCTION

Notes and News

Preliminary steps are being taken by the Durban Municipality towards the establishment of a broadcasting station before the end of the year.

* * * *

The annual licence for South African listeners-in is to be 5s.

* * * *

A proposal to instal a wireless installation in the local workhouse has been rejected by the Rochford Guardians.

* * * *

For the safety of aeroplanes flying at night red bstruction lights are to be placed on the three wireless masts near Farnborough aerodrome.

* * * *

The P. and O. Line have decided to instal wireless direction finding gear on all their mail steamers. The company's cargo vessels will probably be similarly equipped in the near future.

* * * *

Active service wireless telegraphists on Admiralty dockyard tugs are to be replaced by competent civilian operators.

Experimental Transmitters.

As proof of the rapid growth in the number of amateur transmitters in this country, it is interesting to note that call signs have now reached 6 ZZ. What will the next call sign be?

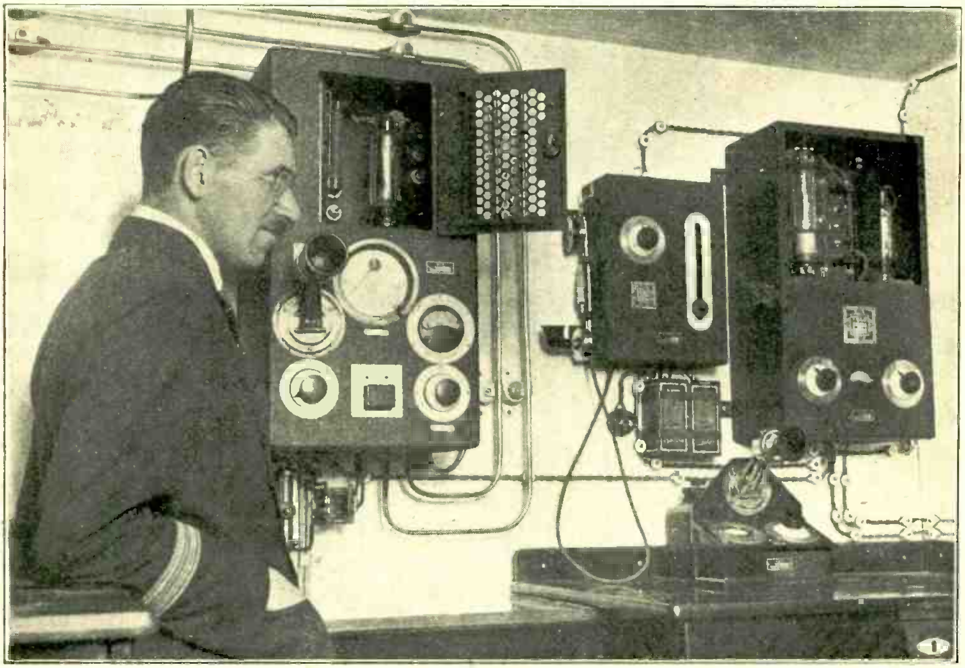
We shall be glad to hear from readers who learn of the allocation of a new series.

Russian Wireless Developments.

The Soviet Government, it is stated, has ratified a five years' agreement with the General Wireless Telegraph Company of Paris, for the supply of apparatus for the erection of wireless stations in Russia.

New Norwegian Wireless Station.

Plans have been prepared for a new wireless station at Vardoe, Norway, according to a Reuter message. This station will have a transmission radius sufficient for communication with the station at Ingoe, near Hammerfest, and to the Meteorological Institute's station at Tromsoe. Weather reports are to be sent regularly from Tromsoe, and these will be of very great importance to British and other trawlers fishing in Arctic and White Sea waters.



A typical Telefunken telephony transmitter. The instrument shown has been installed on board the new German liner "Albert Ballin," and will be employed in ship to shore work off the American coast. The compact arrangement of the apparatus and the simplicity of the design will be specially noted.

'ireless between Australia and England.

Definite steps have been taken towards the .auguration of a scheme of direct wireless com- .unication between Australia, England and other ɔuntries. This announcement was made by Mr. .llard, Chairman of the Amalgamated Wireless Australasia), Ltd., at the Company's annual ıeeting at Sydney, on Saturday, September 1st. ʌ tender has been accepted from the Marconi Company for the erection of a high-power station n Australia at a cost of £487,000, and for corres- ɔonding stations in Great Britain and Canada. The transmitting equipment of the Australian station will have a power of 1,000 kilowatts, and the antenna system will comprise twenty steel masts 800 feet high. The receiving arrangements will permit of the reception from five different stations simultaneously.

With regard to broadcasting, it was stated that a company in Sydney is already organising the comprehensive broadcasting of news and entertainments.

Radio in Austria.

The Austrian Government announces that both wireless telegraphy and wireless telephony are to be retained as state monopolies. Meanwhile the Marconi Company has been leased the right to develop wireless services between Austria and other countries. The organisation of an inland service has still to be decided upon, and attention is being given to the question of broadcasting.

Zurich Aerodrome Wireless Station.

In connection with the extension of the Handley Page London-Paris air service to Zurich, a temporary wireless telephone station was established at the Zurich aerodrome by Marconi's Wireless Telegraph Company at very short notice. Within six days of the order being received in London the station was in operation at Zurich. It consists of a Marconi Standard A.D.2 aircraft transmitter and receiver, with sub-control attachment.

Marconi aerodrome stations are now in operation at Croydon, Haren, Ostend, Cologne, Geneva, and several aerodromes in Spain.

FORTHCOMING EVENTS.

THURSDAY, SEPTEMBER 13th.
Ilford and District Radio Society. Informal Meeting.

FRIDAY, SEPTEMBER 14th.
Leeds and District Amateur Wireless Society. Lecture: "Commercial Radio Communication." By Mr. D. E. Pettigrew (Hon. Sec.).
Wireless Society of Hull and District. At 7.30 p.m. At the Co-operative Social Institute, Jarratt Street. Informal Discussion.

THURSDAY, SEPTEMBER 20th.
Hackney and District Radio Society. At the Y.M.C.A., Mare Street. Lecture: "The Skinderviken Microphone Button and its Uses." By Mr. J. Skinderviken.

PROVINCIAL REPRESENTATION ON R.S.G.B. COMMITTEE.

At a meeting of the Committee of the Radio Society of Great Britain, held on September 3rd, Admiral Sir Henry B. Jackson, G.C.B., proposed and Mr. J. Josephs seconded the following resolution, which was passed by the members:—

"That the Committee should express its gratification at the approval which has been given by many of the affiliated societies to the appointment of temporary representatives to the Committee, and is encouraged by this approval to press forward the work of reconstruction and also the organisation of permanent methods of election of representatives."

THE BRITISH WIRELESS RELAY LEAGUE.

THE Committee of the British Wireless Relay League desire to announce that at a meeting held in July last a discussion took place on the desirability of extending the organisation of the League in view of the steadily increasing membership and the fact that it was difficult to conduct the organisation from Manchester alone.

Accordingly, on July 21st, at the instructions of the Committee, a letter was forwarded by the Hon. Secretary to the Hon. Secretary of the Radio Society of Great Britain. The text of the letter was as follows:—

"You will no doubt remember that the British Wireless Relay League was formed by members of the Manchester Wireless Society with a view to establishing connection between amateur transmitters in this country, and for the relaying of messages on somewhat similar lines to that which is done by the A.R.R.L. in the United States. You will remember also that the question of support for the formation of such a League was brought up on the Agenda at the last Annual Conference, and on that occasion Mr. Evans, the Traffic Manager of the British Wireless Relay League and Hon. Secretary of the Manchester Wireless Society, outlined the objects of the League and explained that the idea of the Manchester Society was to get the League going and to invite the co-operation of all amateur transmitters, and asked for the views of the Conference and of the Radio Society of Great Britain on the matter.

"Our Committee felt that at the time of the last Annual Conference the organisation of the Relay League was not of sufficient importance for the Radio Society to interest itself seriously in it, and therefore all that was asked for was the goodwill of the Society in promoting such a scheme.

"The membership of the League has now grown very considerably and it is felt that the organisation has now reached a stage when the Radio Society might interest itself in it, and the Committee would be very glad if the Committee of your Society could see its way to take over the management of the League by the appointment of a Committee to be elected by holders of transmitting licences throughout the country; these elected officers to replace (except in the case of re-election) the temporary officers now carrying on the organisation of the League as at present constituted."

An acknowledgment of this communication was received on July 26th, when the Hon. Secretary of the Radio Society of Great Britain, expressing the views of the Committee, stated that the Radio Society was prepared to take over the organisation of the League, and would take early steps to consider in what way this could most satisfactorily be done.

Broadcasting

Summer Time Ends.

On Saturday, September 15th, at 9.15 p.m., Mr. F. Hope Jones, M.I.E.E. (Vice-Chairman of the British Horological Institute and Chairman of the Radio Society of Great Britain) will remind the public from **2 LO** to set back clocks one hour, thus reverting to Greenwich mean time. Mr. Hope Jones will also give advice as to the methods of so doing.

REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS*:

GREAT BRITAIN.

LONDON 2 LO, 369 metres; **MANCHESTER, 2 ZY,** 385 metres; **BIRMINGHAM, 5 IT,** 420 metres; **CARDIFF, 5 WA,** 353 metres; **NEWCASTLE, 5 NO,** 400 metres; **GLASGOW, 5 SC,** 415 metres. Regular morning and evening programmes, particulars of which appear in the daily press, are conducted from these stations by the British Broadcasting Company. The usual times of transmission are:—Weekdays, 11.30 a.m. to 12.30 p.m. (**2 LO** only), 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 p.m. (**2 LO** only), 8.30 to 10.30 p.m.

FRANCE.

PARIS (Eiffel Tower), **FL,** 2,600 metres. Daily, 7.40 a.m., Meteorological Forecast; 12.15 p.m., Meteorological Report and Forecast; 3.30 p.m., Financial Bulletin (Paris Bourse); 6.10 p.m., Concert; 7.20 p.m., Meteorological Forecast; 11.15 p.m., Meteorological Report and Forecast. Sundays, 6.10 p.m., Concert and Meteorological Report.

PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), 1,780 metres. Daily, 12.30 p.m. Exchange News, 12.45 p.m. News and Concert, 4.45 p.m. Commercial Intelligence, 5 p.m. Concert, 8.30 p.m. News, 9 p.m. Concert, Tuesday and Friday, 5 to 6 p.m., Dance Music. Thursday and Sunday, 10 to 10.45 p.m., Dance Music.

ECOLE SUPERIEURE des Postes et Telegraphes, 450 metres, Tuesday and Thursday, 8.30 p.m., Concert. Saturday, 2.30 to 7.30 p.m., Concert.

LYONS, YN, 3,100 metres. Weekdays, 10.45 to 11.15 a.m., Gramophone records.

DENMARK.

LYNGBY OXE, 2,400 metres. 10.30, 4.40 p.m., and 9.45 p.m. Meteorological Report in Danish. 8.30 p.m. to 9.45 p.m., Concert (Sundays excepted).

HOLLAND.

THE HAGUE, PCGG, 1,050 metres. Sunday, 3 to 5 p.m., Concert. Monday and Thursday, 8.40 to 9.40 p.m., Concert.

THE HAGUE (Heussen Laboratory), PCUU, 1,050 metres, Tuesday, 7.45 to 10 p.m., Concert. Sunday, 9.40 to 10.40 a.m., Concert.

THE HAGUE (Velthuyzen), PCKK, 1,050 metres. Friday, 8.40 to 9.40 p.m. Miscellaneous.

IJMUIDEN, PCMM, 1,050 metres. Saturday, 8.40 to 9.40 p.m., Concert.

AMSTERDAM, PA 5, 1,050 metres. Wednesday, 8.10 to 9.10 p.m., Concert and News.

BELGIUM.

BRUSSELS, BAV, 1,100 metres. Working days, 1 p.m., Meteorological Bulletin. Daily, 5.50 p.m., Meteorological Bulletin; Tuesday and Thursday, 10 p.m., Concert. Sunday, 7 p.m., Concert.

GERMANY.

BERLIN (Koenigswusterhausen), **LP,** Sunday, 4,000 metres, 11 a.m. to 12 noon, music and speech; 2,700 metres, 12 noon to 1 p.m., music and speech; Daily, 4,000 metres, 7 to 8 a.m., 12 to 1.30 p.m., 5 to 6.30 p.m., Financial and other news.

EBERSWALDE (2,930 metres), Daily, 1 to 2 p.m., 8 to 9 p.m. Tuesday and Saturday, 6.30 to 7.30 p.m., Concert.

CZECHO-SLOVAKIA.

PRAGUE, PRG, 1,800 metres, 8 a.m., 12 noon and 4 p.m., Meteorological Bulletin and News. 4,500 metres, 10 a.m., 3 p.m. and 10 p.m., Concert.

KBEL (near Prague), 1,000 metres. Daily, 7.20 p.m. Concert Meteorological Report and News.

SWITZERLAND.

GENEVA, HB 1, 900 metres. Daily, 6 to 8.30 p.m., Concert ("Utilitas").

LAUSANNE, HB 2, 1,350 metres. Daily, 6 to 8.30 p.m., Concert ("Utilitas").

* British Summer Time is given in each case.

Calls Heard.

Boxworth, Cambridge.
2 CU, 2 DF, 2 DU, 2 GU, 2 HF, 2 KM, 2 KZ, 2 LX, 2 PP, 2 P 2 TB, 2 UG, 2 VC, 2 VW, 2 WA, 2 WM, 2 XR, 2 ZO, 5 DN, 5 H 5 LF, 5 SV, 6 IM, 8 BF, 0 AA, 0 DX, 0 FN.
(E. B. Thornhill).

Hampstead, N.W.3.
2 AF, 2 AH, 2 AJ, 2 BZ, 2 DF, 2 KT, 2 MF, 2 MK, 2 OD, 2 O 2 PA, 2 QQ, 2 SF, 2 TI, 2 TQ, 2 UI, 2 UV, 2 VJ, 2 VM, 2 W 2 XB, 2 XI, 2 XL, 2 XZ, 5 BW, 5 BT, 5 CB, 5 CP, 5 HW, 5 H 5 LO, 5 IS, 5 LP, 5 OB, 5 OX, 5 PD, 5 PU, 5 SU, 5 VD, 5 V 5 VP, 5 VR, 5 XI, 5 XR, 6 BF, 6 HD, 6 IM, 6 KI, 6 QT.
(W. Poynter).

Chelford, Cheshire.
2 BB, 2 WA, 2 WK, 2 WO, 2 ZK, 5 AJ, 5 BK, 5 CC, 5 HS 5 IF, 5 KC, 5 KR, 5 LB, 5 NX, 5 OT, 5 TA, 5 TC, 5 TK, 5 TR 5 UQ, 5 VK, 6 BC, 6 HS, 6 KK, 6 LR, 6 NI, 6 NL.
(J. B. Glegg).

New Moston, Manchester.
2 AW, 2 AY, 2 AX, 2 DF, 2 FZ, 2 GG, 2 IJ, 2 IN, 2 JF, 2 JO 2 KF, 2 KW, 2 KX, 2 NA, 2 OD, 2 ON, 2 PC, 2 PO, 2 PP, 2 RM, 2 RP, 2 TB, 2 TR, 2 UM, 2 UF, 2 VT, 2 VW, 2 WA, 2 WK, 2 XW, 2 YK, 2 ZK, 5 AJ, 5 BG, 5 CC, 5 CX, 5 DQ, 5 HI, 5 IK, 5 OW, 8 AB, 8 AP, 8 AQ, 8 BM, 8 BV, 0 DV, 0 MX, 0 NY, OYS, 8 CS, 5 KC.
(J. Barnes).

Tivello, Holland.
2 FU, 2 JF, 2 KF, 2 MK, 2 NA, 2 NM, 2 OD, 2 OM, 2 RG, 2 TU, 2 VN, 2 XR, 2 ZT, 5 CX, 5 KO, 5 GS, 7 FP, 8 AQ, 8 AW, 8 BF, 8 BM.
(R.W.C. van Boetzelaer).

West Bridgford, Nottingham.
2 AW, 2 FR, 2 HF, 2 NP, 2 PP, 2 QH, 2 TV, 2 UY, 2 NM, 5 GS, 5 LF, 5 MN, 5 RI, 5 ZV.
(A. S. Gosling, **2 VC**).

Birmingham.
2 FH, 2 FQ, 2 FU, 2 GD, 2 GG, 2 HF, 2 HQ, 2 HV, 2 JJ, 2 JU, 2 KD, 2 KO, 2 KQ, 2 KR, 2 LG, 2 LT, 2 LV, 2 ML, 2 NA, 2 NO, 2 NP, 2 NV, 2 OD, 2 OM, 2 OQ, 2 OX, 2 RD, 2 RG, 2 SG, 2 SV, 2 SY, 2 TM, 2 TN, 2 TV, 2 UX, 2 UY, 2 VB, 2 VK, 2 WB, 2 WF, 2 WM, 2 WQ, 2 WT(?), 2 YX, 2 ZD, 5 BL, 5 BM, 5 BV, 5 CW, 5 DG, 5 FH, 5 FI, 5 KD, 5 KO, 5 LP, 5 LV, 5 NH, 5 PD, 5 PX, 5 QU, 5 RI, 5 TW, 5 YS, 6 AG, 6 AK.
(G. Curtiss, **5 VB**).

London, N.W.
2 AO, 2 AZ, 2 BS, 2 CB, 2 DF, 2 DI, 2 DU, 2 DX, 2 FH, 2 FL, 2 GG, 2 ID, 2 JK, 2 JL, 2 JM, 2 KM, 2 KV, 2 KZ, 2 LQ, 2 LR, 2 LZ, 2 MS, 2 NA, 2 NM, 2 NN, 2 NQ, 2 OD, 2 OS, 2 PL, 2 PU, 2 QQ, 2 RS, 2 RZ, 2 SL, 2 TV, 2 VH, 2 VJ, 2 VN, 2 WD, 2 WQ, 2 WZ, 2 XA, 2 XD, 2 XX, 2 YD, 2 YM, 2 YR, 2 ZM, 2 ZT, 5 AP, 5 CV, 5 CX, 5 FR, 5 GP, 5 HA, 5 IC, 5 IF, 5 LL, 5 MA, 5 MD, 5 PR, 5 PS, 5 VP, 5 VU, 5 VX, 5 WR, 5 XC, 5 ZJ, 6 AF, 6 HJ, 6 IX, 6 IY, 6 KU, ODV, 8 AA, 8 BM.
(S. K. Lewer).

Windsor.
2 AJ, 2 BM, 2 BZ, 2 DX, 2 FG, 2 JL, 2 KS, 2 KV, 2 KZ, 2 MF, 2 MO, 2 MT, 2 NM, 2 OD, 2 OM, 2 ON, 2 OS, 2 PP, 2 QQ, 2 SF, 2 SQ, 2 TT, 2 VJ, 2 WD, 2 XB, 2 XI, 2 XL, 2 XR, 2 XZ, 2 YJ, 2 YR, 2 ZM, 2 ZO, 5 BT, 5 CD, 5 CP, 5 DK, 5 DT, 5 HW, 5 HY, 5 IO, 5 KV, 5 LP, 5 LS, 5 MA, 5 OB, 5 PS, 5 PU, 5 SU, 5 VI, 5 VR, 6 FD, 6 GZ, 6 IM, 6 KI. (S. T. Nottley).

Roskilde, Denmark.
2 DF, 2 DX, 2 FN, 2 FP, 2 FU, 2 GG, 2 GW, 2 HF, 2 IJ, 2 IN, 2 JF, 2 JO, 2 KF, 2 KW, 2 KX, 2 LG, 2 LZ, 2 NA, 2 NK, 2 NM, 2 OD, 2 OM, 2 RB, 2 TA, 2 TB, 2 VN, 2 VW, 2 WK, 2 XR, 2 ZK, 5 BV, 5 CK, 5 DN, 5 FS, 5 GS, 5 HN, 5 JX, 5 KO, 5 LC, 5 NN, 5 OX, 5 RI, 5 RZ, 5 SI(?), 5 WR, 5 YM, 5 ZV, 6 NI, 8 AA, 8 AQ, 8 AS, 8 AW, 8 BF, 8 BM, 8 BN, 8 CF, 8 CS, 8 XX, 8 ZZ, OFN, OMX, OVS, OXO. (Gunnar Bramsler).

ONY, Holland.
2 AO, 2 AW, 2 DF, 2 DX, 2 FP, 2 FQ, 2 FU, 2 GV, 2 HF, 2 IN, 2 JF, 2 JO, 2 JP, 2 JZ, 2 KD, 2 KF, 2 KT, 2 KX, 2 LG, 2 LZ, 2 MC, 2 MM, 2 NA, 2 NM, 2 OD, 2 OJ, 2 OM, 2 ON, 2 PX, 2 RB, 2 RG, 2 RY, 2 SH, 2 SX, 2 TA, 2 TB, 2 VT, 2 VW, 2 WJ, 2 WK(?), 2 XI, 2 XR, 2 YR(?), 2 YT, 2 ZK, 2 ZS(?), 2 ZY, 5 BV, 5 CX, 5 DN, 5 GS, 5 HI, 5 IC, 5 IT, 5 KO, 5 LC, 5 LZ, 5 NN, 5 NO, 5 OX, 5 PU, 5 QM, 5 QV, 5 RI, 5 ZV, 6 NI, 8 AA, 8 AB, 8 AP, 8 AQ, 8 AW, 8 BC, 8 BF, 8 BM, 8 BN(?), 8 BV, 8 CF, 8 CS, 8 CZ, 8 DP, 8 XX, 8 XY, 8 GS, 0 AA, 0 AB, 0 BB, 0 BQ, 0 BS, 0 DV, 0 FL, 0 FN, 0 GX, 0 MX, 0 NX, 0 RD, 0 SA, 0 ST, 0 XA, 0 XL, 0 XO, 0 XP, 0 XW, 0 XX, 0 XY, 0 YB, 0 YS.

Lincoln.
2 AW, 2 CH, 2 DU, 2 FN, 2 GJ, 2 IQ, 2 KF, 2 KO, 2 LX, 2 NM, 2 OD, 2 QH, 2 VC, 2 VQ, 5 FU, 5 GL, 5 GS, 5 KO, 8 AB, 8 AQ, 8 BN, 8 XX, 0 AA, 0 FN. (Ralph Bates).

The Latest Interference Eliminator

Further Details of M. Marrec's Device.

THE latest development in the direction of interference elimination is due to a French engineer, Mons. Y. Marrec, whose instrument was illustrated in *The Wireless World and Radio Review* of July 7th and August 8th.

The specimens of tape shown in Fig. 1 were obtained at an interesting demonstration of the device given by the inventor, who recently appeared before the Radio Society of Great Britain. The first specimen is obviously illegible, and was taken from the machine during an unusually heavy spell of interference. The elimination apparatus was then placed in circuit, with the result that a perfectly legible record, as shown in the second specimen, was produced.

Fig. 2 depicts the diagram of connections employed in Mons. Marrec's device. As will be seen, it consists of a series of low-frequency valves. After rectification the current passes through one or more aperiodic amplifying circuits, which mutually react through transformers to produce first, an amplification of the signal; and second, local low-frequency oscillations. When these oscillations (the frequency of which is determined by suitable aperiodic circuits), are imposed on the combined transmitted and parasitic signals, two waves of a different character are obtained. A filtering effect is therefore possible, and interference and undesired noises can thus be eliminated.

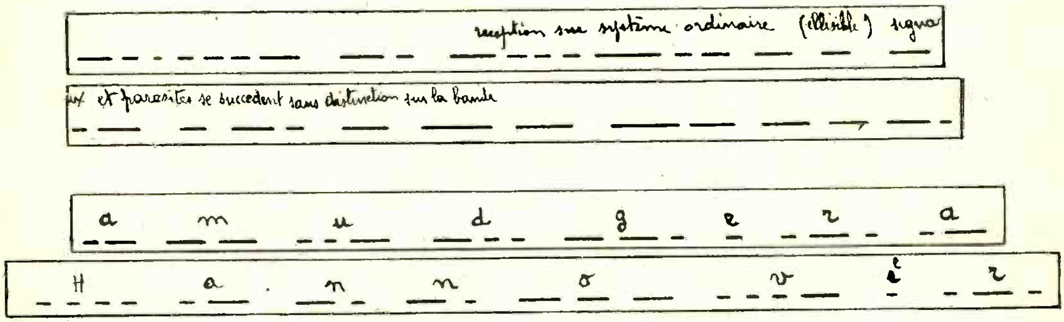


Fig. 1. Specimens of tape signals received on Mons. Y. Marrec's interference eliminator. The two upper strips, which are illegible, were received before the apparatus was placed in circuit. The lower portions were obtained with the apparatus in operation.

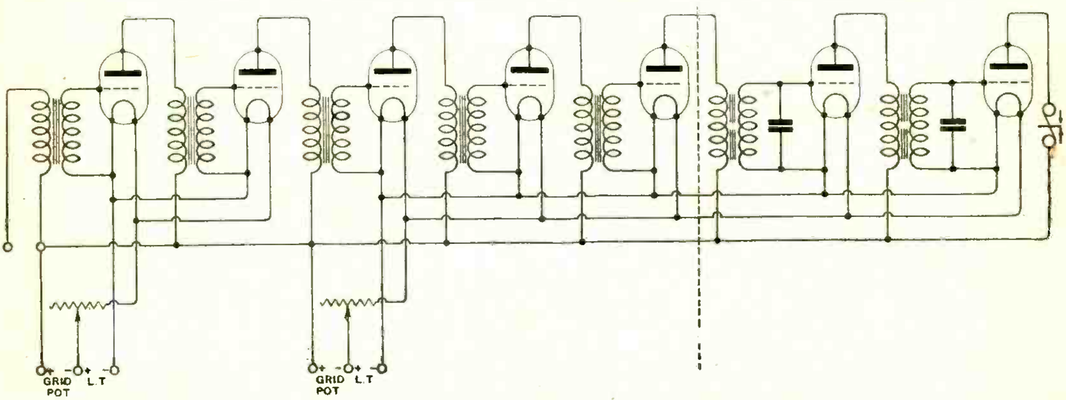


Fig. 2. A diagram of the circuit employed in the new interference eliminating device.

D

QUESTIONS AND ANSWERS

"S.J.D." (Newcastle-on-Tyne) *asks* (1) *For advice on the effect of certain alterations to the tuner described in the issue of July 14th.* (2) *Will switches of the Dewar type be suitable for switching H.F. and L.F. valves in or out of circuit.* (3) *Is bakelite suitable for making the panels of receivers.* (4) *For suggestions on some method by which self-oscillation in his receiver may be prevented.*

(1) The alterations will not affect the working of the instrument. We do not advise, however, the use of Dewar switches in H.F. circuits, owing, generally, to the poor insulation provided in this type. (2) The switches will be suitable for the L.F. circuits. (3) The material mentioned is quite suitable for the panels of receivers.

"F.P." (Shoreham) *asks for a diagram of a three-valve receiver on the unit system, employing two H.F., and detector valves.*

The diagram is given in Fig. 1.

"C.H." (Ely) *asks what is the cause of a continuous whistle during reception with a four-valve receiver.*

We cannot help you much from the particulars furnished, but there is the possibility that the grid leak is faulty.

"J.P.D." (Paisley) *asks* (1) *Is the diagram correct.* (2) *What No. Igranic coil will be suitable for use in the anode circuit of the H.F. valve, to tune to a wavelength of 1,500 metres.*

(1) The diagram is correct. (2) A No. 250 coil will be suitable. We would refer yourself, and others who find difficulty in selecting suitable coils, to the chart given on page 624, August 8th issue.

"C.H.S." (Derby) *asks* (1) *Is a single wire aerial better than a double wire.* (2) *Would it be advisable to raise an aerial which at present runs close to a lead roof.*

(1) Provided the full permissible length of aerial can be obtained using a single wire, little advantage will result from employing a double wire, especially if you are mainly interested in short wavelength signals. (2) Keep the aerial as far as possible from the lead roof.

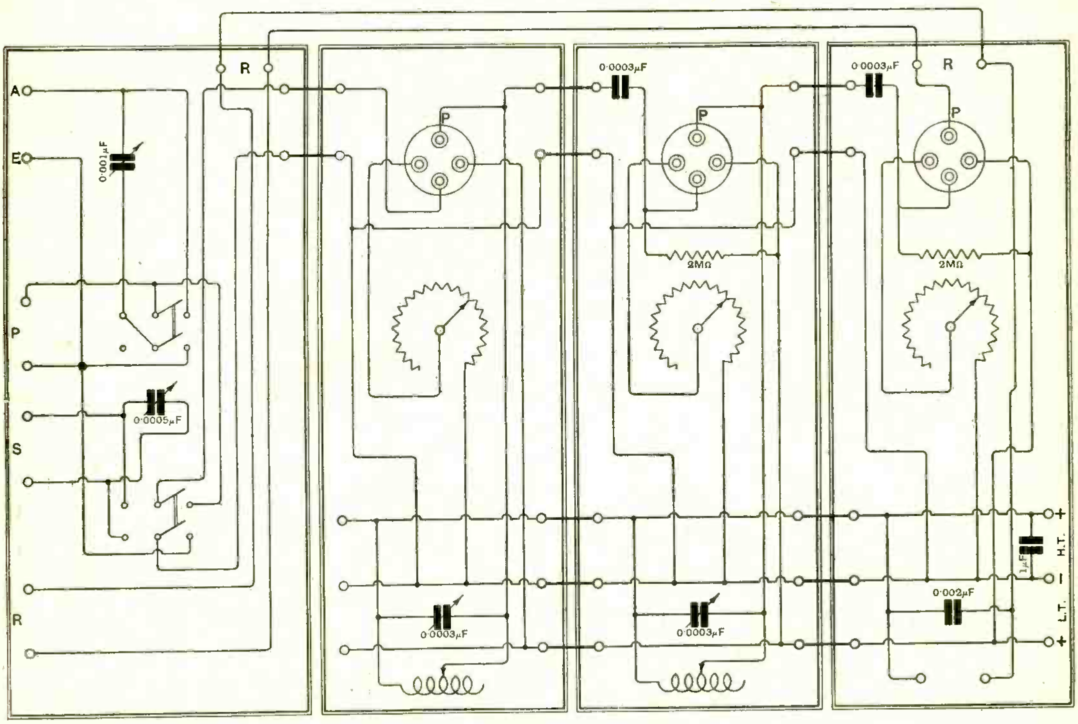


Fig. 1. **"F.P." (Shoreham).** *Tuner, 2 H.F. and rectifier units. If one is not required it may be removed and the remainder connected.*

"L.J.B." (West Norwood) *submits details the core and bobbin of a choke coil, and asks what a suitable winding which will give an inductance 8 henries, and be capable of passing* 500 *milliam- ɔres.*

The bobbin should be wound full of No. 28 .S.C. wire. The inductance will then be in the eighbourhood of 8 henries.

"CRACKER" (Aston) *asks* (1) *With reference › the combined high and low frequency amplifier escribed in the issue of August* 1*st*, 1923, *what is he size of the variometers.* (2) *What type of crystal eceiver will be most satisfactory.* (3) *Will the complete eceiver operate a loud speaker.*

(1) The aerial tuning variometer may be con- ıtructed with cardboard formers, one rotor being 3½″ in diameter, and the stator 4″ in diameter. Each may be wound with 25 turns of No. 24 D.C.C. wire. The anode tuning variometer may be constructed with formers of the same diameter, each being wound with 100 turns of No. 26 D.C.C. wire. (2) Any reliable crystal receiver may be employed. (3) The receiver may satisfactorily operate a small loud speaker.

with series parallel switch, and switches for controlling the number of valves in circuit.

(1) The wire is No. 41 S.S.C. (2) The diagram is given in Fig. 2.

"R.J. McI." (Liverpool) *asks* (1) *With reference to the combined high and low frequency amplifier described in the issue of August* 1*st, are two variometers required.* (2) *Will a* 60*-volt H.T. battery be suitable for use in this receiver.*

(1) Two variometers are required, one for aerial tuning, and one for the high frequency coupling. (2) The battery will be quite suitable.

"H.B.B." (Marston Green) *asks* (1) *and* (2) *Is it possible to utilise Daniell cells for the purpose of filament lighting of valves, and for accumulator charging.*

(1) and (2) The type of cell referred to may be used for the purposes mentioned, but the cost, both initial and maintenance, of a suitable battery installation, would be out of all proportion to the service obtained.

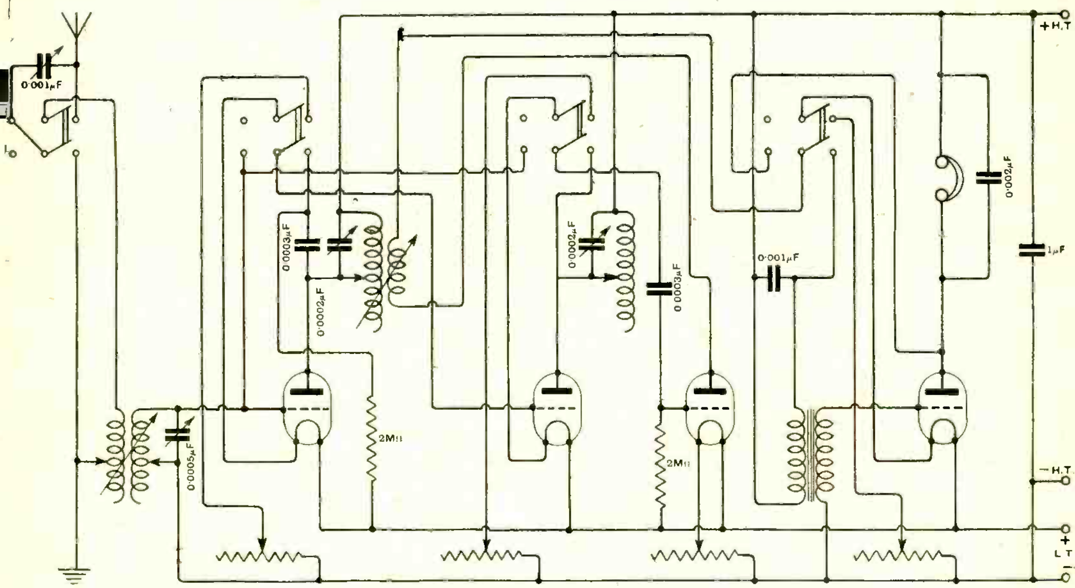


Fig. 2. **"E.S." (Aberbargoed).** *Receiver with* 2 *H.F., rectifier and note magnifier. The switches connected are as follows: Aerial condenser connected in series or parallel with tuning coil; first or second H.F. valves on or off; note magnifier on or off.*

"DECAY" (Winchmore Hill) *asks, with reference to the combined high and low frequency amplifier described in the issue of August* 1*st, is a special form of low frequency transformer necessary.*

Any reliable low frequency transformer will give satisfactory results in the amplifier mentioned.

"E.S." (Aberbargoed) *asks* (1) *What is the description of the sample of wire submitted.* (2) *Will we give a diagram of a four-valve receiver employing two H.F., detector, and one L.F. valves,*

"R.T." (Inverness-shire) *submits a diagram of a receiver constructed on the Flewelling principle, with which he experiences certain difficulties. He asks* (1) *to* (4) *Is the diagram correct, and what is the explanation of the results obtained.*

(1) to (4) The diagram is correct. The values of the grid leak and resistance across the bank of condensers should both be critically variable, as on these adjustments the successful operation of the receiver largely depends. We would refer you to the articles on this circuit appearing in the issues of April 21st and May 26th, 1923.

"W.H." (Gloucester) *asks how many plates are required in two fixed condensers, in order that their capacity shall be 0·001 and 0·007 mfd. using mica 0·002″ thick.*

For a capacity of 0·001 mfd. two plates will be required with overlap dimensions 2″ × 1″, and for a capacity of 0·007 mfd. three plates will be required with overlap dimensions 3″ × 2″.

"P.G.S.J." (Ryde, I.W.) *submits a diagram of a two-valve receiver employing one H.F. and detector valves. He asks* (1) *Will we give a diagram of this receiver employing a fixed A.T.I. in place of the tapped coil, and a reaction coil coupled to it.* (2) *What is a suitable number of turns for a basket coil wound with No. 26 D.C.C. wire which is to be used as an A.T.I. when receiving from the London Broadcast station.* (3) *If the vanes of a variable condenser are slightly bent, will this assist self-oscillation.*

(1) The diagram is given in Fig. 3. (2) The coil may have 65 turns when wound on a former 1½″ in diameter. (3) The defect in the condenser will not affect the receiver in the manner suggested

"E.L.S." (Swanage) *asks* (1) *Is it possible to use a valve as detector in a receiver employing double magnification.* (2) *Will we give a diagram of a three-valve receiver operating on the double magnification principle, with valve detector.* (3) *How will the results of this receiver compare with those obtained from a five-valve receiver employing two H.F., detector, and two L.F. valves.*

(1) It is possible to employ a valve as detector in a double magnification receiver. A crystal is employed in preference to a valve to avoid trouble from self-oscillation. (2) We would refer you to Fig. 10, page 213, of the issue of May 19th, 1923. (2) The results obtainable from the two receivers will depend very largely on the skill with which they are manipulated and no definite comparison can be drawn.

"F.W.W." (Harringay, N.4) *refers to H.F. choke coils employed in small power transmitting apparatus.*

The value of this choke coil is not usually critical and the best value for a particular transmitter will easily be found after a little experimenting.

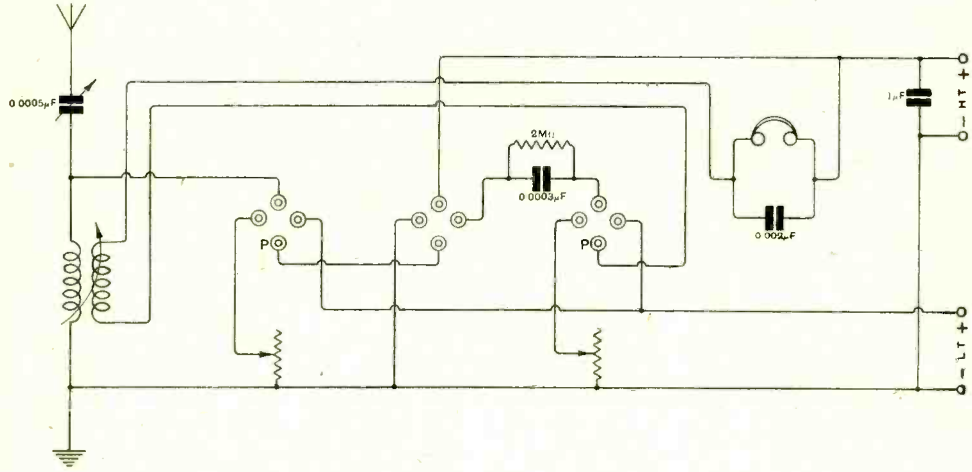


Fig. 3. **"P.G.S.J." (Ryde, I.W.).** *A two-valve receiver with H.F. and rectifier. The valves are transformer coupled.*

NOTE.—*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—*(1) *Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor,* **The Wireless World and Radio Review, 12/13,** *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

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Under the Supervision of W. JAMES.

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

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B

IS BROADCASTING WANTED ?

BROADCASTING in this country has now been with us for approximately a year and considering the novelty of the innovation and the pioneer work which has had to be done, there is probably no one who would suggest that every credit is not due to those who have been responsible for the organisation of the service and the programmes. We feel sure that no energy on the part of the officials of the Broadcasting Company has been spared in endeavouring to give the public what it wants in the matter of programmes.

Broadcasting, however, has been launched on national lines, and the purpose for which it has been created will never be achieved until it becomes in every sense of the word a " national " service.

Through no fault of the officials of the Broadcasting Company, nor yet through lack of enterprise on their part, the broadcasting programmes at present can scarcely be said to provide more than an alternative for other methods of providing amusement or entertainment for the public. After all, however excellent the musical programme broadcasted, this never will, and never should, supersede the public performances given at concert halls. It does, however, provide a substitute in isolated areas where the public is not in the position of being able to attend ordinary concerts and other forms of entertainment. Those in the isolated areas, however, are in the minority amongst the users of broadcasting, and, to achieve the utmost success, broadcasting must make its appeal to the majority.

At the present time the Broadcasting Company is providing excellent lecturettes on educational topics, but these again hardly provide what cannot be obtained from other sources.

In our opinion broadcasting has before it a career of far greater importance than can ever be achieved merely by providing what can be obtained elsewhere. Broadcasting should provide something which the public is unable to obtain through any other medium. Then, and not till then, the broadcasting service will stand out as something of national importance, and unique in the service it provides for the community.

If, then, broadcasting is to be a truly national service, it must provide everything which the public may consider itself entitled to receive through such a service. Those responsible for the programmes ought not to be hampered and hedged in on all sides, with the result that instead of providing what the public wants, they are compelled to provide only what they are able to get. If broadcasting is to be a national service, and the public desires that a certain public speech should be broadcasted for their benefit, then they ought to be able to have it, but, in order to do so, the Broadcasting Company's officials would necessarily have to be given a much freer hand than at present.

Again, if the public desires that it should be possible to listen-in to some important debate in the House of Commons, it is difficult to see why this should be regarded as undesirable. Many other similar subjects for broadcasting present themselves, all of which would contribute to making Broadcasting a really new service, providing something hitherto withheld from the general public.

We cannot, of course, here enter into any argument as to whether the granting of such facilities to the Broadcasting Company would be providing that Company with a monopoly. In our opinion matters of that kind are details in comparison with the importance of making the very most of the possibilities which broadcasting presents. After all, it is the public which pays for broadcasting and indirectly maintains the stations and the personnel ; should not the public have the right to take advantage of every new facility which can be provided through this means ?

SHORT WAVELENGTH HIGH FREQUENCY AMPLIFICATION.

New methods of securing high and stable amplification are described

By W. JAMES.

ORDINARILY, to obtain best results with high frequency amplification, especially when tuned circuits are used, requires considerable skill, and the amplification falls far short of that predicted from a knowledge of the valve and circuit constants. The trouble lies in the capacity of the valve *and circuits* operating as feed back (reaction) condensers.

Considering the valve alone, its effective grid and filament capacity varies with the character of the circuit attached to its anode circuit; this is a big difficulty which at present modifies the operation of receivers specifically designed to neutralise capacity back coupling.

A. In the issue of April 21st, we described very fully the work of Prof. Hazletine directed towards neutralising capacity coupling. Prof. Hazeltine is a distinguished research worker, and to him is due the Neutrodyne receiver. Since that time others have attempted to devise circuit arrangements which give the same results, but the means proposed for the cure give greater complication than that arising from the evil it is sought to minimise.

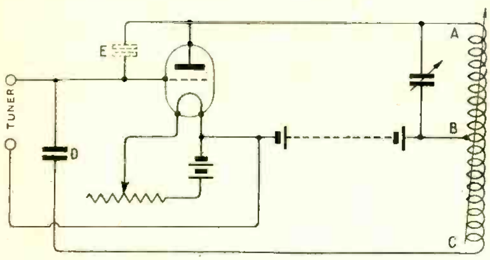


Fig. 1. *Showing the principle of capacity neutralisation, using a coil BC and condenser D.*

The circuit Fig. 1 shows how it was at first proposed to neutralise the capacity. Here the circuit is that of a *tuned anode* high frequency amplifier. The coil AB is the anode coil tuned with the variable condenser. Coil BC is connected at B to the anode coil, and C is joined through condenser D with the grid. The condenser E represents the stray capacity which it is desired to neutralise. By proper adjustment of the coupling between coils AB and BC, the current fed back through condenser D may be made equal to that passing

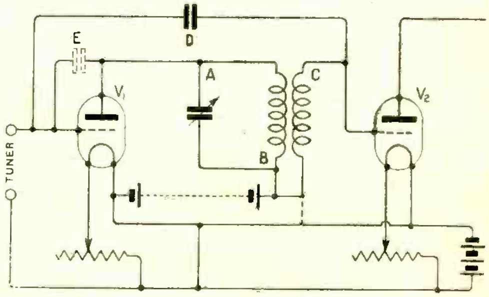


Fig. 2. *The arrangement of Fig.* 1 *with the coil BC operating as the secondary winding of a transformer.*

through E. Thus there will be no voltage variations due to capacity coupling at the grid.

B. This arrangement, though useful, was thought by the originator to be not so satisfactory as that arrangement shown in Fig. 2, which consists simply of coil BC,

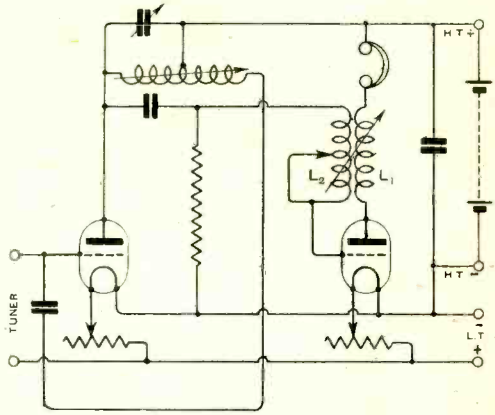


Fig. 3. *Reaction effects may be obtained between coils L_1 and L_2 without changing the tuning of the amplifier circuits.*

Fig. 1, connected to the grid of valve V_2, so that the valve coupling is now not "tuned anode" but "tuned transformer." The receiver using this arrangement, called a *neutrodyne receiver* by its inventor, was fully described in the issue of April 21st. The coil CB is actually joined with —L.T. as shown dotted.

C. A satisfactory method of obtaining reaction effects, which is not widely known, is shown in Fig. 3. Coil L_1 is coupled with L_2. Plug-in coils, or a vario-coupler, may of course be used. (This method may be applied to any type of amplifier often with beneficial results.)

D. A great improvement over the plain tuned anode scheme of Fig. 1 is given in Fig. 4, in which are important features, suggested after considerable work with short wavelength reception.

In the first place the valves are transformer coupled, and capacity not wanted is neutralised. The coils C and C_1 are the transformer secondary windings; the coils B and B_1, the primary windings; and coils A and A_1, the neutralising windings.

The condensers F and F_1 are not used as ordinary tuning condensers, but are for the purpose of acting in conjunction with the coils to give neutralisation of the back capacity coupling. The development of this receiver from Figs. 1 and 2 may be seen, and to the writer appears to possess advantages over both, in that the operation is easier and results better.

The condensers F and F_1 have one moving plate (shown longer), and by adjusting it, the capacity between the top end of coil A or A_1 with the grid is variable. One of the fixed plates in each is connecte with earth, so that by adjusting thes condensers very easy control over regenera tion through capacity coupling is obtained There is no need to provide a variabl coupling between coils A (or A_1) and B (or B_1)

The transformers may have their secondarie C and C_1 tuned with a variable condense if desired, or the coils B and C, and B_1 and C_1, may be wound *variometer fashion* so that each winding is tuned together without the use of a condenser.

The windings A and A_1 are wound next to the primary windings B and B_1 to obtain the desired coupling. In building the unit to operate with a tuning condenser, coils A and B should be wound on the same former, and coil C on a larger former fitting outside the other windings. The transformer has the usual windings, depending on the wavelength.

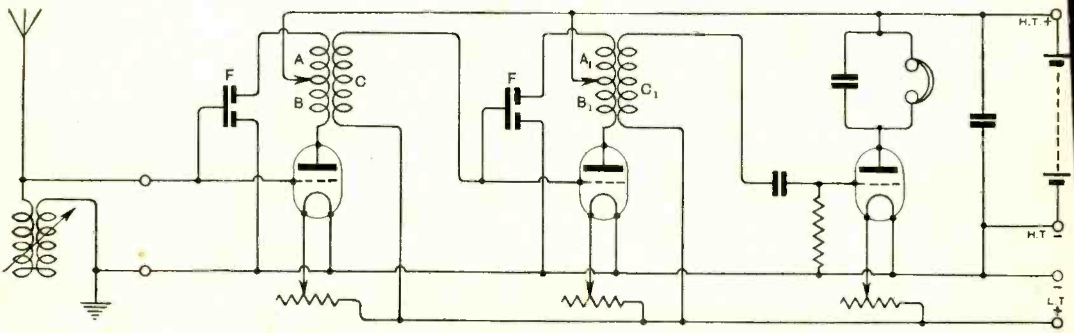


Fig. 4. A receiver with provision for neutralising capacity coupling. The transformers may be tuned with condensers in the usual manner, or a special transformer wound like a variometer may be used. If the tuned anode method of amplification is preferred, in place of the secondary windings C and C_1, connect grid condensers and leaks in the usual way.

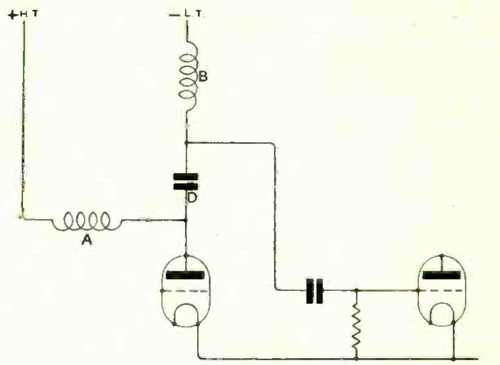


Fig. 5. This is a special arrangement in which the coil B and condenser D are joined in series. The anode current is fed through a choke coil of low self-capacity A.

E. The usual arrangements for high frequency amplification consist in providing *parallel resonance* anode circuit to which he next valve is coupled either through a second winding (transformer secondary) or through a grid condenser and leak.

Series resonant circuits have not received much attention, and it is believed the receiver to be described is new.

The arrangement is shown in Fig. 5. Here the series circuit consists of the condenser D and the coil B. Condenser D may be variable, and has a small capacity. Coil B may be either a plain coil or a variometer. In the former case, the circuit B—D is tuned with the variable condenser D. In the latter case the circuit is tuned with both the variometer B and condenser D.

On account of the condenser D, it is necessary to provide the plate potential through a choke coil A. This coil should be specially wound to have a *very small self-capacity*. An iron core coil with very fine iron wires, wound with three or four layers, is satisfactory, or several basket coils connected in series may be used.

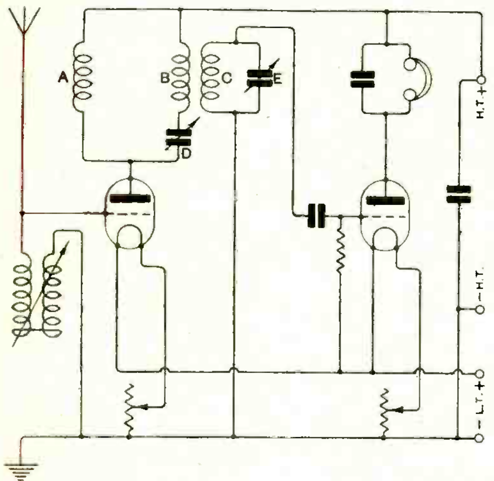


Fig. 6. Connections of a receiver built up on the principle of Fig. 5, but a transformer is used for coupling the valves. The arrangement of Fig. 5 may be used equally well, but a grid condenser and leak is connected to the bottom of coil B in the usual manner.

The series condenser D is very small, and may consist of two or three plates, so that its capacity does not exceed about 0·0001 μF.

The wiring of a receiver constructed on this principle is given in Fig. 6. Coil A is the choke coil, connected so that the anode of the valve receives its current. The two valves—amplifier and rectifier—are coupled through a transformer with primary winding B and secondary winding C. The transformer is tuned with the condenser E, which may be connected across the primary or secondary windings. D is the series condenser.

For short wavelengths the primary winding B may consist of 50 turns of No. 24 D.C.C. wound on a 3 in. former; the secondary winding may be 90 turns of No. 24 D.C.C. wound on a 3½ in. former fixed over the primary. Condenser D has a maximum value of about 0·0001 μF, and E 0·0003 μF.

In operating the receiver, signals are tuned in the usual manner, and the adjustment of condenser D will prevent oscillation. Of course the arrangement shown in Fig. 5. may be used instead of that of Fig. 6.

[*It would be of interest to hear from experimenters the results obtained with the circuits of Figs.* 4, 5 *and* 6.—ED.]

Radio Society of Great Britain.

The first ordinary meeting of the new session will take place at the Institution of Electrical Engineers at 6 p.m. on Wednesday, September 26th, when an address will be given by the President, Dr. W. H. Eccles, F.R.S., on "Wireless Topics."

A series of informal meetings (at which smoking will be allowed) has been arranged to take place this session. The first of these meetings will be held on Thursday, September 20th, at 6 o'clock, in the large room adjoining the tea room at the Institution of Electrcial Engineers. On this occasion there will be a discussion on "Short Wavelength Transmissions," dealing particularly with wavelengths around 200 metres. It will be opened by Mr. Maurice Child. Associates of the Society are welcomed to these meetings, which will supersede the monthly lectures for Associates which were held during last session.

At a meeting of the Western group of Metropolitan Affiliated Societies held on September 6th, Mr. J. H. Reeves, M.B.E., was elected to represent the Western Metropolitan Group on the Radio Society of Great Britain.

The meetings of the Metropolitan Southern and Eastern Groups of Societies are about to take place for the purpose of electing representatives for these areas.

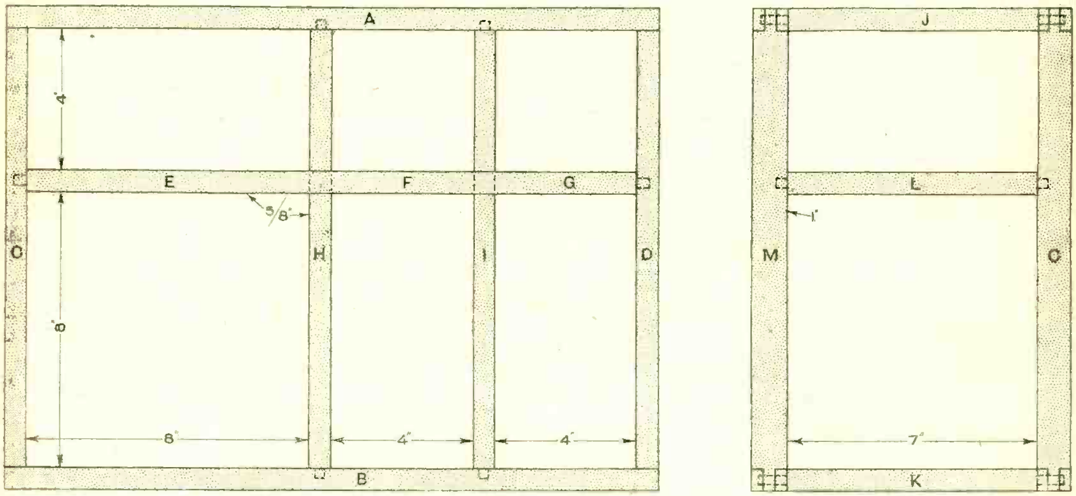
The Apparatus Frame: A New Idea in Instrument Construction

The introduction of the Apparatus Frame should prove a solution to the problem of efficiently accommodating a large amount of experimental apparatus in limited space. It is economical in cost and involves no more work than base board arranged apparatus. Components are easily accessible and the complete outfit is portable.

By F. H. Haynes.

EITHER of two methods is generally adopted in the bringing together of component parts for the construction of wireless receiving and transmitting equipment. The first is that in which the components are secured to the bench or a mounting board and wired to the particular circuit chosen, while in the second method the parts are attached to an ebonite or, sometimes, wooden panel which is elaborately finished and enclosed by a well-made box. The first method has the advantage of saving time and outlay, but usually results in a slight loss of efficiency particularly if wired up beneath the table. The complete instrument is also somewhat ugly, and occupies an unnecessarily large amount of space, in addition to which it must be operated in a horizontal position and it may be necessary to reach across certain components to adjust others. The second method, though producing probably a beautiful instrument, which functions perfectly, involves much work and locks up more component parts than the experimenter of modest means can often afford. Another drawback is that a complicated instrument requires considerable panel space to support the many components unless a sub-panel is supplemented beneath the main panel to carry those parts which do not require adjustment.

To overcome the disadvantages possessed by the two arrangements mentioned above, the writer devised the following means of housing a large number of components into small panel space, involving no more labour than is required by the somewhat inefficient method of board-mounting.



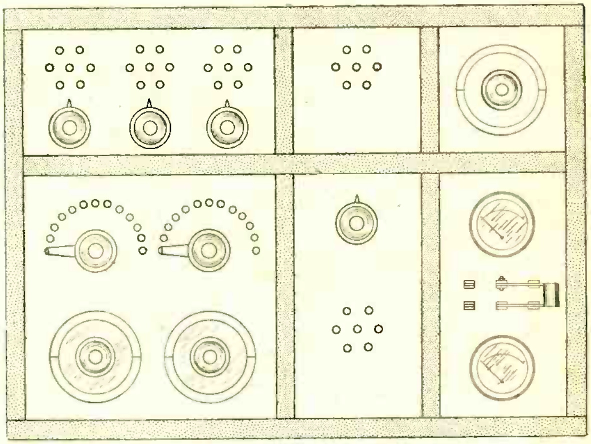
Front and end views of an Apparatus Frame with suggested dimensions.

From the diagrams it will be seen that the arrangement necessitates the construction of a simple frame having special compartments. The dimensions are only given as a suggestion, and are controlled essentially by the ultimate aims of the experimenter. A good way of fitting together corners and sides is shown, and if glued and screwed ıll make a strong job. As most enthusiasts aduate in the processes of woodworking ›fore developing an interest in wireless, ıe building of the frame should prove quite mple without going into workshop methods.

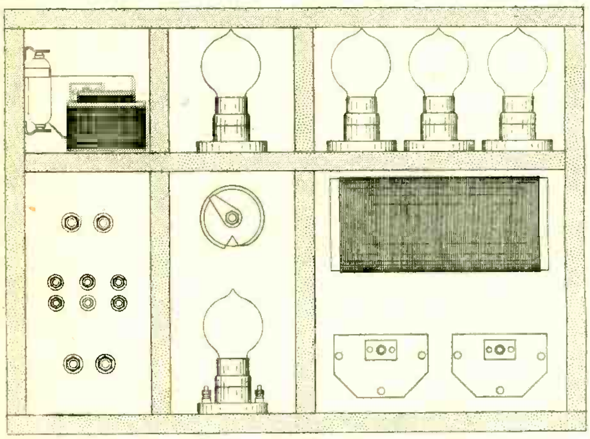
The top and bottom, side and ross pieces may all be alike in cross ection, and if soft wood is used such s pine or American white wood, they vill need to be 1 in. by ⅝ in., preenting the narrower dimension to he front. Harder woods, such as oak or good mahogany, possessing greater strength and durability allow of the use of a smaller cross section such as ¾ in. by ⅜ in., and the reduced thickness of ⅜ in., as it appears on the front is much neater, particularly if French polished. In the case of the narrow wood, triangular corner pieces may be useful to add strength and ordinary square mortising will replace the peg fitting for the cross pieces.

At least one platform should be run right across the frame to accommodate apparatus, whilst a number of vertical partitions arranged at intervals serve a similar purpose. Only with the object of excluding dust need top, back and end panels be fitted. The framework is really better without them so that all parts are easily visible, and dust can be removed by blowing with a cycle pump.

Narrow filets, run along two opposite sides of each compartment a little way in from the front, may be used for attaching panels, and only those components which have actually to be operated from the front should be secured to them. The appearance of screwheads on the front of panels can be entirely avoided. Even the valves may be mounted inside the framework, and thus protected, and the filament brigntness viewed through suitable holes.



Front of equipped Apparatus Frame.



Back view with a few typical components.

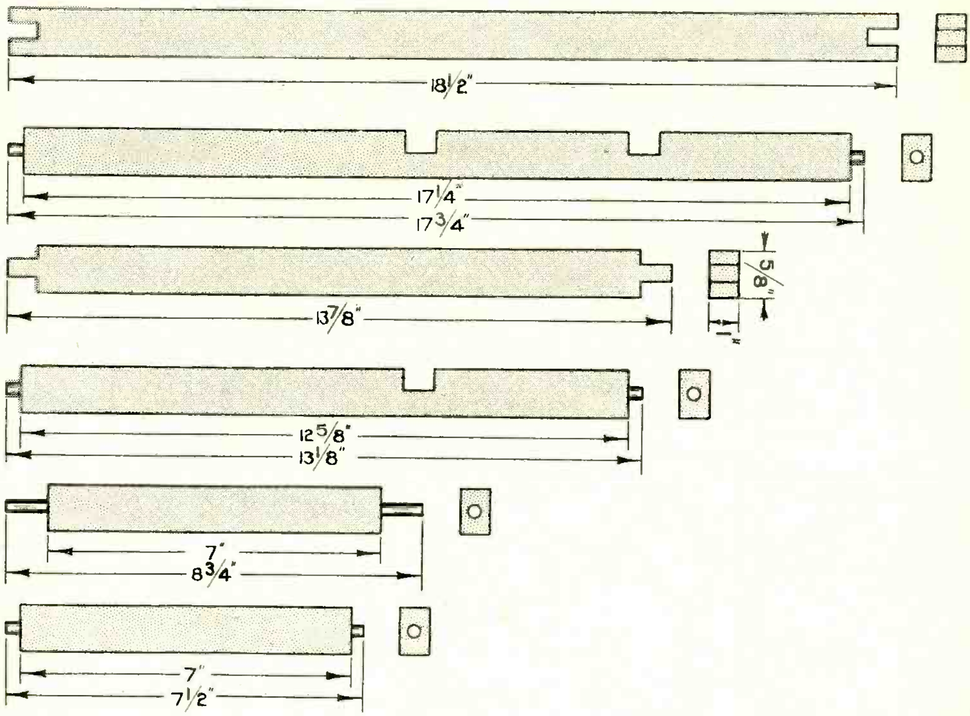
It will be readily seen that by this arrangement is achieved all the facilities of board mounting, and at the same time operating panels are presented having, probably, a better appearance than boxed-up instruments. The wiring-up of board-mounted components presents difficulties, but with the arrangement described short stiff leads can be run from point to point without the slightest loss of efficiency, whilst circuit changes can easily be made and faults traced. Wiring up is best effected with No. 16 S.W.G. tinned copper wire, which should be straightened and then given right angle bends in order to exactly fit between the points to be connected. To give rigidity to long leads ebonite cleats may be used of the type shown in the accompanying diagram. Clearance holes as large as ½ in. in diameter should be made through platforms and partitions for those leads passing from one compartment to another. Unsightly wiring is thus avoided, and it can be made to look very attractive, at the same time facilitating the tracing of circuits if the leads are carefully enamelled in various colours.

All terminals may be at the back, and with the large amount of accommodation which this shelving and partitioning system affords, the H.T. battery may be installed behind the panels. It is not advisable to house the accumulator battery in the installation, as its acid associations may prove detriment to other components.

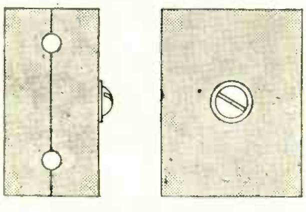
Should the experimenter desire to ma changes in the apparatus it is only necessa to dismantle the panel and section concerne thus avoiding the redrilling or scrappin of large panels, whilst the undisturbed apparatus may remain in working order. The ambitious experimenter may decide to construct a large frame and fit panels embodying ideas as they appeal to him.

When strongly constructed as described the whole receiving apparatus can be transported without difficulty, which is often a distinct advantage.

(Perhaps some enterprising manufacturer will satisfy the needs of those experimenters not possessing woodworking facilities by placing Apparatus Frames of various dimensions on the market.—ED.)



Constructional details of wooden rods.



An easily constructed ebonite cleat for providing additional support to connecting leads.

A PRACTICAL COURSE IN THE PRINCIPLES OF WIRELESS

EXPERIMENTS FOR THE RADIO AMATEUR

By MAURICE CHILD
(Vice-Chairman of the Radio Society of Great Britain).

EXPERIMENT No. 18.

To demonstrate how the effect of capacity in certain circumstances will reduce signal strength.

The apparatus required is the same as in Experiment 17, but some arrangement in the way of two small terminals connected to the 80,000 ohm. resistance should be provided. A small metal plate, say 4 ins. by 4 ins., with a stiff copper wire attached should also be available.

The diagram shown in Fig. 27 indicates that part of the circuit on which the experiments will be made (see also Fig. 26, Experiment 17). Before commencing, the reader will have no doubt discovered, if he has carried through the previous experiments, that the more inductance placed in series with the aerial circuit and the smaller the

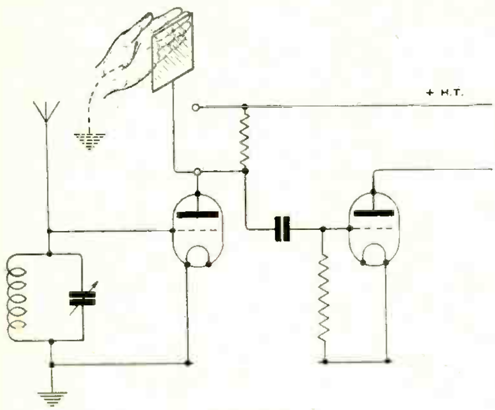


Fig. 27.

capacity of the variable condenser employed with it, the greater the strength of signal received. If any capacity is employed across the coil, it tends to lower the voltage between the two ends connected to grid and filament respectively; thus the corresponding plate potential variations are smaller with weak signals. In the case of the circuit of Fig. 27, the voltage variation on the plate of the first valve is transferred *via* the fixed condenser to the grid of the second valve.

In order to demonstrate how the signal strength varies if any capacity exists between the plate of the first valve and earth, the metal plate already mentioned should be joined to the extra terminal provided,

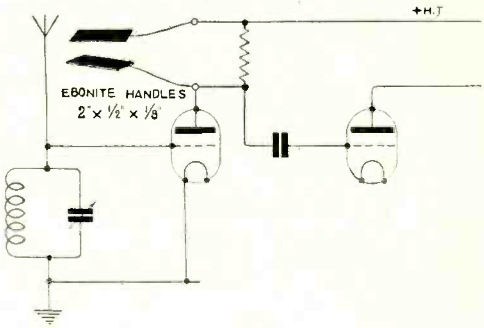


Fig. 28.

which is already in contact with the plate of the first valve.

Signals from a spark station, or, if available, telephony (say from Paris) should be tuned in, and the strength noted. If then the hand is placed within an inch or two of the plate, there will be a decided weakening of the signals, indicating that some of the voltage which should be transferred to the grid of the second valve has now been lost, owing to the condenser formed by the plate and the hand. If the capacity of this condenser is increased by placing the hand directly on the plate with a sheet of paper between, the signals will fail, possibly completely.

A variation of this experiment can be made by taking two flexible *insulated* wires about 3 ft. long, and fixing the ends to two small bars of ebonite to act as handles. The other ends of the wires should be joined to the two terminals of the resistance (see Fig. 28). If, now, while signals are being received the wires are slowly twisted up, the strength will gradually fall off. The capacity of two wires twisted in this manne is very small, depending, of course, on the area of the two conductors and the amount of insulation on each, but it is probably not more than 0·00002 to 0·00003 microfarads. The experiment may be further

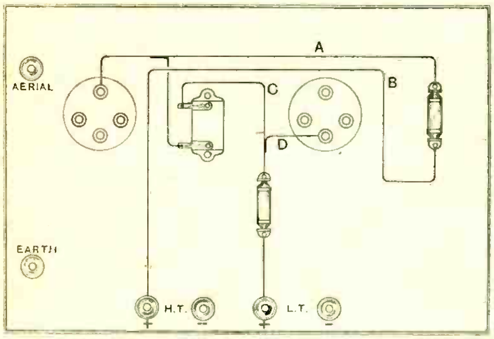


Fig. 29. An arrangement of wiring to be avoided.

varied by connecting the plate to the grid terminal of the second valve, when the same result is to be expected, and the tw insulated wires can also be connecte across the ends of the grid leak, with agai loss in strength.

The lessons to be learned from this experiment are important to those who desir to construct their own apparatus. Fig. 2(shows a general plan of a two-valve resistance coupled amplifier, and indicates the kinc of wiring inside the instrument *which must be avoided* if efficiency of operation is desired. An instrument of this character must have its parts very carefully set out, with a view to keeping the wiring very short, and those particular parts and wires which have to deal with potentials for the grids of the valves should be spaced well away from any others in the instrument, air spacing being employed as far as possible.

Instruments which have their parts very congested for the sake of portability or compactness, are usually not so efficient as those of a more cumbersome but theoretically better construction.

CRYSTAL RECEPTION OF FL TELEPHONY.

IT would appear that the crystal detector receiving set is not to be despised after all, for here are particulars of a set on which the writer has been regularly receiving FL telephony. The intensity and quality of the speech and music varies slightly, but not to any great extent.

The receiving station is situated at Ravenscourt Park, West London, under ordinary amateur conditions. It can hardly be called freak reception, because of the ease and regularity of reception. The writer would not have devoted his attention to a crystal receiver but for an accident to the accumulators which put the valve set out of commission and compelled reception to be made on the crystal detector set. To say that the writer had many surprises as to what can be accomplished with a crystal detector would be putting it mildly, and to those who would be sceptical at these lines, one thing only can be said—have a go at it. These results are not claimed to be exceptional, but simply a record of what can be done.

The aerial used is not a wonderful affair stretched high in the heavens, but simply a twin wire aerial fifty feet long, the far end being barely twenty feet high, and only about twenty-eight feet from the ground at the lead-in end. The lead-in is approximately fourteen feet, and the earth lead fifteen feet to a lead water pipe which has about twenty-five feet to go before reaching the earth. The detector used, and also the tuner and potentiometer, form part of the valve set, suitable switching arrangement enabling the valve circuits to be cut out.

The detector is a combination of zincite and tellurium, and a potential is applied by means of the potentiometer and a single dry cell. At first the tuner was single circuit, being a 240 turn "honeycomb" coil (No. 36 S.W.G. double cotton covered wire on a two-inch former) shunted by a 0·001 mfd. variable condenser. A loose-coupled circuit gives better results, the signals being stronger and interference eliminated. The telephones used are Brown's "A" type 8,000 ohms.

The 0640 G.M.T. weather report comes in equally as well as the 1720 G.M.T. concert.

J. D. B.

NVESTIGATIONS ON SOME VALVE CIRCUITS WITH THE CATHODE RAY OSCILLOGRAPH.

Three interesting applications of the oscillograph to investigations of the wave-forms in certain wireless circuits are dealt with in this article, together with an explanation of its use as an accurate frequency meter.

By N. V. KIPPING.

THE ability of the cathode ray oscillograph to deal with frequencies up to about a million cycles per second has opened up a new field for oscillograph investigations amongst radio circuits and their parts, with the high frequencies often associated with them.

The failure of the oscillograph faithfully to record waves only occurs when the time taken by the ray to cross the fluorescent screen becomes comparable with the time it takes to reach the screen from the anode. The latter time, even with only 250 volts anode potential, is only a fraction of one-millionth of a second. Specially designed oscillographs, with a high velocity projection of the electrons have been successfully used by Dufour at about thirty million cycles per second.

Amongst investigations in connection with valve circuits with the cathode ray oscillograph which have proved of value, perhaps the following are of general interest :—

Measuring modulation of high frequency currents.

Obtaining resonance curve of a reactive circuit.

Investigation of oscillatory circuits.

Use of oscillograph as an accurate frequency meter.

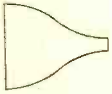


Fig. 1A.

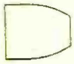


Fig. 1B.

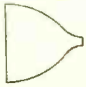


Fig. 1C.

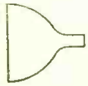


Fig. 1D.

In studying the first of these it was found to be possible to study both the percentage modulation and the quality reproduction characteristics of a radio transmitting set.

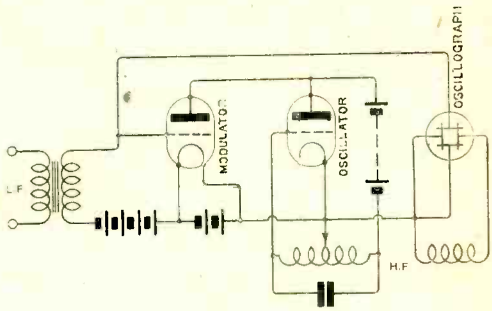


Fig. 2. Method of connecting the oscillograph for measuring the modulation of high frequency currents.

In Fig. 1 are shown some tracings of the curves obtained by the use of the circuit shown in Fig. 2. The two pairs of oscillograph deflecting plates are represented diagrammatically.

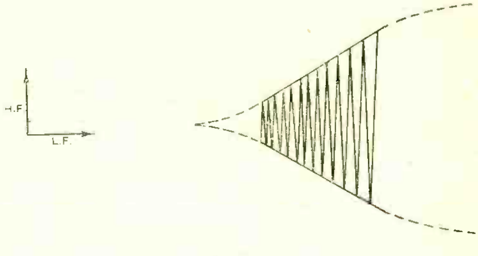


Fig. 3.

It will be seen that horizontal deflection of the beam was made proportional to the low frequency modulation, and the vertical deflection to the radio frequency output.

Assuming modulation to be complete and undistorted, the curve traced by the cathode ray is an isosceles triangle, its altitude horizontal on the screen, and its base vertical, so that the altitude of the triangle represents the amplitude of the modulating frequency, and the base represents the maximum amplitude of the radio frequency output.

When the modulating voltage applied to the grid of the modulator tube is a maximum, the radio frequency output should be zero. When the modulating voltage is zero, the radio amplitude should be twice the unmodulated value.

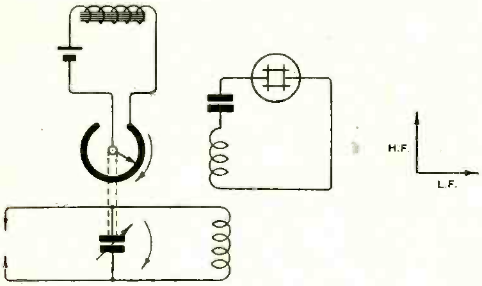


Fig. 4. Arrangement of apparatus for examination of the resonance point in reactive circuits.

Fig. 1A shows a curve approaching this condition. The radio amplitude does not quite reach zero, and the figure is therefore a trapezoid rather than a triangle. If the shorter of the parallel sides is called a, and the longer one b, the percentage modulation is given by

$$\frac{b - a}{b + a} \times 100$$

In Fig. 1A this works out at about 82 per cent.

Distortion of the modulating wave which occurs between the grid of the modulator tube and the aerial output is indicated by the shape of the converging boundary lines of the curve.

In Fig. 1B no appreciable increase in the radio frequency is brought about by a normal decrease in the modulator grid voltage. This shows the condition of too great a negative voltage on the grid of the modulator tube. This negative grid voltage has been decreased in Fig. 1C, so that modulation is good. In this case the curve approximates more nearly to the isosceles triangle of complete and undistorted modulation.

In Fig. 1D the vertical deflection due the radio oscillations are practically stopp during an appreciable part of the lc frequency cycle, due to the modulator gr voltage being too low.

These figures illustrate well to the novic the vital importance of correct grid biassing The radio frequency used in these experiment was about a million cycles, and the modu lating frequency was 200 to 1,000 cycles The individual oscillations are, of course, no shown in the tracings, which are themselve reproduced from photographs. The whol area enclosed by the triangular shape is bright on the screen, being practically coverec by the individual oscillations of the spot, as shown in Fig. 3.

An interesting application of the tube was made for the examination of the resonance point of reactive electric circuits. The arrangement shown in Fig. 4 was used for

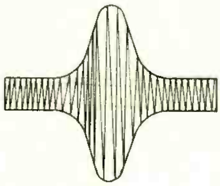


Fig. 5.

this purpose. Alternating current was applied to the circuit, and the potential difference across the circuit applied to the oscillograph, connection being made to the pair of plates governing vertical deflection. The second pair of plates of the oscillograph were shorted together to prevent a drifting of the ray due to their becoming charged.

The frequency of the alternating current was varied by means of a variable condenser, and synchronously with the variations in frequency, the current passing through an iron core coil was varied by means of a rotating potentiometer. The increasing field exerted by the coil caused increased magnetic flux in the iron core, which was so placed as to deflect the ray horizontally. The result was the type of curve illustrated in Fig. 5, in which the amplitude of the oscillations in the reactive circuit increased as the resonance frequency was passed. The variable condenser and potentiometer being rotated together the deflections due to the potential across the reactive circuit, and to the magnetic flux, were cyclic and synchronous, and a fixed curve was obtained.

Interesting though often puzzling curves ve been obtained of the variables in simple cillatory circuits, one of those investigated ing shown in Fig. 6. The variations in is circuit, that is to say, the potential riations between grid and filament and etween anode and filament, were arranged deflect the cathode ray, the former horiontally, the latter vertically. The curve roduced under certain conditions with qual deflections in either direction, is the heoretically correct circle of the perfect scillator varying in size with the tightness r looseness of the coupling. With the ertical deflection made proportional to the

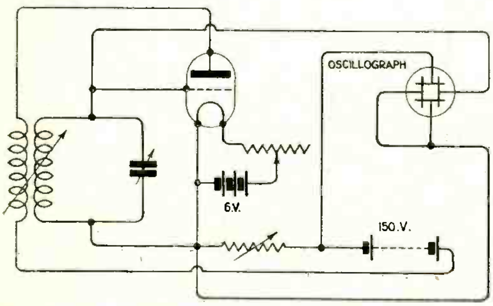


Fig. 6. Connections for the examination of potentia variations in oscillatory circuits.

anode current, curious results are obtained under conditions less favourable than those above, in which the anode potential was one of the variables causing deflection.

The plate current may not be flowing during a considerable portion of each cycle of oscillations of the grid potential, and the curve becomes unsymmetrical accordingly. The plate and grid potentials are perhaps so adjusted that the operating point does not lie on the characteristic curve of the valve, but is situated beyond the intersection of the characteristic with the axis of the grid potential. The type of curve shown in Fig. 7 is then obtained, there being some period in each cycle during which plate current is zero. In the curves shown in Fig. 7A, however, the plate current drops to zero a second time during each cycle, when the grid voltage becomes so positive that no electrons are permitted to pass through to the anode. The rapid rise in grid voltage is assisted also by the fall in anode potential, due to the oscillations in the circuit. The rapid increase in anode current which follows this condition is due to the rapid decrease in grid potential and increase in anode potential which the oscillations produce, until once more the grid becomes too negative to permit of anode current flowing. In this way the curious boot-shaped curve is produced, through the various stages of Fig. 7 and 7A.

It will be seen that for oscillations up to a million cycles, most interesting information can be obtained with the oscillograph of the conditions existing in oscillatory circuits. Once again, the vital importance of suitably selecting the grid bias is emphasised by these results.

Another adaptation of the oscillograph, included here because of its general interest as well as its application to wireless work, is its use as an accurate frequency meter. Exceedingly accurate frequency comparisons can be made in this way, a difference of one-twentieth of a cycle being easily measured.

When the alternating voltage from one source is applied to one pair of the oscillograph plates, and that from another source to the second pair of plates, a stationary pattern is traced on the screen if one frequency is a rational multiple of the other. The simplest case is that in which the two frequencies are equal and in the same phase. The spot then traces a straight line, which is stationary if the frequencies remain exactly equal, but which appears to rotate if there is any difference in the frequencies. The line does not actually turn, but the figure passes through the various stages of the

Fig. 7.

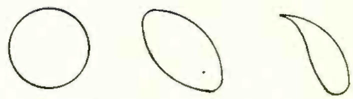


Fig. 7A.

ellipse. A difference in frequency of one cycle per second causes the line to turn once per second, no matter what the actual frequencies are. Two high frequencies can therefore be compared to within a fraction of a cycle by timing the revolutions of the line.

If the two frequencies stand in some other than the 1 : 1 relation, say 3 : 3 or 8 : 1, the well known forms of Lissajou's figures are produced, which again are stationary if the relation is exact. A high frequency may thus be easily compared with an accurately known very low frequency, in several stages if necessary. These accurate frequency measurements may be applied to other problems, such as the accurate calibration of condensers and inductances, and the measurement of very small reactance.

The foregoing covers investigations wi the useful cathode ray oscillograph of son types of valve circuits, and the last of the articles will describe its application to th study of valve characteristics, and son others of the many constituent parts whic go to the making of valve circuits.

Transformer study will be included, as we as a method of examining rectifier wav forms.

NOVEL IDEAS AND INVENTIONS.

Abstracted by Philip R. Coursey, B.Sc.

Supersonic Heterodyne Reception.

The usual arrangement of a supersonic heterodyne receiver comprises a detector valve which is influenced by the incoming signal and also by a local heterodyne oscillator which is tuned to a different wavelength to that of the signals being received, so that instead of producing an audible beat note, the beat is of supersonic frequency, and can be amplified by an ordinary long wave radio-frequency amplifier. If the separate heterodyne is replaced by an autodyne detecting valve, having reaction between the anode and grid circuits, it becomes difficult to retain stable and sufficiently strong oscillations in the valve circuits when they are detuned to an extent sufficient for obtaining the super-heterodyne effect. Further, this detuning of the grid circuit renders the receiver less responsive to the incoming signal than it would be were the circuit tuned in the usual manner.

However, if the circuits are rearranged this disadvantage may be overcome in the manner indicated diagrammatically in Fig. 1* The aerial circuit $A C_1 L_1 E$ and the secondary circuit $L_2 C_2$ are tuned to the frequency of the incoming signals in the usual manner, with, however, the distinction that the inductance L_2 should be small, and the condenser C_2 large as compared with the values most usually employed. Between the secondary circuit $L_2 C_2$ and the usual grid condenser C_3 and leak R_1 is inserted the extra coil L_3. To this coil, instead of to L_2 is coupled the reaction coil L_4 which is included in the anode circuit of the valve. The reaction coil is shunted with the variable condenser C_4, and is thereby tuned to a wavelength different to that being received, so as to produce supersonic beats with the signal currents. By separating in this manner the coil in the grid circuit on to which the reaction is applied, from the coil L_2, which forms the secondary circuit, and is tuned to the wavelength of the incoming signals, it becomes possible to cause the valve to oscillate at any desired frequency irrespective of the frequency of the incoming signals. It is thus possible to get any desired beat frequency for application to the long-wave

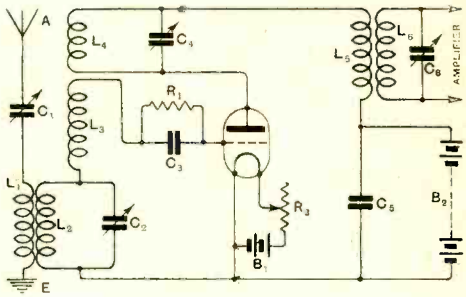


Fig. 1.

amplifier—and in fact it thus becomes possible to employ a standard long-wave amplifier tuned to one given wavelength only, for all signal wavelengths shorter than the amplifier wavelength. The supersonic beat frequency is made to have the same frequency as that to which the amplifier is tuned merely by adjustment of the reaction coil tuning condenser C_4.

The reason for making L_3 small and C_3 large is to ensure that the oscillations

*British Patent No. 197405, by T. H. Kinman.

nerated by the valve—the frequency which is determined by the circuit $L_4 C_4$—hall not be much affected by the tuning of he circuit $L_2 C_2$.

The anode current of the valve which esults from the combination of the locally roduced oscillations and the signal currents ows through the coil L_5 to which is coupled he circuit $L_6 C_6$, forming the input circuit f the long-wave amplifier. This circuit is uned to the supersonic frequency resulting rom the interaction of the local oscillations nd the signal currents.

The arrangement shown in Fig. 1 is but one way of carrying out this idea—the essential feature being the separation of the points at which the signal impulses, and at which the reaction impulses are applied to the grid circuit of the detector valve, and this feature may evidently be applied in several ways, as may be preferred in any given case.

Radiogoniometers for Direction Finding.

The conventional patterns of radiogoniometers for direction finding with fixed loop aerials, are often somewhat difficult to construct. A simplified method is sketched in Fig. 2; simplification has the advantage of producing a more uniform magnetic field in which the search coil can be rotated. It will be seen to consist of an insulating rectangular framework round which, in slots, are wound four coils. Coils A and A_1 are joined together to form one of the fixed windings and coils B and B_1 are likewise joined to form the other.

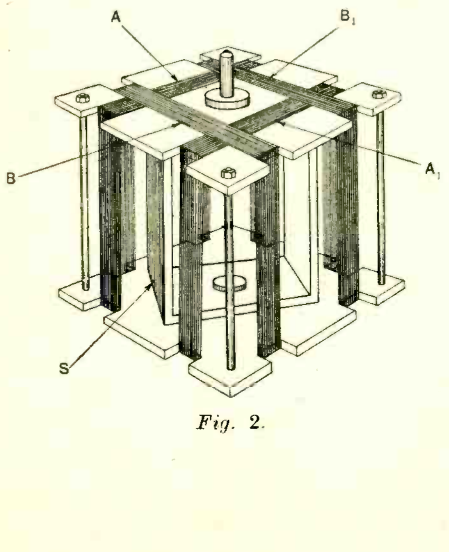


Fig. 2.

The search coil S can be turned round inside the fixed coils, and from the open disposition of these coils can easily be taken in and out of the framework without disturbing the fixed coils, should it be desired to do so.

Static Frequency Raisers.

Many are the devices which have been proposed at one time or another for effecting the multiplication of the frequency of a given alternating current. Their importance arises from the facility which they give for transmitting radio signals by multiplying up the frequency of a comparatively low frequency alternator. Of these devices, the most successful have been those which depend upon the magnetic properties of iron, and in particular, of iron-cored windings in which the iron is subjected to auxiliary magnetic saturation from a direct current source.

The difficulty usually experienced is that such methods distort the waveform of the supply generator by introducing not only one harmonic, but many, and the energy is distributed over all these harmonics instead of being confined into one.

It has recently been shown, however, that by properly adjusting the tune during the alternating current period, during which the iron core reaches the saturation point, that almost any desired harmonic frequency can be selected.* Thus, for instance, if it is desired to multiply the frequency five times the magnetisation ampere turns of the iron should be so proportioned that commencing from zero point of the cycle of the supply current, the iron becomes saturated in a tune $= \frac{1}{4 \times 5} = \frac{1}{20}$ of the tune period of fundamental supply frequency. The pulse of voltage obtained in the secondary circuit operated by the iron core will then have a tune period of $\frac{1}{5}$ of the fundamental, *i.e.*, it is equivalent to a frequency of five times the fundamental. Similarly for a multiplication of *n* times, saturation of the iron shou d be attained in a tune $= \frac{1}{4n}$ of the fundamental tune period.

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*British Patent No. 180672, by the Gesellschaft für drahtlose Telegraphie ("Telefunken" Co.).

INSTRUCTIONAL ARTICLE FOR THE LISTENER-IN AND EXPERIMENTER.

WIRELESS THEORY—XXV.

The series has been specially arranged so that the reader who follows each section as it appears will have obtained a complete wireless education with a minimum of time and trouble, and he will be in a position to successfully design his own wireless equipment.

Recent sections deal with series and parallel circuits, damping, choke coils, transformers, and coupled circuits.

By W. James.

49.—The Single Layer Coil.

On account of their simple construction, single layer coils are greatly used when small inductances are required.

A. The conductor is wound on a *former*, which consists of an insulating material such as ebonite, bakelite, prepared paper tube or dried wood. The requirements are good insulating properties and low losses, particularly the latter.

The losses are caused through the material being subject to the high frequency field. Metal cannot, of course, be used on account of the eddy currents which would flow, and it is better to secure the former to supports without the use of metal screws, particularly if they are situated at parts where the field is dense. In the case of transmitters, where heavy currents may flow, it is naturally essential to bear this point in mind. Cases have been known where screws have become so hot that they have burnt themselves loose.

Naturally only a minimum of material, consistent with mechanical strength, should be used; skeleton constructions are better. In the case of those materials which are likely to be affected by moisture (wood, paper, etc.), the former should be thoroughly dried out and impregnated with an insulating substance such as shellac. Such treatment does not appreciably add to the losses; on the other hand, the losses which would occur through moisture, during use, are avoided. It is considered useless to merely soak the former in, say, shellac.

B. The inductance of the coil is easily calculated from the formula $L = \frac{\pi^2 n^2 D^2 l k}{1{,}000}$ microhenries (μH) where

π = 3·14 and π^2 = 9·86.

n = the number of turns of wire wound per cm.

D = the mean diameter of the winding in cms.

l = the total length of winding in cms.

k = a factor which depends upon the ratio $\frac{D}{l}$.

All the measurements are made in centimetres, and the inductance would be in centimetres also, but we have divided by 1,000 to obtain the result in microhenries, ($1 \mu H = 1{,}000$ cms.).

The value of k may be taken from tables, or from the curves given in Fig. 126. When the coil is very long compared with its diameter, $k = 1$; when the reverse is true, k is very small.

For accuracy, the turns should be wound touching. In cases where the turns are spaced, a correction factor ought to be used, but the error through ignoring it is not great, and the accuracy of the inductance calculated is as close to the truth as that of the measured dimensions of the coil.

It should be observed that the inductance depends upon the number of turns per cm. *squared*; consequently the inductance of a coil wound, let us say, with 20 turns per cm., is four times as much as that of a coil of similar size wound 10 turns per cm. Similarly with the diameter; this quantity is squared, and in making mental estimates should be allowed for accordingly. The inductance, however, only varies directly with the length (with of course the small variation due to the factor k).

That is to say—a coil 10 cms. long and 8 cms. in diameter, wound with 10 turns per cm., has an inductance of 465 μH. If it is wound with 20 turns per cm., the inductance is 4×465 (*i.e.*, $\frac{20^2}{10^2} \times 465$) =

860 μH. If the diameter is oubled, other factors as before, e inductance is roughly ×465 = 1,860 μH (not exactly, f course, on account of the hange in the value of k). To void the calculation, which is umbersome in design work, he curves given on pages 696 nd 697, August 22nd issue, hould be used. We have given xamples of their use and there s no need for repetition.

C. The important question of design—*which shape of coil* gives the highest inductance for a given length of wire—is easily answered. From a few trials it is quickly seen that when the diameter is 2.46 times the length; that is, when the ratio $\frac{D}{l}$ is 2·46, the coil has the highest inductance possible with that length of wire. This relationship, however, is not sharply defined; a small departure from the ideal ratio does not materially affect the length of wire necessary for the inductance.

D. This solution does not necessarily mean that the coil with a ratio $\frac{D}{l} = 2{\cdot}46$ will have the minimum *high frequency resistance.* With the H.F. resistance is involved the factors outlined in section 48, and capacity especially is pro-

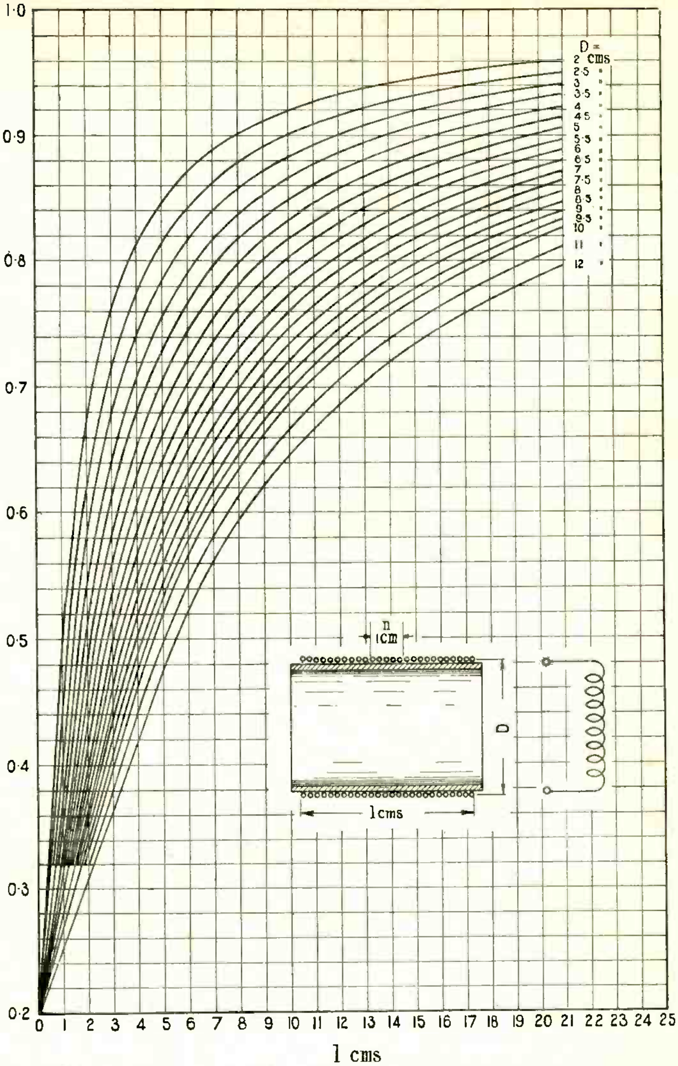
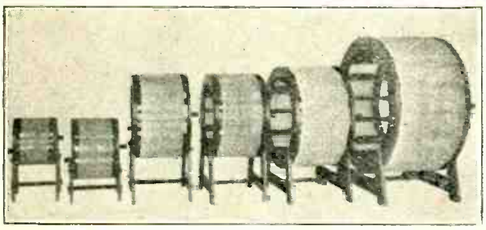


Fig. 126. Curves giving the value of k for use in the inductance formula. Thus if D = 10 cms, and l = 18 cms., the value of k = 0·8.



Photograph of single layer inductance coils used as standards by the BUREAU OF STANDARDS. *The coils have diameters from 13 to 38 cms., and an inductance from 60 to 5,350 μH. The capacities of the coils are from 9 $\mu\mu F$ for the smallest to 16 $\mu\mu F$ for the largest. Notice the shape and skeleton construction of these coils.*

minent, particularly when a small value of tuning capacity is used.

The *self-capacity* varies directly with the diameter (D) of the coil, as the specific inductive capacity of the dielectric (k), and inversely with the distance between the turns (t). Thus self-capacity is proportional to $\frac{Dk}{t}$. The length of the coil is also, of course, partly involved.

Consequently, a *reduction in coil capacity* may be expected by reducing the diameter;

using material for insulation between the turns which has a low value of k; and by spacing the turns.

It follows that the *best shape* given in *C* should be modified by reducing the diameter with a corresponding increase in

Coils should be protected from moistur especially when absorbent materials ar used in their construction, and to this en they are impregnated with shellac or paraffi wax. Clearly this needs to be carefull carried out; no excess over the quantit

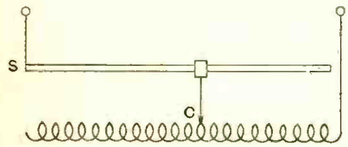


Fig. 127. *A variation of inductance may be obtained by providing a rod S, along which may be moved the slider which makes contact at C with the turns.*

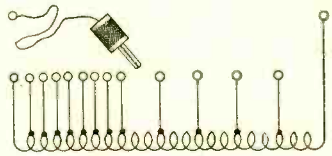


Fig. 128. *A coil may be provided with taps, so that only part of the coil is in circuit.*

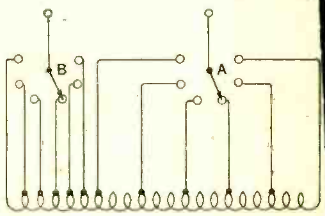


Fig. 129. *A fine adjustment of inductance is possible by using two sets of tappings, one set being from single turns B, and the other from groups of turns A.*

length; and the coil is improved by using a minimum of dielectric in both the former and the covering of the wire; and by spacing the turns.

As the spacing is increased, although the capacity becomes smaller, the length of wire

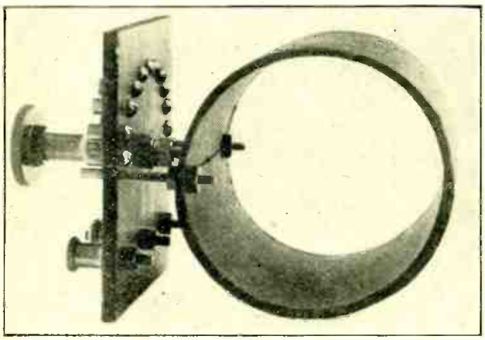


Fig. 129*A*. *The photograph shows clearly the method of mounting a coil, and a tapping switch.*

increases (*i.e.*, through the departure of the ratio $\frac{D}{l}$ from 2·46), so there is a *best spacing*. It is suggested that a spacing equal to half the wire thickness is satisfactory. Then the wire covering need only be thin; for example, an enamel or single cotton covering. (Cotton has a lower inductive capacity than silk).

No exact figures are available, but it is suggested that the *best coil* will have a diameter about 1·5 times its length. The importance of reducing the amount of dielectric (coil former, and wire insulation) to a minimum cannot be too strongly emphasised.

essential to damp-proof the coil should be used.

Coils which are to be used in transmitters have the turns spaced to prevent breakdown due to the voltage between turns, so that their self-capacity is low on this account.

The wire to be used is largely decided by the bulk of the coil permissible; for a small inductance No. 18 or No. 20 wire is satisfactory; larger inductances should be wound with finer wire, and for the inductances

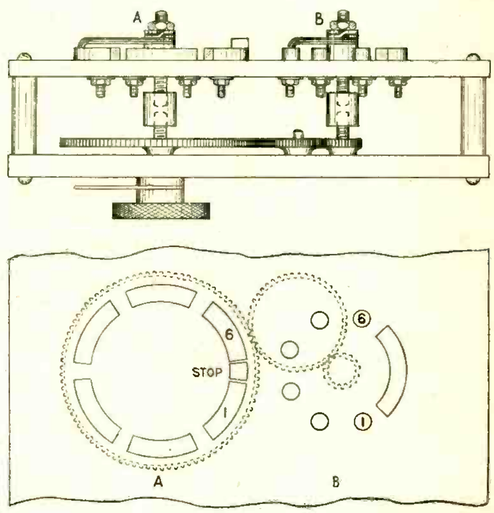
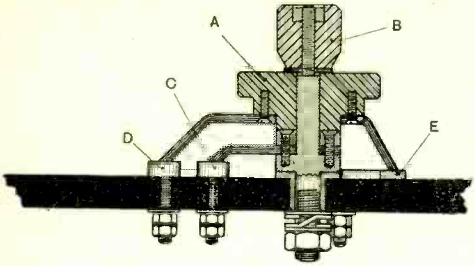


Fig. 129*B*. *The unit and group switches may be operated by one knob through gear wheels. The groups of turns are taken to contacts A, and the single turns to contacts B. The single turns, in this case from* 1 *to* 6, *are tapped out while switch A moves over the contact section* 1 *and so on.*

commonly obtained with single layer coils No. 26 or No. 28 is the finest wire used.



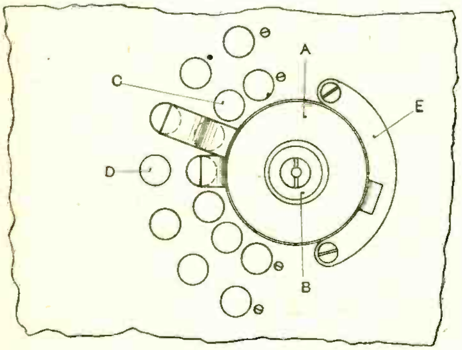


Fig. 129C. *An arrangement consisting of two switches used to tap units and groups of turns. The single turns are connected with contacts C, and the groups with contacts D. Knob B moves the contact brush over the contacts C, and knob A moves the second contact brush over the studs D. The connection with studs D is made through the brush and contact E. The connection from contacts C is made through the brush and the spindle attached to knob B.*

E. The natural wavelength of the coil is determined from a knowledge of its inductance and capacity, thus

$\omega = 2\pi f = \sqrt{L_0C_0}$ where L_0 = low frequency inductance of coil in henries

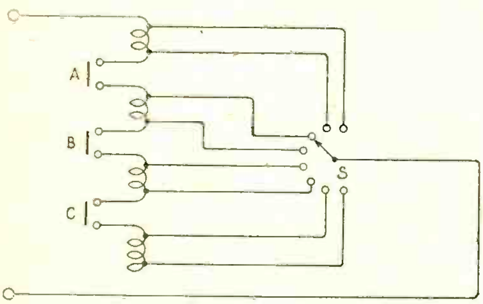


Fig. 130. *The switch S is provided to tap out the turns, and the coil is split up into sections to reduce dead end effects by the isolating switch with contacts A, B and C.*

and C_0 = natural capacity of coil in farads,

or $\omega = \dfrac{10^6}{\sqrt{L_0(\mu H)C_0(\mu F)}}$ where L is in μH and C in μF.

When the coil length = coil diameter, the natural wavelength is equal to nearly 2·5 multiplied by the length of wire in the coil.

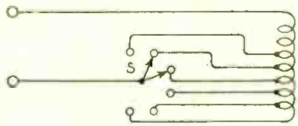


Fig. 131. *To minimise dead end effects, the switch has two blades which make contact with two studs, providing a short-circuited section between the used and unused portions.*

50.—Variation of Inductance.

A. To obtain an inductance *lower than that of the coil,* contact is made with the turns. The most elementary method is to bare the conductor insulation so that a

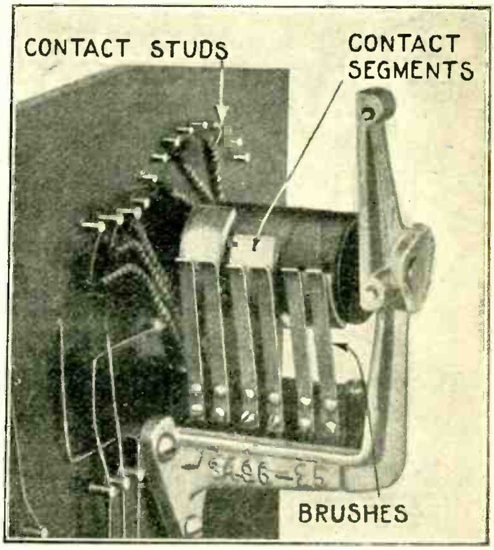


Fig. 132. *Photograph of dead end and tapping switch. The connections are given in Fig.* 130.

contact may be made with any turn. Commonly a slider is fitted, and the contact arranged to make connection between it and the turns. See Fig. 127. The method is inherently inferior, and only the desire for the simplest (and least expensive) coil should warrant its use. The contact in general is not reliable, and several turns are short-circuited, greatly increasing the coil resistance. Further, the effect of short-circuited turns is to reduce the inductance, so that any unreliable contact, causing a change in the number of turns short-circuited, prevents

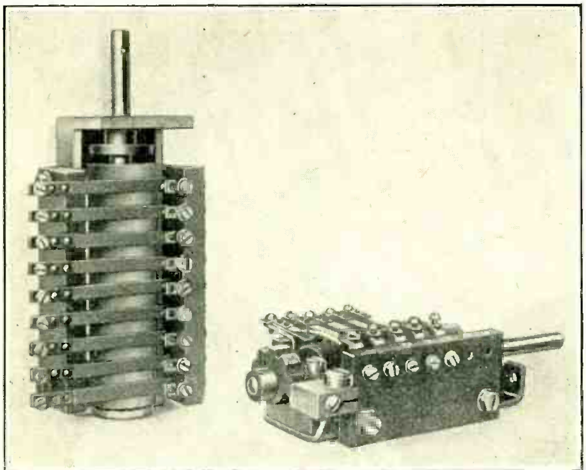


Fig. 133. A barrel-type switch may be used to tap out the coil and at the same time disconnect the portion not in use.

the delicate adjustment of inductance which it is the aim of the arrangement to provide. Again, the portion of the coil in use may be a small part of the total, giving "dead end" losses (Section 48*D*).

B. A better method is to *take tappings* from the coil to switch contacts or sockets, Fig. 128. If a fine adjustment is required, single turns may be tapped from one end, and groups of several turns from the other, Fig. 129. The inductance is then readily variable, but here again one must remember the portion not in use acts to modify the behaviour of the used portion.

C. The difficulty is partly removed by the use of *isolating* ("dead end") *switches*, which are constructed so that the portion of coil not in use is disconnected and broken into sections (Fig. 130). Another arrangement, which is simpler, though not quite so effective, is to short-circuit a section of coil next to that in use, Fig. 131, leaving the remainder connected but open at one end.

In the first arrangement tappings are provided at the switch S, Fig. 130, and the winding is broken in sections through the use of a switch such as Fig. 132 at A, B and C. There are many satisfactory switches—*e.g.*, a barrel switch, Fig. 133, often used in Germa apparatus.

D. When only *small changes* in the valu of the inductances are required for tuning a metal disc may be mounted to rotat within the coil, so that the plane of the dis relative to the direction of the mag netic field may be changed. Th extent to which eddy currents ar induced in the coil determines th reduction in coil inductances, and 25 per cent. or more reduction may often be obtained. The coil losses are of course increased, but some times the ease of adjustment more than compensates for losses on this account. A copper disc $\frac{1}{8}$ in. thick is often used, but the best thickness in size will be decided by the inductance variation required. However, when a continuously variable inductance is required, it is better to use a *variometer* (described below).

E. In cases where a coil is required which has *no external magnetic field*, the winding shown in Fig. 134 is used. The former may be of circular

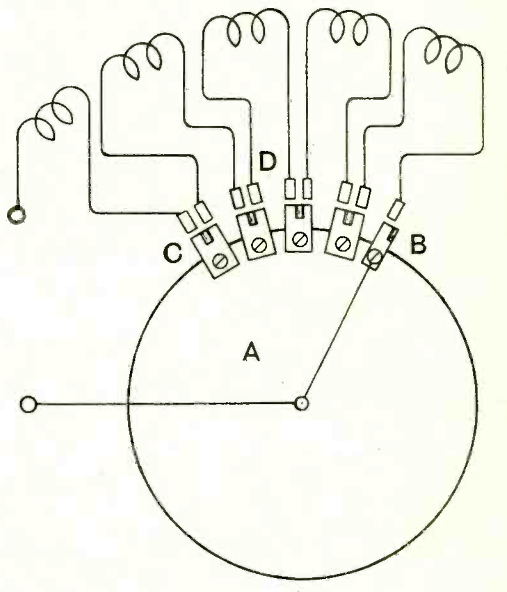


Fig. 133A. This is another form of dead end switch. The contacts C to B are mounted on a piece of ebonite (A) attached to the knob. The coil sections are joined as at D. As the knob is turned, say to the right, more sections are brought into circuit, the contacts D being bridged by the contacts C to B.

rectangular cross section as shown. When he former has a circular cross section

$$L\mu H = 0{\cdot}01257\ n^2\ (R - \sqrt{R^2 - r^2})$$

here $0{\cdot}01257 = \frac{4\pi}{1{,}000}$

n = number of turns per cm. of winding.

R = radius of coil in cms.

r = radius of cross section.

When the coil is wound upon a rectangular cross section former.

$$L\mu H = 0{\cdot}0046\ n^2 h \log \frac{r_2}{r_1}$$

where n = number of turns per cm. of winding,

h = depth of former (height),

r_1 = radius from centre to inside of coil.

r_2 = radius from centre to outside of coil.

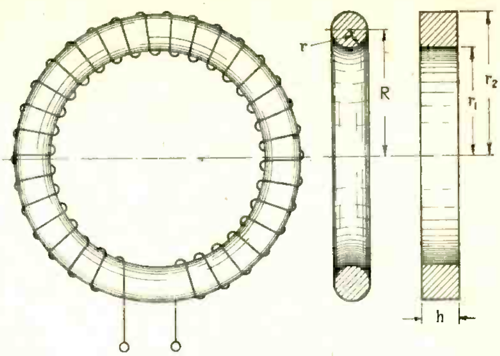


Fig. 134. *Data of circular coils required in inductance calculations.*

It will be observed that either of these coils will not couple magnetically with other coils. The cross section should be large if the inductance is to be reasonably satisfactory.

CORRESPONDENCE

Hertzite.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—As there seems to be a certain amount of misapprehension as to what the crystal so well known as Hertzite is, I should be glad if you would kindly repeat in your valuable columns the fact, which I believe is plainly understood if properly read, that Hertzite is not a so-called synthetic production. Synthetic crystals are apparently produced by subjection to a prolonged high temperature, whereas Hertzite, as I have pointed out, is prepared from natural galenas subjected to certain chemical processes. Of these I have several kinds, by which almost any galena can now be made to attain as sensitive a condition as any crystal known, and produced from absolutely insensitive ores.

W. J. FRY.

London, N.W.

Radiocite—A Synthetic Galena Crystal.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I see in your issue of July 7th that Mr. W. J. Fry states that in the year 1913 he was the first *maker* in this country of a crystal known as Hertzite. Mr. Fry states that he *treats* six pieces, and that natural sensitive crystals cannot be improved by treatment. I think in the circumstances the claims are that Mr. Fry's process consists of *treating* natural galena crystals in order to increase their sensitivity.

In conjunction with Mr. L. McMichael, I manufactured in 1910 to 1913, and again during the last few years, an entirely synthetic (*i.e.*, artificially produced) galena crystal from the elements existing in galena, viz., lead and sulphur. It has been known for a considerable time that a piece of lead sheet suitably scraped and exposed to sulphur fumes for a short time becomes quite a fair detector for Hertzian waves, and in the early days the process consisted in burning a phosphorus match on a small strip of lead, using the lead thus treated. The drawback was that after a short time oxidation took place and the same process had to be repeated.

In conjunction with the late Mr. Russell Clark and partly helped by a suggestion and experiments made by Mr. G. Lambert we proceeded to investigate the nature of the sensitive spots of natural galena. For this purpose a piece of galena and a gold point were placed under a powerful microscope and examined while signals were being received, Mr. Lambert's contention being that the gold point actually moved in rhythmical unison with the Morse signals received.

Although we were unable to verify this fact, during numerous experiments I observed the following point :—The sensitive part of a natural galena crystal showed a slightly different appearance to the surrounding mass of crystal, *i.e.*, it had a yellowish tinge. I came to the conclusion that the composition of the sensitive part of a natural galena crystal must be slightly different to the composition of the rest of the crystal. Galena is lead sulphide of the composition of PbS. I endeavoured to isolate the small yellowish specks in order to analyse their composition and detected after some time that the sensitive spots seem to be a mixture of various higher sulphides of lead.

It is a well-known fact that artificial galena, *i.e.*, PbS, can be readily manufactured by fusing lead and sulphur at a suitable temperature, and although I succeeded in manufacturing a number of crystals of artificial galena, yet none of these were sensitive, the presence of the slightest trace of oxygen rendering the crystal quite insensitive. The next step was to cause fusion to take place in an inert atmosphere, and various experiments were made by causing the reaction to take place in a quartz tube passing through nitrogen, hydrogen, and eventually sulphur fumes, still without getting the desired results.

Accidentally I discovered one day that the only method to obtain the sensitivity of the artificial galena was to manufacture it in its own vapour. Although the component parts of galena, *i.e.*, lead and sulphur, both melt at very low temperatures, yet its components P.b.S., *i.e.*, galena, melts only at a temperature of about 2,000° centigrade.

Therefore, artificial galena, to be sensitive, can only be manufactured by using electric furnaces, allowing the reaction to take place in its own gas. At present only small quantities can be manufactured at a time. The process is costly, and we are still working at a simplified method which no doubt will eventually eliminate the use of all natural crystals.

The advantage of artificial galena is that its sensitivity is not merely on the surface but right through the specimen, and further, that the sensitivity remains practically indefinite providing no greasy matter, *i.e.*, touch of fingers, and so on, is allowed to interfere with its properties.

A piece of radiocite manufactured in 1911, and mounted as a curiosity in a gold tiepin, gives as powerful signals to-day as it ever did. In order to get the best result with radiocite, contact, which should be extremely light, must be made with a fine gold point.

R. H. Klein.

London, W.C.2.

To the Editor of The Wireless World and Radio Review.

Sir,—As there are many amateur wireless stations, the owners of which are interested in amateur transmissions, I would suggest they keep a log, if they do not already do so, and enter therein the date, time, wavelength (180 or 440), call signs of all signals intercepted, whether Morse or telephony, and signal strength, whether weak, fair, good, strong or very strong. Also, if convenient, the number of valves used at receiving station could be recorded.

I would like to urge transmitting operators to speak as clearly as possible when mentioning their call letters, as I have received, just lately, correspondence from two amateurs saying they had heard me very clearly on telephony. I know for a fact that they had not heard me as they very wisely stated the call sign of the station I was supposed to be working with. As it happened I had never worked with the stations mentioned. It is a pity that a person taking the trouble to send a report should learn that he has been mistaken.

Ralph Bates.

Lincoln, *August*, 1923.

Low Temperature Valves.

To the Editor of The Wireless World and Radio Review.

Sir,—I think that all Wireless people will welcome the long overdue reduction in the price of these valves. It seems to me, however, that the question of the voltage required has not received the consideration it should.

It is usual to find that 1·8 to 2 volts is needed. This is excellent for use with a single accumulator cell but is very bad from the point of view of the use of dry cells. In effect it means that two cells must be used and about one third of the available energy is lost in the resistance.

In view of the small energy consumption of these valves it would have been better, in my opinion, to have designed them for use with one or two dry cells. If, for example, the filament required 2·75 volts it would mean that the valve could be worked quite efficiently from two dry cells in series. The efficiency when worked from an accumulator would, of course, be lower, but the point is that one can afford to throw away a certain amount of energy when an accumulator is used, whilst with the dry cell the highest possible efficiency is most desirable.

I believe that in America the manufacturers are much more alive to the use of dry cells for valves. For those who live in the country and have no facilities for having accumulators charged, and for portable sets, the arrangement is ideal.

C. H. Stephenson.

Wolverhampton, *August*, 1923.

Continental Stations.

To the Editor of The Wireless World and Radio Review.

Sir,—In your issue of August 8th, No. 208, you refer to the reception of Continental stations, and state that Mr. Fildes of Llandudno has been successful in hearing Königswusterhausen, Berlin on three successive Sundays, on one H.F., detector and L.F. valves.

We are 40 miles from Llandudno and it may interest the readers of your excellent paper to know that my boy, thirteen years of age, has built a four-valve set, and working only on three valves, H.F., detector and L.F., he gets Berlin telephony *twice a day* with the greatest ease and very loud. It is only necessary to set the condensers, put on telephones, and turn on valves, and you can always depend on hearing them. He also gets the Eiffel Tower, Radiola, the Hague, and other Continental stations, besides all the B.B.C. stations, on two valves, using basket coils which cost 5s. for a set up to 4,000 metres. With four valves he gets Manchester (50 miles) without the aerial or earth wires attached.

I hope the above will encourage some of your young readers to do likewise.

M. W. Morgans.

Mold, *August*, 1923.

A SWITCHING ARRANGEMENT.

By R. J. SAWBRIDGE, A.M.I.R.E.

HAVING tried both single and double circuits for reception, and realising the advantages of both, the author has devised the circuit shown in Fig. 1 to enable a quick change

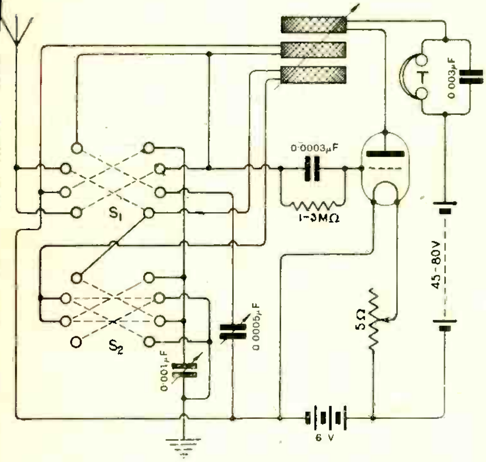


Fig. 1.

to be made from one to the other. When the switches are placed in the positions as shown in Fig. 2, the aerial tuning condenser is placed in series with the aerial tuning inductance. In Fig. 3 the primary is connected directly to the set, and is untuned for experimental work. In Fig. 4 the primary is connected to the set and the secondary serves as an absorber circuit for undesirable signals. This is of considerable value when receiving broadcast jammed by another station. Fig. 5 shows the primary with the aerial tuning condenser in series with it and the secondary connected to the set, the secondary condenser being shunted. In Fig. 6 the primary is aperiodic or untuned, while the secondary is tuned as in Fig. 5.

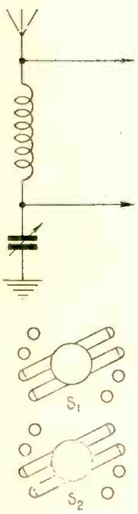


Fig. 2.

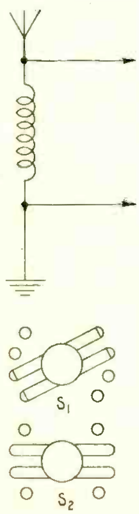


Fig. 3.

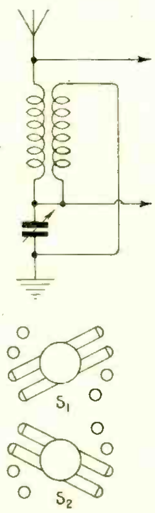


Fig. 4.

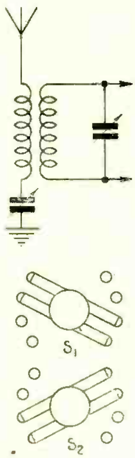


Fig. 5.

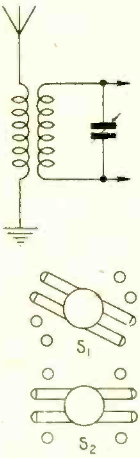


Fig. 6.

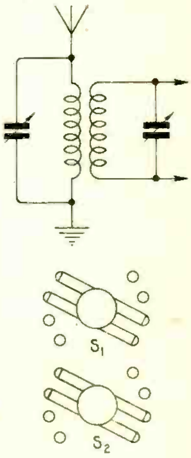


Fig. 7.

In Fig. 7 the primary and the secondary are both shunted by their respective condensers. It will be seen, therefore, that a station can be readily picked up when using a single circuit as in Fig. 2, the switch then being thrown over to the position indicated in Fig. 5, when it is only necessary to vary the capacity in the secondary circuit until the desired station becomes audible again. The usual values of the components are inserted for the benefit of those who may be beginners, but who wish to incorporate this system of switching in their set.

Wireless Club Reports.

Contributions to this section are welcomed. Reports should be as concise as possible and should record the most interesting features of each meeting. The Editor reserves the right to edit the reports when necessary. **Papers read before Societies will receive special consideration with a view to publication.**

An Asterisk denotes affiliation with the Radio Society of Great Britain.

Hackney and District Radio Society.*

On September 2nd fourteen members of the Society paid a visit to Croydon Aerodrome, and after viewing the machines and hangars, were shown round the wireless receiving station by Mr. Mackford, senior W/T officer, to whom the Society expresses its warmest thanks for his kindness.

The usual meeting of the Society took place on Thursday evening, the 6th inst., and a demonstration of the Society's new seven-valve set, which includes three H.F. valves, was given by Mr. Walker.

Hon. Sec., C. C. Phillips, 247, Evering Road, Upper Clapton, E.5.

The Radio Society of Highgate.*

The first meeting of the Society since the summer vacation was held on September 7th, when a very interesting lecture was given by Mr. H. Andrewes, B.Sc., A.C.G.I., D.I.C., entitled "Plain Facts About the Armstrong Super."

The lecturer described his own experiences with the circuit, and suggested an explanation of the actual conditions prevailing during the operation of this type of receiver.

A programme of lectures for the next three months is now ready, and may be obtained on application to the Hon. Sec.

Hon. Sec., J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate N.6.

Guildford and District Wireless Society.*

On Saturday, September 1st, members of the Society spent an enjoyable afternoon at the London Terminal Aerodrome, Croydon.

The wireless installation was first inspected, after which the party visited the hangars and had the various types of aeroplanes and engines explained to them. A few members took advantage of the opportunity for a "joy-ride."

Thanks are again due to Ald. W. T. Patrick for his kindness in providing tea. It is hoped that the winter lectures, which commence in a few weeks time, will be enthusiastically supported, and that more of those interested in wireless in the Guildford district who are not yet members of the Society will attend the many discussions that are held.

Hon. Sec., R. T. Bailey, 148, High Street, Guildford.

North London Wireless Association.*

At the 140th meeting of the Association o September 3rd, Mr. Frank S. Angel delivere a lecture entitled "Hints and Tips on Wireless. Useful advice in connection with aerials, lead-i connections, and filament resistances, was give and created much interest.

Openings exist for 20 junior members of 1 years, to make up the complement for this sessio at an inclusive fee of 5s. per member.

Hon. Sec., J. C. Lane, Physics Theatre, Norther Polytechnic Institute, Holloway Road, N.

North Middlesex Wireless Club.

This Club has continued to hold its meetings throughout the summer, and on Wednesday, the 5th inst., at Shaftesbury Hall, Bowes Park, N., the 123rd meeting was held, Mr. A. G. Arthur being in the chair.

The proceedings opened with a presentation made by the Chairman on behalf of the Committee and members to Mr. M. F. Symons, the Club Installation Officer, who is shortly sailing for Australia.

Mr. G. E. Dockree then gave a lecture on "Distortion in Valve Receivers." Beginning with a short description of the transmitting apparatus, he indicated the various modifications undergone by the original sound waves before they issued as music or speech from the loud speaker. The design of apparatus, management of valves, and choice of telephone receivers were all discussed by Mr. Dockree.

The next meeting of the Club will be held on September 19th, at the Headquarters, Shaftesbury Hall, Bowes Park Station.

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

Brockley and District Radio Association.

On Friday, August 31st, at our Headquarters, The Gladstone Hall, New Cross Road, S.E.1., Mr. J. F. Stanley, B.Sc., A.C.G.I., delivered a lecture entitled, "Interference Elimination." This subject, which is one of great moment with most of us, was treated by Mr. Stanley in a most comprehensive manner, and it was obvious that he had studied the matter thoroughly. Altogether it was a most interesting and instructive lecture, certainly a most fitting one for the commencement of our winter session.

Meetings of the Society are held every Friday at 8 p.m. at the above address, and interested persons are invited to visit us, or to write for full particulars to the Hon. Sec., R. O. Watters, "Grove House," Brockley, S.E.4.

Honor Oak Park Radio Society.

On Wednesday, September 5th, after a keen discussion of a winter programme, which among other interesting items will include a lecture demonstration by the chief engineer of Messrs. Alfred Graham & Co., members of the Society istened to an interesting talk on the "Possibilities of Dual Amplification," by Mr. McVey.

During the demonstration which followed, strong signals were obtained without the use of an aerial, or reaction, and using one valve only.

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

Tottenham Wireless Society.

The usual monthly business meeting was held on Wednesday, September 5th, when Messrs. Neale & Tracy were elected on the Committee, and Mr. Clare as librarian, to fill vacancies caused by members leaving the district. A sale and exchange of various apparatus, conducted by the Secretary, followed, a noticeable feature being that no article remained unsold. A short discussion took place on a crystal and valve circuit giving loud speaker strength.

Prospective members should note that meetings are held every Wednesday at the Institute, 10, Bruce Grove, Tottenham, where they will be welcomed.

Hon. Sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

Barnet and District Radio Society.

A meeting of the Society was held at the Radio Club Room, Bells Hill, Barnet, on Wednesday, September 5th.

At 8.30 p.m., after the usual Morse practice, Mr. H. R. Fry, the Vice-President, gave an interesting lecture on early experiments conducted by himself with crystal receivers. Members listened to the reception of 2 LO with apparatus, constructed in 1912, which was used in the experiments.

After Mr. Fry's interesting and instructive address, the members present inspected the Society's new receiver. The excellent results obtained are due to Messrs. Green and Finch, who have had the work in hand.

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

The Mount Pleasant Radio Research Society.

The annual general meeting of the above Society was held on Saturday, September 1st at the Headquarters, 21, John Street, W.C.

The proceedings opened with a remarkably fine lecture and demonstration by Mr. M. Volent, on "The Production and Uses of High Tension Currents."

The following officers were elected :—Asst. Hon. Sec. and Treasurer, Mr. M. Volent ; Hon. Tech. Adviser, Mr. W. D. Keiller ; Auditors, Mr. R. J. Hunt, Mr. F. Green. Committee : Mr. R. J. Bridgeman, Mr. F. W. Cavanagh, Mr. J. O. J. Hudson, Mr. W. A. J. Smith.

Hon. Sec., Mr. G. H. Vine 23, Melville Road, Walthamstow.

Dewsbury and District Wireless Society.

The first meeting of this Society in the 1923-24 session was held on Thursday, September 6th, at the Central Liberal Club, Dewsbury. There was a good attendance, and several new members were enrolled. New rules were passed, and it was decided to commence a series of monthly "Beginners' Lectures."

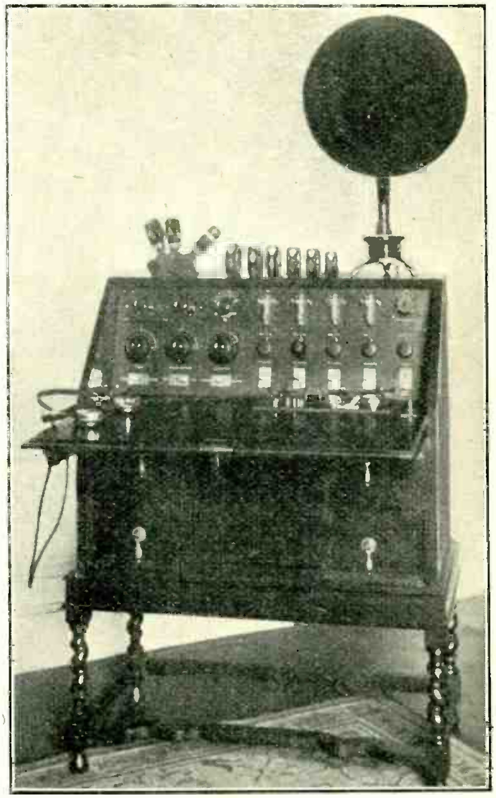
Hon. Sec., F. Gomersall, A.S.A.A., 1, Ashworth Terrace, Dewsbury.

Holy Trinity Meccano and Radio Club.

This Club (formerly the "Holy Trinity Meccano Club") has now been enlarged to include a Radio Section. This section will commence its activities on Saturday, September 15th, at the Holy Trinity Parish Hall, Richmond Road, London, N.1., at 7 p.m., and anyone over 14 years of age will be welcomed. All further information as to subscriptions, etc., should be addressed to the Radio Section Secretary, Mr. Walter Stretton, 15, Thornhill Houses, Thornhill Road, London, N.1.

AN INDICATION OF PROGRESS.

The accompanying photograph is of special interest as indicating progress in the design of an amateur-built receiver. It also serves to indicate that those who take a serious interest in wireless can never be quite satisfied, but are always introducing improvements into their apparatus. The



photograph shows the same bureau as was illustrated on page 674 of the issue of *The Wireless World and Radio Review* of February 17th, of this year, but the set has been entirely redesigned by the owner, Mr. A. G. Foster of West Hampstead. The layout of the parts, as well as the report of the efficiency of the receiver, show what strides are being made in amateur competence.

Notes and News

New Army Wireless Telephone Sets.

During the army manœuvres of a fortnight or so ago, new military wireless sets have been thoroughly tested, and the "C" set, with a range of from 20 to 60 miles, has been very successful for communication between divisional and brigade headquarters. Telephonic communication between tanks on the move has been shown to be possible when the tanks are not more than 5 or 6 miles apart.

Broadcasting and the Musical Profession.

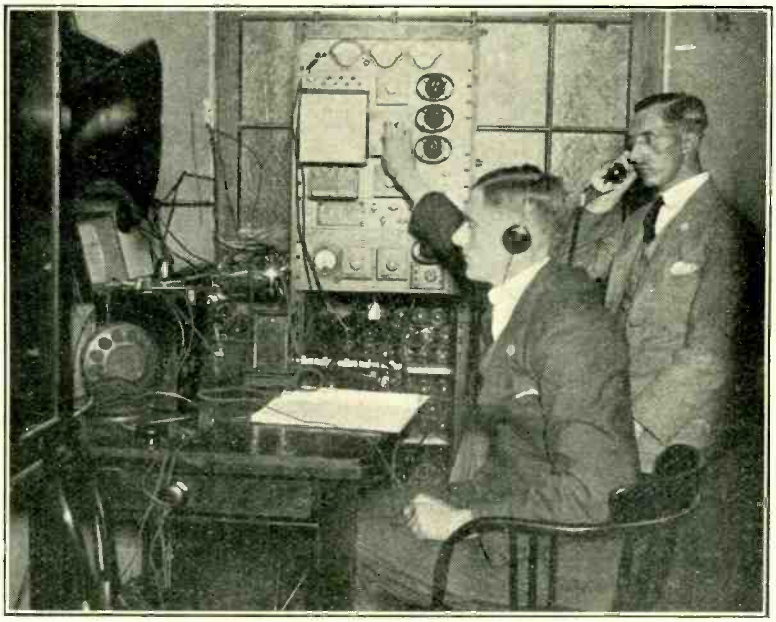
As time goes on, more and more musicians, probably, will become converts to broadcasting as a means of widening their sphere of popular recognition. The latest "convert," if one may call him so, is Mr. Josef Holbrooke, who broadcast an entire programme from the Cardiff station on Sunday evening last, the 9th inst.

Soviet's Wireless Plans.

Reports from Moscow state that the Soviet Government is erecting a large wireless station on the Island of Nova Zembla capable of communicating with Archangel and Siberia.—*The Times.*

More U.S. Broadcasting Reception.

Listening-in on 360 metres at 12.39 a.m. on August 20th, Mr. W. R. Stainton, of Leigh, Lancashire, heard a speech from an American station, followed by a musical selection. No call letters were intercepted. A programme consisting of speeches and music continued until 2.19 a.m., when WGY was tuned in on 380 metres, music being well received on one valve.



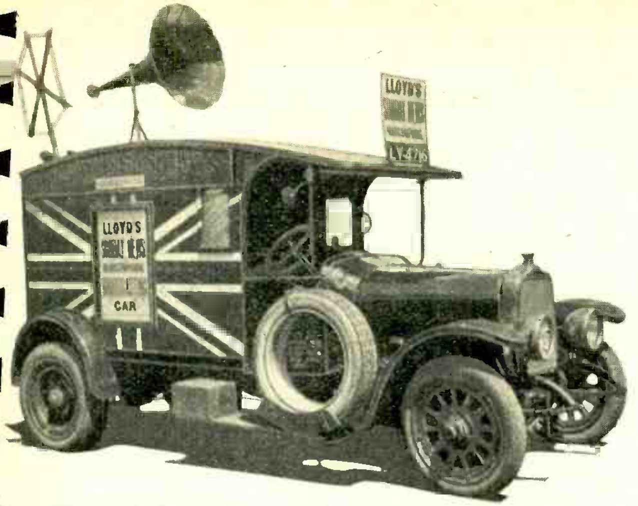
Our illustration shows the modulation and studio signal control room of the Birmingham broadcasting station. The control room is a mile from the Summer Lane Transmission House and is connected by land line.

The Post Office Station at Rugby.

The survey by the Office of Works of the site of the Empire Wireless Station at Hillmorton, near Rugby, has been completed, and Post Office engineers are now on the ground preparing the stations for the huge masts, eight in number, that are to be erected on the ground.

Glasgow Broadcasts "Rob Roy."

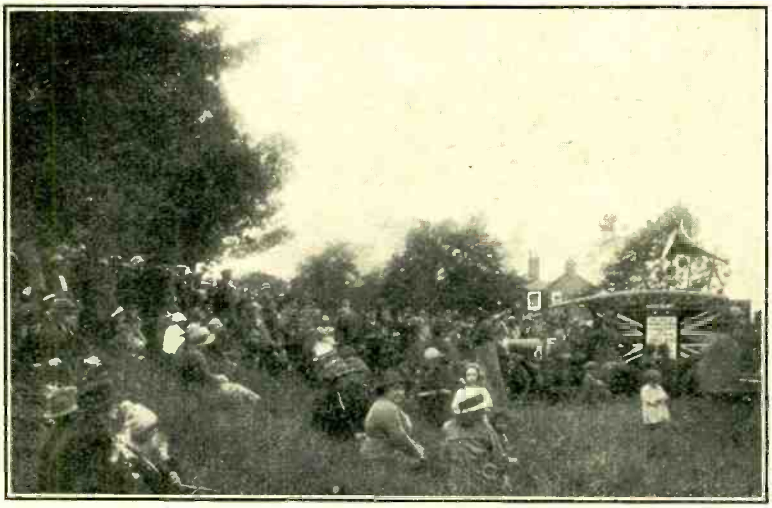
From the many eulogistic reports received, it is evident that listeners-in in the Glasgow area fully appreciated the performance of the Scottish play "Rob Roy," broadcast from 5 SC on August 31st. The method of presentation was similar to that employed for the transmission of Shakespearian plays from 2 LO. A synopsis of the story was read by Mr. Carruthers, and the play was interspersed with choral selections rendered by members of the Lyric Club. The station orchestra



A multi-valve Marconiphone set is used to equip the "Lloyd's Sunday News" wireless concert car that has recently been touring the south of England.

and the band of the 1st Royal Fusiliers augmented the musical programme.

On October 6th, "Rob Roy" is to be transmitted by land line to all the broadcasting stations in the country.



The popularity of free broadcast concerts can be judged by the good crowd gathered round the "Lloyd's Sunday News" concert car.

Listening-in in the Far North.

Anxiety regarding the safety of the Merton College Arctic Expedition which was experienced following the breakdown of the wireless communication aboard the little ship *Teringen*, has been relieved by the receipt by the Central News of a lengthy message from Mr. F. G. Binney, the leader of the expedition. Reporting "All well," he sends a stirring story of the party's adventures while exploring the ice-capped islands of North East Land and Spitzbergen. The following is one of the most interesting passages in Mr. Binney's message :—

"Last week (undated) we had a real treat. After the day's work we 'listened-in' on the wireless, and to our intense joy, here amid the eternal ice and snow, were able to hear a British broadcast station operating. We could scarcely believe our ears when, through the head-pieces, we heard an English voice speaking, and then followed a few news items, and musical selections. Of course, at this distance away, the sounds were somewhat faint, but nevertheless reasonably clear and welcome. It brought home nearer. We can claim rightly to be the first explorers in Arctic regions to "listen-in" to news and musical items broadcast from home."

Mr. Binney asks if any of their transmissions have been heard. He thinks "listeners-in" in Scotland should be able to pick them up between 9 and 10 p.m. G.M.T. The call signal is **RRR** and the wavelength 440 metres.

New Greek Wireless Service Proposed.

The Marconi Company has proposed to the Greek Government to instal a private wireless service.

How Wireless might have Prevented a Tragedy.

The tragic death of Mr. Allan Crawford and his party on Wrangel Island, which has recently been announced in the daily press, might easily have been averted had it been possible to equip the party with a portable wireless transmitter, but, as it was, they were completely cut off, and unable to communicate with the outside world.

Eiffel Tower Earthquake Reports.

Those who have listened in recently to the Eiffel Tower Meteorological broadcasts, may have noticed additional code messages relating to earthquake reports. An account of the seismological telegrams was given in *The Wireless World and Radio Review* for May 12th, 1923, p. 189, in one of Mr. W. G. W. Mitchell's contributions.

The Broadcasting Report and the New Regulations.

It is reported on good authority that it is extremely likely that the new regulations to be issued by the Postmaster-General will be published simultaneously with, or at any rate shortly after, the publication of the Broadcasting Committee's report. Perhaps this may be another reason for a postponement of the report itself. At any rate, it is known that the authorities have been in consultation with the officials of the B.B.C. recently, and it is believed that the Company views favourably the terms of the new regulations.

Ediswan Valves.

We are asked to mention that, owing to an error, the price of "Ediswan" type A.R. D.E. valves appeared as 27s. instead of 27s. 6d. in their announcement appearing in the advertisement columns of our issue of September 5th.

Nineteen American Amateurs Heard.

Reports of transatlantic reception are again being received, and considering the time of year, the results achieved augur well for the coming winter's experiments. Listening-in on the early morning of September 2nd, Mr. W. R. Burne **(2 KW)** of Manchester, heard no fewer than nineteen different American amateur stations, the most distant being **4 DL** at West Palm Beach, Florida. Mr. Burne was handicapped by very bad atmospherics, but hardly any fading was noticeable, and the strength of the signals varied round about R.7.

In addition to this report, several further reports have been received recently of the reception of **WGY**, the General Electric Broadcasting Station at New York.

Mr. H. Constable, of Shepherd's Bush, reports reception between 5.23 and 5.44 on the morning of September 1st. One H.F. and detector valve were used, and with the addition of two L.F. valves, the transmission could be heard in a loud speaker at a distance of 10 yards.

Mr. H. C. Broxup, of Croydon, reports reception on August 29th, at 5.15 a.m. until 5.45, the apparatus used being one detector and one L.F. valve.

Misuse of "SOS" Signal.

A serious problem has arisen in the shipping world owing to the unjustified use of the wireless SOS distress signal by many vessels. The Post Office and the Board of Trade, assisted by Lloyd's, are now considering the question of imposing penalties for such improper use.

Marking Out Jig for Valve Legs.

From Mr. J. O. Nichol, B.Sc., A.M.I.E.E., A.M.I.M.E., of 46, Lancaster Avenue, Fennel Street, Manchester, we have received a photograph which we reproduce, and a description of a very

useful jig for the purpose of marking out the positions of valve legs on ebonite. It is constructed of sheet steel, and should last indefinitely.

Full particulars will be supplied on application to Mr. Nichol.

Radio Transmitters.

In the Large Lecture Hall at King's College, Strand, on Wednesday, September 19th, at 6.30 p.m., a meeting of those amateurs who are interested in the formation of a new Society for the holders of transmitting licences will be held.

It will be recalled that at a previous meeting at the same address, on July 27th, a Committee was appointed to go into the matter of forming a Society, drawing up Constitution, Rules for Membership, etc. This Committee has now completed its task, and will report to prospective members on Wednesday next, when it is hoped their suggestions will be approved, and the Society will in fact come into being.

Those amateurs who gave in their names and addresses on the occasion of the last meeting are being communicated with, and all others who hold transmitting licences and are interested, are cordially invited to attend.

South London League of Radio Societies.

The first meeting of the above will be held at the Greyhound Hotel (Chess Room), Sydenham (near Southern Railway Station, L.B. & S.C. section), on Saturday, September 22nd, at 6.30 p.m. All radio societies are invited to send their two representatives.

Glasgow Wireless Lectures.

In connection with the department of electrical engineering of the Glasgow Technical College, a course of ten lectures on "Wireless Telegraphy and Telephony," is to be given by Prof. G. W. O. Howe, Glasgow University, on Friday evenings, beginning on October 12th. The fee for the course will be ten shillings.

Books and Catalogues Received.

Holeworthy Patents, Ltd. (6, Iddesleigh House, Caxton Street, S.W.1.) A descriptive pamphlet relating to their collapsible Portable Frame Aerial which sells at the price of £3 10s. complete in case.

This frame aerial is a particularly attractive product, and should find favour wherever an easily portable and efficient frame aerial is required.

The Carpax Company, Ltd. (312, Deansgate, Manchester. A descriptive leaflet of the Home-charger for battery charging. We note that the price is now reduced to £7 10s.

C. S. Dunban (234-236, Brixton Hill, S.W.2.) New Season's Catalogue of valve apparatus.

Sterling Telephone and Electric Co., Ltd. (210-212, Tottenham Court Road, W.1.) Radio headphones and handphones.

Burndept, Ltd. (Aldine House, Bedford Street, W.C.2.) "The Student's Set of Wireless Receiving Apparatus," instructions and diagrams, price 6d.

This booklet describes a new product, consisting of a variety of useful component parts neatly mounted up on a panel so that the components can be wired up to any required circuit for experimental and demonstration purposes. The arrangement is specially designed for use in schools, and it is stated that the idea is due to the initiative of Mr. R. J. Hibberd, the original organiser, and Secretary of the Schools Radio Society of Great Britain.

A description is given of a number of the very many circuits to which the apparatus can be adapted.

Autoveyers, Ltd. (84, Victoria Street, S.W.1.) A revised leaflet describing their three-electrode Variable Condenser, with a suggested method of application to receiving circuits.

FORTHCOMING EVENTS.

WEDNESDAY, SEPTEMBER 19th.

Meeting of Radio Transmitters. 6.30 p.m. at Large Lecture Hall, King's College, Strand.

THURSDAY, SEPTEMBER 20th.

Radio Society of Great Britain. Informal Meeting, 6 p.m., at the Institution of Electrical Engineers. Discussion on "Short Wavelength Transmission."

Hackney and District Radio Society. At the Y.M.C.A., Mare Street. Lecture: "The Skinderviken Microphone Button and its Uses." By Mr. J. Skinderviken.

Ilford and District Radio Society. Lecture: "Vacuum Tubes." By Mr. A. J. Thompson.

FRIDAY, SEPTEMBER 21st.

Leeds and District Amateur Wireless Society. At 7.30 p.m. Third Annual General Meeting (for Members only).

SATURDAY, SEPTEMBER 22nd.

South London League of Radio Societies. First meeting, 6.30 p.m., at the Greyhound Hotel, Sydenham.

WEDNESDAY, SEPTEMBER 26th.

Radio Society of Great Britain. 6 p.m. At the Institution of Electrical Engineers. Address by the President, Dr. W. H. Eccles, F.R.S., on "Wireless Topics."

Broadcasting Topics.

Radio Auction at 5 IT.

The Birmingham station on September 6th introduced a new wireless event, that of a radio auction.

When **5 IT** moved from Witton to Summer Lane, the erection of a new aerial meant that the Witton aerial became superfluous. During the evening programme the announcer, after the second news bulletin, said so, and invited offers. Five minutes later he announced that a gentleman at Edgbaston had telephoned an offer of £5, and asked for any advance.

When **5 IT** closed down for the evening the aerial had not been sold.

B.B.C. Relay Station for Sheffield.

The opening of the new relay station in Corporation Street, Sheffield, is expected shortly. The new station will link up Sheffield and Manchester by land-line, and it is intended to relay concerts from London and Manchester. Captain Eckersley, the chief engineer of the B.B.C., is in Sheffield, in charge of the relaying experiments.

Correspondents to the Sheffield newspapers indicate a feeling of dissatisfaction that the B.B.C.'s new station there will be a relay station only. The erection of a complete broadcast station is urged.

The British Broadcasting Co.'s New Magazine.

This new magazine which the B.B.C. is putting out (and I am sure that our readers will give it a hearty welcome as it fills a long-felt want), ought to be particularly valuable to the trade. It will print all the programmes of all stations a week ahead so that everyone can see exactly what is happening. The trade will be able to arrange demonstrations on a particular night.

Sir Ernest Rutherford's Address.

Those who listened to the broadcasting of Sir Ernest Rutherford's address at the opening of the British Association's meeting at Liverpool, or who have since acquainted themselves with the nature of the address through the reports published in the daily press, will have had impressed upon them very strongly the importance of knowing something of the fundamental ideas upon which all theory and fact regarding the nature of matter depends. In the study of electricity and wireless telegraphy, one cannot get very far without being first acquainted with the nature of electricity and the electron theory.

Those who made a study of the series of articles entitled "Electrons, Electric Waves, and Wireless Telegraphy," by Dr. J. A. Fleming, F.R.S., which appeared in the last volume of *The Wireless World and Radio Review*, will have realised the benefit to be derived from such a study. This series of articles can now be obtained in book form from The Wireless Press, Ltd., price 7s. 6d., and the book should be of special interest to those new readers who have not obtained a copy of the last volume of this journal.

The Aberdeen Station.

The station of the British Broadcasting Company at Aberdeen is now almost completed, and it may be expected that it will be put into operation well before the end of this month. The location of the station is: The Aberdeen Electrical Engineering Company, Belmont Street, Aberdeen.

Broadcasting

REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS:

GREAT BRITAIN.

LONDON 2 LO, 369 metres; **MANCHESTER, 2 ZY**, 385 metres; **BIRMINGHAM, 5 IT**, 420 metres; **CARDIFF, 5 WA**, 353 metres; **NEWCASTLE, 5 NO**, 400 metres; **GLASGOW, 5 SC**, 415 metres. Regular morning and evening programmes, particulars of which appear in the daily press, are conducted from these stations by the British Broadcasting Company. The usual times of transmission are:—Weekdays, 11.30 a.m. to 12.30 p.m. (**2 LO** only), 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 p.m. (**2 LO** only), 8.30 to 10.30 p.m.

FRANCE.

PARIS (Eiffel Tower), **FL**, 2,600 metres. Daily, 6.40 a.m., Meteorological Forecast; 11.15 p.m., Meteorological Report and Forecast; 2.30 p.m., Financial Bulletin (Paris Bourse); 5.10 p.m., Concert; 6.20 p.m., Meteorological Forecast; 10.15 p.m., Meteorological Report and Forecast. Sundays, 5.10 p.m., Concert and Meteorological Report.

PARIS (**Compagnie Francaise de Radiophonie Emissions "Radiola"**), 1,780 metres. Daily, 11.30 a.m. Exchange News, 11.45 a.m. News and Concert, 3.45 p.m. Commercial Intelligence, 4 p.m. Concert 7.30 p.m. News, 8 p.m. Concert, Tuesday and Friday, 4 to 5 p.m., Dance Music. Thursday and Sunday, 9 to 9.45 p.m., Dance Music.

ECOLE SUPERIEURE des Postes et Telegraphes, 450 metres, Tuesday and Thursday, 7.30 p.m., Concert. Saturday, 5.30 to 6.30 p.m., Concert.

LYONS, YN, 3,100 metres. Weekdays, 9.45 to 10.15 a.m., Gramophone records.

DENMARK.

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

HOLLAND.

THE HAGUE, PCGG, 1,050 metres. Sunday, 2 to 4 p.m., Concert, Monday and Thursday, 7.40 to 8.40 p.m., Concert.

THE HAGUE (**Heussen Laboratory**), **PCUU**, 1,050 metres, Tuesday, 6.45 to 9 p.m., Concert. Sunday, 8.40 to 9.40 a.m., Concert.

THE HAGUE (**Velthuyzen**), **PCKK**, 1,050 metres. Friday, 7.40 to 8.40 p.m. Miscellaneous.

IJMUIDEN, PCMM, 1,050 metres. Saturday, 7.40 to 8.40 p.m., Concert.

AMSTERDAM, PA 5, 1,050 metres. Wednesday, 7.10 to 8.10 p.m., Concert and News.

BELGIUM.

BRUSSELS, BAV, 1,100 metres. Working days, 12 noon, Meteorological Bulletin. Daily, 4.50 p.m., Meteorological Bulletin; Tuesday and Thursday, 9 p.m., Concert. Sunday, 6 p.m., Concert.

GERMANY.

BERLIN (**Koenigswusterhausen**), **LP**, Sunday, 4,000 metres, 10 a.m. to 11 a.m., music and speech; 2,700 metres, 11 a.m. to 12 noon, music and speech; Daily, 4,000 metres, 6 to 7 a.m., 11 a.m. to 12.30 p.m., 4 to 5.30 p.m., Financial and other news.

EBERSWALDE (2,930 metres), Daily, 12 noon to 1 p.m., 7 to 8 p.m. Tuesday and Saturday, 5.30 to 6.30 p.m., Concert.

CZECHO-SLOVAKIA.

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

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

SWITZERLAND.

GENEVA, HB 1 (**Radio Club de Genève**), 1,100 metres. Thursdays, 8.30 to 9.15 p.m., Concert (temporarily suspended).

LAUSANNE, HB 2, 1,100 metres, Tuesdays, Thursdays and Saturdays, 4 p.m., Concert. Monday, Wednesday, Friday and Sunday, 7 p.m., Concert.

Calls Heard.

Braintree, Essex.

2 BS, 2 FQ, 2 MF, 2 OM, 2 SZ, 2 TI, 2 TO, 2 VJ, 2 WJ, 2 ZO, 2 ZV, 5 CP, 5 DB, 5 DK, 5 HY, 5 LP, 5 MA, 5 PU, 5 VD, 5 VR, 6 HD (1 H.F., V.det., 1 L.F.). (L. C. Krailin

Norfolk.

2 AW, 2 CZ, 2 DU, 2 GJ, 2 IQ, 2 LM, 2 LR, 2 LX, 2 NP, 2 O. 2 QH, 2 SZ, 2 VQ, 2 WD, 2 WM, 2 WQ, 2 YP, 2 YR, 2 ZK, 2 Z 5 BW, 5 CP, 5 CK, 5 FU, 5 LP, 5 LT, 5 OW, 5 PU, 5 RI. (C. F. Parke

Brixton, S.W.2.

2 BC, 2 BT, 2 DF, 2 DX, 2 FL, 2 GG, 2 ID, 2 JZ, 2 KQ, 2 KV 2 LG, 2 LZ, 2 MM, 2 NM, 2 OD, 2 OS, 2 OY, 2 QQ, 2 SJ, 2 TO, 2 T 2 VJ, 2 VM, 2 WC, 2 WO, 2 WP, 2 WQ, 2 ZO, 2 ZZ, 5 AC, 5 C 5 DJ, 5 DO, 5 IX, 5 LK, 5 LP, 5 LT, 5 LY, 5 MA, 5 MR, 5 M 5 OS, 5 PD, 5 UD, 5 VJ, 5 VL, 5 VP, 5 XD, 5 XP, 5 XY, 6 I 6 IM, 6 IY, 8 AB, 8 BQ (1 H.F., V. Det.). (A. Richardson)

Co. Durham.

2 AW, 2 GO, 2 GT, 2 JO, 2 KF, 2 LL, 2 MY, 2 NA, 2 ND, 2 PQ 2 TV, 2 UZ, 2 VT, 2 YG, 2 ZT, 5 BA, 5 BH, 5 CU, 5 CX, 5 DA, 5 ID, 5 SZ, 6 GO, 8 AA, 8 AB, 8 AQ, 8 BF, 8 BM, 8 CF, 8 CZ, 8 GS, 0 BQ, 0 DV, 0 SA, 0 YS, 0 XL, WJY (V. det., 2 L.F.). (S. Stephenson).

Ascot, Berks.

2 BT, 2 DX, 2 JO, 2 KT, 2 KV, 2 LW, 2 NM, 2 OJ, 2 OM, 2 ON, 2 OS, 2 PR, 2 QQ, 2 SI, 2 SM, 2 SQ, 2 SX, 2 SZ, 2 TQ, 2 UV, 2 VN, 2 XI, 2 YM, 2 YX, 2 ZZ, 5 CP, 5 HY, 5 PX, 5 XC, 5 XY (all above on V det.). **2 BV, 2 BZ, 2 CQ, 2 DT, 2 GG, 2 JL, 2 KS, 2 QL, 2 QM, 2 SH, 2 ST, 2 VR, 2 VT, 2 WJ, 2 WW, 2 XB, 2 XH, 2 XL, 2 XO, 2 XR, 2 XZ, 2 YM, 2 ZO, 5 BW, 5 GP, 5 IS, 5 LP, 5 OP, 5 PU, 5 VD, 5 VI, 5 VM, 5 XR, 6 IM, 6 OD** (1 H.F., V. det., 1 L.F.). (F. Charman).

Finchley, N.3.

2 AQ, 2 BZ, 2 CB, 2 DY, 2 ID, 2 KF, 2 KV, 2 KZ, 2 MF, 2 MK, 2 MQ, 2 NP, 2 OM, 2 PA, 2 PX, 2 QQ, 2 QW, 2 SC, 2 SJ, 2 SX, 2 SZ, 2 TO, 2 TQ, 2 TV, 2 UD, 2 UI, 2 UV, 2 VJ, 2 VN, 2 VW, 2 VZ, 2 WJ, 2 XB, 2 XL, 2 XR, 2 XZ, 2 YR, 2 ZO, 5 AR, 5 BT, 5 BW, 5 CB, 5 CD, 5 DB, 5 DK, 5 GP, 5 HJ, 5 HT, 5 HY, 5 IO, 5 IS, 5 IX, 5 KS, 5 LF, 5 LM, 5 LP, 5 MA, 5 OA, 5 OB, 5 OX, 5 OY, 5 PD, 5 PU, 5 QM, 5 SU, 5 TA, 5 UN, 5 UO, 5 VD, 5 VL, 5 VM, 5 VP, 5 VR, 5 VU, 5 VX, 5 XD, 5 YS, 5 YX, 5 ZJ, 6 AP, 6 BD, 6 BX, 6 HD, 6 HJ, 6 IM, 6 KI (V. det., 1 L.F., sometimes 1 H.F., V. det.). (A. C. Grimes).

Thurnby, Leicester.

2 BZ, 2 CZ, 2 DU, 2 FN, 2 HA, 2 HF, 2 HS, 2 IQ, 2 LX, 2 MB, 2 NP, 2 NV, 2 OK, 2 OM, 2 OX, 2 OY, 2 PK (?), **2 SC, 2 SZ, 2 TN, 2 TO, 2 TV, 2 TX** (?), **2 WD, 2 YC, 2 YV, 2 ZZ, 5 CC, 5 CK, 5 KM, 5 KO, 5 KY, 5 LO** (?), **5 LP, 5 PU, 5 RI, 5 RR, 5 VR, 6 MJ.** (T. E. Forsell).

Wallasey.

2 AG, 2 AN, 2 CI, 2 FQ, 2 FZ, 2 FQ, 2 IN, 2 JF, 2 TP, 2 VF, 2 WK, 2 ZK, 5 AD, 5 AJ, 5 AY, 5 BF, 5 CT, 5 DC, 5 FG, 5 FO, 5 HA, 5 IF, 5 LC, 5 LH, 5 ML, 5 NN, 5 NX, 5 OT, 5 OW, 5 PR, 5 RT, 5 SS, 5 UQ, 5 VI, 5 XI, 6 NI, 6 NL (1 H.F., V. det., 1 L.F.). (S. Higson).

Lancaster.

2 AK, 2 II, 2 IJ, 2 IN, 2 IW (?), **2 NY, 2 PO, 2 PP, 2 TR, 2 VF, 2 ZK, 5 DC, 5 LB, 5 OW, 5 OY, 6 KT, 6 NI.** (G. E. Hebden, **6 OD**).

Norbury, Surrey.

2 AD, 2 AV, 2 AW, 2 AZ, 2 FL, 2 HC, 2 HF, 2 HX, 2 IF, 2 IJ, 2 IL, 2 JF, 2 JZ, 2 KO, 2 LZ, 2 MS, 2 NA, 2 NP, 2 OD, 2 OS, 2 PC, 2 RB, 2 TV, 2 WD, 5 CO, 5 CX, 5 DK (?), **5 HZ, 5 KO, 8 AV, 8 AW** (?), **8 BF, 8 BM, 8 BV, 8 FP** (?), **8 ZZ** (?), **0 MX, WOR** (V. det., 1 L.F.). (G. E. Hitchcock).

Denmark.

2 AO, 2 DF, 2 HF, 2 JF, 2 KF, 2 NA, 2 NM, 2 OD, 2 OM, 2 TB 5 GS, 5 KO, 8 BM, 8 BV. (Steffensen).

QUESTIONS AND ANSWERS

"D.S." (East Sheen, S.W.14) *submits a diagram of a three-valve receiver employing either crystal or valve rectification. He asks (1) Is the diagram correct. (2) Is a purer tone obtainable by using crystal rectification during the reception of music. (3) Will the proposed switching arrangements affect the efficiency of the receiver.*

(1) The diagram is correct. (2) Crystal rectification is generally considered to give purer reproduction than valve rectification. (3) The switching arrangements will slightly affect the efficiency of the receiver.

"T.A.L.D." (Woking) *asks (1) Will we give a diagram of a two-valve receiver employing one H.F., and detector valves. A H.F. transformer is to be employed, with a reaction coil coupled to it. A switch for cutting out the H.F. valve is to be included.*

The diagram is given in Fig. 1.

"FLY" (Teddington) *asks, will we give a diagram of a three-valve receiver employing one H.F., detector, and one L.F. valves. Plug-in type H.F. transformers are to be used, and switches are required for cutting out the H.F. and L.F. valves. It is desired to employ reaction, coupling with the closed circuit inductance.*

The diagram is given in Fig. 2.

"A.H.P." (Redhill) *submits a diagram of a three-valve receiver, and asks (1) Is the diagram correct. (2) Is the proposed method of double magnification correct as indicated by a diagram submitted.*

(1) and (2) The diagrams are not correct. We would refer you to the diagrams given in the articles on double magnification, in the issues of May 12th and 19th.

"E.R.M." (Manchester) *asks for a diagram of the double magnification receiver shown in Fig. 10, page 213, of the issue of May 19th, with the transformer H.F. coupling replaced by tuned anode.*

We do not recommend "tuned anode" coupling in a receiver of this description.

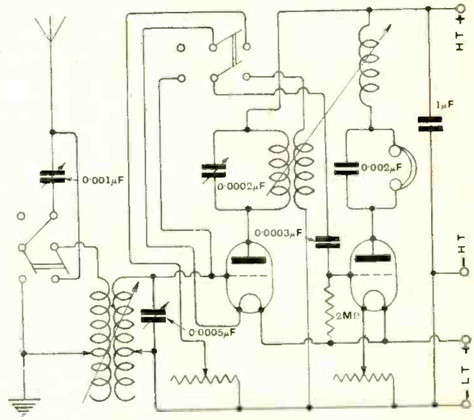


Fig. 1. **"T.A.L.D." (Woking).** *Diagram of receiver with aerial and closed circuits, one stage of H.F. transformer coupled amplification, with reaction to the transformer. The switch is joined to switch the H.F. valve circuit.*

"G.M.D." (Whitby Bay) *asks (1) Will we give a diagram of a receiver, including the Reinartz tuner, and having one H.F., detector, and one L.F.*

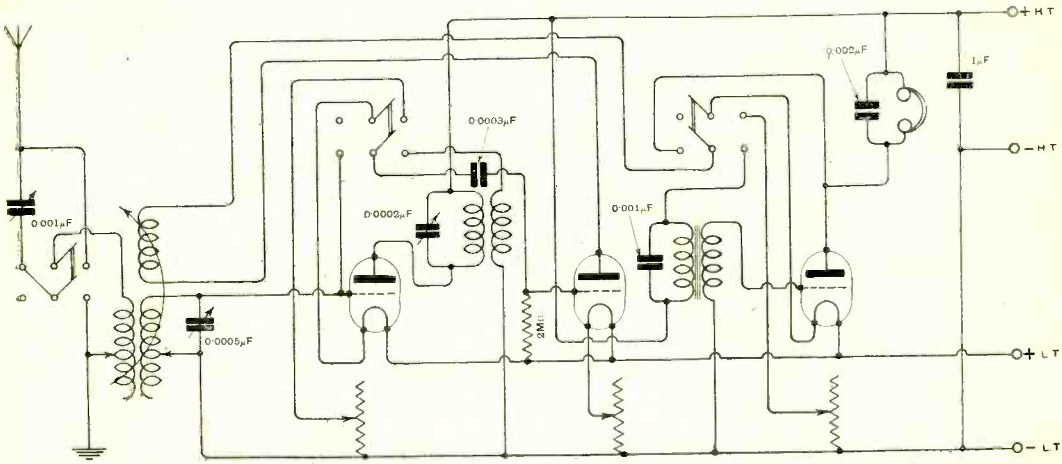


Fig. 2. **"Fly" (Teddington).** *This receiver has an aerial and closed circuits, with the reaction coil coupled to the closed circuit coil. The first valve operates as a H.F. transformer coupled amplifier and may be switched in or out. The second is the rectifier, and the third may be switched in as a note magnifier.*

valves. (2) *What are suitable windings for the tuner, to cover a wavelength range of 250-440 metres.*

(1) Circuit No. 66 of "The Amateurs' Book of Wireless Circuits" shows a Reinartz circuit with one stage of amplification. L.F. amplifying valves may be added in the usual way, the telephones being replaced by the primary of the first intervalve transformer. (2) The inductances may be wound with No. 22 D.C.C. wire on formers 2¾″ in diameter, and should have the following windings. The portion of the inductance between grid and filament should contain 40 turns, with tappings taken at every five turns. Between filament and aerial tap, ten turns are included. each of which is tapped. The lower inductance may consist of 30 turns tapped at every ten turns.

"T.W." (Oughtrington) *gives details of unusual variations in results experienced with a three-valve receiver. He asks for an explanation.*

It is probable that some alteration to the aerial or earth arrangements has taken place, which has slightly altered the capacity of the aerial circuit, thereby necessitating slight adjustments to the tuning arrangements.

"A.H.H." (Stoke Newington) *submits two diagrams of a crystal receiver, with which he has obtained satisfactory reception from the London broadcasting station, without an aerial. He asks* (1) *For an explanation of the results obtained.* (2) *For suitable windings of a variometer rotor.* (3) *Should the unused portion of the stator winding be switched out of circuit.*

(1) A receiver constructed from the simplest components will give satisfactory reception when used at such a short distance from a powerful broadcasting station. (2) The rotor winding may consist of 40 turns of the same gauge of wire as used on the stator. (3) A switch provided for cutting out the unused portion of the stator winding will be an advantage.

"C.F.W." (Hammersmith) *asks with reference to the diagram given in reply to* **"DUAL" (Durham)** *in the issue of June 16th, will we repeat this diagram, showing one valve as a double magnifier, and valve detector.*

The diagram is given in Fig. 3.

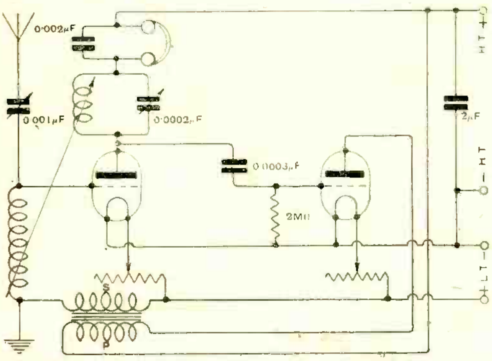


Fig. 3. **"C.F.W." (Hammersmith).** *The first valve operates as a double amplifier, and the second as a rectifier.*

"R.C.W." (New Eltham, S.E.9) *describ[es] his receiver, and asks* (1) *What is a suitable ty[pe] of anti-capacity valve for use in the receiver.* (*Having regard to the purer quality of the recepti[on] obtainable when a crystal is used as rectifier, compared with a valve, do we consider the differen[ce] justifies the addition of a L.F. valve to obtain th[e] same volume of sound.*

(1) The V.24 type valve will be suitable. (2) Yes, although a certain amount of the purity ma[y] be lost in L.F. amplification.

"M.B." (Guy's) *asks* (1) *With reference t[o] the article describing a four-valve detector amplifie[r] in the issue of March 24th,* 1923, *would the additio[n] of a potentiometer to control the grids of the H.F. valv[es] reduce the tendency to oscillate.* (2) *Why is it tha[t] oscillation commences as soon as a station is sharpl[y] tuned.* (3) *Which are suitable types of transformer[s] and valves to use in the power amplifier describe[d] in the issue of May 26th,* 1923. (4) *Will "Ora" type valves be satisfactory for use as H.F. and detector valves.*

(1) The suggested addition will be an improvement. (2) When the tuned circuits of the receiver are in resonance the tendency to oscillate is greatest. (3) The type of transformer mentioned will be quite suitable. We suggest you use "L.S.3" type valves. (4) The valves will be satisfactory when used as suggested.

"T.B.H." (Erith) *asks for values of the components shown in the diagram given in reply to* **"DUAL" (Durham)** *in the issue of June 16th,* 1923.

We would refer you to the issues of this journal of May 12th and 19th, 1923, for full information on the most suitable values of the components given in the double magnification circuit mentioned.

"P.W.T." (Lancs.) *asks for a diagram showing how a certain type of switch may be used in a four-valve receiver to give various combinations of valves.*

The type of switch mentioned cannot be employed for the switching arrangements required.

"P.T." (Norway) *asks* (1) *and* (2) *What are suitable sizes of coils for use in a tuner to cover a wavelength range of from* 300 *to* 15,000 *metres.*

(1) and (2) We suggest that you wind a set of honeycomb plug-in type coils, using No. 26 D.C.C. wire and formers 1½″ in diameter. The first coil should have 50 turns, and each subsequent one an additional 50 turns up to 300, when the number of turns should increase by 100 turns each until the last coil of 1,000 turns is reached. A 0·001 μF variable condenser should be used in conjunction with a series-parallel switch to tune the aerial circuit, and a 0·0005 μF variable condenser in parallel with the secondary coil.

"H.R." (Sheffield) *submits details of a four-valve receiver, comprising one H.F., detector and two L.F. valves. He asks* (1) *Is the type of H.F. coupling employed known as the tuned anode method.* (2) *Why is it that satisfactory reception of British broadcast transmissions is only obtained from the local station.* (3) *Which are suitable sizes of honeycomb plug-in type coils to use for reception* *m the other British broadcast stations.* (4) *Is y improvement advisable in the method of H.F. upling.*

(1) The H.F. coupling described is that known as e tuned anode. (2) and (3) Using the same tuning ils with which reception from the Manchester ation is obtained, it will be possible for you to ceive from the other British broadcast stations ith slight adjustments to the tuner, provided that e receiver and aerial and earth arrangements re in good order. (4) From the description given e do not think that any alteration is necessary n the receiver itself. Look carefully over the aerial nd earth arrangements.

"B.O.P." (Highgate, N.6) *asks for a diagram of a double magnification receiver, employing one valve operating as high and low frequency amplifier with crystal rectification.*

We would refer you to Fig. 5, page 166 of the issue of May 12th, 1923.

what is the coil between the telephones and detector valve plate, and how many such coils are required. (2) *For particulars that will enable him to construct a* 0·002 *μF fixed condenser.* (3) *Is* 3/12 *electric light cable suitable for wiring under the panel of the receiver referred to.* (4) *If a certain varnish used in dynamo manufacture will be suitable for coating the coils of the receiver.*

(1) The coil referred to is the reaction coil. Full details are given for its construction in the articles describing this receiver. (2) We would refer you to the article on the construction of condensers in the issue of June 9th, 1923. (3) The wire is not suitable. Use No. 18 copper wire. The varnish is probably suitable.

"G.M." (Brussels) *submits a diagram of a two-valve receiver, one H.F., and detector valves, with resistance capacity H.F. coupling. He asks* (1) *Will we give a diagram of this receiver with the tuned anode method of H.F. coupling.* (2) *How is it*

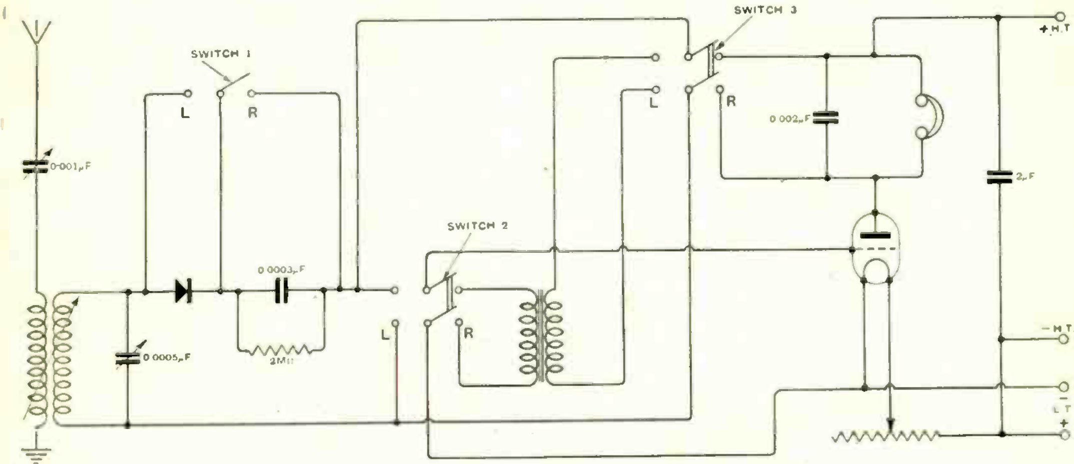


Fig. 4. **"D.C.S." (Birmingham).** *Crystal and valve receiver with switches to use combinations of valve and crystal.*

"J.A.B." (Manor Park, E.12) *submits a diagram of a crystal receiver, and asks how is it possible to add one valve to this receiver, to operate as a high and low frequency amplifier.*

We would refer you to Fig. 5, page 166, of the issue of May 12th, 1923.

"D.C.S." (Birmingham) *asks* (1) *For a diagram of a receiver comprising a crystal and one valve, with switches arranged to give the following circuits: crystal alone; valve detector alone; crystal as detector and valve as L.F. amplifier.* (2) *Will a D.E.R. type valve be satisfactory for use in this receiver.*

(1) The diagram is given in Fig. 4. Switching will be effected as follows: For crystal alone: switch (1) to right, 2 out, 3 to right. For valve detector: switch 1 to left, 2 to left, 3 out. For crystal rectifier with L.F. amplifier: switch 1 to right, 2 to right, 3 to left.

"PANEL" (Carlisle) *asks* (1) *With reference to the two-valve receiver described in* "Conquest," *possible to add coils to the Reinartz tuner described in the issue of February 3rd, 1923, in order to receive on a wavelength to 2,600 metres.*

(1) We would refer you to the diagram given on page 462 of the issue of July 7th, 1923. (2) We suggest that you wind a number of basket coils of 80 turns each, using No. 26 D.C.C. wire, and formers which give a commencing diameter of 2 in. Two or three of these coils will be required in series for the A.T.I.

"E.S." (Leominster) *asks for diagrams of tuning H.F. and L.F. units suitable for coupling to the detector unit as shown in sketch submitted.*

A suitable tuning arrangement is shown in circuit No. 30 and H.F. and L.F. panels are given in circuit No. 51 of "The Amateurs' Book of Wireless Circuits."

"A.V.D." (New Barnet) *asks* (1) *For criticism of a diagram submitted.* (2) *How may self-oscillation be prevented.* (3) *Which of two types of switch* *described do we recommend for use as stand-by, tune, and series-parallel switches.* (4) *Our opinion on certain results obtained in the reception of broadcast transmissions with a crystal receiver.*

(1) The diagram is not correct. In Fig. 5 is given the correct diagram of this receiver. (2) Try a smaller reaction coil and use a potentiometer to control the grid potential of the H.F. and detector valves. (3) Either type of switch mentioned will be satisfactory. (4) The results are very good.

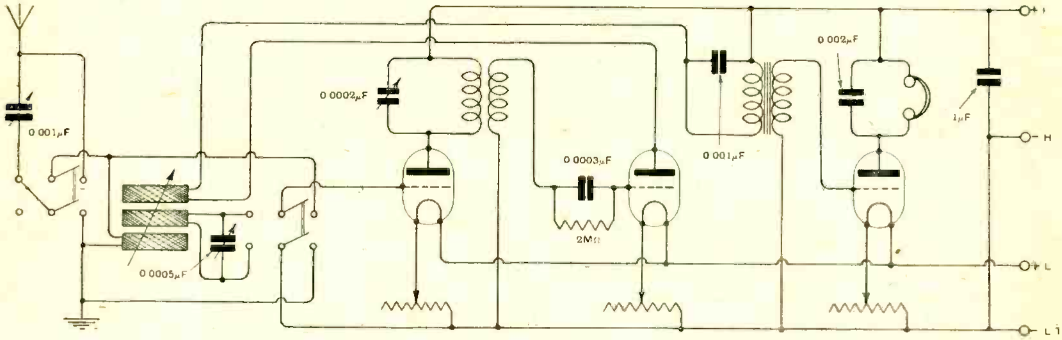


Fig. 5. **"A.V.D." (New Barnet).** *Receiver with one H.F., rectifier and one L.F. The switch is used to connect either the aerial or closed circuits to the first valve.*

"A.V.R." (Hampshire) *asks* (1) *For diagrams of the 1½ k.W. ship's set.* (2) *For equations indicating the chemical reactions in an accumulator.*

(1) We would refer you to the handbook "The 1½ k.W. Ship's Set," by H. E. Penrose, 1s. 5d. post free from the mail order department of this journal. (2) The chemical processes taking place in the lead storage battery are, as yet, not completely understood. The following equations, however, are a close approximation to the truth :—

Charging :

Positive plate : $PbSO_4 + SO_4 + 2H_2O + aq. = PbO_2 + 2H_2SO_4 + aq.$

Negative plate : $PbSO_4 + H_2 + aq. = Pb + H_2SO_4 + aq.$

Discharging :

Positive plate : $PbO_2\ H_2SO_4 + H_2 + aq. = PbSO_4 + 2H_2O + aq.$

Negative plate : $Pb + H_2SO_4 + O + aq. = PbSO_4 + H_2O + aq.$

"E.F.C." (Chiswick, W.4) *asks* (1) *How may the magnets of a pair of telephone receivers be remagnetised.* (2) *What increase in signal strength will be obtained by using a double-wire aerial instead of a single wire.* (3) *What are suitable windings for a variometer.*

(1) We would advise you not to attempt this work yourself. Send the magnets to a reliable firm, specialising in this class of work. (2) Very little increase in signal strength will be noticeable. (3) To cover the broadcast band of wavelengths both rotor and stator may be wound with 25 turns of No. 26 D.C.C. wire.

"H.T." (Stockwell, S.W.9) *asks* (1) *W[...] any appreciable loss in efficiency be caused if plu[...] and jacks are employed for switches in L.F. circu[...] in place of the change-over type.* (2) *Do valv[...] which have had their filaments renewed, work sati[...]factorily afterwards.* (3) *What is the name an[...] address of a firm who will undertake this work.*

(1) The plugs and jacks will be quite satisfactory. (2) We believe that the valves give satisfactory service when the filaments have been renewed. (3) The names of firms undertaking this work are to be found from time to time in the advertisement columns of this journal.

NOTE.—*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—*(1) *Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor,* **The Wireless World and Radio Review, 12/13,** *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

THE

WIRELESS WORLD

AND RADIO REVIEW

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

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ABOUT THOSE AERIALS

PROBABLY every new development in civilisation, in its early stages, has to comba unintelligent and absurd opposition from some sources. There is again a sectior of the community which is always on the look out for an opportunity to take advantage of any new developments to benefit themselves financially at the expense of others. Most certainly, wireless is no exception to this rule. In the days before broadcasting and the boom in the popularity of wireless, no one ever thought of seeking a landlord's permission before installing wireless, nor, to the best of our knowledge, did landlords ever raise objection when they learnt that an installation had been put up. There was then as now, of course, the necessity, when putting up an aerial, to have due regard to the structure of the premises on which it was erected, and any damage done would, of course, have to be made good at the expense of the tenant who put up the aerial ; that is a matter which applies in the case of any fixture to a building if damage should ensue.

This new attitude of landlords and property owners generally towards wireless has only arisen since the subject became so popular, but now one hears complaints on all sides of persons who, in some cases, are prohibited from erecting aerials, and in others are charged a sum which is out of all proportion to the risk of damage, particularly when it is remembered that any damage must be put right by the tenant.

It is difficult to understand by what right a landlord can refuse permission to a tenant to instal wireless, provided that every precaution is taken that the structure of the building shall not be damaged. In our opinion the tenant is not enjoying the full rights of tenancy if such permission is withheld.

Again, no one ever hears of a landlord refusing permission to the tenant to have the telephone fixed, and the landlord is never asked in such cases, yet what risks there are in connection with the erection of a wireless aerial apply equally well in the case of the installation of the telephone, and undoubtedly it often happens that the side pull to a chimney stack on which telephone wires are fixed, would be considerably in excess of any such strain put on to the structure in erecting a small aerial.

Just recently we have had brought to our notice cases where as much as a guinea is charged annually for permission to put up an aerial, and when one considers that this is far in excess of the licence paid to the Post Office, out of which a contribution goes to the Broadcasting Company, it seems altogether absurd.

To the best of our knowledge, no one who has been refused permission or who has been exorbitantly charged for it, has yet gone so far as to seek legal protection in the matter, but we would very much like to hear from any readers who know of such a case having been brought to the Courts. We would also like to hear from readers in any cases where permission has been definitely refused, or where an unreasonable charge has been made. When one speaks of " an unreasonable charge " we mean to convey that, in our opinion, a very small fee would not be unreasonable, but that such a fee should be uniform, as far as possible, throughout the country. This would put an immediate stop to the practice which now appears to be indulged in, of taking advantage of the development of wireless and its increased popularity for a further charge to be made against the tenant, who is already sufficiently burdened with enhanced rent.

We do not advocate that masts and aerials should be erected without any consideration of the landlord's property ; on the contrary, the landlord has no doubt every right to inspect and see that the work of installing an aerial has been satisfactorily carried out, and the tenant is still responsible for any damage which may result, and should therefore take steps to ensure himself against such eventualities.

Another point which, perhaps, may be overlooked by the tenant is that, in all probability, the law would decide that a mast or aerial, once permanently attached to a building or mast erected on a piece of rented land, would, as a fixture, become the property of the landlord in the event of the tenant discontinuing his occupation of the premises.

CARD HONEYCOMBS.

By Frank H. Hayes.

MOST amateurs, whose pockets will not allow the purchase of honeycomb and other low capacity coils, will have endeavoured to wind coils by hand on formers with radiating spokes, and will probably have found some disadvantages in this method. The windings are difficult to keep neat and even when the larger coils are reached, on account of the greater distance between the spokes as the diameter of the coil increases, and because the two rows of spokes have a tendency to pull in towards one another. Also, unless proper coil plugs are used, mounting presents some difficulty.

For the coils I am about to describe, I do not make any claim to electrical superiority over the ordinary honeycomb coils, but they will be found to be more compact, and, in the winding and mounting, they do not present the difficulties mentioned above. Their capacity is somewhat higher than that of honeycombs, but in this respect they are greatly superior to slabs and solenoids. One point very much in their favour is the fact that formers are ready to hand, since cardboard and some adhesive are the only materials required for their construction.

Each former consists of a number of circular cards with slots cut radially, dividing them up into an odd number of equal sections exactly as for the flat basket coils, now so popular. The number of cards in each former depends upon the number of turns of wire per layer required, and, incidentally, the number of slots in each card depends upon the number of cards used. Thus, coils can be wound, having equal diameters but different natural wavelengths, simply by varying the number of cards in constructing the different formers; this will be found to be of some advantage where space has to be considered.

The means by which the number of cards (and slots per card) is arrived at, is quite simple. First, decide the number of turns required in the finished coil, and a convenient number of layers, and divide the first number by the second, the result (obviously the number of turns per layer), halved will give the number of cards required. Now, the number of slots per card equals the number of cards multiplied by 2 or 4, plus, or minus 1, or more simply—

$$\text{slots} = \text{cards} \times 2 \text{ (or 4)} \pm 1.$$

For example, a coil of 120 turns total with 12 layers gives 10 turns per layer, *i.e.*, five cards, so the number of slots per card

$$= 5 \times 2 \pm 1 = 11 \text{ or } 9.$$
$$\text{or } 5 \times 4 \pm 1 = 21 \text{ or } 19.$$

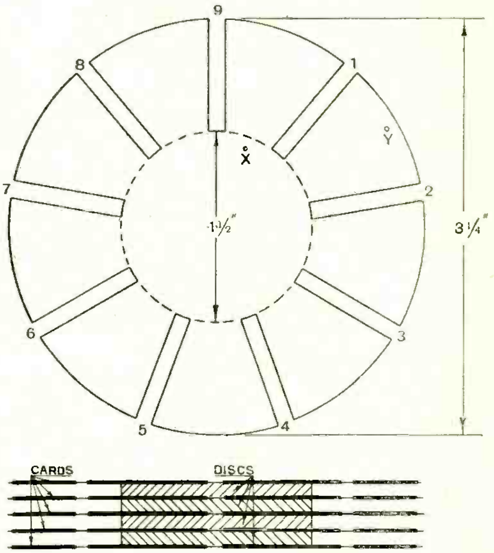


Fig. 1. The upper figure gives the dimensions for the cards. The lower figure shows the cards and cardboard separators assembled.

Any even number may of course be substituted for the 2 or 4, but these are sufficient for all practical purposes, since a larger figure will make the slots too numerous to allow the cards to be cut without danger of breakage.

The method of cutting the cards is too well known to require repetition here, but a drawing is given (Fig. 1) showing a convenient size of card. All cards must be cut as accurately as possible, and all exactly alike. A good plan is to draw the card shape on paper, and then prick through the paper at every point on to the card; this will ensure all cards being alike. If thin cards are used, such as post cards, it is possible to cut through four at once with a sharp knife, whilst keeping the cards pressed down on a sheet of glass.

Having cut the required number of cards, next cut from thicker card, which should be *at least* three or four times the thickness of a post card, a number of plain discs slightly less in diameter than the clear space in the centre of the slotted cards. You will require one disc less than the number of cards. Now glue the discs and cards altogether in the following manner :—Lay one card flat and stick one of the discs exactly in the centre of the card ; glue the upper side of the disc and lay a second card exactly over the first, taking care that the slits in the two cards exactly coincide. Proceed in this manner taking a disc and a card alternately until the last card is reached. Fig. 1 shows the elevation of a five-card former, the dark lines representing the cards, and the shaded portion the thicker discs separating them. When the whole is firmly stuck together the former is ready for winding.

Double cotton covered wire is to be recommended for these coils, as this covering gives slightly more space between crossing wires than does silk.

Start as for simple basket coils by drilling a hole through the former in the centre space near one of the slots, and passing the end of the wire through and bending back

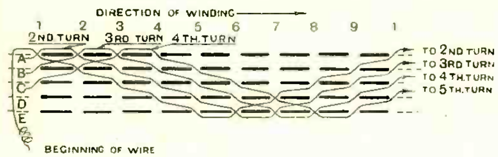
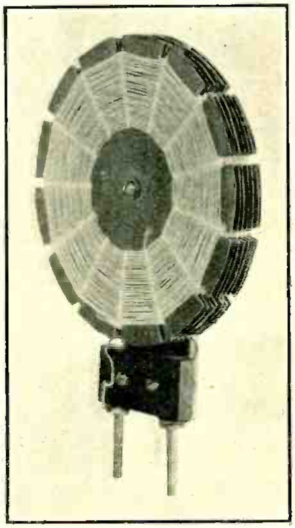


Fig. 2. The method of winding is clearly shown in this figure.

to keep secure. The method of winding is best seen from the diagram (Fig. 2), which shows a former made up of five cards, each having nine slots. For simplicity an edge-on view is given, as if the perimeter were cut through at one of the slots and spread out to show the whole of it at once. The slots are numbered from 1 to 9, and the cards are lettered from A to E. The wire is passed through the former at X (Fig. 1) to secure the end, and then brought back through slot 1 of card A, slot 2 of card B, slot 3 of card C, and so on until slot 5 of card E is reached ; it is now passed outside one section of card E and returned back through 6E, 7D, 8C, 9B, and 1A ; this will complete one turn. The second turn passes through 2A, 3B, 4C, 5D, 6E, 7E, 8D, 9C 1B, and so on. At the end of the tenth turn the first layer will be complete, and the subsequent layers, of course, follow the same path as the first. The wire should be kept



The photograph shows a completed coil with mounting. The coil is compact and strong, and quite pleasing in appearance.

quite taut during winding, and the coil can be finished off by passing the wire through all the cards at a point near the edge (see Y, Fig. 1). The completed coil will be compact and neat, and really needs nothing to hold it together, but a thin coating of shellac on the outside and edges will prevent the cotton covering from absorbing dampness.

It will be seen that for mounting, similar methods as for flat basket coils may be employed, and one excellent method was shown in *The Wireless World and Radio Review*, No. 208, page 628.

The winding of these coils may, perhaps, appear rather formidable from the foregoing description, but my own experience is that they are more quickly wound than ordinary honeycombs. A little patience is required in the cutting of a number of cards, but I think that the experimenter will feel amply repaid by the compactness and neat appearance of the finished coils, for any little trouble he may take in their construction.

AN EFFICIENT INDUCTANCE.

By DARTREY LEWIS, M.Met.

THE true wireless experimenter is more concerned with devising new circuits and trying them out than with constructing a piece of wireless furniture. It is often a great saving of time to him to mount his component parts on the top of a board rather than inside a box. If each component is arranged so that it can be screwed down to a base board and provided with terminals or some simple means of making connection to it, the same units may be used for the construction of an endless variety of circuits, and the time taken to set up any particular circuit is reduced to a minimum.

The inductance illustrated in the accompanying photograph has been constructed for use in this way. In its design the following points have been kept in view :

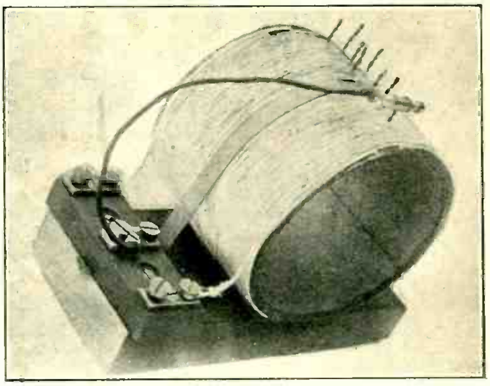
(1) Maximum efficiency (*i.e.*, low resistance, low self-capacity, and high insulation).

(2) Ease, speed, and low cost of production.

The coil, which is wound with 22 S.W.G. D.C.C. enamelled wire, on a 3 in. cardboard tube, is held in position on a deal base 5 in. by 2½ in. by ¾ in. by a thin red fibre strap. Connection is made to the coil by means of brass strips, ¾ in. by 5/16 in. by 3/32 in., provided with two 4 BA studs. These are ex-Government stores, and were bought for 2s. per gross. Three of them are secured to an ebonite strip, 2½ in. by ⅞ in. by ⅜ in., by means of wood screws screwed into holes a little smaller than the overall diameter of the screw. The ebonite strip is fixed to one end of the deal base, and also serves to secure one end of the fibre strap, the other end of which is secured by means of a wood screw and washer. The coil is separated from the base by a narrow strip of empire cloth.

Having made the coil holder, it is only a few minutes' work to release the fibre strap, remove the coil, and replace it by another of different wavelength range.

If desired, tappings may be taken from the coil by making twisted loops the required number of turns apart during winding. These loops are made by baring the wire of insulation for about 1 in. by means of a small doubled piece of *coarse* sand paper. This easily cuts away the cotton covering and removes the enamel. A twisted loop is made of the wire thus bared, and care taken that the bare wire does not come in contact with the cardboard. If the bottom of the twisted loop is pressed into line with the rest of the wire with a pair of pliers no bulge in the regularity of the winding is produced. Connection may be made from any tapping point to the third brass strip by means of a



An inductance made to the design given. The illustration shows the method of fixing the coil.

short length of flexible wire attached to a small brass terminal, which is made from 3/16 in. brass rod. Its axis is drilled and tapped at one end to take an 8 BA screw, and the flexible wire is soldered into the other end. At right angles to this hole another small hole is drilled to accommodate the twisted loop, which is securely held in position by screwing up the 8 BA stud.

The use of D.C.C. *enamel* wire for winding is very strongly recommended, because enamel is an extremely efficient insulator, and, being waterproof, it is unnecessary to shellac or wax either the winding or the former. Besides saving time, this materially reduces the self-capacity of the coil, and thus increases its wavelength range. The D.C.C. covering protects the enamel from abrasion, and at the same time secures ample spacing of the turns, with the consequent reduction in self-capacity. This type of wire can be obtained from any reputable firm of wire manufacturers, and costs about 4s. 6d. per lb.*

For convenience in determining the number of turns required, the following table has been worked out.

Coils Wound with 22 S.W.G. Enamel Wire on a 3 in. Former.

Turns.	Lgth. cms.	Induct. mhys.	Wavelength with parallel condenser of			
			0·0001 mfd.	0·0003 mfd.	0·0005 mfd.	0·001 mfd.
27	3	49	135	225	300	410
36	4	93	185	310	400	560
45	5	136	225	380	490	690
54	6	178	260	430	560	790
63	7	220	290	480	630	880
72	8	260	310	520	690	950
81	9	300	330	560	740	1,020
90	10	340	350	600	780	1,090

The first column gives the number of turns of wire, the third column the inductance of the coil, and the succeeding columns th wavelength with parallel capacities of 0·0001 0·0003, 0·0005 and 0·001 mfds.

When the coil is used in the aerial circui the capacity of the aerial should be added t that of a parallel condenser, or if a serie condenser is used the resultant paralle capacity is given approximately by the formula—

$$C = \frac{C_1 C_2}{C_1 + C_2}$$ where C_1 = Capacity of series condensers in mfds.

and C_2=Capacity of aerial in mfds.

In this connection it should be noted that many cheap variable condensers have capacities much below that advertised, and the actual capacity should be measured or calculated. For instance, a condenser purchased by the writer as 0·0005 mfds. had an actual maximum capacity of 0·0003 mfds.

In conclusion it should be mentioned that the same type of coil holder may be used for longer wavelength coils, which may be wound with finer wire on larger formers, or be of the lattice type.

* Such wire can be obtained from Messrs. P. Ormiston & Sons, 79, Clerkenwell Road, E.C.1.

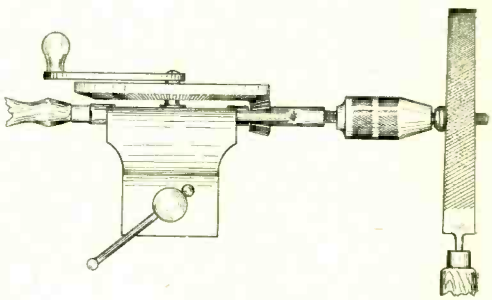
A WORKSHOP TIP.

SIMPLE LATHE WORK WITH A GEARED HAND BRACE.

THOSE experimenters who are not the fortunate possessors of a lathe will find that the workshop tip here illustrated may be employed for a variety of small jobs which might otherwise be difficult to accomplish neatly.

For instance, the tapping out of BA nuts, rubbing down oversize terminal stems, polishing valve legs, terminals, etc., for lacquering, may all be quickly and effectively carried out by this means.

The geared hand brace is clamped horizontally in the vice, and the part to be worked on is gripped in the chuck as shown. The handle is rotated by the left hand, and the tool or emery cloth applied to the work with the right hand.



Some practice may be necessary before one gets accustomed to working with both hands in this manner, but considerable dexterity may quickly be acquired.

J. H. L.

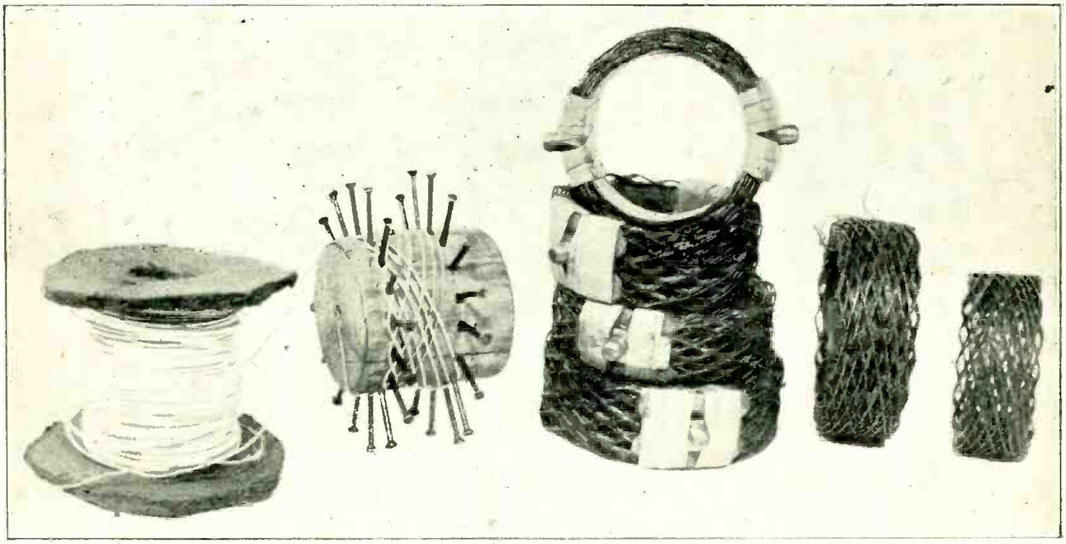
AN EASY METHOD OF WINDING HONEYCOMB COILS.

By R. O. CHALLIS.

IN this article I have endeavoured to describe a cheap, simple and efficient method of winding coils of the honeycomb type.

Most readers know that a "basket" coil is much more efficient than a "slab" or "hank" wound coil, but when high wavelengths are reached, a basket coil becomes too large to be conveniently handled. If fine gauge wire is used the resistance of the coil is increased, which is an undesirable feature. The duolateral coil, however, does not have any such disadvantages, and at the same time still has the same low self-capacity of the basket coil. It can also be made very easily and cheaply by the following method, which does not involve any complicated machine or similar appliance, or the use of tools other than can be found in any home. The appearance of the finished coils can be seen by the photograph, which also shows the materials required.

The former is constructed of wood and is 1½ inches long, and about 1¾ to 2 inches in diameter. A piece of old curtain pole will serve excellently. Mark two lines round the circumference of this cylinder ¾ in. apart, or the desired width of the coil. Cut a piece of paper exactly to the length of the circumference of the wood and fold it in halves to get the length of half the circumference. Fold one of the halves similarly and then fold that half, and so on four times, to get 1/16 part of the circumference. This should have been done very carefully. Mark off distances on the two lines equal to 1/16 of the circumference, so that a mark on one line is in the middle of two on the other line. Having done this, get some French nails about 1½ ins. long, and drill each of the positions marked on the lines a little smaller than the nails, so that they will fit with a little forcing. Fit a nail into each hole.



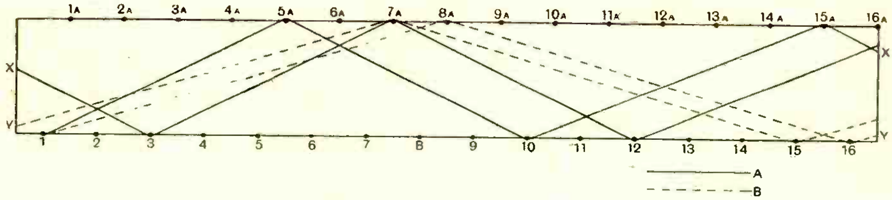
Honeycomb coils wound on the principle described in this article.

Some cardboard tube must now be procured to fit on the former. From this cut some rings just under ¾ in. wide, to fit in between the rows of nails.

This finishes the former except for a small nail or screw in its side to fasten the end of the wire to. One of the cardboard rings should now be placed on the former and the nails replaced. Coils should be wound with double cotton covered wire of about No. 26 gauge. As to the actual winding of the coils, the fewer the nails left between each wave in the wire the fewer will be the turns required to complete one layer and thus there will be a consequent further spacing of wires. For reference we will number the nails from 1 to 16 in one row, and 1a to 16a in the other. The four

to just hold it together. If the coil b shellaced, it is an advantage to have a hol drilled through the middle of the former s that a pencil or similar article may be pu through it and be used as an axle to rotat the whole above a flame to dry it quickly It should afterwards be baked in an oven tc get it perfectly dry before mounting.

The coils may be mounted howevei desired. The writer's are mounted by the gimbal method as can be seen in the photo-



Method of winding the coils.

mounted coils in the photograph are short wave coils, tuning up to about 900 metres, and are wound leaving 10 nails between each wave, *i.e.*, start winding at pin No. 1, cross to pin 5a and finish the wave at pin 10. The two coils on the right of the photograph are wound leaving 16 pins between each wave, *i.e.*, start pin 1, cross to pin 8a and finish the wave at pin 16. The diagrams will make this quite clear. It is difficult to make a good coil having more pins than 18 between each wave.

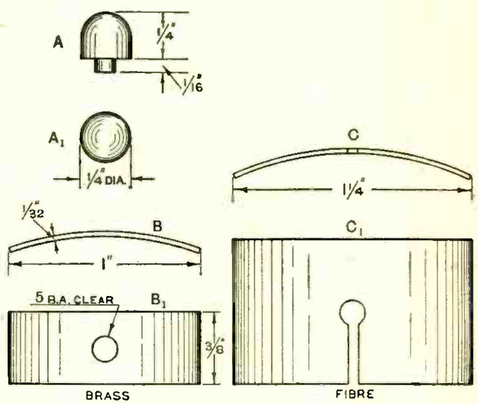
The following table is given to enable a coil having any desired number of turns to be made. If it be a small number have, say, 9 or 11 turns per layer, or if it be a large coil, have, say, 13-17 turns per layer. Start winding at pin 1 in each case.

Turns per Layer.	Cross to Pin.	Finish Pin.
9	5a	10
11	6a	12
13	7a	14
15	8a	16
17	9a	2

When a coil has been wound it may be given either a coat of wax or thin shellac, but in either case it must only be enough

graph. Besides being very easily done, it keeps the self-capacity of the finished coil low.

The contact pieces are made of contact studs with the head rounded off and the



Construction of the coil contact pins.

threaded part cut down to about 1/16 in. long. A small piece of curved brass is then drilled in the middle to take the bit of the thread remaining. This is put into the hole and the end hammered over so that it forms a rivet. To this the ends of the coil are soldered. A piece of fibre is then made the exact width of the coil, a hole is drilled in the middle and a small cut made from one side to meet it. Put the fibre between the brass and the coil and bind it to the coil with a thin strip of empire cloth.

A NEW SYSTEM OF DUPLEX TELEPHONY.

By HUGH N. RYAN (5 BV.)

DUPLEX telephony is very little used by amateur transmitters, and is, in fact, not required for most classes of amateur work. But a simple and efficient system of duplex, which can be adjusted as easily and quickly as an ordinary transmitter and receiver, would undoubtedly be of use to the amateur station. The writer has felt the need of it chiefly when he and some other London station have been co-operating in working with a distant station. For exchanging brief notes with the near by co-operating station, C.W. is too slow. Ordinary simplex telephony also wastes time in changing over, and they both have the disadvantage (often surprisingly noticeable in practice) of muddling the distant station, who hears your carrier or C.W. switching on and off, and does not know what is happening. Those who have tried it know how much time can be wasted if you let your distant station get "lost."

What is needed, then, is a simple receiver which will receive telephony of moderate strength while a transmitter is working in the same room.

Many experimenters have succeeded in doing this by using their ordinary receivers without an aerial. In the case of those using loose coupling to the aerial they usually try to receive on the closed circuit coil. Those using direct coupling have in some cases obtained good results by substituting a condenser for the aerial and earth, thereby bringing the wavelength for given settings of the receiver to approximately the same as that obtained with the aerial and earth connected.

This arrangement seems to give far better results than are obtained by disconnecting the aerial and tuning up to the required wavelength by adding inductance to the A.T.I. Very good results are obtainable by this method, provided that the transmitting and receiving wavelengths differ by 15 metres or more, that the transmitter employs fairly low power, and that the C.W. emitted by the transmitter is absolutely pure. Any trace of A.C. or generator hum causes a horrible noise in the receiver. This method, or one like it, is, I believe, the only one in use by amateurs, except the usual commercial system of receiving a resultant wavelength on several thousand metres, which is obviously inconvenient for our purpose.

The problem then, is to get intelligible speech out of weak modulated oscillations in a circuit, when very strong oscillatory currents are tending to flow in the same circuit. Now this is almost the same problem with which we are faced in a super-regenerative receiver, so why not deal with it in the same way? In the "super" we get rid of the unwanted oscillations by quenching them at frequent intervals. The same can be done with the oscillations which the transmitter causes in our receiver. At the same time, since we have a quenching frequency in action, we can push our receiver beyond oscillation point, and thus get a "super" receiver. The quenching oscillations will then have two frequencies to deal with, but in the experiments tried they dealt with them quite satisfactorily.

In the writer's experiments, a Flewelling receiver was used, with an "R" valve and 100 volts H.T. This was connected to a 4-foot frame aerial, the distance between the frame and the transmitting inductances being only about three feet. The aerial lead to the transmitting set passed within a few inches of the frame. At first the transmitter was worked at about ½ watt, with the H.T. supply (rectified A.C.) carefully smoothed out. When a telephony station of any strength was tuned in on the Flewelling, switching on the transmitter made no difference to reception. The power of the transmitter was increased, and it was then found that the receiver had usually to be retuned when the transmitter was switched on, but there was never any difficulty in receiving any station which could be received with the transmitter turned off.

The following may be quoted as some of the results obtained.

With single valve receiver, and 0·4 ampere in the transmitting aerial, the following telephony stations were easily read:—**2 NM, 2 OD, 2 OS, 2 SX, 5 OX, 5 DT, 2 XR, 5 HI, 2 FP,** and others. Stations like **2 KF, 2 OM, 5 PU,** could be read easily with 1 ampere in the transmitting aerial. On one occasion, with 0·25 in the aerial, fairly good telephony was received from **8 BF,** of Orleans.

Removing part of the transmitter filter circuit, and thereby introducing a 100 cycle hum into the C.W. did not appear to affect reception very much except when the transmitter was on full power. Unlike most duplex systems, it was unaffected by the nearness or otherwise of the transmitting and receiving wavelengths, except when they were so close as to produce an audible heterodyne note.

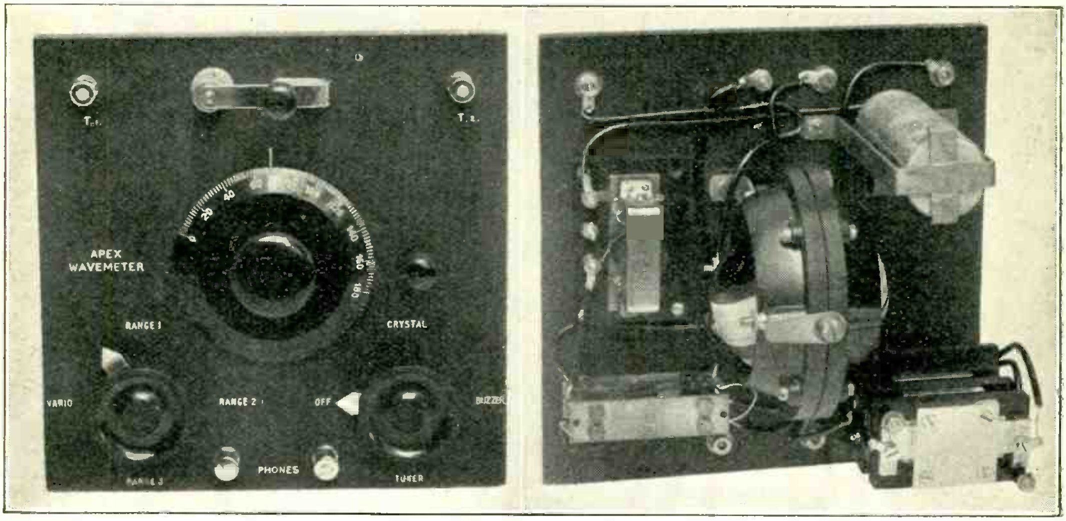
The chief objection to the system lies in the number of different frequencies in operation simultaneously.

There are four main frequencies involved—(1) that of the distant transmitter, (2) that of the "home" transmitter, (3) the heterodyne resultant of these two, and (4) the quenching frequency.

The inter-heterodyning of these frequencies sometimes causes difficulties, sometimes causing a "dead spot" on some wavelength, and sometimes distorting the speech, but adjustment of the Flewelling reaction and resistances will usually put things right. Finally it must be said that the experiments described were very brief, and the apparatus thrown together very roughly. The writer had not (and still has not) any experience or skill in handling the Flewelling circuit, and it is probable that an experienced Flewelling fiend, with the time to spare, could greatly improve upon the results given. It is also quite likely that an Armstrong would give better results than the Flewelling, though it would probably be more difficult to control.

A WELL DESIGNED WAVEMETER.

A well-made wavemeter is an essential part of the equipment of every amateur station. In the accompanying photograph we illustrate the front and inside of the McClelland Wavemeter, known under the trade name of "Apex." Great care has been taken in the design of this instrument, and it should find special favour with the amateur. As the illustration shows, the McClelland variometer is used and the whole construction is substantial. Buzzers used in wavemeters are sometimes a source of trouble to adjust, but that used in this instrument appears to be an exception. The wavelength range is 100 to 3,200 metres.



NOVEL PATENTS AND NEW IDEAS.

Abstracted by

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

A Heterodyne Receiver for Reducing Interference.

WHEN receiving C.W. by means of a valve receiver in conjunction with a separate heterodyne oscillator a certain degree of selectivity is obtained as against interfering spark signals or other non-periodic impulses. Such interference is not heterodyned to a regular beat note unless the disturbance is sufficiently powerful to shock or excite the aerial.

By employing a species of double heterodyning a further selection becomes possible, but a still greater degree of freedom from the wavelength of the incoming signal. The other valve, V_1, however, is adjusted so as to operate at or near saturation, so that it acts as a wave distorting valve, and thus introduces harmonics into what would otherwise be a pure sine wave C.W. The tuned loop, L_2 C_2, in its anode circuit is tuned to a frequency of say three times the frequency of the incoming signal, *i.e.*, in the example chosen above, to a frequency of 300,000 cycles (1,000 metres).

These two tuned loops, L_2 C_2 and L_3 C_3, are respectively coupled to circuits L_4 C_4 and L_5 C_5, both of which are in the grid circuit of a third valve, V_3. These two fre-

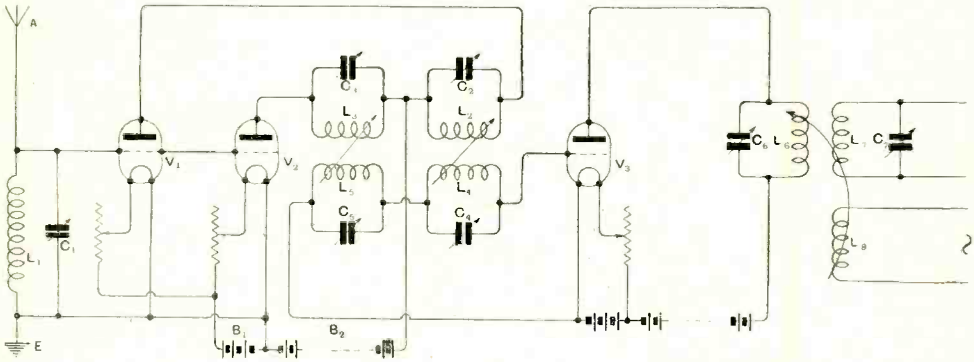


Fig. 1.

disturbance is secured if the signal itself is made to produce its own heterodyning oscillations.*

The general idea of the arrangement may be explained by reference to Fig. 1. In this diagram the aerial circuit is shown as consisting of the coil L_1 tuned by the condenser C_1 to the frequency of the incoming signals, say 100,000 cycles, which corresponds to a wavelength of 3,000 metres. Across this tuning coil are connected the grid circuits of two valves V_1 and V_2, one of these, V_2, acting as a radio-frequency amplifier in the usual way, and having a tuned loop, L_3 C_3, in its anode circuit which is tuned to

quencies, therefore, set up beats, which in the case of the example chosen, would have a frequency of 200,000 cycles (1,500 metres), this beat frequency being as usual the difference between the component frequencies —*i.e.*, 300,000 − 100,000 = 200,000 cycles.

Circuit C_6L_6 in the anode circuit of V_3 is tuned to this beat frequency, and is coupled to L_7, which forms the input to the detector valve of the receiver. To L_7 is also coupled the separate heterodyne, which is adjusted to produce audible beats with the currents of 200,000 cycles frequency, *i.e.*, it is set to a frequency of somewhere about 199,000 cycles. In the telephones attached to the detector valve or to a subsequent amplifier will

*British Patent No. 199428, by J. Scott-Taggart.

therefore be heard a beat note corresponding to the difference between the heterodyne frequency and the 200,000 cycles beat frequency.

The importance of such a method of reception arises from the fact that a pure harmonic frequency of 300,000 cycles will only be derived from the signal frequency when the latter is a steady C.W. signal in the first place. Spark signals or other non-periodic disturbances will not readily give rise to harmonics by the action of the distorting valve V_1 with the result that in such cases there will be little or no beat action between the fundamental and harmonic currents, or in other words the valve V_3 will not, in such cases, be able to set up the resultant beat currents of 200,000 cycles frequency. Hence only good steady C.W. signals should penetrate through such a receiver if properly designed.

Various other arrangements of receiving valves can be designed to operate upon this principle, but the above description should suffice to explain the general method underlying all such.

Burndept Key Switches.

The key switches used for controlling the circuits of high and low frequency amplifying valves in Burndept receiving sets* differ from the key switches used for ordinary telephone work in the replacement of the flat spring contacts by stiff wire contacts, as sketched at CC in Fig. 2, the switch arm pressing one or other of the springy contacts SS outwards depending upon which wa the knob is moved.

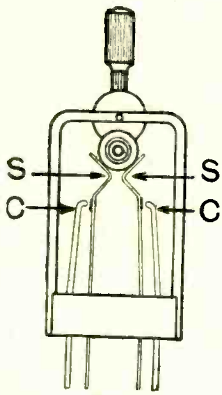


Fig. 2.

*British Patent No. 196968, by W. W. Burnham.

The Gambrell Inductances.

Self capacity in inductances always tend to augment the effective losses in such coil when they are traversed by high frequency currents, and it is therefore importan to reduce such self-capacity as much as possible. Spacing the turns and layers of the coil tends to reduce this capacity, and therefore to make the coil more efficient. In the Gambrell inductances this result is achieved in a manner which is well suited to the manufacture of a rigid coil structure which will withstand wear and tear easily.†

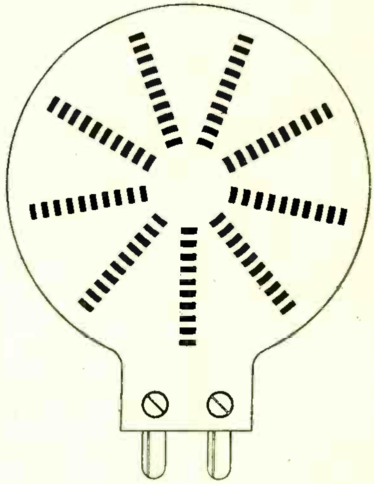


Fig. 3.

The sides of the coil are formed of ebonite discs, and the layers are spaced apart by ebonite strips which pass through slots in the ebonite side cheeks (Fig. 3). By spacing out the turns in each layer, and the layers from one another in such a way that the various coils having different number of turns (for different tuning ranges) all occupy a constant volume, the spacing between adjacent wires is increased in the smaller sizes of coil, with the result that these smaller coils are particularly efficient, since losses due to self-capacity become more important at the shorter wavelengths, and by this means the self-capacities are reduced for the short wavelength coils.

†British Patent No. 197140, by A. Onwood.

INSTRUCTIONAL ARTICLE FOR THE LISTENER-IN AND EXPERIMENTER.

WIRELESS THEORY—XXVI.

The series has been specially arranged so that the reader who follows each section as it appears will have obtained a complete wireless education with a minimum of time and trouble, and he will be in a position to successfully design his own wireless equipment.

Recent sections deal with series and parallel circuits, damping, choke coils, transformers, and coupled circuits.

BY W. JAMES.

51.—Multilayer Coils.

A. When *large inductances are required*, say about three or four thousand μH, which is that of a coil about 10 cms. (4 ins.) diameter, by 15 cms. (6 ins.) long, wound with No. 26 D.S.C., the coil not only becomes bulky, but the coil resistance (through the length of the wire and the departure from the best shape ratio) is high, and difficulty is experienced with coupling to other circuits, not only by magnetic coupling but by capacity coupling as well. Consequently compactness as well as efficiency is now the consideration.

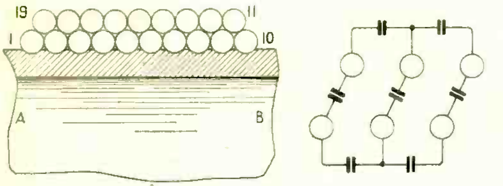


Fig. 135. A two-layer coil wound upon a former AB. There is capacity between each turn and between layers, consequently the coil capacity is prohibitively high.

B. Suppose we wind the second layer directly over the first (Fig. 135), that is from 1-10, and back from 11-19. It will be noticed there is capacity between each turn in the first layer, each turn of the second, and also capacity between the first and second layers. The capacities between the layers are in parallel; thus the coil, so far as its capacity is concerned, may be reckoned as a condenser, each layer forming one plate. Consequently the internal capacity is very high.

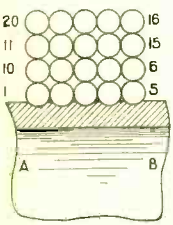


Fig. 136. A simple multi-layer coil.

The voltage operating to charge the condensers is highest at end A, and smallest at end B. The energy, W, of the charge stored in a condenser is proportional to the voltage squared (E^2) and the capacity (C), or $W = \frac{1}{2}E^2C$; therefore if the voltage across the condenser can be reduced, the energy charging the condensers will likewise be reduced with a consequent reduction in power losses through the bad dielectric. A reduction in the capacity is also helpful.

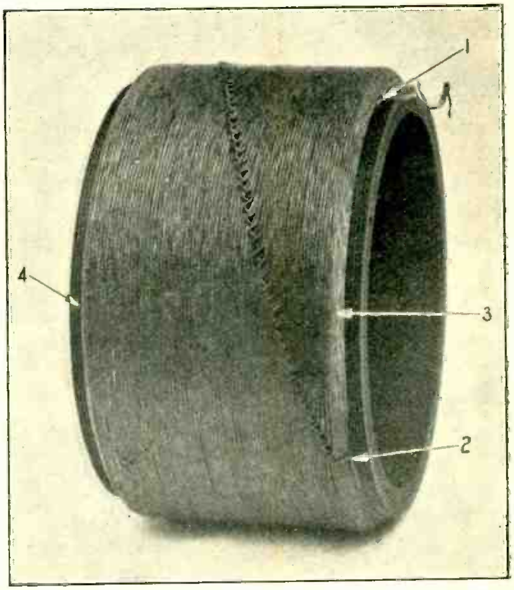


Fig. 137. A well-made banked or Telefunken coil. It has five piles or layers. Notice the end of the winding (1); the bends in the upper turns where the wire is led down to the first layer (2); the lie of the end turns (3); and the grooved former (4).

The former is brought about by the use of less turns per layer with more layers, and by properly arranging the position of the wires. The capacity is reduced by increasing the spacing between turns and layers. Thus the capacity of the coil (Fig. 136) is about $\frac{1}{4}$ that of Fig. 135.

C. The dependence of inductance upon the shape of the coil is easily seen. Thus, if the mean diameter of the two coils (Fig. 135 and Fig. 136) are the same, and the lengths are the same, the inductance of the four-layer coil is nearly *four times* that of the two-layer coil, yet the length of wire required is only *twice.*

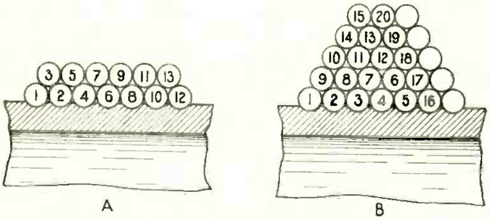
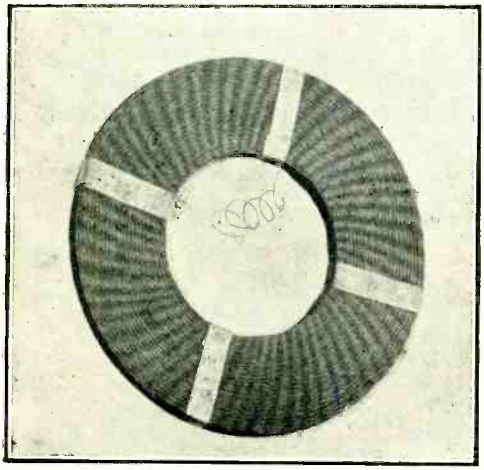


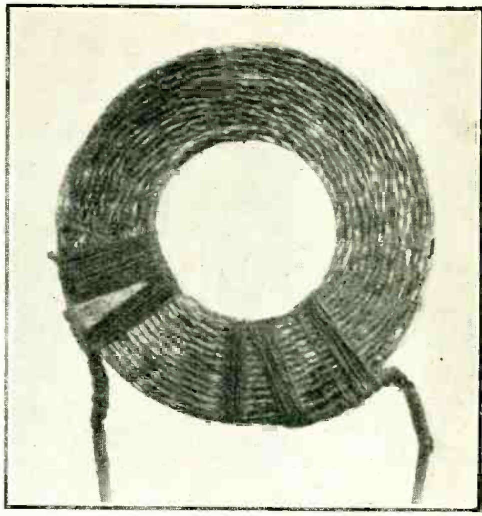
Fig. 138. *Coil A is a two-pile bank winding; coil B, a five-pile bank winding. Notice the order of the turns, indicated by the numbers. Compare with Figs.* 135 *and* 136.

It must be pointed out, however, that since the flux density is much greater than in the case of an equivalent single layer coil, the skin effect is correspondingly greater. Therefore, the ratio of high-frequency resistance to low frequency resistance of an inductance is much greater when it is wound with a number of layers, irrespective of the style of winding.

The advantage of the multilayer coil is thus demonstrated, apart from the question of self-capacity, which by proper design may be made very small.



A slab coil. This coil is machine-wound, and the turns are wound from side to side, giving a wave winding.



Another slab coil of litzendraht. These coils are ordinarily not used in receivers on account of the large losses, but they make excellent high-frequency chokes, and are often used when the losses are of not great account, but when space is the main consideration.

The multilayer coils to be described represent the attempts made to produce coils of small bulk with small self-capacity and losses.

D. When on account of constructional considerations the cylindrical form of coil is desired, the wire is often wound to form a *banked* (*Telefunken*) *winding.*

A bank wound coil is illustrated in Fig. 137. It has five layers. Sections of bank-wound coils are given in Fig. 138, A and B, and Fig. 139. In Fig. 138 (A) the coil has two layers, but the turns are arranged in a special manner. The numbers indicate the order of the turns. Turn 3 is placed immediately over turns 1 and 2; consequently the maximum voltage between these turns is that between 3 turns, and the self-capacity is low. Compare with the two-layer cylindrical winding of Fig. 135.

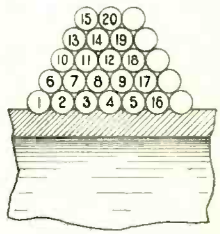


Fig. 139. *A special method of bank winding, which, however, is difficult to wind. Compare with previous figures.*

If the reader grasps the reasons for the peculiar construction of the bank winding, he will understand the reason for the special onstruction of the coils commonly referred to as basket, honeycomb, Burndept, etc.

Fig. 138 (B) shows the cross section of a five-layer bank winding. Notice the first layer of five turns is wound, then the second layer of four turns, and so on. But the ninth turn is wound over the first and second turns; therefore the voltage between these is that between nine turns, which is sufficiently high to make the arrangement undesirable.

Bank windings are therefore unsuitable when more than three or four layers are required, the self capacity being too high, though of course much less than that of an equivalent inductance arranged in two parallel layers, like Fig. 135.

is too high, and it is necessary to make use of two other factors, p and μ when accurate results are required. The factors p and μ take account of the ratio of the winding length to its depth, and the winding depth to the diameter.

Writing the complete formula we obtain :—

$$L\ \mu H = \pi^2 D^2 n^2 l\ k \times p\ \mu$$

where $\pi^2 D^2 l$ and k have the same meaning as before, n = the total number of turns per cm. of winding, *i.e., the number per cm.* × *the number of layers.*

p = a factor which depends upon the ratio $\frac{l}{t}$ when t is the depth of winding in cms.

μ = a factor which depends upon ratio $\frac{t}{D}$

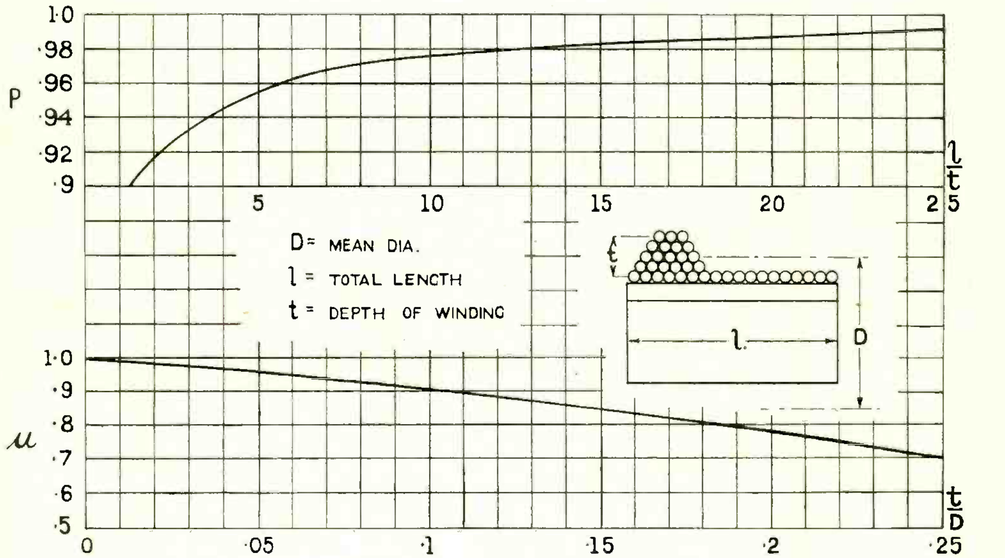


Fig. 140. *Curves giving the value of the factors p and μ which have to be taken into account when finding the inductance of a bank-wound coil.*

The arrangement of Fig. 139 suggests itself. Here the winding is different, and the coil is better, but such a winding is difficult to construct.

E. The inductance may be calculated with the formula given in section 49 *B* above, provided the number of turns per cm. is made equal to the *total number per cm.* The results would, however, not be accurate on account of the fact that the values of the factor k only allow for the uneven flux distribution when the winding consists of a single layer. When more than one layer is used, the flux distribution is changed. The inductance obtained with this formula

Values of p and μ are given in the curves of Fig. 140.

Of course, it is not necessary to work out the first part of the formula ($\pi^2 D^2 n^2 lk$). This may be obtained as in the case of single layer coils direct from the curves on pages 696 and 697 August 22nd issue.

Similarly, when designing bank-wound coils, roughly work out the design from the curves, afterwards allowing for the factors p and μ.

Example.—We want to find the inductance of the bank-wound coil of Fig. 141. There are four layers. A wire is used which winds five turns per cm. ; therefore $n = 5 \times 4$

and $n^2 = 400$. The depth of winding is a little less than four times the wire diameter (0·2 cm.), on account of the turns bedding between the lower turns, say by $\frac{1}{8}$ the wire thickness. Hence the winding depth is $(4 \times \cdot 2) - \frac{1}{8}(4 \times \cdot 2) = 0{\cdot}7$ cms. The diameter is 8 cms., and the overall length 10 cms.

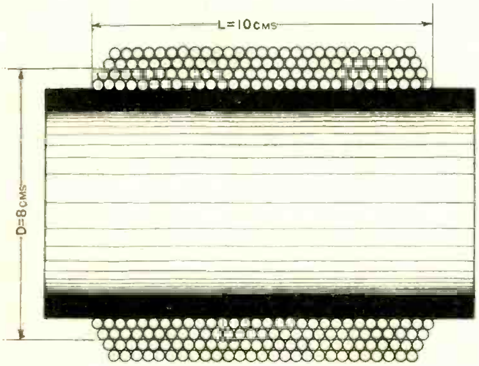


Fig. 141. A coil of this size, wound with five turns per cm., has an inductance of 1677 μH.

From the curves on page 696, corresponding with $D = 8$ and $l = 10$, we find $\frac{L}{n^2} = 4{\cdot}66$.

Therefore

$L = 4{\cdot}66 \times 400 = 1864\ \mu H.$

This quantity must be multiplied by the factors p and μ. From Fig. 140 the value of p corresponding with $\frac{l}{t} = \frac{10}{0{\cdot}7} = 0{\cdot}98$, and the value of μ corresponding with $\frac{t}{D} = \frac{0{\cdot}7}{8} = 0{\cdot}92$.

Consequently the true inductance is

$1864 \times 0{\cdot}98 \times 0{\cdot}92.$
$= 1677\ \mu H.$

F. A variation in inductance is obtained as before, namely, by providing tappings from suitable points of the winding.

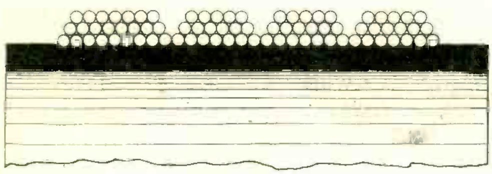


Fig. 142. To easily make tappings, the coil may be wound in sections. This construction gives less coil capacity and losses.

To easily make the tappings, the windin may be divided into sections (Fig. 142. There is then the advantage that the self capacity and losses are reduced, but th remarks concerning the effects of the unuse part of the coil upon the used portio (section 48) apply here with equal force

Plainly, bank windings are not suitabl when large inductances are required.

52.—Plug-in Coils.

A. It is clear, from an electrical point of view, that it is better to provide a coil with the correct inductance, and to change that coil if a different inductance is required.

Such coils are constructed with the ends of the winding terminating at contacts; generally those of a plug. Hence they are designated collectively as *plug-in coils*. A socket or mounting is used to accommodate the contacts attached to the coil, which is generally self-supporting. Changes of inductance are then easily made by simply removing one coil and substituting another.

Such an arrangement, though expensive when a number of coils suitably mounted are required, provides an additional advantage in that it is so easy to mount two or more coils in a coil holder with variable coupling between them.

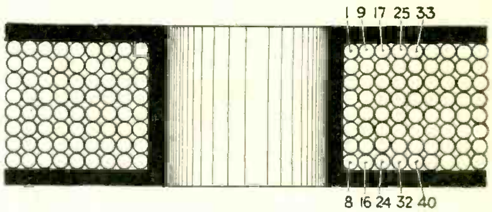


Fig. 143. A multilayer coil with lower capacity than one wound like that of Fig. 136. Notice the difference in the windings. When the coils are thin they are called "slab" coils.

B. Not being now troubled with dead end losses, plug-in coils are designed to provide the inductance with a minimum resistance and self-capacity consistent with reasonable dimensions.

From the previous remarks it is clear that multilayer coils wound as shown in Fig. 136, which may be called slab coils, are of little value on account of their high internal capacity. The capacity will be reduced, though by winding the coil after the fashion of the bank-wound coil of Fig. 139, but placing the turns so that the wires rest on each other, giving straight sides.

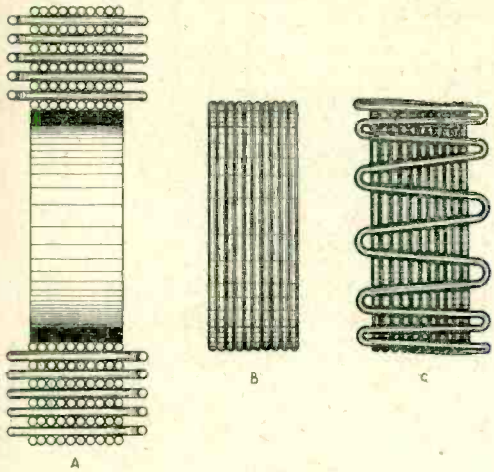


Fig 144. *Showing the construction of a Burndept coil. A is a section. B shows the first layer, and C the second layer. Then another layer is wound as at B, and so on.*

Such a coil would be constructed by winding the wire in layers with the aid

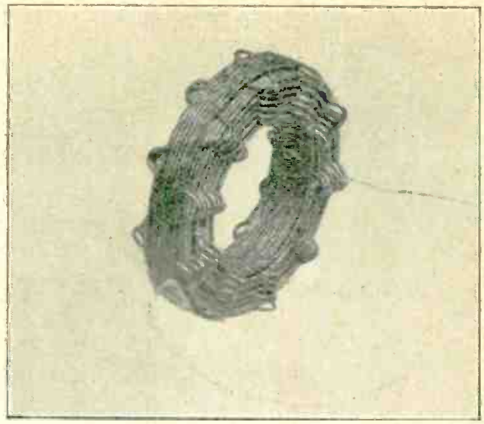


Fig. 145. *An amateur-made coil wound like Fig.* 144, *on a former such as Fig.* 147.

of a former (Fig. 143), and the result is a very compact inductance, although its capacity is much higher than need be.

If a coil of this description were wound, there would naturally be lumps in the layers, due to the wire passing from the end turns back to the other side of the former

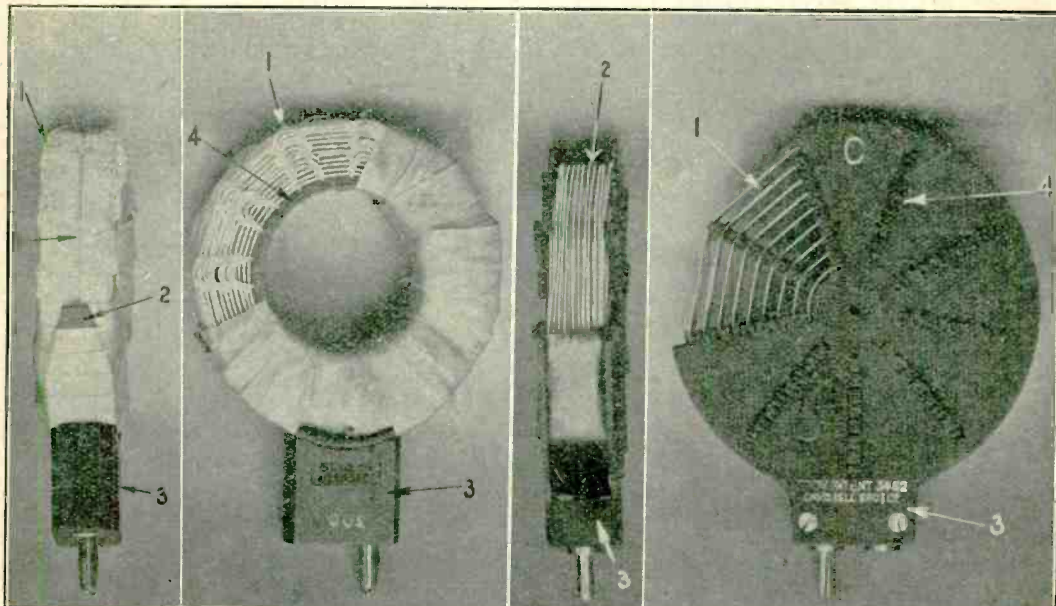


Fig. 146. *The left-hand photographs show an end view and a side view of a Burndept coil. Notice the loops* (1) *formed at the side by layer C, Fig.* 144 *; the spacing of the layers, and the turns which pass from side to side (C Fig.* 144) *marked* 5. *The coil former is marked* 4, *and the plug* 3. *The coil is held to the plug by binding the strap* 2 *with tape. The right-hand photograph illustrates the special winding of the " Efficiency " coils of Messrs. Gambrell Bros. The layers are spaced as at* 1, *by the ebonite separators A. The turns of the layers are spaced as at* 2, *by the slots in the separators.*

to begin the fresh layer. Thus the layer 1 to 8, Fig. 143, is wound; then the wire passes across this layer to commence the second at turn 9.

Thus the coil would look clumsy; but if the wire at the end of the first layer is wound back and forth across the coil around the circumference, the second layer will not be uneven.

C. This type of coil is shown in the drawings of Fig. 144, and the photographs of Figs. 145 and 146. It is

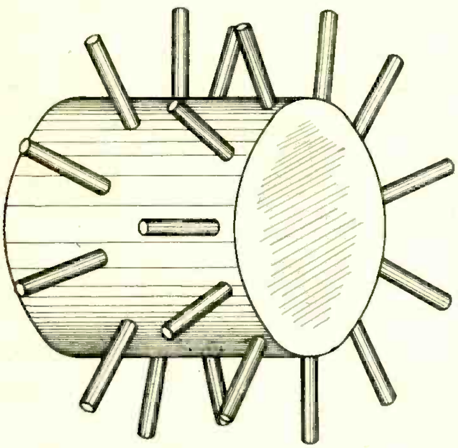


Fig. 147. The former used in the construction of home-made coils, such as Figs. 144 and 145.

generally called a Burndept coil. The coils are wound upon a former consisting of a cylinder, say 2 ins. in diameter, with two rows of removable pegs, Fig. 147. An odd number of pegs, is used, and those in one row lie opposite the spaces of the other. To construct a coil, the first layer is wound in a straightforward fashion (B, Fig. 144), then the wire is wound forth and back across the surface of the layer round the pegs (C, Fig. 144). The second layer is commenced over the beginning of the first layer, and so on. After the coil is wound and the ends secured, the pegs are removed. The coil, it will be noticed, has projections on each side where the wire passed round the outside of the pegs.

Since the layers are spaced by the wire thickness, the coil capacity is lower than in the arrangement of Fig. 143. Unfortunately the loops themselves, and also the wires

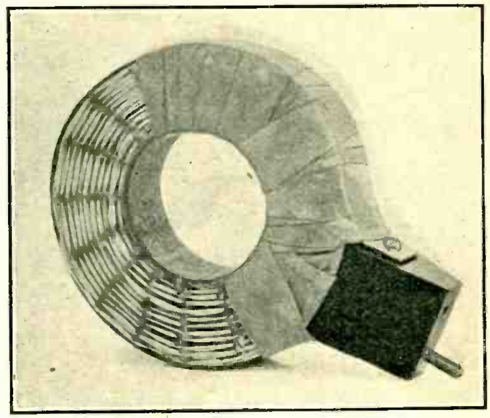


Fig. 148. The layers of this coil are spaced with string. The turns in the layers are not spaced.

which are wound back and forth across the coil, help to keep the capacity high.

Coils of this type are not machine wound.

D. Instead of spacing the layers with the wire used in the coil itself, other methods are employed. A coil with the turns spaced

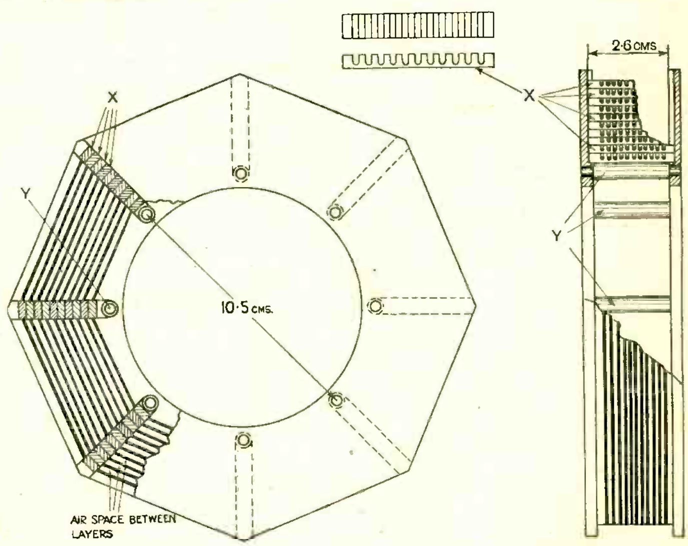


Fig. 149. The coil designed by Prof. Morecroft, called a Morecroft coil. The cheeks of the former are of wood, held apart with wooden pins Y. The turns and layers are spaced through the use of the separators X, shown larger in the upper drawing. This was probably the first coil of its kind.

with string is shown in Fig. 148. Probably there is little advantage over the arrangement of section *C*, on account of the power losses in the separators.

E. A machine-wound coil is called the "Giblin Remler" coil. The arrangement is similar to those just described, but the layers and the turns are spaced with cotton, which is run on by the machine along with the wire. These coils are very solid and compact, and, it is stated, have lower high-frequency losses than either the coils of section 52, C or D.

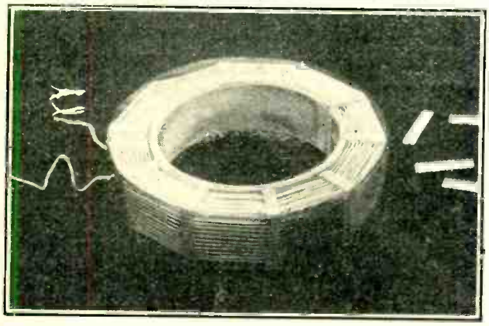


Fig. 150. *An amateur constructed coil like that of Fig.* 149.

F. A further improvement may be obtained by spacing the turns and the layers. The drawing of Fig. 149 shows the construction of a coil designed by Prof. Morecroft. The coil with dimensions given has an inductance of 10,000 μH. It has 10 layers, the air space between layers being 0·16 cms. Prof. Morecroft gives some interesting data of these coils. When wound with No. 26 wire, the direct current resistance was 21 ohms, and the resistance at 100,000 cycles had *increased to* 415 *ohms*. With No. 22 wire, the resistance increased from 6·7 to 267 ohms.

G. Coils built upon the Morecroft principle are manufactured in this country, and are called "Efficiency inductances." The construction is shown in the photograph of Fig. 146. The outside dimensions of all the inductances forming a set are the same; consequently those coils with the smallest inductance have the largest spacing between turns and layers.

As an example, the constants of some of these coils are given below:—

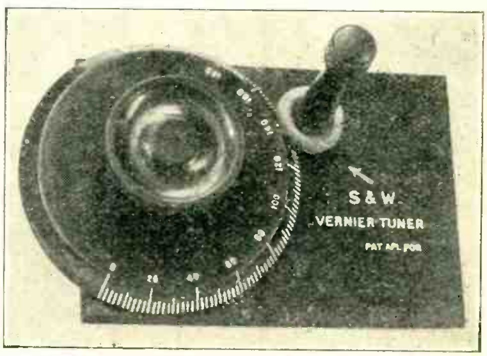
Coil.	Self-Capacity, micro-micro-farads.	Inductance, micro-henries.
A	4	90
B	5	200
C	6	440
D	6	900
E	8	2,250
F	9	6,600
G	11	12,800
H	14	36,500

An amateur constructed coil after the same principle is shown in Fig. 150.

Other constructions following the same principle suggest themselves.

Improving Condenser Tuning.

A convenient method for providing critical adjustment of variable condensers and other instruments fitted with dials is shown in our illustration. The length of the ebonite spindle to which the indiarubber is attached permits of fine adjustment being made without bringing the hand so near to the instrument that tuning would be affected. The ring is sufficiently thick and pliable to allow the device to be operated on a dial which may not be mounted perfectly true.



The device for critical adjustment of variable condensers.

A NEW APPLICATION OF WIRELESS

An Effort to Speed-up the Motor Breakdown Service.

WIRELESS, particularly since the development of the wireless telegraph, is continually finding new applications in different branches of industry. It was very natural that, in the early days, the first and foremost application of wireless was for communication between ships at sea and the shore, and it is not surprising to find that now, more and more, wireless is being pressed into service as a means of communication not only between fixed stations and ships at sea, but also between fixed stations on shore and aeroplanes, airships, moving trains, and motor vehicles. A short while ago accounts were published describing the value of wireless in connection with moving vehicles employed by the Police Force whereby these vehicles are kept in touch with headquarters at Scotland Yard and receive their instructions whilst *en route*.

Just recently we have had the opportunity of observing interesting experiments in another application of wireless telephony. When a repair lorry, attending to breakdowns of motor vehicles on the road, leaves its headquarters, considerable difficulty has been experienced in the past owing to the fact that, with each breakdown to be attended to the lorry has had to return to headquarters in order to receive instructions as to where to proceed for the next hospital case. Mr. J. A. Woodhams, of the Park Motor Co., Ltd., has found a way out of these difficulties. Having been keenly interested in wireless over a number of years, he has installed at his headquarters a transmitting and receiving station, and has equipped a repair lorry with a wireless receiver. By arranging that an operator on the repair lorry shall listen in at a definite time, say once every hour, it is now possible for instructions to be given without the necessity of the van returning to headquarters, perhaps only to be sent out again to a break-

Figs. 1 and 2. The repair lorry showing aerial and receiving apparatus.

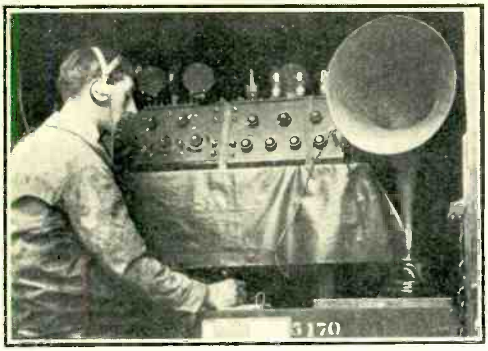


Fig. 3. A closer view of the receiving apparatus.

down case which may be within a very short distance of the locality last visited. The operator can be one of the personnel of the repair lorry who has received just sufficient instruction in wireless to be able to operate a receiver, very little of his time being taken up since he only listens in for a few minutes at intervals.

The accompanying illustrations show the transmitting station at the garage and the receiving gear on the repair lorry.

At a recent demonstration the repair lorry was sent away to a breakdown. Later on particulars of another breakdown, arranged for the test, were sent. During the test **2 LO** was transmitting, and the repair lorry was about one mile and a half from **2 LO**, and three miles from the garage. The instructions were properly received with the ordinary receiving apparatus, and also using the loud speaker with Western Electric power amplifier.

Fig. 1 shows the aerial fitted to the lorry. It consists of four copper strips slung between insulators held by movable masts.

The receiver shown in Figs. 2 and 3 was supplied by Messrs Gambrell Bros. The three-coil tuner may be seen on the left of the photographs. The amplifier has one stage H.F. (tuned anode) rectifier, and two note magnifiers. The anode coil may be seen fixed behind the valves.

The transmitter which is located at the garage is shown in Fig. 4. The choke control method of transmission is used, one valve operating as oscillator and the other as modulator, the transmitter being built from parts. It will be noticed that "Ever Ready" dry cell batteries are used, and these are preferred to a motor generator, not from the point of view of cost, but because of their reliability and the fact that they require very little attention and are therefore suitable for firms without a skilled operator.

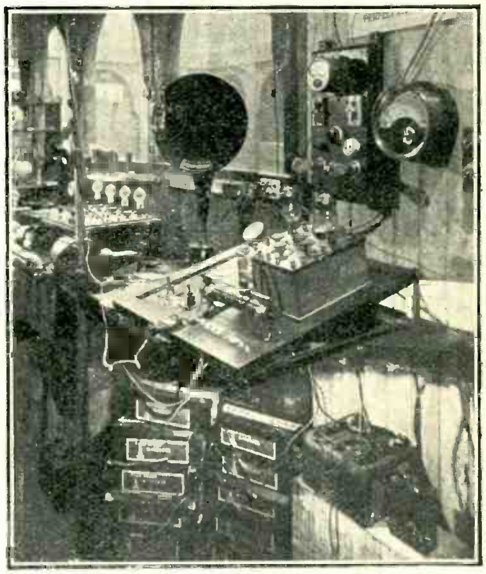


Fig. 4. The transmitter apparatus situated at the garage.

QUESTIONS AND ANSWERS: AN IMPORTANT NOTE!

Owing to the large number of questions submitted and the limited amount of space which can be allotted to this section of the journal, it is not always possible to make the replies as full as we would wish, and there is bound to be some delay in publishing the answers.

It is felt readers' interests will be best served if all replies are sent through the post. On account of the additional expense through the extra work involved in the preparation of diagrams and the replies, a small charge will be made to help defray the cost.

To meet the needs of those who would rather not pay the charge, a free Questions and Answers Coupon will be placed in the advertisement columns of the first number of each month, and one question will be answered free through the post if the question is accompanied by this coupon and a stamped addressed envelope. This free coupon is valid for the current week only.

Commencing with questions sent in with the coupon contained in this number, all replies will be sent through the post, and every question sent in must, as in the past, be accompanied by the current Questions and Answers coupon and a postal order for the amount of 1/-, or 3/6 for a maximum of four questions.

When use is made of the free coupon, which is only valid for the week following the date of issue, a stamped addressed envelope must be enclosed with the question. Only those questions which are of general interest will be published.

Wireless Club Reports.

Contributions to this section are welcomed. Reports should be as concise as possible and should record the most interesting features of each meeting. The Editor reserves the right to edit the reports when necessary. **Papers read before Societies will receive special consideration with a view to publication.**

An asterisk denotes affiliation with the Radio Society of Great Britain.

The Bristol and District Radio Society.*

An ordinary meeting of the Society was held on Friday, September 14th, at the Physics Lecture Theatre, Bristol University, when a lecture on aerials was given by Mr. A. E. Siddons-Wilson, and the future policy of the Society was outlined.

The first smoking concert and wireless demonstration has been fixed for Friday evening, September 28th, and will take place at the County Ground Hotel, Bishopston. As the seating accommodation is limited it is hoped that early application for invitation tickets will be made by the members on behalf of themselves and their friends to the hon. secretary.

In addition to the series of lectures and wireless demonstrations the committee are hoping to make arrangements whereby they can fix up a workshop for the use of their members at which workshop members will be able to carry out tests and generally discuss wireless matters from the practical side with other members of the society.

A further item of considerable interest to the members is that a visit is being arranged to the Cardiff Broadcasting Station of the British Broadcasting Company. The date of the visit has not yet been fixed,but will take place in the near future, of which an announcement will be made in due course.

It is expected that the membership of the Society will increase by leaps and bounds as soon as the Bristol Relay or Land Station of the Bristol Broadcasting Company is open, which opening is anticipated to take place at an early date.

Hon. Secretary, Mr. A. S. Harvey, 6, Woodleaze, Sea Mills, Bristol.

Ilford and District Radio Society.*

On September 6th Mr. G. F. Hearn gave a lantern lecture on "Post Office Telegraphs." After referring to some of the interesting exhibits contained in the Post Office Museum, Mr. Hearn, with the help of some very excellent slides, described the various methods used in handling the telegraphic traffic.

Hon. Sec., L. Vizard, 12, Seymour Gardens, Ilford.

Hackney and District Radio Society.*

At the weekly meeting on September 13th, a long discussion took place regarding the three-day exhibition and demonstration the Society is holding on November 21st, 22nd and 23rd, at the Clapton Palais de Danse.

The public will be agreeably surprised when full details of speakers, attractions, etc., are announced.

Hon. Sec., 66, Ballance Road, Homerton, E.9.

Newcastle-on-Tyne Radio Society.*

The annual general meeting of the Society was held on September 6th last. The following officers were elected :—President, Dr. R. H. Smallwood; Secretary, Mr. Colin Bain; Assistant Secretary, Mr. R. W. Smith. Committee, Mr. Burdis, Mr. Dixon, Mr. Fabian, Mr. Head, Mr. Hartley, Mr. Clague. Librarian, Mr. Fabian.

Mr. Burdis read out the balance sheet for the twelve months. This showed a "balance forward" of £11 18s. 6d.

The Society will resume the regular weekly meetings on Monday evenings, beginning with Monday, October 1st. Members please note subscriptions are now due.

Hon. Sec., Mr. Colin Bain, 51, Grainger Street, Newcastle-on-Tyne.

Kingston and District Radio Society.*

A meeting of the Kingston and District Radio Society was held on September 4th, Mr. T. W. Bloxam, M.I.E.E., being in the chair. A lecture on "The Electrical Properties of Selenium," was delivered by Dr. Fournier D'Albe.

The lecturer stated that selenium was first discovered one hundred years ago by a Swedish chemist, but it was not until fifty years later that it was put to a commercial use, when it was employed as an insulator. It was subsequently found to be unreliable for this purpose, however, its insulating properties being variable, and after long and careful observation it was noticed that the substance was a better insulator at night than during the day.

After this remarkable discovery it was the subject of exhaustive laboratory experiments, and it was found that when placed in circuit with an electric current and suitable measuring instruments it allowed a minute current to flow whenever exposed to light.

Several selenium cells which the lecturer had made were passed round for the members' inspection. A cell consisted of a piece of fine-grained porcelain, about an inch square, and an eighth of an inch thick, upon which was deposited a layer of graphite from a soft pencil. As many fine grooves as possible, about one sixty-fourth of an inch apart, are cut in zigzag fashion in the graphite with a diamond. The porcelain, together with a piece of selenium, is then heated, and on reaching the correct temperature the selenium liquifies, and with careful manipulation can be made to run into the grooves. The heating requires a certain amount of practice, however, for if overheated the selenium rapidly vaporises.

He described an instrument of his invention to enable the blind to read, called the optophone, which directed a beam of light on to the printed matter, and, in turn, the paper reflects light of varying intensity, according to the shape of the letters, on to the selenium cells. The cells operate an electric current which is heard as a musical note in the telephones.

In acknowledging a very hearty vote of thanks Dr. Fournier D'Albe stated he hoped to speak before the Society again in the future.

The Lewisham and Catford Radio Society.*

On Thursday, August 30th, Mr. R. J. Stanley gave a very instructive lecture entitled " Armstrong and other Supers," and concluded by saying that the recent discovery of these super circuits shows that such things are still in their infancy and he told the members that when anything strange happened in their receiving sets, they should set themselves the pleasant task of discovering the cause of such happening, and that if they did this then the country would one day, perhaps, sing the praises of a set which bore their name.

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

Streatham Radio Society.*

The opening meeting for the winter session of the above Society was held on the 12th inst., when an excellent paper on " Distortion in Radio Telephony " was given by Mr. H. A. Thomas, M.Sc. The paper, which was illustrated by lantern slides and blackboard diagrams, dealt with all forms of distortion in every portion of radio apparatus from the microphone to the telephone receiver, and the lecturer showed by means of curves how far the practical curves gained differed from the true acoustic curves required. Again, it was pointed out what a truly unsatisfactory piece of apparatus the diaphragm was, whether used in a microphone or receiver. The discrepancies of transformers and valves were also referred to, while a few remarks upon loud speaker design were most carefully noted. The lecturer further gave hints regarding possible lines of improvement and left the experimental members with plenty of food for thought. A hearty vote of thanks to Mr. Thomas concluded the evening.

The winter programme of the Society includes lectures by many well-known radio and other scientists, and promises to be most successful. Full particulars and dates, together with information relating to membership, can be obtained from the Secretary.

Hon. Sec., S. C. Newton, A.M.I.E.E., " Compton," Pendennis Road, S.W.16.

The Thames Valley Radio and Physical Association.*

The second annual general meeting of the above Association will be held on October 1st, 1923, at 8.15 p.m., at The Hut, Wigan Institute, Mortlake.

All members are specially asked to be present.

Any new members in the districts of Richmond, Kew, Twickenham, Barnes and Mortlake will be welcomed.

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

Derby Wireless Club.*

An extraordinary general meeting will be held in the new club room at the above address on Thursday, September 27th, at 7.30 p.m. :—

To receive entries for, and discuss the competition in connection with fading of signals.

To settle the question of receiving apparatus for the club room and to arrange when the room will be open to members for working such apparatus if it is decided to instal same.

To form an elementary wireless instruction course.

To form a Morse practice class.

To discuss the library and to decide on the purchase of new books.

Will all members kindly note that they are requested to sign the attendance register on entering the club room.

Bournville Radio Society.

The opening meeting of the Session will be held on Tuesday evening, September 25th, in the clerks' dining room, to commence at 7.15 p.m. prompt, when a lecture will be given on " The Design of Broadcast Receivers," by Mr. W. Forbes-Boyd.

The Men's Council have kindly arranged for the Society to have the use of the clerks' dining room on alternate Tuesday evenings throughout the session. Meetings to commence at 7.15 p.m.

The Board have kindly granted permission for a permanent aerial to be erected from the clerks' dining room to the Youths' Club. This will enable members of the Youths' Club Section of the Radio Society to have wireless demonstrations from the Youths' Club.

Members of Bournville Radio Society are invited to visit the University on Saturday, October 20th, 1923 (free Saturday).

Hon. Sec., A. P. Hutchinson.

Tottenham Wireless Society.

" Accumulators " was the subject of a lecture given by Mr. W. Hulbert, on September 12th.

The lecturer used demonstration models kindly loaned by Messrs. Peto & Radford, to show the construction of a cell and exhibited positive and negative plates.

After explaining the cause, avoidance and removal of sulphate, buckled and sulphated plates were shown as " horrible examples."

Mr. Hulbert gave good advice on efficient maintenance of an accumulator. A demonstration of an accumulator H.T. battery of 1 amp. hour capacity, and an anode converter (kindly loaned by the M.L. Magneto Syndicate) for obtaining H.T. supply from an L.T. battery, gave fine results. For multivalve sets the steady H.T. current obtained by these methods render them invaluable.

Hon. Sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

South Shields and District Radio Club.

Although during the summer months the above club has been fairly inactive, the winter session programme promises good fare to its members. Already weekly papers on wireless and general electrical subjects have been arranged, together with visits to local works and stations. Papers will be read on Wednesday evenings, commencing at 7.45 p.m. Friday evenings will be devoted to one hour's buzzer work, followed by apparatus testing and should the latter prove successful a special evening will be devoted to it.

Application for membership should be made to Hon. Sec., W. Smith, High Dock House, South Shields.

On Wednesday, September 26th, a visit to N.E. Wireless Schools has been arranged, where Marconi, Telefunken, Poulsen and other commercial apparatus will be demonstrated.

CORRESPONDENCE

The Radio Society's Representation Scheme.

A Constructive Criticism by the Radio Society of Highgate.

The following letter addressed to the Radio Society of Great Britain has also been forwarded to this Journal with a request for publication:—

DEAR SIR,—A meeting of my Committee was held on August 29th when your circular letter of July 30th was fully discussed, and I was instructed to write to you as follows:—

My Committee fully appreciate the spirit of co-operation which has prompted the Committee of the Radio Society of Great Britain to formulate a scheme whereby the affiliated Societies may be represented on the Central Committee. We realise that the proposal put forward is only of a temporary and preliminary nature, but we feel, however, that the scheme is utterly inadequate, and that very little benefit will be gained thereby by the provincial Societies. An organisation calling itself the Radio Society of Great Britain should be a national organisation, and should truly represent the whole of Great Britain. My Committee feel that the Radio Society of Great Britain, having recently changed its name, has thereby increased its responsibilities, but nevertheless in reality the Society is still the Wireless Society of London, and the addition of four new members to the Committee of that Society is not sufficient to raise the status of the Wireless Society of *London* to that of what should be the Radio Society of *Great Britain*. We do not wish to interfere in any way with the affairs of the Wireless Society of London, but since that Society has ceased in name, we feel that the executive of the organisation that has taken its place, should be drastically altered. The suggestion that one individual can represent the sixty (or thereabouts) Societies comprising the Eastern Group is ludicrous in the extreme, however capable that one individual may be.

My Committee consider that the whole existing organisation needs to be completely remodelled, and that a true Radio Society of *Great Britain*, with headquarters in London, should be formed. Realising that constructive alternatives are more helpful than destructive criticisms, we have drafted a scheme which we consider would have the desired effect of giving every affiliated Society in the kingdom the opportunity of direct representation on the Committee of a national organisation such as the present Radio Society of Great Britain claims to be, but which, in its present state, even with the addition of the suggested four representatives, it can never be.

The proposal which my Committee wishes to submit is briefly as follows:—

The British Isles to be divided into four Territorial Groups, as suggested by the Radio Society of Great Britain, *i.e.*, Eastern, Western, Southern and Scotland. This number of divisions may not prove adequate, but it will suffice for the sake of argument. Each of these Territorial Groups to nominate three representatives to a Central Committee, which has its headquarters in London. There would thus be 12 members in the Central Committee, and this number could perhaps be increased by four independent members, taken from the present Committee of the Radio Society of Great Britain, who are specially qualified to conduct negotiations with the Post Office and other authorities.

Each Territorial Group to consist of a number of Sub-Groups, the number depending on the number of individual Societies comprising the Territorial Group. We would suggest one Sub-Group for every ten Societies in the Territorial Group, *e.g.*, there are nearly 60 societies in the Eastern Group, and there should, therefore, be six Sub-Groups in the Eastern Group.

Each Sub-Group to send one representative to the Group Committee. In this way the Eastern Group Committee would consist of six members, the Western Group Committee would consist of five, and so on.

Each Sub-Group, as already stated, to consist of ten individual Societies, each Society to send one representative to its Sub-Group Committee. Each Sub-Group Committee would, therefore, consist of ten members, and every affiliated Society in the Kingdom would have direct representation on the Sub-Group Committee.

We fully appreciate that such a scheme would entail a large amount of initial organisation, and it would be necessary for the Central Committee to have a full-time salaried Secretary. If such a scheme were adopted, we feel convinced that it would receive the vigorous support of all the Societies, whether at present affiliated or not, and in return for the great advantage of direct representation they would doubtless be prepared to subscribe to the Central Funds at the rate of say, 6d. per member, with a minimum fee of one guinea. We consider that a fee of 1s. per head, as suggested at the last Annual Conference, is excessive.

We realise that the whole question is fraught with great difficulties, but unless some such scheme as outlined above is adopted, the Radio Society of Great Britain will never receive the whole-hearted support that it desires.

In conclusion, with a view to encouraging other Societies to put forward concrete proposals for the organisation of a body which will be a Radio Society of Great Britain in fact as well as in name, and knowing that the Radio Society of Great Britain welcomes a full expression of opinion, copies of this letter have been sent to one or two wireless journals with a view to publication.

I remain, dear Sir,

Yours very truly,

J. F. STANLEY,

Hon. Secretary, Radio Society of Highgate.

Notes and News

Reception of WDAP (Chicago).

Mr. J. L. Mitchell, of The Manse, Mauchline, Ayrshire, reports reception, in addition to **WGY**, of **WDAP**, Chicago, on approximately 360 metres, from 04·15 till 04·50 on the morning of Sunday, September 9th (B.S.T.).

The Dutch Concert from PCGG.

We hear that the transmissions from **PCGG** conducted by the Nederlandsche Radioindustrie have been temporarily discontinued as from September 9th. The reason given is that, as a result of a complaint from a neighbouring resident with regard to the noise created by the motor generator, the authorities have closed the station and sealed up the apparatus. Naturally, the owners of the station are appealing against this high handed treatment, but nevertheless it is expected that it will not be possible to resume the concerts before the end of October.

Distortion in Valve Receiving Circuits.

It is regretted that an error appeared in Part 2 of this article (Valve Detectors), September 12th issue. On page 791, col. 1, line 12, Fig. 6 should read Fig. 3; and on page 792, 8th line after the diagram, Fig. 4 should read Fig. 1.

Reception of American Stations.

A large number of reports continue to arrive of reception of American Broadcasting Stations, and these are now so numerous that it will not be possible to refer to them individually in the columns of this journal. In addition, reception by several stations is reported of American amateur transmitters.

Mr. J. Ridley who, it will be remembered, was one of the first to report reception of American broadcasting stations last year, has recently been at it again, and we have received the following list of American amateur stations heard on the night of September 9th:—

4 FT, 2 AG, 1 BDT, 1 AW, 1 BD, 3 TJ, 1 ABS, 2 SP, 8 ASL, 1 CPN, 1 CMP, 2 II, 4 GX, 2 WR, 2 CQ, 2 AGS, 7 BCT, 8 CEO, 1 BWF, 8 BCI, 3 BDB, 1 ACU, 8 GA, 1 ARF, 5 EV (spk.), **1 BSF, 2 FP** (TT).

This reception was preceded by excellent strength of **WGT** on a loud speaker. Mr. Ridley's receiving station is located in South London.

Mr. W. E. F. Corsham **(2 UV)**, of Harlesden, reports reception of **1 AR** and **4 FT** (both American stations) in the early morning of September 13th. He also reports reception of several other stations at about 6 o'clock on the morning of the 17th (*i.e.*, approximately an hour after daylight here), he received a message complete except for one word from **1 FB** working to **2 AG** on spark. Considering that all these stations were received on two valves, and **1 FB** was good strength even on one valve, Mr. Corsham expresses the view that it should not be by any means impossible to receive American stations during periods of daylight all the way across.

Mr. W. R. Burne, of Manchester, reports further reception between September 5th and 9th of a very large number of stations, including telephony from **5 ZA** and reception of a A.R.R.L. broadcast message, which Mr. Burne believes is the first ever received in this country.

A New Broadcasting Station to Listen for.

Mr. Ralph Bates, of Lincoln, and Mr. G. T. Sindall, of Newark-on-Trent, both report reception of a station on about 520 metres which called "Hello! Hello! Stockholm? Christiania Radio calling." It is stated that the musical selection which followed was exceedingly good, and reception in Lincoln was with only one valve, whilst Mr. Sindall was using a three-valve set, and the strength of the signals was about R.7.

Radio Transmitters' Society.

As announced in the last issue, a meeting took place on September 19th at King's College, Strand, of those interested in the formation of a new society for holders of transmitting licences. The temporary formation committee, under the chairmanship of Captain Ian Fraser, submitted to the meeting the constitution which they had prepared, and this was discussed and adopted with some modifications.

The election of officers and committee then took place, Captain Fraser being unanimously re-elected as chairman. After nominations for the committee had been made, the following were elected:—W. K. Alford, F. L. Hogg, Drysdale Kilburn, G. Marcuse, J. E. Nickless, J. A. Partridge, H. S. Pocock, E. J. Simmonds, H. S. Walker.

Informal Meeting of the Radio Society of Great Britain.

The first informal meeting of the present session was held on Thursday, September 20th, in the tea-room of the Institution of Electrical Engineers, at 6 p.m. An entirely informal and enjoyable discussion took place on short wave transmitters, opened by Mr. Maurice Child. A number of those present took part in the discussion, relating their experiences with short wave transmission.

The interest displayed in this, the first of the informal meetings, indicates that they are likely to be very popular during the winter months.

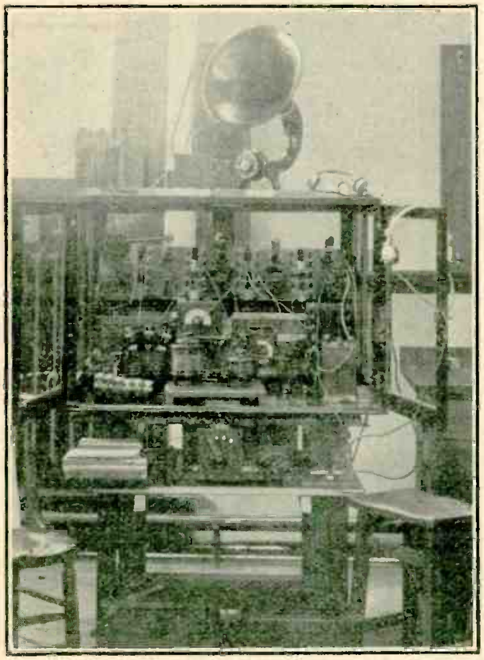
"On Joining a Wireless Society."

A number of Societies have written asking for reprints (on payment) of the Editorial which appeared in a recent issue under the title "On Joining a Wireless Society," with a view to distribution for the purpose of recruiting new members.

Those Secretaries of Wireless Societies who would care to receive reprints, can obtain them on application to *The Wireless World*. It is not proposed to make any charge for small quantities of reprints, as it is realised that the distribution amongst prospective members of Societies will also be beneficial to the Journal. Those who wish for copies should write at once, stating the quantity required, as only a limited number have been printed.

Wireless in Schools.

The two illustrations on this page show the wireless receiving apparatus installed at George Heriot's School, Edinburgh, The set which has been constructed in the school is designed on the unit system, and consists of 2 H.F. (tuned anode), detector, and 1 L.F. valves, wired to a circuit given in our "Amateurs' Book of Wireless Circuits." The results are stated to be all that could be desired.



The receiving apparatus at George Heriot's School, Edinburgh.

The All-British Wireless Exhibition.

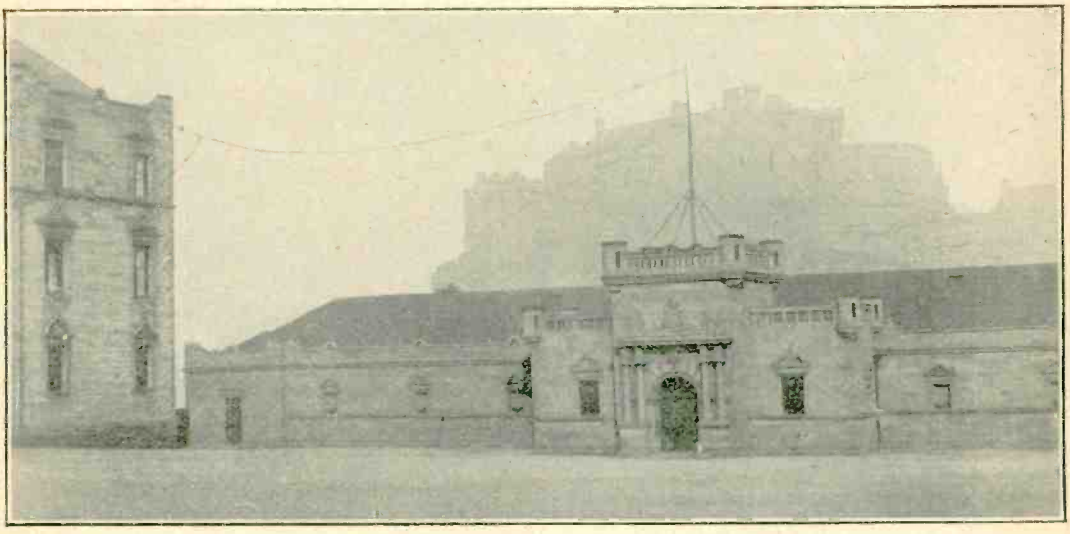
From all reports which have been received the progress of the arrangements, the All-British Wireless Exhibition and Convention, to be held from November 8th to 21st, at the White City, Shepherd's Bush, promises to be an event of very special interest. The Exhibition is organised in conjunction with the National Association of Radio Manufacturers, by Messrs. Bertram Day & Co. Special arrangements have been made for broadcast transmissions by The British Broadcasting Co., whilst it is stated that it will be possible for all exhibitors to give actual demonstrations of their apparatus with head-telephones (not loud speakers) in operation.

Linking up P.O. Exchange with Ships at Sea.

Another useful application of wireless which we may look forward to in the future is the linking up of vessels at sea (which are equipped with wireless telephony), with the local post office telephone exchanges. Experiments conducted along these lines formed the subject of an address to the British Association recently by Commander J. A. Slee, R.N.

The Post Office Station at Rugby.

An area of about 800 acres of land recently acquired for the P.O. station at Hillmorton, near Rugby, has now been surveyed for the purpose of the erection of the Empire Wireless Station. Messrs. Foster & Dixey of Rugby and London, have commenced the work of preparing the foundations for the eight steel masts. The masts will be 820 ft. high, and the contract for these has been placed with Messrs. Head, Wrightson & Co., Ltd., of Stockton-on-Tees.



The aerial erected at the school. It is interesting to note the view of the Edinburgh Castle that can be seen in the background.

TRANSMITTER AND RELAY SECTION OF THE RADIO SOCIETY OF GREAT BRITAIN.

The following is the text of a letter addressed by Dr. W. H. Eccles, F.R.S., President of the Radio Society of Great Britain, to all those holding transmitting licences as far as their addresses were available.

DEAR SIR,—The British Wireless Relay League in July last became absorbed into the Radio Society of Great Britain under conditions which will ensure the continuance of its activities and give it the advantage of the financial and administrative support of the larger body. The Committee of the Society have now decided to make preparations for the organisation of an attractive programme of relay work for the winter, and for this purpose have arranged to establish a special section of the Society called the "Transmitters and Relay Section." The work of the Section will be guided by a Committee democratically elected from within the Section, and will have several grades of membership. As an outline of what may be arranged, Corporate Members of the Radio Society and its Affiliated Societies may become members of the Transmitter and Relay Section on payment of an annual subscription of 5s. if they hold transmitting licences, and 3s. 6d. if they hold only receiving licences; persons who are not members of the Radio Society or its Affiliated Societies may become members of the Section upon payment of a subscription of 10s. per annum if they hold transmitting licences and 7s. if they hold only receiving licences. These suggested rates of subscription are provisional, and, besides, are not intended to apply to those original members of the Relay League who have already paid a subscription which has not yet expired, and for whom special terms will be arranged. All classes of members will receive the circulars giving details of the programmes of work organised by the Committee of the Section.

The Radio Society will be liable for any excess of expenditure over income which may arise in operating the Section in accordance with the Rules which are being drawn up. Prospective members of the Section, whether members of the Radio Society of Great Britain and the Affiliated Societies or not, should send their names to Mr. L. McMichael, 32, Quex Road, London, N.W.6., who will send them a copy of the Rules as soon as they are ready.

The present epoch is critical in the history of the amateur movement in this country. The advent of broadcasting and the possibility of the rapid growth in the number of broadcasting stations, each of which will require a special band in the already crowded spectrum of wavelengths, calls for a united and definite statement by the amateurs of their own claim to an adequate waveband. There is at the moment some danger that the needs of the amateurs will be overlooked unless by union they bring to bear upon the Departments of State concerned an influence equal to that of any other interest.

It will be realised that if through lack of cohesion British experimenters are ultimately barred from the use of transmitting apparatus, the progress of wireless discovery and invention in this country will be crippled, and many of the honours of pioneer work in the still unexplored regions of our wonderful subject will be left to other nations.

Yours faithfully,
W. H. ECCLES,
President.

September 21st, 1923.

FORTHCOMING EVENTS.

WEDNESDAY, SEPTEMBER 26th.

South Shields and District Radio Club. A Visit to N E. Wireless Schools.

Kingston and District Radio Society. Conversazione at Atkins' Scotch Café, Kingston. Reception by the President, Mr. F. Peake Sexton. Exhibition of Apparatus and Demonstration of Selenium by Dr. Fournier D'Albe.

THURSDAY, SEPTEMBER 27th.

Ilford and District Radio Society. Informal Meeting.

MONDAY, OCTOBER 1st.

Newcastle-on-Tyne Radio Society. 7.30 p.m. at Club Rooms. First Meeting of Winter Session.

WEDNESDAY, OCTOBER 3rd.

Tottenham Wireless Society. 8.30 p.m. at the Institute, 10, Bruce Grove. Annual General Meeting.

Hall Green Radio Society. Presidents' Night.

Calls Heard.

Co. Durham.
2 II, 2 IJ, 2 OM, 2 QS, 2 VN, 2 WN, 5 KO, 5 WR, 5 ZY, 8 AG, 8 BN, 8 BV, 8 CA, 8 CS, 8 TC.
(S. Stephenson.)

Dollar, N.B.
2 AW, 2 DF, 2 DQ, 2 FL, 2 FN, 2 FP, 2 GG, 2 GY, 2 HF, 2 JF, 2 JZ, 2 KF, 2 KR, 2 LG, 2 LN, 2 LZ, 2 MG, 2 MT, 2 NA, 2 NM, 2 NU, 2 OD, 2 OJ, 2 OM, 2 ON, 2 RY, 2 TF, 2 UU, 2 UV, 2 VK, 2 VN, 2 VT, 2 WX, 2 ZF, 5 AW, 5 BV, 5 FW, 5 GS, 5 HW, 5 IC, 5 IO, 5 JX, 5 KO, 5 LC, 5 MG, 5 NN, 5 OD, 5 OM, 5 SI, 5 ST, 5 XC, 8 AA, 8 AB, 8 AC, 8 AQ, 8 AW, 8 BF, 8 BM, 8 BQ, 8 BV, 8 CF, 8 CS, 8 CZ, 0 BQ, 0 FN, 0 GS, 0 MX, 0 NX, 0 NY, 0 XL, 0 YS, 1 GD, 2 UMU, 5 TAR, 5 YEB, HBI, SFR, WGY, WJZ, WOR.
(J. M. G. Galloway, 6 GY.)

S. Croydon.
2 BM, 2 BO, 2 ID, 2 IM, 2 KB, 2 KF, 2 KZ, 2 MK, 2 MS, 2 OM. 2 PX, 2 QQ, 2 (Q)T ?, 2 ST, 2 SX, 2 TI, 2 VZ, 2 WD, 2 WJ, 2 XR, 2 XO, 2 XR, 2 X?, 2 ZO, 2 ZZ, 5 CP, 5 DT, 5 FQ, 5 HW, 5 MF, 5 MX, 5 MY, 5 OB, 5 OP, 5 PB, 5 PU, 5 SR, 5 SU, 5 VD, 5 VR, 5 WQ, 5 XE, 6 IM, 6 IY.
(A. W. K. Dickinson.)

Birmingham.
2 AW, 2 BL, 2 BN, 2 BQ, 2 CV, 2 CW, 2 CZ, 2 DF, 2 DU, 2 DX, 2 EF, 2 FD, 2 FF, 2 FH, 2 FK, 2 FL, 2 FN, 2 FQ, 2 GG, 2 GV, 2 HA, 2 HF, 2 HV, 2 IQ, 2 JF, 2 JP, 2 JZ, 2 KF, 2 KO, 2 KQ, 2 KR, 2 KW, 2 KX, 2 LF, 2 LG, 2 NA, 2 NB, 2 NL, 2 NO, 2 NP, 2 NV, 2 NY, 2 OD, 2 OH, 2 OM, 2 OQ, 2 OX, 2 PD, 2 QR, 2 RD, 2 RG, 2 SH, 2 SI, 2 ST, 2 SY, 2 SZ, 2 TM, 2 TN, 2 TO, 2 TV, 2 UG, 2 UO, 2 UP, 2 US, 2 UX, 2 UY, 2 VU, 2 XC, 2 XG, 2 XI, 2 XU, 2 YK, 2 YN, 2 YX, 2 ZD, 2 ZK, 5 BD, 5 BI, 5 BM 5 BR, 5 CH, 5 CI, 5 DR, 5 FH, 5 FI, 5 GL, 5 JX, 5 KE, 5 KM, 5 KO, 5 LC, 5 LT, 5 MR, 5 MS, 5 NH, 5 OF, 5 OS, 5 TV, 5 US, 8 AB, 8 AG, 8 BC, 8 BF, 8 BM, 8 BV, 8 DP, 8 XY, 0 MX, 0 NY, 0 YB, 0 YS, 8 RRX, 8 BQR.
(D. A. Brown.)

Battersea, S.W.11.
2 FQ, 2 KF, 2 NS(?), 2 OM, 2 PU, 2 PX, 2 QQ, 2 SQ, 2 WJ, 2 XL, 2 XR, 2 XB, 2 XI, 2 YH, 2 BZ, 2 BV, 5 CP, 5 DT, 5 FR, 5 HY, 5 IM, 5 IO, 5 JJ, 5 LP, 5 OP, 5 OX, 5 PU, 5 SU, 5 UD, 5 UL, 5 VD, 5 VM, 5 XC, 5 VR, 5 VD, 6 IM.
(V. det.) (C. W. Picken.)

Bradford.
2 AH, 2 CH, 2 CX, 2 GU 2 GW, 2 HF, 2 IJ, 2 IN, 2 JF, 2 KD, 2 KF, 2 KW, 2 MI, 2 NA, 2 NG, 2 NM, 2 OD, 2 OG, 2 OM, 2 PO, 2 PP, 2 QS, 2 RG, 2 TB, 2 TC, 2 TR, 2 VF, 2 VO, 2 VN, 2 WF, 2 WJ, 2 WK, 2 XF, 2 YF, 2 ZK, 5 AJ, 5 BG, 5 BH, 5 BV, 5 CR, 5 CU, 5 CX, 5 DC, 5 DN, 5 HW, 5 KO, 5 KZ, 5 MU, 5 OC, 5 OK, 5 OW, 5 OX, 5 PJ, 5 PR, 5 QM, 5 SI, 5 SW, 5 SZ, 5 ZV, 6 LN, 6 ML, 6 NI, 6 NR, 6 ZY, 8 AP, 8 AQ, 8 AW, 8 BN, 8 CF, 8 CS, 8 CZ, 0 YS.
(1 H.F., V. det., 1 L.F.) (F. W. Garnett.)

Malvern.
2 AR, 2 KF, 2 KZ, 2 OM, 2 QY, 2 SF, 2 SX, 2 TM, 2 XC, 5 FV, 5 KV.

Weybridge.
2 DE, 2 DF, 2 DX, 2 FC, 2 GG, 2 JL, 2 KF, 2 KP, 2 KV, 2 LI, 2 LT, 2 OM, 2 OS, 2 QD, 2 QJ, 2 QL, 2 QS, 2 QY, 2 QZ, 2 SF, 2 SH, 2 SX, 2 SZ, 2 TI, 2 TO, 2 VM, 2 VS, 2 WJ, 2 XZ, 2 YL, 2 YM, YY, 2 YZ, 2 2 ZO, 5 BT, 5 BV, 5 CB, 5 CV, 5 FP, 5 FQ, 5 FY, 5 HL, 5 HW, 5 HY, 5 IO, 5 IS, 5 KY, 5 LP, 5 MA, 5 MF, 5 OS, 5 PB, 5 PM, 5 PP, 5 PU, 5 SQ, 5 SU, 5 VJ, 5 WP, 5 XI, 6 GZ, 6 IM.
(L. C. Snowden.)

Broadcasting

REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS:

GREAT BRITAIN.

LONDON 2 LO, 369 metres; **MANCHESTER, 2 ZY,** 385 metres; **BIRMINGHAM, 5 IT,** 420 metres; **CARDIFF, 5 WA,** 353 metres; **NEWCASTLE, 5 NO,** 400 metres; **GLASGOW, 5 SC,** 415 metres. Regular morning and evening programmes, particulars of which appear in the daily press, are conducted from these stations by the British Broadcasting Company. The usual times of transmission are:—Weekdays, 11.30 a.m. to 12.30 p.m. (**2 LO** only), 3.30 to 4.30 p.m., 5 to 10.30 p.m. Sundays, 3 p.m. (**2 LO** only), 8.30 to 10.30 p.m.

FRANCE.

PARIS (Eiffel Tower), **FL,** 2,600 metres. Daily, 6.40 a.m., Meteorological Forecast; 11.15 p.m., Meteorological Report and Forecast; 2.30 p.m., Financial Bulletin (Paris Bourse); 5.10 p.m., Concert; 6.20 p.m., Meteorological Forecast; 10.15 p.m., Meteorological Report and Forecast. Sundays, 5.20 p.m., Concert and Meteorological Report.

PARIS (Compagnie Francaise de Radiophonie Emissions "Radiola"), 1,780 metres. Daily, 11.30 a.m. Exchange News, 11.45 a.m. News and Concert, 3.45 p.m. Commercial Intelligence, 4 p.m. Concert 7.30 p.m. News, 8 p.m. Concert, Tuesday and Friday, 4 to 5 p.m., Dance Music. Thursday and Sunday, 9 to 9.45 p.m., Dance Music.

ECOLE SUPERIEURE des Postes et Telegraphes, 450 metres, Tuesday and Thursday, 7.30 p.m., Concert. Saturday, 5.30 to 6.30 p.m., Concert.

LYONS, YN, 3,100 metres. Weekdays, 9.45 to 10.15 a.m., Gramophone records.

DENMARK

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

HOLLAND.

THE HAGUE, PCGG, 1,050 metres. Sundays, 2.40 to 5.40 p.m., Concert. Mondays, 8.40 to 9.40 p.m., Concert. Thursdays, 8.10 to 10.10, Concert (temporarily suspended).

THE HAGUE (Heussen Laboratory), PCUU, 1,050 metres. Sundays 9.40 to 10.40 a.m., Concert. Tuesdays, 7.40 to 9.40 p.m., Concert.

THE HAGUE (Velthuisen), PCKK, 1,050 metres. Fridays, 8.40 to 9.40 p.m., Miscellaneous.

IJMUIDEN (Middelraad), PCMM, 1,050 metres. Saturdays, 8.10 to 9.40, Concert.

AMSTERDAM, PA5, 1,050 metres. Wednesdays, 7.40 to 9.40 p.m. Concert.

AMSTERDAM, PCFF (News Office, Vas Daiz), 2,000 metres. Daily, except Sundays, 7.50 to 8.10 a.m., 9.40 to 9.55 a.m., 11.10 to 11.15 a.m., 11.25 to 11.35 a.m., 11.55 to 12.10 p.m., 12.45 to 1 p.m., 2.40 to 3.10 p.m., 3.55 to 4.10 p.m., News and Market Reports. 1.10 p.m., 1.25 p.m., 1.40 p.m., 1.55 p.m., 2.10 p.m., 2.25 p.m., Stock and Bond Quotations.

BELGIUM.

BRUSSELS, BAV, 1,100 metres. Working days, 12 noon, Meteorological Bulletin. Daily, 4.50 p.m., Meteorological Bulletin; Tuesday and Thursday, 9 p.m., Concert. Sunday, 6 p.m., Concert.

GERMANY.

BERLIN (Koenigswusterhausen), LP, Sunday, 4,000 metres, 10 a.m. to 11 a.m., music and speech; 2,700 metres, 11 a.m. to 12 noon, music and speech; Daily, 4,000 metres, 6 to 7 a.m., 11 a.m. to 12.30 p.m., 4 to 5.30 p.m., Financial and other news.

EBERSWALDE (2,930 metres), Daily, 12 noon to 1 p.m., 7 to 8 p.m. Tuesday and Saturday, 5.30 to 6.30 p.m., Concert.

CZECHO-SLOVAKIA.

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

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

SWITZERLAND.

GENEVA, HB 1 (Radio Club de Genève), 1,100 metres. Thursdays, 8.30 to 9.15 p.m., Concert (temporarily suspended).

LAUSANNE, HB 2, 1,100 metres, Tuesdays, Thursdays and Saturdays, 4 p.m., Concert. Monday, Wednesday, Friday and Sunday, 7 p.m., Concert.

DIRECTORY OF EXPERIMENTAL TRANSMITTING STATIONS.

Additions and corrections to list published in our issue of July 7th, 1923.

2 CK City and Guilds (Engineering) College, Exhibition Road S. Kensington.
2 DR S. R. Wright, 14, Bankfield Drive, Nab Wood, Shipley.
2 JA A. S. Atkins, St. Marlo, Beauchamp Road, Upper Norwood, S.E.
2 JK Philip R. Coursey, Stamford House, Marchmont Road Richmond, Surrey.
2 KA Brighton and Hove Radio Society, 68, Southdown Avenue Brighton.
2 KV W. J. Crampton, Weybridge.
2 LP A. W. Knight, 26, Stanbury Road, S.E.15.
2 LU W. A. Appleton, Wembley Park.
2 MB E. H. Jeynes, 67, St. Paul's Road, Gloucester.
2 MO F. O. Read, 26, Flanders Road, Bedford Park, Chiswick.
2 NF Gordon S. Whale, Whale's Wireless Works, Colwyn Bay, N. Wales.
2 NI R. H. Lyne, 41, Somerset Road, Dartford.
2 PF R. B. Jefferies, Lynn Dene, Mount Hill, Kingswood, Bristol.
2 PG B. Heskett, High Street, Chalvey, Slough.
2 PN C. J. Pratt, 332, Upper Richmond Road, Putney.
2 PP J. Knight, Clark's Hill Nursery, Prestwich, Manchester.
2 QQ C. F. Phillips, Blackheath.
2 QY London, N.W.6.
2 RF Technical College, Bradford.
2 SO T. Geeson, Alder Cottage, Peel Street, Macclesfield.
2 SS Bradford Technical College.
2 TL V. Martin, 128, Dairy House Road, Derby.
2 UF H. Bailey, 51, Manchester Road, Denton, nr. Manchester.
2 UQ H. F. Abell Sanderson, H.A., 23, Palace Road, Llandaff.
2 VB Shooters Hill.
2 VL Mitchell & Co., McDermott Road, Peckham, S.E.15.
2 VV Southampton.
2 WI C. Munday, 37, Leat Street, Tiverton, Devon.
2 XT W. E. Philpott, Appledore, Kent.
2 YV George Milton Whitehouse, Allport House, Cannock.
2 ZG W. J. Badman, Orchard Street, Weston-super-Mare.
2 ZR S. G. Brown & Co., Ltd., 19, Mortimer Street, W.
5 AP A. J. Hill, Buckhurst Road, Bexhill-on-Sea.
5 AY T. F. Crowther, Esq., 29, North Drive, St. Annes-on-Sea, Lancs.
5 BI Bournemouth.
5 CA N. L. Yates-Fish, Clevelands, Mansfield Road, Reading.
5 CF F. G. S. Wise, 12, Crouch End Hill, Crouch End, N.8.
5 CV R. J. Harrison, "Blacklands," Sidney Road, Walton-on-Thames.
5 CW A. H. S. Colebrooke, 82, High Street, Harborne.
5 DH Dollis Hill.
5 DZ Devizes.
5 FF H. Anson, 13, Nottingham Place, Marylebone, W.1.
5 FI H. D. Webb, 59, Bradford Street, Walsall.
5 FU University College, Nottingham.
5 FW S. I. Holt, 21, Bromley Road, St. Annes-on-Sea.
5 GY C. Horwood, 557, Lordship Lane, E. Dulwich, S.E.22.
5 HJ F. A. Sleath, 31, Archery Road, Leamington, Spa.
5 HP Cunningham, Ltd., 169, Edgware Road, W.2.
5 IB L. H. & L. W. Corder, 5, Deeside Parade, W.Kirby, Birkenhead.
5 IL Dr. A. Dinsley, Carlton, Ince Avenue, Great Crosby, Liverpool.
5 IP R. H. Knox, 25, Bridge Street, Berwick-on-Tweed.
5 JC I. J. Morris, Semaes Bay, Anglesey.
5 JD F. Bulmer, 4, Carlton Terrace, Scarborough.
5 JG R. F. Longley, 81, Langdale Road, Thornton Heath, Surrey.
5 JJ L. D. G. Morrison, Beauvais, Ballater, Aberdeenshire.
5 JK The North of Scotland Wireless Co., 13, Bridge Street, Aberdeen.
5 JS H. B. Burdekin, 9, Marine Avenue, Westcliff-on-Sea.
5 KW R. Hodges, "Holly Mount," Westdale Lane, Mapperley, Notts.
5 KX W. Ward, Bingham, Notts.
5 LD Denman Street, London.
5 LJ E. Jackson, 37, Manley Road, Whalley Range, Manchester.
5 MC W. Woodhams, 24, Marlborough Place, Brighton.
5 ML O. R. Healey, 11, Glebe Road, Wallasey, Cheshire.
5 MQ City and Guilds Wireless Society, Kensington.
5 MR N. P. Stoate, 15, Winterstoke Gardens, Mill Hill, N.W.7.
5 MU C. W. Titherington, Dorchester, Dorset.

Further lists of additions and corrections will be included in subsequent issues.

QUESTIONS AND ANSWERS

"J.B.C." (Birmingham) *asks* (1) *For a diagram of a three-valve receiver employing one H.F., detector, and one L.F. valves, the circuit to be as selective as possible, with switches for series-parallel, tune-stand-by, and to cut out the H.F. and L.F. valves.* (2) *For a lay-out for the receiver.*

(1) We would refer you to circuit No. 53 of "The Amateurs' Book of Wireless Circuits." The components required will readily be seen from the diagrams. (2) Arrange the components on the panel so that wiring will be as short and direct as possible. A number of lay-outs have been given recently.

"TUNING" (Birmingham) *asks* (1) *What are suitable dimensions for a loose-coupled tuner which will have a maximum wavelength of approximately 2,600 metres.* (2) *Why is it usual to employ a condenser of 0·001 μF capacity in the aerial circuit, and a condenser of 0·0005 μF capacity in the closed circuit.* (3) *When the connections of the aerial tuning condenser are changed from series to parallel with reference to the A.T.I., is it necessary to alter the connections of the closed circuit condenser.*

(1) We suggest that for the primary of the loose-coupled tuner, you wind a layer of No. 24 D.C.C. wire on a former 4″ in diameter and 8″ long.

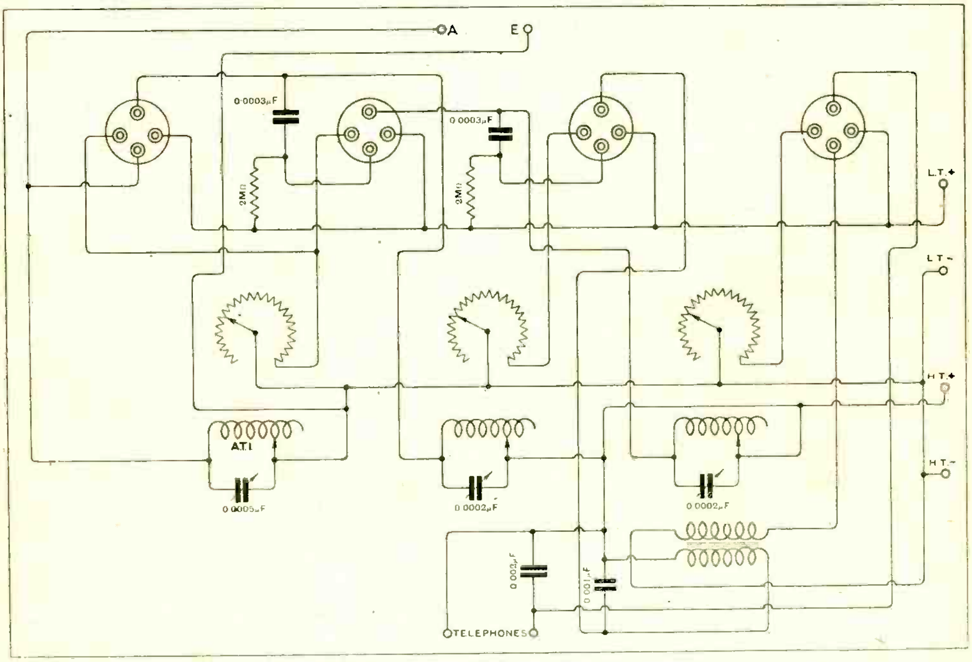


Fig. 1. "E.G.S." (Whitstable). *This receiver has two stages of H.F. (tuned anode) amplification, valve rectifier and one note magnifier.*

"E.G.S." (Whitstable) *submits a diagram of a four-valve receiver, and asks* (1) *Will we give a diagram of this receiver, showing the connections when assembled on a panel.* (2) *What is the wavelength range, and receptive range of the receiver.* (3) *Will it be any disadvantage to mount the coils close together in the cabinet.*

(1) The diagram is given in Fig. 1. (2) The approximate wavelength range of the receiver will be from 200 to 1,800 metres. You should receive all the British broadcasting stations. (3) The coils should be mounted as far apart as possible, with their axes at right angles.

The secondary may consist of a winding of No. 28 D.C.C. wire, on a former 3½″ in diameter and 8″ long. Ten tappings should be taken, the first from the 15th turn and the rest equally spaced along the coil. (2) The closed circuit condenser is connected in parallel with the secondary inductance, and if of too large a capacity will reduce the potential difference built up across that inductance. (3) It is not necessary to alter the connections to the closed circuit condenser.

"E.J.W." (New Cross, S.E.14) *asks* (1) *For a diagram of a one-valve H.F. amplifier to be used with a crystal receiver.*

(1) The diagram is given in Fig. 2. The condenser of the crystal receiver, if one is used, should be joined in parallel with its tuning coil. Also see the issue of August 1st, page 577.

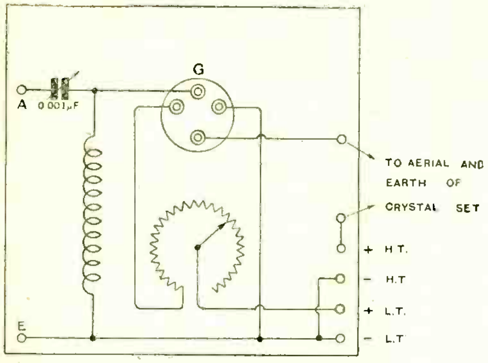


Fig. 2. **" E.J.W." (New Cross, S.E.14).** *Diagram of an amplifying valve to be added to a crystal receiver for H.F. amplification.*

" A.B." (Edinburgh) *submits a diagram of his receiver, and asks* (1) *Is the diagram correct.* (2) *What is the approximate range of the receiver.*

(1) The diagram is correct. We suggest that you employ a condenser across the H.T. battery, having a value of from 0·5 to 2 μF. (2) The range for telephony would be approximately 300 miles.

" A.P.Mc.L." (Barrhead) *asks* (1) *Why is he unable to receive the transmissions of any British broadcasting station except Glasgow.* (2) *Would the substitution of tuned anode H.F. coupling for H.F. transformers improve reception from distant stations, and if so, how might the alteration be carried out.*

(1) The trouble is probably in the H.F. stage. We suggest that you pay careful attention to the wiring of this unit. Make sure that all leads are as short as possible, and well insulated. If possible, try different H.F. transformers. (2) If the H.F. transformers are at fault, the tuned anode method might be substituted with advantage. Diagrams of receivers employing this method of H.F. coupling appear frequently in this journal. We would refer you to Fig. 3a, page 539, of the issue of July 21st. The anode coil may consist of a winding of No. 30 S.S.C. wire on a former 2½″ in diameter and 3″ long, with 10 taps. When tuned with a 0·0002 μF variable condenser, this will be suitable for the reception of British broadcast transmissions.

" AERIAL " (Redditch) *submits a diagram of a proposed aerial arrangement, and asks is there any objection to running the aerial above telephone wires.*

Provided that the aerial is erected well clear of the telephone wires, there is no objection to the proposed arrangement.

" O.H." (West Byfleet) *asks* (1) *What are suitable constructional details for the anode coil in the receiver described in the issue of March 24th.* (2) *Will this receiver give results as satisfactory as thoes obtainable with other receivers described in this journal.* (3) *What is a suitable tuner to employ with this receiver, using plug-in type coils.* (4) *Will the intervalve transformer described in the issue of August 5th, 1922, be suitable for use in this receiver.*

(1) For the reception of British broadcast transmissions, the anode coil may consist of a winding of No. 30 S.S.C. wire on a former 2½″ in diameter and 4″ long. (2) The results obtainable with this receiver will be quite satisfactory. (3) A diagram of a suitable tuner is given in Fig. 3. (4) No intervalve transformer is referred to in the article mentioned. We would refer you to the article on L.F. transformers in the issue of August 15th, 1923.

" J.T." (Edinburgh) *asks* (1) *For the approximate wavelength range of a tuning-coil.* (2) *What is the description of the sample of wire submitted.* (3) *Is it possible to employ a telephone transformer with a crystal receiver.*

(1) The coil will tune from a minimum wavelength of 300 metres to a maximum of 1,500 metres. (2) The wire is No. 26 S.C.C. (3) A telephone transformer may be employed with a crystal receiver when using low resistance telephones. The suggested rewinding will not be necessary.

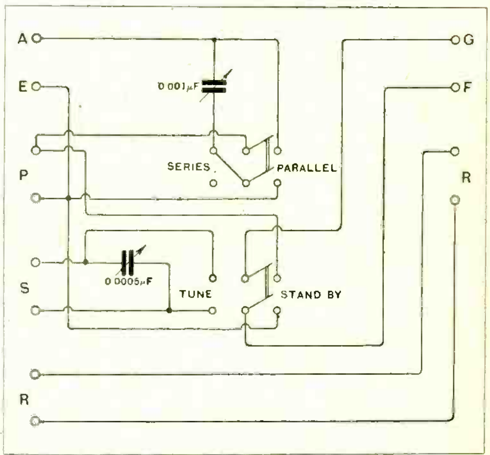


Fig. 3. **" O.H." (West Byfleet).** *Connections of a three coil tuner.*

" W.A.W." (Harrow) *asks* (1) *For a diagram of a double magnification receiver, to include certain switching arrangement.* (2) *Are iron core choke coils as efficient as transformers when used for L.F. intervalve coupling.*

(1) We would suggest that this type of receiver is not suited to the introduction of the suggested switching arrangements. (2) The choke coils will not be so efficient as the transformers. See recent articles entitled " Wireless Theory."

" E.W.S." (Catford, S.E.6) *asks for a diagram of a receiver employing one H.F. valve, one dual amplifying valve, crystal detector and one L.F. valve.*

The diagram is given in Fig. 4. This type of receiver is not suitable for the introduction of the desired switching arrangements.

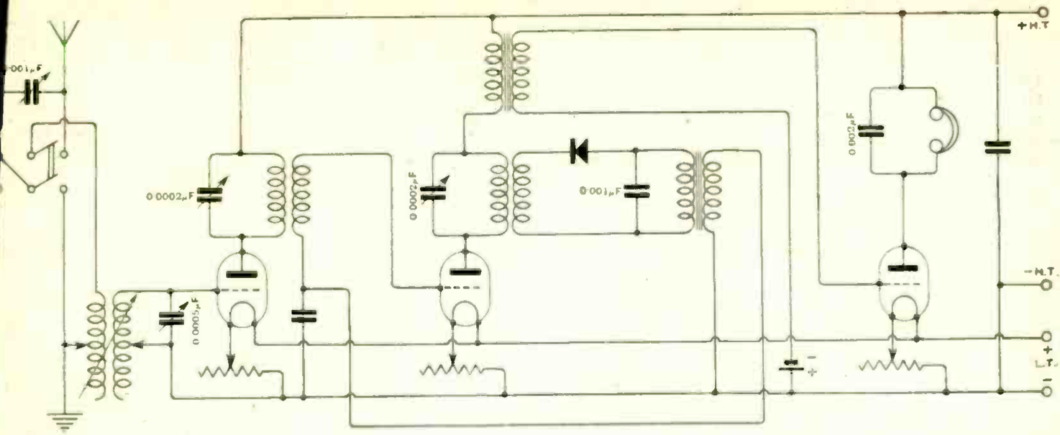


Fig. 4. **"E.W.S. (Catford, S.E.6).** *Diagram of a receiver with the first valve operating as a H.F. amplifier, the second as a double amplifier, and the third as a note magnifier. A crystal rectifier is used.*

"P.L." (Cambs.) *submits a diagram of a double magnification receiver, and asks* (1) *Is the diagram correct.* (2) *Is it necessary for the two L.F. transformers used in this receiver to be of the same make.* (3) *Is it possible to employ tuned anode H.F. coupling with this receiver.* (4) *Will a receiver constructed from the diagram given in Fig.* 10, *page* 213, *of the issue of May* 19th, *satisfactorily operate a loud speaker at a distance of* 70 *miles from the broadcasting station.*

(1) The diagram is not correct. In Fig. 5 is given the correct diagram for this receiver. (2) It is not necessary that the two transformers should be of the same make. (3) Tuned anode H.F. coupling may be employed in a double magnification receiver. See Fig. 8, page 212, of the issue of May 19th, 1923. (4) The results obtainable with the double magnification receiver depend very largely on your operating skill, and no definite figures can be given.

"E.C." (St. Pancras, N.W.1) *asks* (1) *Will we give a diagram of a receiver employing two valves operating as double magnifiers, with crystal as rectifier.* (2) *Can switches be introduced so that one valve only is operating as a double magnifier.*

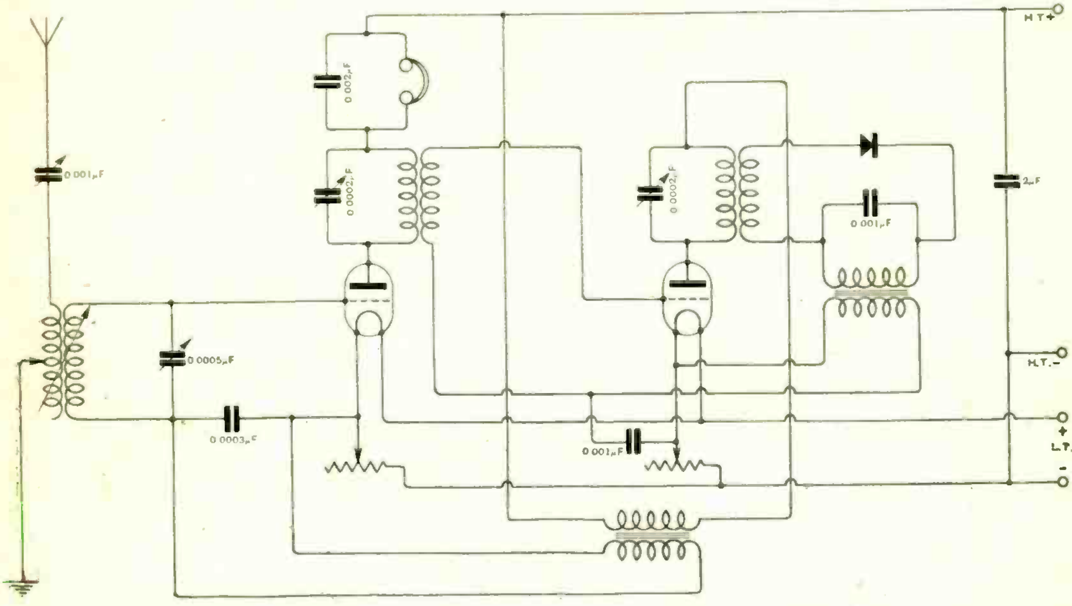


Fig. 5. **"P.L." (Cambs.).** *Double magnification receiver connections.*

(3) *What is a suitable type of indoor aerial to set up in a room 12′ square, and 25′ above the ground.*

(1) The diagram is given in the reply to "**P.L.**" **(Cambs.)**. (2) The receiver is not suitable for the introduction of the proposed switching arrangements. (3) The aerial may consist of an insulated wire running all round the room, or may be a number of parallel wires attached to insulated hooks at the ends of the room and running close to the ceiling.

"**DUAL**" **(Kingsland, N.1.)** *asks for a diagram of a dual amplification circuit employing*

"**ANODE**" **(Skegness)** *asks* (1) *For a diagra of a double magnification receiver employing thr valves, the tuned anode method of H.F. couplin being adopted.* (2) *Will the results obtainable wi this receiver be better than those obtained with three-valve receiver employing single magnificatio and reaction.*

(1) We would refer you to Fig. 8, page 212, o the issue of May 19th, 1923. (2) The result obtained with this receiver when properly handled will generally be better than those obtained with the single magnification receiver.

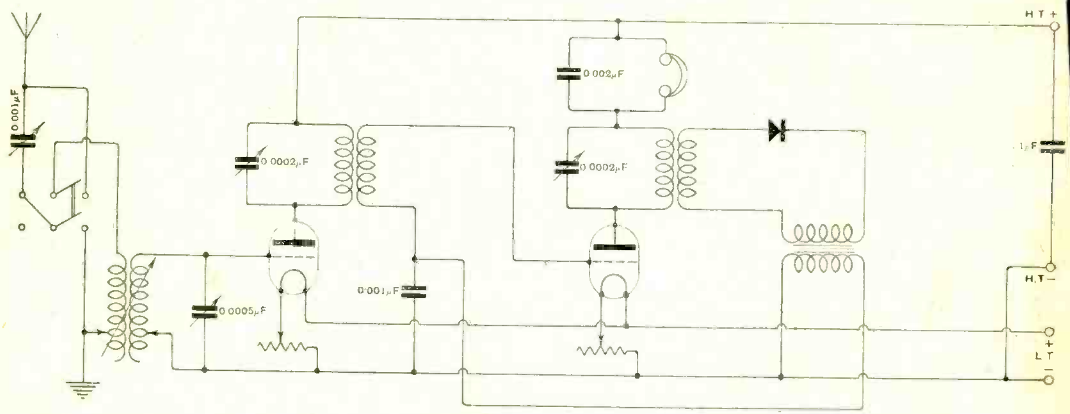


Fig. 6. "**Dual**" **(Kingsland, N.1).** *A double magnification receiver with two stages of H.F., rectifier and one note magnifier.*

wo valves, with a crystal as rectifier. One valve only is to operate as a low-frequency amplifier.

(1) The diagram is given in Fig. 6.

"**G.H.**" **(Oxford)** *submits a diagram of a double magnification receiver employing two valves, and asks* (1) *Can we suggest any improvement to this receiver for the reception of British broadcast transmissions.* (2) *Will we give suitable condenser values for this receiver.* (3) *What are suitable dimensions of a tuning coil for the reception of British broadcast transmissions, and also a loading coil for the reception of the French broadcast transmissions.* (4) *Is it advisable to employ reaction with this receiver, and, if so, how should it be applied.*

(1) The circuit as submitted will be satisfactory. (2) The fixed condenser across the secondary of the L.F. transformer may have a value of approximately 0·002 mfd. The telephone condenser may be of the same capacity. The grid condenser may have a value of 0·0003 mfd., and the condenser across the H.T. battery a value of 0·5 to 2 mfd. (3) The tuning coil may consist of windings of No. 20 D.C.C. wire on a former 3″ in diameter and 4″ long. Eight tappings should be taken, the first from the fifth turn and the rest equally spaced. A 0·001 mfd. variable condenser should be used for tuning in conjunction with a series-parallel switch. The loading coil for the reception of the Radiola transmissions may be a No. 200 Igranic coil, and for the Eiffel Tower transmissions a No. 300. (4) In general, no.

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